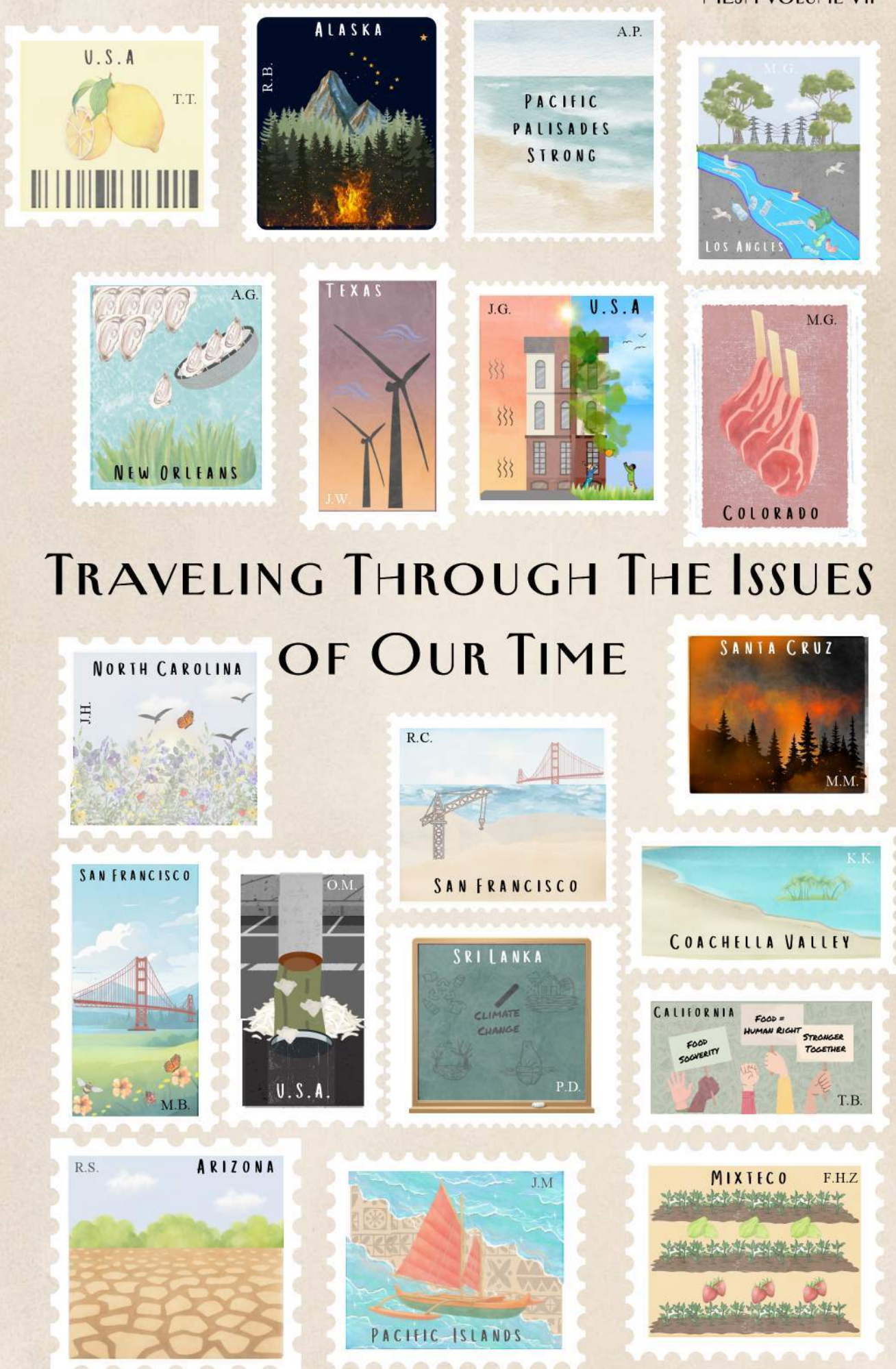


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TRAVELING THROUGH THE ISSUES OF OUR TIME

TRAVELING THROUGH THE ISSUES OF OUR TIME:

A Collection of Knowledge, Culture & Systematic Changes

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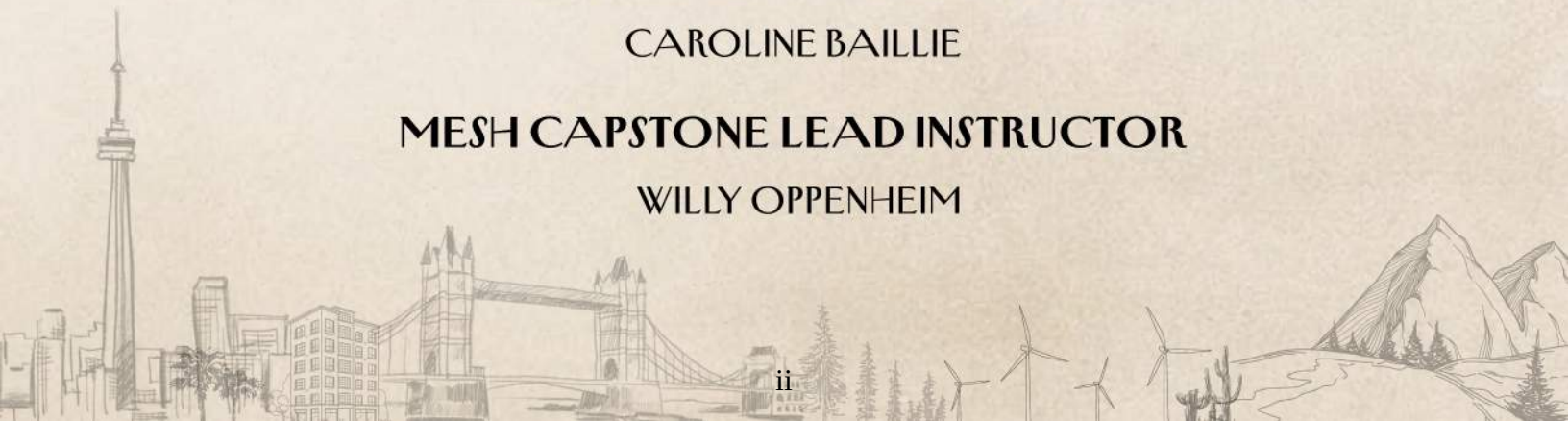
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Dear Reader,

In obtaining our Masters of Engineering, Sustainability and Health (MESH), we have been challenged with past and current issues related to these topics in order to imagine a better future: one that is sustainable, congruous, and ecologically balanced. The following papers reflect the knowledge nurtured throughout the MESH program as well as the lived experiences and personal aspirations of the cohort members. To our cohort members: we have been delighted to experience the MESH program together. These experiences have prepared us to become changemakers. Whether our paths lead us to government organizations, the private sector, higher education, or nonprofit organizations, each sector plays a critical role in creating a sustainable and hopeful future for the generations that follow. We are excited to see what the future holds for each and every one of us!

– Amber George & Tyesha Tate
MESH Magazine, Vol. VII, Editorial team



Letter From Our Academic Director

As I mused the title of our 7th MESH magazine issue, I was reminded of other travelling metaphors that I had used over the years. It was a natural metaphor to use, as I was constantly on the move. Just over 20 years ago I co-edited a volume called 'Travelling Facts'*, which marked the start of my transdisciplinary journey. It is also worth noting that even the word 'travelling' travels differently from place to place – in the US it is spelt with one 'l'. Being from the UK, I did not just make a mistake in the above sentence. Such apparently small differences in translation can become quite large on impact, as we discuss in the 'Travelling facts' book. It was one outcome of a project I was involved with. Around the year 2000, a group of 15 Fellows from the Institute of Advanced Studies in Berlin were working together for two years on the topic of 'Work, Knowledge and Social Cohesion'. I was the only engineer/natural scientist among them. I still recall standing in front of a fireplace in Frankfurt, Germany, asking my peers every question I could think of, about 'post modernism', the 'enlightenment', you name it – I was so angry that ALL of them knew these things and I, with a PhD and the only tenured academic amongst them (they were mostly PhD students or postdocs) had no clue. How could I be so ignorant? How could this be general knowledge for all of them and my engineering degrees lacked everything they talked about. I had a very rapid education which started a lifelong ambition. I needed to find ways to address serious challenges in the world by bringing disciplinary knowledge into contact, in ways that were not simply adding on context or creating new disciplines (such as STS or bioengineering). The book 'Travelling Facts' was my way of starting the process. I asked the Fellows this question: 'What changes when 'facts' (to be discussed on another occasion..) travel from one discipline to another, one time to another, one place to another, one way of knowing and being to another?' This question made a lot of sense to my peers. How can the idea of 'love' in one language and context be translated into another? This is the skill of the poetry translator. Words are not just words. How could the concept of 'competition' be made sense of for those who



grew up in Eastern Europe in the 70's, compared with their children who grew up post-transition to a capitalist system? How can we teach engineering across the world in exactly the same way? Should there not be some locally appropriate cultural and contextual or environmental value that shifts the way we should engineer? And on and on...

MESH was an inevitability that had to come into being. And it thrills me to see how our diverse, beautiful and brilliant students, from all walks of life, disciplines, professions and sectors share their knowledge with each other, with our professors and the communities with which they engage, with generosity and passion and belief. Belief that things can get better. When such forces for good are active in our world, we have a chance to travel along a different path. This cohorts' projects and articles are as exciting and as critical as ever. We take a look in depth at our cities' infrastructure, our food, water and energy systems, our inequities and our eco-consciousness. I have followed your journeys since you began, feeling like imposters in our first introductory course, trying to decide what to focus on. I am very proud of what you have achieved, especially considering the threats we are all experiencing.

Congratulations! You've made it - MESH graduates!!!

- Caroline Baillie MESH Director



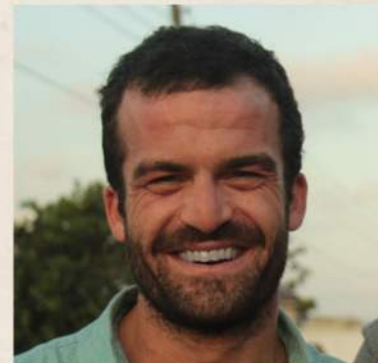
Dr. Caroline Baillie
Founding Director of MESH
Professor of Practice in the Shiley-
Marcos School of Engineering

Letter From Our Capstone Director

I am honored, excited, and grateful to introduce Volume VII of the MESH Magazine! Over the past months, the students in this cohort have devoted themselves to crafting thoughtful articles that engage a stunning array of topics: from clogged toilets to urban rewilding, from Indigenous foodways to water purification, from wildfire resilience to the experiences of wind turbine technicians. The pages of this magazine offer a kaleidoscopic entry point into these topics — not just through their assemblage of photographs, oral histories, literature reviews, and incisive prose, but also through the human voices that they amplify and illuminate. Reader, I invite you to dive deep into these stories, and I hope that when you look away from these pages, you find yourself seeing our world anew. I am grateful to our students for creating this opportunity, and to all of the colleagues who have made it possible.

With respect and appreciation,

Willy



Dr. Willy Oppenheim
MESH Capstone Lead Instructor
Omprakash Executive Director



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¹ Black, Indigenous, People of Color



This issue is dedicated to Bonifacio Hernandez Garcia, the
grandfather of Flor Hernandez.

*Este diario está dedicado a Bonifacio Hernández García, el
abuelo de Flor Hernández.*

THE CLOG CHRONICLES

How the \$26 Billion "Flushable" Wipe Industry Turned Our Pipes Into a Time Bomb and Left Taxpayers Holding the Plunger

By Omar Muñoz Rodriguez

Professor: Willy Oppenheim

MESH Magazine | Master of Engineering, Sustainability, and
Health | University of San Diego
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Abstract

This article follows the story of a popular hygiene product that has become a serious problem for public infrastructure, costing taxpayers billions while manufacturers face little accountability. It looks at policy responses, wastewater treatment solutions, and efforts to teach people what should and should not be flushed. The magazine also examines the flushable wipes crisis using theories learned in MESH classes, such as environmental justice, the adaptive challenge, and the treadmill theory. It argues that the wipes crisis is both a design and behavior issue that needs coordinated solutions, not just technical fixes.

Research question: How do the material properties, regulatory frameworks, and consumer behaviors surrounding "flushable" wipes interact to produce economic, environmental, and public health consequences, and what integrated solutions are needed to address this systemic problem?



With a simple push of the lever, water swirls and the problem seems to disappear. But that's not really the case.

Every day, millions of Americans flush so-called "flushable" wipes down their toilets, believing they are making a hygienic choice for themselves and a harmless one for the world beyond their bathroom walls. The packaging tells them it's okay. The advertisements reassure them. The name itself, "flushable," is a promise. But beneath our cities, in the dark labyrinth of sewer pipes that most of us never think about, those wipes are just beginning their destructive journey. They do not disappear. They accumulate. They tangle. They combine with grease and oil to form massive, concrete like masses that wastewater professionals have come to call "fatbergs." And when those fatbergs grow large enough to block entire sewer lines, raw sewage backs up into basements, overflows into rivers, and spills onto streets. The bill for this mess, which runs into the hundreds of millions of dollars annually, lands squarely on the taxpayers who never asked for any of it.

The flushable wipes crisis is not just a technical problem or a result of people not knowing better. It has been created by a few large corporations that take advantage of weak regulations, shift environmental and infrastructure costs onto the public, and avoid responsibility while selling products they know won't break down. Solving this problem will take more than better technology or public education. It will require new approaches that address the way companies operate, close legal loopholes, and listen to the communities and workers most affected.

The global wet wipes market was worth about \$26.45 billion in 2023 and is expected to reach \$38.56 billion by 2032, growing at 4.28 percent each year. This rapid growth comes from real demand for convenience and hygiene. Products like

baby wipes, makeup remover wipes, disinfecting wipes, and personal hygiene wipes are now common in American homes. During the COVID-19 pandemic, people used even more disinfecting wipes, making them a bigger part of daily life.

But the convenience comes at a hidden cost. According to the National Association of Clean Water Agencies (NACWA), improper disposal of wipes costs U.S. utilities up to \$1 billion annually. This figure includes emergency repairs to clogged pumps, increased labor costs for maintenance crews, and damage to treatment plant equipment. It does not include the costs borne by individual homeowners whose private sewer lines become blocked, nor does it include the environmental damage caused when sewage overflows contaminate local waterways. In Detroit, a sewer collapse attributed to wipes created a sinkhole that swallowed part of a roadway and cost millions to repair. In London, a single fatberg discovered in 2017 weighed as much as 130 tones and took weeks to remove.

The word "flushable" is used in marketing but has no clear legal meaning in the United States. Unlike terms like "organic" or "recyclable," which are regulated, "flushable" is not. Companies can put this label on almost any product, following only voluntary guidelines that many say are not strict enough. This means many products that go down the toilet do not break down in city sewer systems. A 2020 study found that half of wipes labeled as flushable had polyethylene terephthalate (PET), a plastic fiber that does not break down in water and adds to microplastic pollution in the ocean.

The consequences of this regulatory vacuum are not evenly distributed. Wastewater treatment facilities are disproportionately located in low income communities and communities of color, a pattern of environmental racism that has been documented for decades. When those facilities face increased operational costs due to wipe related blockages, the burden falls on residents who can least afford it, often in the form of higher utility bills or deferred infrastructure maintenance. In Detroit, where the population is majority Black and poverty rates are high, the city's wastewater system has been overwhelmed by wipes, forcing officials to divert limited resources from other pressing needs.

This situation is not just a matter of where people live or how they use products. It is the result of a system that lets companies make more money by passing costs onto the public. As one wastewater worker in Austin, Texas, said in an interview for this article, the industry now believes that "it's just better to prepare ourselves, redesign our equipment, redesign our plants to handle this because it's just not going to go

away". While this attitude is understandable, it shows a serious lack of accountability. This magazine aims to find out why this failure happened and to explore what real solutions might look like.

Theory: Understanding the Machinery of Crisis

To see why the flushable wipes crisis continues despite people knowing about it and the high costs involved, we need to look past technical reasons and consider the deeper social and economic forces at play. Two helpful ways to analyze this are the treadmill of production, created by sociologists Allan Schnaiberg and Kenneth Gould, and the idea of adaptive challenges versus technical problems, described by leadership expert Ronald Heifetz.

The Treadmill of Production

The treadmill of production theory, introduced by Schnaiberg in 1980 and later developed with Gould, helps explain why capitalist economies often cause environmental damage even if no one means to do harm. The theory says that chasing economic growth creates a cycle: more production needs more resources, which leads to more waste and pollution. Companies compete by expanding production, cutting costs, and passing environmental problems onto society.

In the case of flushable wipes, the treadmill operates on multiple levels. Manufacturers like Kimberly Clark and Nice Pak, the two largest players in the market, face relentless pressure to maintain profit margins in a highly competitive industry. One way to do that is to use cheaper materials, such as synthetic fibers derived from petroleum, rather than more expensive natural fibers that would actually break down in water. Those synthetic fibers are durable enough to withstand vigorous wiping but do not disintegrate when flushed. The result is a product that performs well for the consumer in the moment but creates enormous downstream costs for wastewater utilities.

The treadmill theory also helps explain why the industry resists new regulations. Since companies pass environmental costs onto the public, these costs do not show up in their financial reports. For any one company, there is no reason to spend more on truly flushable materials unless every competitor has to do it too. This is a classic collective action problem that only government rules can fix. However, the same companies that avoid these costs often have enough political influence to stop or weaken new regulations.

Technology has two sides in this situation, as Schnaiberg and Gould pointed out. New technology can help the environment by making production cleaner or more efficient. But it

can also make production cheaper, which leads to even more growth and waste. In the wipes industry, both effects are clear. Some companies now make truly flushable wipes with short, non-plastic fibers that break down in water, but these make up only about 10 percent of all wipes sold. At the same time, wastewater utilities have had to buy costly new equipment like grinders and screens just to handle the large amount of wipes that do not break apart. As James Dias of Austin Water said, pump makers like Flygt have changed their designs so wipes can pass through instead of clogging the system. This means the infrastructure is being changed to deal with the problem, rather than fixing it at the source.

The treadmill of production highlights a basic unfairness in the flushable wipes crisis. Companies gain profits and consumers get the benefits of cheap, sturdy wipes, but the costs fall on marginalized communities with poor wastewater systems, on people who pay higher utility bills, and on the environment, which sewers from ongoing microplastic pollution. This is not just a simple market failure. It is a built-in part of a system that gathers wealth for some while spreading harm to others.

Adaptive Challenges and Technical Problems

Ronald Heifetz draws a clear line between technical problems and adaptive challenges. Technical problems can be solved using current knowledge and skills. Even if they are complicated, the solutions are already known. For example, a mechanic can fix a broken pump, and a maintenance crew can clear a clogged sewer line. These issues fit within existing systems and can be handled by experts.

Adaptive challenges are different because they need people to change their values, beliefs, and behaviors. Experts alone cannot solve these problems since they are social as well as technical. Solutions involve learning, adapting, and sometimes making difficult changes together. Heifetz gives the example of a doctor telling a heart disease patient that the answer is not a new drug, but a real change in diet and exercise. The doctor can help, but the patient has to make the change.

The flushable wipes crisis is a good example of an adaptive challenge that looks like a technical problem. For years, industry and government have mostly responded by treating it as a technical issue. They have invested in better screens, stronger grinders, and public campaigns telling people not to flush wipes. While these steps help, they do not solve the main problem. The real issue is a system that puts profit before responsibility and allows companies to label products as they wish. As one wastewater professional said, the industry has mostly stopped trying to prevent the problem and now focuses on

"Redesigning our equipment, redesigning our plants to handle this because it's just not going to go away". This is a technical fix for an adaptive challenge dealing with symptoms instead of changing the root causes.

The adaptive nature of the crisis becomes clear when we consider what genuine solutions would require. They would require manufacturers to accept responsibility for the full life cycle costs of their products, a fundamental shift from the current model in which those costs are externalized. They would require government to establish and enforce legally binding standards for what can be labeled flushable, overcoming decades of industry lobbying against such regulation. They would require consumers to change deeply ingrained habits and to resist marketing messages that have been carefully crafted to create confusion. And they would require society as a whole to reckon with uncomfortable questions about convenience, disposability, and who bears the burden of our consumption.

These are not technical adjustments. They are adaptive transformations. They are adaptive shifts that need ongoing effort, strong political will, and the courage to challenge powerful interests. The treadmill of production theory helps explain why these groups resist change. Heifetz's ideas show why change is hard and what kind of leadership is needed.

Analysis: The Anatomy of a Manufactured Crisis

The View from Inside the System

One Wednesday afternoon in March 2026, I sat down with James Dias, who has worked in the wastewater industry for 32 years. He now manages lift station operations for Austin Water, overseeing 140 stations that move wastewater from homes and businesses to treatment plants. During our hour-long conversation, Dias described what the flushable wipes crisis looks like from his perspective inside the system.

"The biggest problem is mostly just labor increase," Dias explained. "It's not really so much of a cost thing other than labor costs if you're now spending more hours really removing the debris." In his operation, crews clear about 20 pumps each week, and each one takes around two hours. That means they spend 40 hours every week just dealing with clogs from wipes and other materials that do not break down. "That's where the big cost really comes in at," he said.

Dias said his operation spends about half a million dollars each year on "unplugging lines," a number that has stayed about the same for the past ten years. But that is only part of the

issue. When wipes mix with fats, oils, and grease (FOGs) that people pour down drains, they create what Dias calls a "snowball effect." A single wipe can travel up to 20 miles through the sewer system before reaching a treatment plant, picking up more material as it goes. "Eventually you end up with a pretty big snowman," he said. "And grease is like the glue keeping it together."

The volume of material being removed from the system has increased dramatically over Dias's career. Ten years ago, his crews filled about half as many dumpsters with debris as they do today. That debris, mostly a congealed mass of wipes and grease, ends up in landfills. Despite rigorous screening at treatment plants, Dias confirmed that wipes do shed microfibers that can pass through treatment processes and enter the environment. Those microfibers, increasingly recognized as a significant source of plastic pollution, have been found in waterways around the world and are ingested by aquatic organisms throughout the food chain.

When asked what he would say to manufacturers like Kimberly Clark, Dias answered right away. "I would give them two options," he said. "One, take 'flushable' off the package. Or two, actually make them degradable." He explained that wipes are "like putting a plastic bag in a landfill. The plastic bag is going to be there." Dias said he tested wipes that claimed to be biodegradable and found they did not break down, which matches what research has found: many wipes labeled as biodegradable still have synthetic fibers that do not decompose.

Dias's view matters because he has spent decades dealing with this problem firsthand. He is not an activist or an academic, but a professional whose job is to keep things running, even when products make that difficult. His acceptance of the situation, and the idea that the industry has just learned to live with it, shows how current solutions are not enough. "Unfortunately, I think the industry has kind of gotten to a point where we're kind of saying, okay, this is our life. This is not going to go away," he said. "Nobody seems to be in a big rush to make a big push."

The Manufacturer's Perspective and Its Limitations

While researching this article, I contacted Kimberly Clark and Nice Pak, two major flushable wipes manufacturers, to ask for interviews or written responses. Kimberly Clark declined, explaining they get too many student requests to handle. Their email, signed by "Chuck" from Consumer Services, was polite but clear: "Because our products and our company have become so well known over the years, we have been invited to participate in

many student projects. Although we would certainly like to help, the volume of requests is simply too great to accommodate." Nice Pak did not reply.

It would be easy to interpret this silence as evasion, and perhaps it is. But it is also worth taking seriously the arguments that manufacturers might make in their defense, if only to understand why the crisis has persisted. So let us play devil's advocate and consider the case for the industry.

First, manufacturers might say they are just meeting consumer demand. People want products that are convenient and hygienic, and wipes provide that. The industry has created millions of jobs and brought in billions of dollars. If people were really worried about the environment, they would stop buying wipes. Since sales keep rising, manufacturers believe the market has made its choice.

Second, manufacturers often mention voluntary industry standards, like those from INDANA (the Association of the Nonwoven Fabrics Industry) and EDANA (the European Disposables and Nonwovens Association). These standards include tests for flushability, and products that pass can get certified. From their point of view, the real problem is consumers flushing items clearly marked as non flushable. As [Lara Wyss](#) from the Responsible Flushing Alliance pointed out, a study found that 34 percent of materials collected from wastewater screens were wipes labeled with the "Do Not Flush" symbol. Paper towels, which also shouldn't be flushed, made up 53 percent.

Third, manufacturers may say they have spent a lot on making truly flushable and biodegradable wipes. Some wipes now use short, non plastic fibers and are meant to break down in wastewater. The technology is available. The real challenge is getting people to buy these products and use them the right way.

Some of these arguments make sense, but they often hide more than they explain. Saying that the market has spoken overlooks that consumers rely on information from manufacturers when making choices. If a product is labeled "flushable," most people expect it to be safe to flush. Even if some people flush items marked "Do Not Flush," that does not let manufacturers off the hook for products they claim are flushable. Also, the voluntary industry standards manufacturers mention have been called inadequate. In a [2020 study](#), researchers tested 23 wipes sold as flushable and found that none broke down completely in standard sewer conditions. Many wipes stayed intact in pipes and wastewater treatment plants. So, the certification process does not actually ensure these products will break down in real life.

There has been some investment in truly flushable products, but these make up only a small part of the market. As mentioned before, just 10 percent of wipes sold in the U.S. are

made to be flushable. The other 90 percent are non-flushable wipes that add to the problem. Manufacturers have not used their resources to move the market toward more sustainable products. Instead, they keep selling large amounts of products they know can cause harm, using unclear labels and consumer confusion to keep sales up.

The Regulatory Landscape: Loopholes and Missed Opportunities

The rules for flushable wipes in the United States are a mix of voluntary guidelines, state efforts, and a lack of federal action. Knowing how this system works helps explain why the problem continues and what might fix it.

There is no official federal definition of "flushable." The Federal Trade Commission (FTC) can act against false advertising under Section 5 of the FTC Act, which bans unfair or deceptive practices. In theory, the FTC could take action against companies that call their products flushable when they are not. In reality, the FTC has rarely acted, possibly because there are no clear standards to judge these claims. Without a legal definition, companies can say their products are flushable based on their own tests or industry rules.

The Environmental Protection Agency (EPA) oversees wastewater treatment under the Clean Water Act, but it cannot regulate consumer products before they reach the system. The EPA can offer guidance and do research, but it cannot set rules for what products can be called flushable. The EPA cares about this issue, but it cannot do much without new laws.

Because the federal government has not acted, states and cities have started to step in. In 2021, California passed Assembly Bill 818, which says all wipes sold in the state must have a "Do Not Flush" label unless they meet certain flushability standards. The law also makes manufacturers run education campaigns about proper disposal. Other states like Washington, Illinois, and New York have proposed similar laws, but not all have passed.

At the federal level, the WIPPES Act (Wet Individual Packaging and Proper Disposal Education for Sustainability Act) has been introduced in multiple sessions of Congress but has not yet become law. The bill would require the FTC to establish a national standard for flushability and would mandate clear labeling on non flushable wipes. It has bipartisan support and is backed by both industry groups and wastewater associations, suggesting that a compromise is possible. Yet it has repeatedly stalled, a testament to the difficulty of moving legislation through a polarized Congress.

Private lawsuits are also part of the legal picture. In 2014, Joseph Kurtz from New York sued Kimberly Clark and Costco, claiming their "flushable" wipes caused major plumbing problems in his home and asking for \$5 million in damages. The result of this case is not public, but it shows how private lawsuits can step in when regulators do not. Other class action lawsuits have been filed against different companies, with mixed results.

One of the key challenges in these lawsuits has been the absence of a clear legal standard for flushability. Without such a standard, courts have struggled to determine whether a particular product's label is deceptive. This is precisely the problem that the WIPPES Act would solve, and it explains why industry groups have been willing to support the bill. A federal standard would provide certainty for manufacturers and reduce their exposure to litigation, even as it imposes new requirements.

International actions could also shape U.S. policy. The European Union has taken stronger steps, using the Single Use Plastics Directive to limit products with plastic and require clear labels. The United Kingdom has banned wet wipes with plastic, which has sped up the move to cellulosic alternatives. These changes put pressure on U.S. companies to follow similar rules worldwide, at least to keep things simple for their operations.

The Material Science Gap: What Really Happens When You Flush

To understand why wipes cause problems, it helps to know a bit about material science. Toilet paper is made to break down quickly in water. Its short cellulose fibers are only loosely held together. When you flush it, the water's movement and the pipe walls help pull the fibers apart, so the paper breaks into small pieces that move easily through the sewer system.

Wipes are made to be strong and last through tough use, whether for cleaning, makeup removal, or baby care. To do this, they use longer fibers and stronger bonds. Most wipes are made from synthetic fibers like polyester or polypropylene, which are basically small plastic threads. These do not break down in water and can stay in the environment for decades or more.

"Flushable" wipes are meant to be different. They use shorter, non-plastic fibers, usually made from wood pulp or cotton. The way these fibers are bonded lets them come apart when they move through the sewer system. In theory, a real flushable wipe should break down like toilet paper, turning into fibers that wastewater treatment plants can handle.

But in real life, things are more complicated. Even wipes made from cellulose fibers can last in the environment for weeks or months. A 2025 study by Allison and colleagues showed that cellulosic wipes placed in urban rivers stayed mostly whole after five weeks. How fast they broke down depended a lot on what they were made of and the conditions in the water. Wipes made mostly from natural cellulose broke down faster than those with regenerated cellulose, like viscose or rayon, but both types lasted long enough to cause pollution problems.

Chemical additives make things even more complicated. Many wipes have antimicrobial preservatives, moisturizers, and other ingredients that can stop microbes from growing and slow down how fast the wipes break down. These additives are not always listed on the packaging, so it is hard for consumers or researchers to know the real environmental impact.

Even when wipes break apart, they do not just vanish. They turn into smaller pieces, including microfibers that can slip through treatment plant filters and end up in rivers and oceans. One gram of wipe can release up to 56 microfibers, and these have been found everywhere from city rivers to the deep sea. Once in the water, animals from tiny zooplankton to fish can eat them, which could have serious effects on the health of ecosystems.

The material science gap is not only a technical issue. It is also a problem for regulations and consumer protection. Since there is no legal definition of what makes a wipe flushable, companies can use the term even if their products do not meet any real standard. Consumers cannot tell which wipes will break down and which will add to fatbergs and microplastic pollution. This means the market is full of products that make promises they cannot keep.

The Environmental Justice Dimension

The flushable wipes crisis has real environmental impacts. Its costs fall mostly on communities that already face more environmental problems. This is a clear example of environmental injustice, where harm is concentrated on marginalized groups while benefits go to those who are more privileged.

Wastewater treatment plants are often found in low-income neighborhoods and communities of color. Robert Bullard and other environmental justice experts have shown that this is the result of racist land use decisions and political neglect. When these plants face higher costs from wipe blockages, the people living nearby, who often have the fewest resources, end up paying more. Their utility bills go up, maintenance

gets delayed, and when sewers overflow, these communities are the ones most likely to deal with raw sewage.

Detroit offers a clear example. In 2025, a sewer collapse caused by wipes created a sinkhole that shut down a major road and needed emergency repairs. Most of Detroit's residents are Black, and the city has struggled with disinvestment and financial problems for years. Money spent fixing wipe-related issues means less funding for other important needs like schools and public safety. Meanwhile, the companies that make these wipes are based in wealthy suburbs and pay taxes in other places.

Environmental justice also affects the workers who keep these systems running. James Dias explained that his teams spend 40 hours a week clearing clogged pumps, often in tough and unpleasant conditions. They work through hot Texas summers and cold winter nights, handling materials most people would rather avoid. Their work is vital for public health, but it is risky and often goes unnoticed. It is unfair that they have to do this difficult job because of decisions made by companies far away.

There is also the issue of who suffers most from microplastic pollution. Microfibers from wipes have been found throughout the food chain and are now seen as a possible health risk. People who depend on seafood for protein, often low-income communities near the coast, and those living downstream from treatment plants are most at risk. Again, the burden falls on people who did not cause the problem.

The Adaptive Challenge of Reform

If the flushable wipes crisis were only a technical issue, it would have been fixed by now. We already have the technology to make truly flushable wipes, and the cost is not too high. The real barriers are political and economic. This makes it an adaptive challenge.

The treadmill of production helps explain why manufacturers do not want to change. In a competitive market, no company wants to take on extra costs that others avoid. If Kimberly Clark alone switched to more expensive, truly flushable materials, its products would cost more and it would lose customers to cheaper brands. The only way to fix this is with government rules that make all companies follow the same standard. This is the usual answer to collective action problems, and it is what environmental advocates have pushed for over the years.

However, regulation is not just a technical solution. It is also a political fight. The same companies that benefit from the current system have a lot of political influence. They donate to campaigns, hire lobbyists, and support industry groups that oppose new rules. They have blocked federal action for years and weakened state efforts when they could not

stop them. Overcoming this influence will take more political action than we have seen so far.

This adaptive challenge also affects consumers. For years, companies have advertised wipes as convenient, clean, and easy to throw away. They have made flushing wipes seem normal and even responsible. Changing this mindset takes more than just public awareness campaigns. It means people need to rethink how they dispose of things, what convenience means, and how they relate to the systems that support them. This change will take time and ongoing effort.

There is also the challenge of how we govern these issues. The rules that allowed this crisis are outdated and scattered across different agencies. No one agency is clearly in charge, and no single law sets clear standards. Solving this will take more than new laws. We need to rethink how we manage consumer products and their environmental effects, and we need new ways for different groups to work together.

Conclusion: Toward a Truly Flushable Future

The flushable wipes crisis highlights problems in modern capitalism. When companies chase profits and regulations fall short, the most vulnerable people often suffer the most. Technical solutions help, but they cannot solve issues that are rooted in society and politics. Real solutions must include the voices of workers who maintain our infrastructure and the communities most affected.

The thesis of this magazine has been that the flushable wipes crisis is not simply a technical failure or a matter of consumer ignorance. It is a manufactured crisis, one in which a small number of multinational corporations have exploited regulatory loopholes, externalized billions of dollars in environmental and infrastructure costs onto the public, and systematically avoided accountability while marketing products they know will not break down. The evidence for this thesis is overwhelming. From the \$1 billion annual cost to U.S. utilities to the 40 hours per week that Austin Water spends pulling clogged pumps, from the fatbergs choking sewers in Detroit and London to the microfibers accumulating in rivers and oceans, the crisis is real and its costs are substantial.

This analysis uses two main ideas: the treadmill of production and adaptive challenges. The treadmill of production explains that the problem is not just a few bad companies, but a system that encourages shifting costs onto others and discourages responsibility. The adaptive challenge idea shows that fixing the crisis will take more than technical changes. It will require big changes in how we make, regulate, and get rid of consumer products.

Moving forward will take action at many levels. Congress should pass the WIPPES Act to set a clear legal standard for what is flushable and require clear labels on products that are not. States should follow California's example by requiring "Do Not Flush" labels and educating consumers. Local utilities should keep pushing for stronger rules and try new ideas, like making manufacturers help pay for the costs of dealing with their products after use.

Manufacturers must also change. They should stop using ambiguous labels and should invest in genuinely flushable, biodegradable materials. They should disclose the full composition of their products, including chemical additives, and should support research into the environmental fate of those additives. And they should engage meaningfully with the communities and workers who bear the costs of their products, rather than hiding behind polite form letters declining interviews.

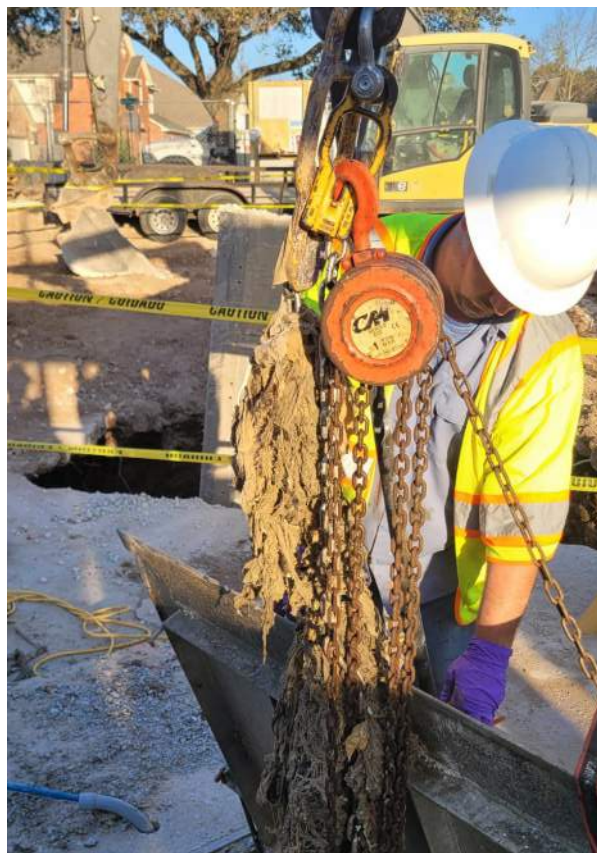
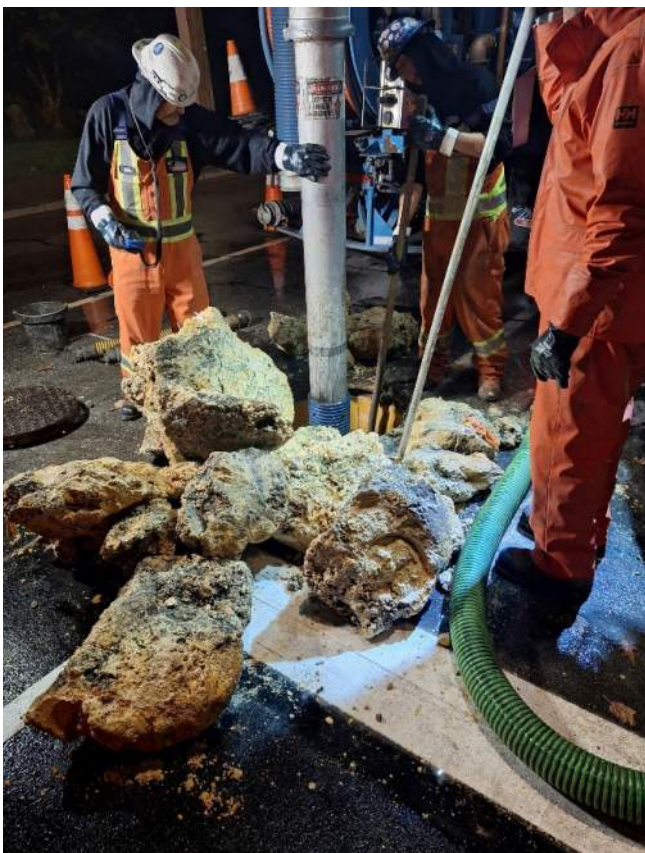
Consumers also play a part. They should question marketing claims and choose products that meet strict, third-party standards. Wipes should go in the trash, not the toilet, no matter what the label says. Consumers should also ask their elected officials to close the loopholes that have let this crisis continue.

The broader contribution of this case study to the environmental justice literature is to show how seemingly mundane consumer products can become vectors of injustice. We tend to think of environmental justice in terms of toxic waste dumps or industrial pollution, the classic cases of overt discrimination. But the flushable wipes crisis shows that injustice can also be built into the ordinary fabric of daily life, into the products we use without thinking and the infrastructure we take for granted. It shows that environmental justice requires attention not just to obvious hazards but to the hidden costs of convenience.

James Dias ended our interview with a simple plea. "I would give them two options," he said of the manufacturers. "One, take 'flushable' off the package. Or two, actually make them degradable." It is a reasonable demand, and it is long overdue. The technology exists. The need is clear. What remains is the political will to make it happen. Until that will materializes, the wipes will keep coming, the pumps will keep clogging, and the taxpayers will keep paying. The only question is how much longer we are willing to let the treadmill run.

Media Gallery Courtesy of Austin Water

Built up wipes debris and crew working to pull wipes



Useful Links from Austin Water

<https://www.fox7austin.com/news/special-report-pre-moistened-wipes-clogging-up-austin-sewers>

<https://www.facebook.com/watch/?v=1420318813134738>

<https://cbsaustin.com/news/local/the-high-cost-of-dealing-with-flushable-wipes-and-how-youre-paying-for-it>

Disney's Cotino Bay:
Water Demand Estimates and the Mirage of Sustainable Desert Development

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ESH 540- Final Capstone Paper
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Abstract

This study examines how water-intensive urban development is justified within environmental planning systems in arid regions where water resources are limited and unevenly distributed. Using the Cotino Storyliving by Disney development in Rancho Mirage, California, as a case study, this research analyzes how projected water demand calculations, regulatory frameworks, and planning language interact to frame large-scale development as sustainable within a groundwater-dependent desert environment. The study employs a mixed-methods approach that combines empirical recalculation of lagoon water demand estimates using regulatory equations from the Model Water Efficient Landscape Ordinance (MWELO), document and regulatory analysis of the project's Environmental Impact Report (EIR) and Water Supply Assessment (WSA), interpretive discourse analysis of planning language, and GIS-based spatial analysis of regional environmental justice conditions.

The quantitative analysis shows that the lagoon water demand estimate presented in the planning record is highly sensitive to methodological assumptions, particularly the selection of evapotranspiration adjustment factors and landscape classification. Recalculations using coefficients consistent with regulatory frameworks produce water demand estimates more than double those presented in the WSA. The discourse analysis further reveals that planning documents use language, classification choices, and selective omission of regulatory equations to frame these calculations as compliant, sufficient, and sustainable on paper. When placed alongside spatial evidence of unequal water vulnerability in the Coachella Valley, these findings demonstrate how technical compliance can coexist with uneven environmental burdens across the region.

Introduction

In arid regions, urban development is increasingly justified through planning systems that transform hydrologic uncertainty into quantifiable certainty in the planning record, producing regulatory compliance and the appearance of sustainability on paper. In California, large development projects must demonstrate that sufficient water supplies exist to support projected growth through technical calculations embedded in planning documents. These calculations, however, can mask uncertainty while shaping development approval.

This problem is especially significant in groundwater-dependent regions that rely on imported water for replenishment, where the risks associated with future water supply are not experienced evenly across communities. The Coachella Valley makes these uneven realities especially visible. In the western valley, affluent cities such as Palm Springs and Rancho Mirage project the image of a desert oasis through luxury resorts, shimmering pools, lush golf courses, and now artificial lagoons. Yet beneath this constructed oasis lies a fragile, finite, and highly managed water system, while just a few miles away communities in the [eastern Coachella Valley](#) continue to face contaminated groundwater, aging infrastructure, and uneven access to safe and reliable water.

This paper uses the approved Cotino Storyliving by Disney development in Rancho Mirage as a case study to examine how water-intensive luxury development is justified in an arid, groundwater-dependent region marked by unequal water realities. This capstone project examines how water demand estimates, planning language, and regulatory frameworks work together to frame development as manageable, compliant, and sustainable on paper, even though the underlying assumptions and uncertainties raise questions about whether they truly are.

Background and Context

The Coachella Valley relies on groundwater as its primary water source, but continued extraction of this finite resource has required active replenishment to stabilize the groundwater basin. [Groundwater](#) is water stored beneath the earth's surface in underground layers of porous soil, sand, gravel, or rock, that make up what is known as a groundwater aquifer. Water accumulates and moves throughout this underground basin and is pumped to the surface through wells. The [Coachella Valley Water District \(CVWD\)](#), the region's primary water supplier, acknowledges that natural precipitation alone is not enough to replenish the groundwater being pumped from the aquifer. As a result, groundwater recharge, the process of restoring water back into the aquifer, relies on imported water supplies from the Colorado River and northern California water supplies from the State Water Project.

This dependence is significant because the Coachella Valley receives [less than 3 inches of rainfall annually](#) and cannot naturally sustain its region's water demands within its own hydrologic system. Local groundwater replenishment is therefore dependent on the long-term reliability of imported supplies, as those same supplies are growing increasingly more uncertain. The broader Colorado River region is already experiencing intensifying climate conditions, including rising temperatures, prolonged drought, and declining flows, which have already [reduced Colorado River allocations](#). Rising temperatures have [reduced Colorado River flows](#) by about 20 percent over the past century, and the United States Geologic Survey (USGS) warns that continued warming is expected to intensify future water shortages. The Bureau of Reclamation's (BOR) [April 2026 update](#) reports Lake Powell's inflow at 40 percent of normal,

revealing the hydrologic uncertainty surrounding a water source relied upon for local groundwater replenishment.

These hydrologic uncertainties are also not experienced evenly across the valley, where luxury development exists alongside deep inequalities in access to clean and reliable water. Cities such as Rancho Mirage are linked to tourism, golf courses, resort landscapes, and other water-intensive forms of development, while many communities in the eastern valley face very different conditions, including contaminated groundwater, aging infrastructure, and uneven access to clean water. These differences reflect long-standing economic and infrastructural disparities across the region, where lower-income communities rely on smaller water systems and face greater environmental burdens. This divide reveals that water in the Coachella Valley is shaped not only by hydrologic constraints, but also by unequal social and infrastructural conditions that influence how development and water risk are experienced across the region. It is within this broader regional context of groundwater dependence and uneven water realities that the Cotino Storyliving by Disney development was approved in Rancho Mirage.

Case Study: Cotino Storyliving by Disney

Cotino Storyliving by Disney (Cotino) serves as the central case study for this project because it brings together many of the planning and water management issues examined in this research. Located in Rancho Mirage within the Section 31 Specific Plan area, the project represents a highly visible form of luxury desert development within a region characterized by aridity, groundwater dependence, and increasing pressure on long-term water reliability.

The Cotino Storyliving by Disney development is a proposed luxury master-planned community located in Rancho Mirage in the western Coachella Valley. The project is part of Disney's Storyliving by Disney initiative, where "new home communities are infused with the imagination of Walt Disney Imagineers and managed by Disney Cast members with the simple notion of bringing people together" ([Storyliving by Disney, n.d.](#)).



Figure 1: An artist concept rendering of Cotino Bay illustrating the advertised recreational amenities of the proposed lagoon.

Source: [Los Angeles Times](#)

This large-scale residential and resort-oriented development is said to include 1,932 mixed-density residential units, a 15,000-square-foot residential clubhouse, 400 luxury resort hotel rooms, and up to 350,000 square feet of mixed-use space ([City of Rancho Mirage, 2019](#)). The development is centered around Cotino Bay, a 24-acre man-made lagoon developed by Crystal Lagoons that functions as a defining feature of the community's design, advertising its [recreational amenities](#) such as swimming, paddle boarding, and kayaking. Marketed as a place "where the beach lifestyle meets desert living, and the Disney touch is at the heart of it all," the project presents the lagoon as central to its identity" ([Story Living by Disney, n.d.](#)).



Figure 2: Cotino lagoon during construction, December 2, 2025
Source: Crystal Lagoons

The project was approved through the City of Rancho Mirage's Section 31 Specific Plan, supported by an Environmental Impact Report (EIR) and Water Supply Assessment (WSA) prepared to evaluate the project's projected water demand. Under California law, large development projects must demonstrate that sufficient water supplies are available to meet future demand, and these assessments rely on technical calculations that estimate water use based on land use, landscaping, and population assumptions. Within this planning framework, the estimated water demand for Cotino was determined to be compliant under state regulations.

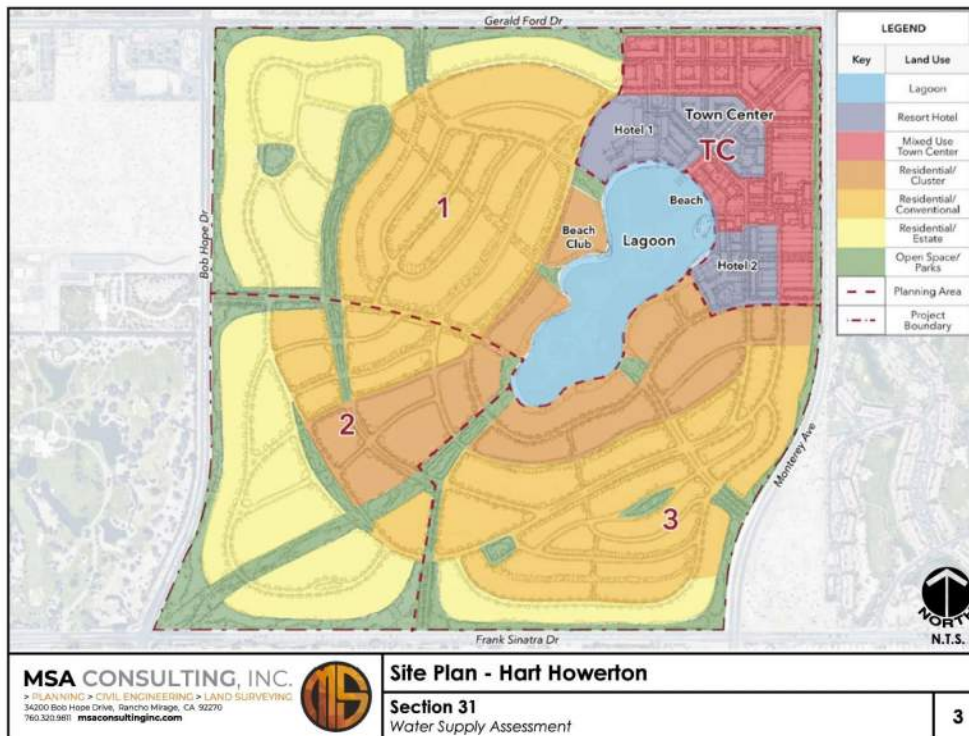


Figure 3: Cotino Site Plan map
Source: Section 31 Specific Plan Water Supply Assessment

Due to its scale and corresponding water demand, the lagoon is a focal point within Cotino's planning record, providing a useful entry point for this capstone case study to examine how water demand is evaluated within the environmental review process. It provides a clear example of how water demand projections, environmental review documents, and regulatory compliance frameworks are used to evaluate large-scale development in an arid region.

Problem Statement and Research Question

This study addresses the problem that planning approval for large-scale development in arid regions can rely heavily on projected water demand estimates and regulatory calculations that present future water use as quantifiable, manageable, and sufficient. In projects such as Cotino, these calculations are shaped by coefficient choices, embedded assumptions, and planning language that can make water-intensive development appear compliant and sustainable on paper while obscuring hydrologic uncertainty, uneven water realities, and broader questions of environmental justice. Using the approved Cotino Storyliving by Disney development in Rancho Mirage as a case study, this project examines how quantitative water demand estimates and the planning record work together to justify development in a groundwater-dependent desert region.

This study asks: How do quantitative water demand estimates, planning language, and regulatory frameworks work together in the Cotino case to construct the appearance of compliance and sustainability in the approval of water-intensive development?

Policy and Regulatory Framework Governing Water for Urban Development

Water supply determinations for large-scale urban development in California are shaped by several overlapping planning and regulatory frameworks. The most relevant to this study are the California Environmental Quality Act (CEQA), Environmental Impact Reports (EIR), Water Supply Assessments (WSAs) under Senate Bill 610, Water Supply Verifications (WSVs) under Senate Bill 221, Urban Water Management Plans (UWMPs), and the Sustainable Groundwater Management Act (SGMA). Together, these frameworks provide the institutional structure through which water demand, supply availability, and environmental impacts are evaluated during the planning process.

For the Cotino project, CEQA and the EIR provide the primary framework for project-level environmental review, while the WSA serves as the main document used to assess projected water demand. The WSA in turn draws from broader planning documents such as the UWMP, while SGMA establishes basin-level groundwater sustainability goals that form part of the wider regulatory context for water management in the Coachella Valley. Table 1 below summarizes the major regulatory frameworks relevant to this study.

Table 1			
<i>Regulatory and Planning Frameworks Governing Water Supply for Urban Development in California</i>			
Framework	Legal Authority	Purpose	Role in Development Planning
California Environmental Quality Act (CEQA)	California Public Resources Code §21000 et seq.	Requires environmental review of projects with potential environmental impacts.	Establishes the Environmental Impact Report (EIR) process used to evaluate environmental impacts of proposed development.
Environmental Impact Report (EIR)	CEQA Guidelines (Cal. Code Regs., tit. 14)	Provides technical analysis of environmental impacts and identifies mitigation measures.	Serves as the primary project-level document used to evaluate environmental impacts, including water demand and supply reliability.
Water Supply Assessment (WSA)	Senate Bill 610 (Water Code §10910–10915)	Evaluates whether sufficient water supplies are available to meet projected demand for large developments.	Prepared by the local water supplier and incorporated into the CEQA review to assess water supply availability for the project.
Water Supply Verification (WSV)	Senate Bill 221 (Water Code §66473.7)	Verifies long-term water supply availability for certain residential subdivisions.	Ensures that subdivisions have adequate water supplies before final approval.
Urban Water Management Plan (UWMP)	Urban Water Management Planning Act (Water Code §10610 et seq.)	Long-term planning document prepared by water suppliers every five years projecting water supply and demand conditions.	Provides the baseline projections and assumptions often used in WSAs to evaluate water supply reliability.
Sustainable Groundwater Management Act (SGMA)	Water Code §10720 et seq.	Requires groundwater basins to achieve long-term sustainability through Groundwater Sustainability Plans (GSPs).	Establishes basin-level groundwater sustainability goals that form the broader regulatory context for groundwater management.

Literature Review

Authority of Numbers in Environmental Planning

Existing research shows that quantitative information often carries significant authority in planning and policy decisions because numbers are widely perceived as rational, objective, and fair. [Jørgensen and Sørensen \(2025\)](#) explain that the processes through which numbers are produced are frequently opaque to the public, leaving citizens with limited ability to evaluate the assumptions, exclusions, and methodological choices that shape quantitative results. The technical expertise required to verify calculations allows projections and estimates to appear

neutral and objective even though they are shaped by specific analytical methods and institutional assumptions.

In environmental planning, projections of future supply, demand, and environmental impact frequently become the basis for determining whether development is acceptable. In this context, numbers do more than describe conditions. They help define what is considered sufficient, reliable, and manageable within regulatory and planning frameworks. This literature provides an important foundation for this capstone study because it helps explain how water demand projections gain authority within the Cotino planning record.

Policy Language and the Interpretation of Technical Findings

Interpretive policy analysis demonstrates that technical findings are never communicated outside of language. Their meaning is shaped through discourse, framing, and narrative, which influence how regulatory frameworks are defined and how acceptable solutions are constructed. [Van Hulst and colleagues](#) identify discourse analysis, framing analysis, and narrative analysis as key interpretive approaches for understanding how policy meaning is produced.

This insight is particularly relevant in environmental review, where regulatory documents rely heavily on terms that appear technical and neutral but carry interpretive force. Words such as *sufficiency*, *significance*, *mitigation*, *compliance*, and *sustainability* do more than describe conditions. They translate technical calculations into administrative conclusions about whether a project is acceptable.

Technocratic Planning and the Narrowing of Environmental Problems

The literature on technocratic planning raises a related concern when challenging environmental and social issues are often narrowed into complex, technical problems that can be managed through expert knowledge, modeling, and administrative procedure. In climate planning, [Buylova et al.](#) (2024) find that long-term climate strategies are dominated by technical terminology and scenario-based planning, often sidelining discussion of political conflict, governance responsibilities, and the institutional challenges of implementation. [Kehler and Birchall](#) similarly argue that technocratic approaches can weaken planning policy by prioritizing hard metrics and quantifiable indicators over the social vulnerability that is much harder to capture on paper. Together, this research suggests that technocratic planning can make governance appear rational and objective while sidelining the broader inequalities that shape who is exposed to risk and who benefits from development.

This literature is relevant to water planning because projected supply and demand models can create the impression that uncertainty is being sustainably managed. When environmental problems are translated into technical metrics and modeled scenarios, broader questions of dependency, power, and regional burden can become hidden into the background. The issue is not necessarily that the analysis is inaccurate, but that it can reflect a narrower form of reasoning in which regulatory adequacy stands in for deeper questions of sustainability and justice. For this capstone case study, technocratic planning provides a useful lens for evaluating whether the Cotino project is justified through technical calculations alone, or whether the

planning framework itself is too narrow to capture the broader hydrosocial realities on which that appearance of sufficiency depends.

Environmental Justice and the Limits of Procedural Compliance

Environmental justice scholarship provides an important counterpoint to technocratic planning by demonstrating that procedural compliance does not necessarily produce equitable outcomes. [Ulibarri et al.](#), drawing on interviews with practitioners involved in National Environmental Policy Act (NEPA) processes, found that institutional barriers continue to limit how procedural, distributive, and recognition justice are incorporated into Environmental Impact Statements. These findings challenge the assumption that projects are equitable simply because they have undergone legally required environmental review. A project may satisfy technical thresholds, include a water supply assessment, and disclose mitigation measures while leaving broader patterns of unequal burden unchanged.

Environmental justice scholarship therefore asks a different set of questions: whose conditions are visible in the planning record, whose vulnerabilities remain outside the formal scope of analysis, and whether the criteria used to evaluate significance are capable of capturing uneven lived realities. These concerns are particularly relevant in the Coachella Valley, where highly visible water abundance in western resort landscapes exists alongside more precarious water conditions for domestic well users and environmentally burdened communities. Building on this scholarship, the present study examines whether project-level determinations of water sufficiency obscure broader regional dependencies, uneven exposure to risk, and unequal distributions of environmental benefit and burden.

Water Inequality in the Coachella Valley

Research on water inequality in the Coachella Valley demonstrates that regional water conditions are unevenly distributed across the valley's social and environmental landscape. A UC Davis research team from the UC Davis Center for Regional Change compiled county-wide data into a Cumulative Environmental Hazards Index (CEHI) and a Social Vulnerability Index (SVI), which were combined to produce a Cumulative Environmental Vulnerability Assessment (CEVA). Mapping these indicators at the census tract level revealed that residents in the Eastern Coachella Valley experience significantly higher levels of overlapping environmental hazards and social vulnerability than those in the Western Coachella Valley and the county as a whole ([London et al., 2013](#)). The study also found that drinking water wells in the eastern valley frequently contained chemical concentrations exceeding state and federal Maximum Contaminant Levels for arsenic, chromium-6, perchlorate, and nitrates. These findings highlight the broader regional context in which water planning decisions occur. Rather than representing a uniform hydrologic landscape, water conditions in the Coachella Valley reflect uneven patterns of environmental risk and infrastructure access.

Jessica Bremner's dissertation, [Thirsty by Design](#), provides further insight into how these inequalities were historically produced. Bremner frames the divide between the eastern and western Coachella Valley as a form of spatial inequality shaped by land tenure patterns, water infrastructure development, and regional governance structures. She argues that historical development patterns created uneven access to water between urban centers and peripheral communities, while contemporary land-use and water district policies continue to reinforce these disparities by expanding infrastructure for luxury development while leaving other communities with more precarious water conditions.

Together, this literature shows that large-scale development in the Coachella Valley is being evaluated within a hydrologic landscape where water security and environmental risk are unevenly distributed. This perspective is important for the present study because it demonstrates that water planning cannot be understood solely through aggregate supply and demand projections. It must also be examined through the geography of water access, the institutional structures that shape allocation decisions, and the uneven distribution of environmental benefits and burdens across the region.

Empirical Modeling and the Limits of Quantitative Water Demand Projections

Empirical modeling plays a central role in California's water planning framework, yet growing research suggests that projected water demand estimates often diverge from observed water use patterns. In a comparative analysis of 39 Urban Water Management Plans (UWMPs) prepared by ten of California's largest urban water suppliers, serving roughly one-quarter of the state's population in 2015, [Abraham et al. \(2020\)](#) found that 98 percent of projections overestimated future water demand. In many cases, projected demand increased substantially while actual water use declined, revealing a significant gap between modeled projections and observed water use. Similar findings emerge from [Capone and Marston's \(2025\)](#) analysis of water demand projections from 61 California water suppliers between 2000 and 2020. Their study found that five-year projections overestimated demand by approximately 25 percent, while twenty-year forecasts overestimated demand by roughly 74 percent. The authors attribute much of this discrepancy to assumptions embedded in per-capita demand projections, which often fail to account for shifts in water use behavior, including conservation during drought, efficiency improvements from rebate programs, and broader changes in public awareness of water scarcity.

These studies highlight a persistent challenge in water planning: quantitative projections often struggle to capture the social, behavioral, and institutional factors that influence real-world water use. Despite these limitations, modeled demand projections continue to play a central role in land-use planning and environmental review processes, where projected water supply and demand estimates are used to determine project feasibility.

Literature Gap and Contribution of the Present Study

The literature examined for this case study shows that environmental planning is not shaped by technical analysis alone, but also by the way numbers are used to support decisions, how policy language justifies project compliance, and how environmental justice concerns can be disregarded within highly technical planning processes.

What remains less developed, however, is how these strands come together in project-level water planning for luxury development in arid regions. Existing literature explains how environmental review works, how interpretive policy analysis can reveal the power of language, and how justice concerns can remain marginalized within formal planning. Yet there is still a gap in understanding how quantitative water demand projections, sufficiency findings, and mitigation language operate together within a specific planning record to legitimize development in the Coachella Valley, a groundwater-dependent desert region marked by uneven water realities. This study addresses that gap through the Cotino case by examining not only the

project's quantitative assumptions, but also how those assumptions are framed as sufficient, mitigated, and environmentally acceptable within the planning process. In doing so, it challenges the assumption that modeled compliance on paper is translated into sustainability on the ground.

Methodology

This study uses a mixed-methods approach to examine how water demand is both calculated and justified in the Cotino project record. The quantitative portion is grounded in a post-positivist perspective, which treats water demand estimates as empirical claims that can be reconstructed, tested, and evaluated, while recognizing that those estimates are shaped by assumptions, coefficients, and methodological choices rather than existing as fully neutral data. The qualitative portion is grounded in an interpretivist perspective, which treats the Environmental Impact Report (EIR), Water Supply Assessment (WSA), and related project documents as institutional texts that do not simply report technical information, but also shape how water demand, compliance, and project approval are understood through language, framing, and procedural logic. This makes it possible to analyze how terms such as “sufficient” and findings framed as “less than significant” help turn uncertainty into administrative conclusions of compliance and sufficiency. My study is further informed by a critical environmental justice framework, which situates these findings within the broader social, environmental, and political context of the Coachella Valley, where groundwater dependence and uneven environmental burdens shape the larger consequences of water planning. Together, this methodological framework allows me to examine both the technical production of water demand estimates and the institutional processes through which those estimates become the basis for water-intensive project approval.

Methodological Framework

1. Quantitative recalculation and analysis of water demand estimates
2. Discourse and interpretive analysis of regulatory frameworks and project record
3. Polyvocal and GIS analysis of uneven water realities

First, this study applies quantitative recalculation and analysis to evaluate the water demand estimates presented in the Water Supply Assessment (WSA). Using the regulatory framework established under the Coachella Valley Water District's Landscape Ordinance No. 1302.4 and California's Model Water Efficient Landscape Ordinance (MWELO), including the Maximum Applied Water Allowance (MAWA) and Estimated Total Water Use (ETWU) equations, the lagoon water demand estimates presented in the project record were recalculated under alternative coefficient scenarios. With the results from my recalculations, I am able to assess whether the calculations presented in the WSA reflect the regulatory framework they claim to follow and evaluate how changes in evapotranspiration adjustment factors and landscape classification influence projected water demand.

Second, this study uses discourse and interpretive analysis to examine how regulatory frameworks and project documents construct the justification for project approval. The EIR, WSA, and related regulatory materials are treated not only as technical reports, but as institutional texts that shape how water demand, regulatory compliance, and environmental impacts are evaluated within the approval process. This analysis examines how regulatory thresholds, coefficient choices, landscape classifications, and omissions within the project

record influence the presentation of water demand estimates, while also considering how terms such as sufficiency, mitigation, compliance, and significance frame projected water demand as manageable and acceptable within the administrative logic of environmental review.

Third, this capstone incorporates polyvocal and Geographic Information Systems (GIS) analysis to situate Cotino within the broader hydrosocial and environmental justice context of water management in the Coachella Valley. GIS-based spatial analysis is used to examine the uneven distribution of vulnerability across the region, highlighting the areas of greater groundwater contamination and environmental burdens. This spatial analysis is considered alongside polyvocal elements and comparison to another large-scale luxury development project to show how water planning decisions that appear technically compliant within project documents and regulatory frameworks can coexist with uneven regional water realities.

Results and Discussion

Quantitative Analysis of Outdoor Water Demand Calculations

The quantitative analysis begins with a close examination of the outdoor water demand estimates presented in the Cotino planning record. The first inconsistency appears in [Table 2.0-3. Outdoor Water Demand](#), within the Water Supply Assessment (WSA) of the final EIR for the Section 31 Specific Plan. The table identifies a 33.96-acre “man-made lake” with an estimated annual water demand of 105.57 acre-feet per year (AFY). However, the project ultimately finalized the lagoon design at 24 acres, meaning the outdoor water demand estimate presented in the WSA relies on an earlier design footprint rather than the final approved configuration. Because surface area is a direct variable in the equation used to estimate outdoor water demand, any change in area directly affects the projected water demand for the project. This discrepancy raised questions about the reliability of the demand estimate and prompted a closer examination of the methodology used in the WSA.

The WSA states that outdoor water demand was calculated using the Maximum Applied Water Allowance (MAWA) framework consistent with the Model Water Efficient Landscape Ordinance (MWELO) and the Coachella Valley Water District (CVWD) Landscape Ordinance. Under this framework, MAWA establishes the allowable landscape water budget according to the following equation:

$$\text{MAWA} = (\text{ETo})(0.62)[(\text{ETAF} \times \text{LA}) + (1.0 \times \text{SLA})] \text{ where}$$

ETo represents reference evapotranspiration

ETAF is the evapotranspiration adjustment factor

LA represents landscaped area

SLA represents Special Landscape Areas such as recreational features or other landscape elements with unique water requirements.

State regulation guidelines under MWELO establish different ETAF limits depending on landscape type:

- 0.55 for residential landscapes
- 0.45 for non-residential landscapes
- 1.0 for Special Landscape Areas (SLA)

Due to the fact that these coefficients represent different categories of water demand, the regulatory framework requires that landscape types be evaluated separately when estimating allowable water use. Table 4 below recreates the outdoor water demand table from the WSA to include the corrected ETA coefficient with the adjusted total outdoor water demand.

Table 2

Adjusted outdoor water demand based on the appropriate ETAW coefficients

Land Use	Total Outdoor Acreage (AC)	Original Coefficient	Revised Coefficient	Original WSA AFY	Revised MAWA AFY	Change in AFY
Hotel - Rooms	16	0.45	0.45	29.73	29.73	0
Hotel - Commercial use	16	0.45	0.45	29.73	29.73	0
Residential - Beach Club	3.5	0.45	0.55	6.5	7.94	1.44
Beach + Edge	6.24	0.45	0.45	5.8	5.8	0
Multi-Use Lake	33.96	0.45	1	105.57	234.6	129.03
Streets / ROW	131.44	0.45	0.45	122.11	122.11	0
Open Space - Parks/Paseos/Perimeter	94.6	0.45	0.45	264.66	264.66	0
Branded Residential	28	0.45	0.55	39.17	47.88	8.7
Mixed-Use Residential	28	0.45	0.55	39.17	47.88	8.7
Residential - Stacked View Units	12.8	0.45	0.55	25.86	31.61	5.75
Residential - Small Lot SFD (Cluster)	16.67	0.45	0.55	33.68	41.16	7.48
Residential - Conventional SFD	36.85	0.45	0.55	74.46	91.01	16.55
Residential - Large Lot SFT	49.59	0.45	0.55	100.2	122.47	22.27
Residential - Estate Lot SFD	60.61	0.45	0.55	122.47	149.69	27.22
Residential - Custom Lot SFD	40.98	0.45	0.55	82.8	101.2	18.4
Restaurants	12.33	0.45	0.45	22.91	22.91	0
Mixed-Use	12.33	0.45	0.45	15.33	15.33	0
Neighborhood Commercial	18.5	0.45	0.45	23	23	0
TOTAL				1143.15	1388.69	245.54

The rows highlighted in red identify the portions of the outdoor demand table where the ETAF coefficient required correction, illustrating how a small number of coefficient changes materially alters the project's total outdoor water demand estimate.

Despite citing this framework, the WSA does not present the MAWA equation, nor does it show the calculations used to generate the outdoor water demand estimates. Instead, the outdoor demand table applies a single ETAF value of 0.45 across all landscape categories, including residential landscapes and the lagoon feature. Applying a single coefficient across multiple landscape types effectively treats residential landscapes as non-residential and does not distinguish Special Landscape Areas (SLA) from regular landscaping, even though the regulatory framework explicitly requires separate treatment for these categories.

This issue becomes particularly significant for the lagoon feature included in the project. The WSA treats the lagoon as a standard landscaped area under the 0.45 non-residential landscaping coefficient, rather than applying the 1.0 SLA coefficient required. Table 2 below presents the results of recalculating the lagoon water demand estimate under alternative scenarios to illustrate the sensitivity of the lagoon water demand based on the three different landscape coefficients listed in the state regulatory framework. Only the Special Landscape Area scenario is the accurate classification and coefficient for a water feature under the state framework the WSA claims to follow yet fails to do so given the coefficient inconsistency.

Table 3*Sensitivity of Lagoon Water Demand to Coefficient Selection*

Scenario	Landscape Classification	Coefficient Used	Estimated Water Demand (AFY)	Percent Increase
WSA estimate	Non-residential landscaping	0.45	105.57	—
Residential scenario	Residential landscaping	0.55	129	22%
Special Landscape Area scenario	SLA classification	1	236	124%

Recalculating the lagoon water demand under alternative landscape classifications demonstrates that coefficient selection materially affects projected water demand estimates. If the lagoon is treated as residential landscaping, estimated demand increases by approximately 22 percent relative to the WSA estimate. When the lagoon is treated as a Special Landscape Area, consistent with the state regulatory structure, estimated demand increases by more than 100 percent, more than doubling the value presented in the WSA.

Interpretation of Quantitative Findings

These results show that projected water demand in the Cotino planning record is highly sensitive to the methodological assumptions embedded in the regulatory calculation. A single modeling choice- the selection of the evapotranspiration adjustment factor- changes the lagoon demand estimate by more than a factor of two. This finding demonstrates that the water demand estimate presented in the WSA is not a fixed hydrologic reality, but the product of specific methodological decisions decided upon by CVWD, the water agency responsible for generating the WSA.

From the epistemological perspective guiding this study, quantitative planning metrics are not treated as neutral representations of environmental conditions. Instead, they are understood as technical constructions shaped by coefficients, model structure, and regulatory assumptions. The lagoon calculation illustrates this dynamic clearly. This result also reflects a broader dynamic in technocratic environmental governance in which quantitative metrics help define what counts as acceptable environmental impact. Once a particular set of modeling assumptions becomes embedded in the planning record, the resulting numbers acquire regulatory authority. In the Cotino case, the lagoon demand estimate functions not simply as a measurement of water use, but as a numerical boundary that helps frame the project as compliant within existing planning thresholds.

Table 4
Compliance outcome based on coefficient choice

Compliance Outcome Based on Coefficient Choice								
Scenario	Residential Coefficient	Lagoon Coefficient	Non-Residential Coefficient	Total Outdoor Demand (AFY)	Total Project Demand (AFY)	MWELo Compliance	CVWD 80% Rule Compliance	Overall Approval Status
Original WSA with .45 non-residential ETWA applied for all land use elements in original outdoor water demand table	0.45	0.45	0.45	1143.15	1532.05	No	Yes	No
Residential ETAW Corrected with Lagoon Still at 0.45	0.55	0.45	0.45	1260.27	1649.17	No	No	No
Residential 0.55 with Lagoon 1.0 (SLA)	0.55	1.00	0.45	1389.27	1778.17	Yes	No	No

* Green across the coefficient and compliance columns would indicate a water demand estimate that aligns with both the MWELo framework and CVWD's 80% rule. None of the tested scenarios satisfy both standards at the same time.

Table 3 above illustrates the compliance outcome based on the coefficient selection. Taken together, these findings indicate that the quantitative analysis presented in the WSA does not fully reflect the structure of the regulatory framework it cites. Although the document repeatedly states that the project complies with MAWA and the CVWD Landscape Ordinance, the calculations necessary to demonstrate that compliance are either missing or inconsistent with the regulatory structure required by MWELo.

Summary of Quantitative Findings

The quantitative analysis identifies several inconsistencies between the regulatory framework cited in the WSA and the methodology used to estimate outdoor water demand:

1. The WSA does not present the MAWA equation or the calculations used to generate the outdoor water demand estimate.
2. The outdoor water demand table applies a single ETAF value of 0.45 across all landscape areas despite identifying residential and non-residential categories.
3. The lagoon feature is not treated as a Special Landscape Area even though its water demand characteristics differ from irrigated landscaping.
4. Alternative coefficient assumptions produce substantially higher water demand estimates.

Discourse and Interpretive Analysis

The discourse analysis in this study examined how the WSA and related planning documents did more than estimate water demand. They framed the project's water use in ways that made it appear controlled, compliant, and environmentally acceptable on paper. Rather than treating these documents as neutral technical records, this analysis reads them as administrative texts that use language, classification, omission, and table structure to stabilize a particular version of

reality in which a large artificial man made lake could be represented as sustainable within an existing conservation framework. Residential water demand was not a focal point of this case study, but residential landscaping became relevant once it became clear that the coefficient used in the outdoor water demand calculations differed from the coefficient that would apply to residential landscaping under the same regulatory framework. That realization further exposed how the WSA's language, omissions, and table structure worked together to hide key classification differences and fold a large artificial lagoon into a landscape logic that kept the projected water demand low enough to remain within the compliance threshold.

For the discourse analysis, direct examples of words, phrases, and document features from the planning record were extracted and interpreted to show how selective language, direct omission, and the structure in which it was presented, worked together to produce a water demand narrative that could appear as compliant regardless of whether compliance thresholds reflected accuracy.

Table 5
Discourse analysis element and its interpretive significance

Quoted word, phrase, or structural element	Interpretive significance
"Although the landscape design is unknown, this method ensures that a sufficient budget is provided to have a sustainable landscape that meets the criteria established in CVWD's Landscape Ordinance"	Acknowledges uncertainty, then immediately neutralizes it through assurance language. The statement presents the method as capable of producing a "sufficient" and "sustainable" outcome even without a known landscape design, shifting attention away from the limits of the estimate and toward the appearance of adequacy and compliance.
"sustainable landscape"	Equates a modeled regulatory outcome with sustainability, deeming paper compliance as sustainable.
"assures compliance"	Uses certainty-based language to frame the calculation as already compliant and technically trustworthy, rather than open to scrutiny.
Repeated reference to "CVWD's Landscape Ordinance No. 1302.4"	Uses institutional authority from the ordinance to make the calculation appear technically grounded and administratively credible.
"which meets the water conservation goals of the California Department of Water Resources (DWR) Model Water Efficient Landscape Ordinance (MWELO)"	Invokes state-level authority to legitimize the local framework, encouraging the reader to assume the method is correct without showing whether it was truly compliant with state regulation.
"the following formula is used to calculate MAWA"	Invokes the authority of a formal equation, yet the formula is not actually provided in the WSA or EIR, creating the appearance of rigor without full transparency.
The MAWA equation is never provided in the WSA or EIR	Obscures the basis of the calculation by withholding the equation from the planning record itself and forcing the reader to reconstruct the method elsewhere, making independent verification more difficult.

“a plant factor to irrigation ratio of 0.45, otherwise known as an Evapotranspiration Adjustment Factor (ETAF)”	Names the 0.45 value but does not explain its regulatory meaning, presenting it as a neutral technical input rather than a classification choice tied to non-residential landscape areas.
“To meet the ETAF of 0.45, a landscape design must use highly water efficient plant materials and efficient irrigation technology, to include drip emitters and smart controllers”	Reveals that 0.45 is tied to a planted, irrigated landscape environment, not an open-water lagoon. This exposes a mismatch between the coefficient’s regulatory application and the physical character of the lagoon.
The 33.96-acre lagoon is embedded within the WSA’s outdoor water demand table rather than being broken out into its own category for open water	Normalizes the lagoon as routine outdoor demand rather than identifying it as a distinct open-water feature with different evaporation behavior, reducing the visibility of the lagoon as a water-intensive feature.
The outdoor water demand table repeatedly uses residential framing. “Residential” appears in 7 of the 11 category headers in the outdoor water demand table.	The table’s language guides the reader toward a residential understanding of the categories, even though the lagoon demand is governed by a non-residential coefficient, making the contradiction harder to ignore.
Indoor demand calculations differentiate between residential and non-residential uses	Shows that the planning record was fully capable of distinguishing categories when it chose to, making the flattening of the lagoon into generalized outdoor demand more significant.
The 0.45 coefficient is used for the lagoon demand and residential landscaping demand	Helps keep the projected demand lower and within the compliance threshold under the MAWA framework.
Outdoor demand calculations do not differentiate the lagoon as open water	Suggests that classificatory specificity was selectively applied, with important consequences for how the lagoon’s demand was represented.
The ETWU equation is not shown	Omits the part of the framework needed to evaluate whether estimated use would actually remain below MAWA, limiting the reader’s ability to assess compliance.
The planning record foregrounds MAWA but omits $ETWU < MAWA$	Highlights the side of the framework that produces a compliant-looking number while obscuring the side that would expose noncompliance. A .45 ETAF would result in non-compliance when ETWU requirement is entered into the planning document.
“The MAWA complies with Division 2, Title 23, California Code of Regulation, Chapter 7, Section 702.”	Invokes formal legal authority to legitimize the calculation, even though the cited regulatory language reflects an older framework. Its inclusion helps present the method as legally grounded and settled, which can discourage scrutiny of whether the ordinance or its application was current, complete, or appropriate for the lagoon calculation.

“This estimation includes indoor and outdoor use for the Residential and Non-Residential areas”	Presents the estimate as covering both residential and non-residential uses comprehensively, even though the outdoor demand section clearly does not apply that same differentiation and instead obscures the lagoon within a generalized landscape category and applies a lower .45 non-residential ETAF coefficient to MAWA equation for residential outdoor demand .

Taken together, an analysis of these examples show that the WSA did not simply describe water demand, but actively constructed a compliant narrative around it through selective language, selective omissions, selective classification classification, and a selective table structured to to invoke compliance without fully disclosing the governing equations, leaving the meaning of the ETAF coefficient undefined, embedding the lagoon within a generalized landscape framework. What emerges is that the issue was not just the math itself, but the way the document quietly inserted the lagoon data into a broader water demand table, and methodologically used the .45 non-residential ETAF coefficient to make the project’s water demand look sufficient, compliant, and acceptable on paper.

Omission of ETWU from the Compliance Framework

A key element of the state landscape water budget framework is the relationship between MAWA and ETWU. Under the Model Water Efficient Landscape Ordinance (MWELO), ETWU represents estimated landscape water demand and must remain below MAWA for compliance. Although the Water Supply Assessment states that the project’s landscape calculations adhere to both local and state requirements, it presents only the MAWA-based demand figure and never shows or evaluates ETWU.

That omission is significant because, under the framework the WSA invokes, compliance is not established by MAWA alone. It requires demonstrating that ETWU does not exceed MAWA. By presenting only the side of the framework that produces a compliant-looking number, the document limits the reader’s ability to evaluate whether the lagoon’s classification is internally consistent with the full regulatory structure it claims to follow. In doing so, it preserves the appearance of compliance while leaving out the part of the framework that could call that appearance into question.

Taken together, these discourse patterns show that the WSA was not simply reporting water demand, but constructing a compliant narrative around it. Through assurance language, invoked yet undisclosed methodology, omission of the ETWU framework, undefined use of the 0.45 coefficient, burial of the lagoon within a generalized outdoor demand table, and repeated appeals to institutional authority, the planning record transformed a questionable classification into a technical fact that appeared acceptable on paper. Neither the table, the language, nor the coefficient was neutral.

An important question remains: why did the water agency apply a coefficient that produces a

demand estimate inconsistent with the state requirement that ETWU must not exceed MAWA? The following table shows what the result would be if the lagoon were correctly classified as a Special Landscape Area rather than placed within a table that applies the lowest coefficient and minimizes the estimated outdoor demand.

Table 6
Compliance outcome based on coefficient choice

Lagoon Scenario	MAWA Coefficient (ETAF)	MAWA (AFY)	ETWU (AFY)	ETWU ≤ MAWA?	Compliant under MWELO State Regulation
Non-Residential Landscape as used in WSA	0.45	105.68	234.85	No	No
Special Landscape Area requirement based on MWELO framework	1	234.85	234.85	Yes	Yes

Table 6 raises a more important issue than whether the lagoon could be made to appear compliant. If the lagoon had been correctly classified as a Special Landscape Area, the project could still have demonstrated compliance with the $ETWU \leq MAWA$ requirement. On the one hand, this would have provided greater transparency by showing the full regulatory comparison the WSA claimed to follow. On the other hand, doing so would have required using the appropriate outdoor coefficients, including 0.55 for residential landscape areas and 1.0 for the lagoon as a Special Landscape Area, which would have produced a substantially higher outdoor water demand estimate. The use of the 0.45 coefficient, combined with the omission of the ETWU compliance test, therefore did more than alter a calculation. It enabled the WSA to present the lowest possible outdoor demand number while avoiding the very comparison that would have revealed how consequential the coefficient choice actually was.

Mitigation as “Less Than Significant”

The same discourse pattern extends beyond the WSA and into the broader EIR framework, where it becomes especially visible in the relationship between significance and mitigation. Under CEQA, agencies are required to disclose significant environmental effects and identify mitigation where feasible, but in practice the planning record often turns on whether those impacts can be reduced to a “less than significant” level. The importance of that phrase is not only technical, but interpretive. It translates modeled conditions, mitigation commitments, and management assumptions into an administrative judgment of acceptability.

In the Cotino case, this logic is clear in the groundwater significance threshold, which asks whether the project would “substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin.” That wording already narrows the question by shifting attention away from whether the project adds pressure to groundwater at all and toward whether that pressure rises to the level of “substantial” interference. The mitigation language deepens

this framing by stating that “The Project Applicant shall pay groundwater replenishment fees to CVWD to offset the Grand Oasis lagoon private well water usage.” In this formulation, groundwater impact is treated not primarily as a physical hydrologic burden, but as something that can be balanced through an accounting mechanism of fees, replenishment, and institutional management.

The planning record does not conclude that the project is acceptable because no water impact exists. It concludes that the impact is acceptable because it is considered manageable within a mitigation-and-replenishment framework. A finding of “less than significant” therefore does not necessarily mean that the demand is environmentally minor. It may instead mean that the regulatory system has accepted a method for offsetting, accounting for, or administratively absorbing that demand. In this case, the language of mitigation helps shift the narrative from one of extraction and uncertainty to one of managed balance and institutional control.

That shift is especially important in a region where groundwater reliability depends on imported recharge and surface water deliveries that are not guaranteed. By framing the lagoon’s water demand as offsettable through replenishment fees, the planning record presents a physically uncertain groundwater burden as administratively manageable on paper. In discourse terms, this language functions as a steering mechanism. It directs attention toward the existence of institutional responses rather than toward the deeper question of whether those responses amount to substantive sustainability in an arid region already dependent on complex and uncertain external supplies. This is what makes mitigation language so powerful in the planning record. It does not erase impact, but it helps convert impact into a form of acceptability that can support approval.

Illusion of “Substantially Less” versus the Reality

The phrase “substantially less” performs important rhetorical work in the Environmental Impact Report. By emphasizing the difference between the project’s estimated demand of 1,532.05 acre-feet per year (AFY) and the 1,923 AFY threshold, the document creates an immediate impression of comfortable compliance that discourages closer scrutiny of the underlying calculations. At first glance, this margin appears significant.

However, the recalculations presented in this study show that this sense of security depends heavily on the assumptions embedded in the demand model. When the appropriate coefficients are applied to outdoor landscape areas, outdoor demand increases to 1,388.69 AFY, raising total project demand to 1,777.59 AFY. Although this revised estimate technically remains below the threshold, it is no longer “substantially less.” The apparent margin of safety shrinks to roughly six percent, revealing how sensitive the compliance narrative is to methodological choices.

Since the corrected outdoor demand narrows the margin so significantly, the residential indoor demand assumption also warrants consideration. The Water Supply Assessment relies on a statewide indoor efficiency benchmark of 55 gallons per capita per day, producing the 111.65 gallons per dwelling unit per day used in the residential demand calculation. Yet by the time the Final EIR was approved in 2019, the Coachella Valley Water District had already reported 2017 residential water use of approximately 215.9 gallons per capita per day, nearly four times higher than the coefficient used in the WSA.

When this observed residential value is substituted into the indoor demand calculation, residential indoor demand increases to 948.48 AFY, raising total project demand to 2,484.45 AFY, which exceeds the 80 percent threshold substantially.

Table 7

Estimated total project water demand using corrected ETAF coefficients for outdoor demand and adjusted residential water demand based on average per-person daily water use from 2017 measured water use data

Scenario	Total Demand	Relationship to 80% Threshold
WSA estimate	1,532 AFY	20% below threshold
Corrected outdoor demand coefficients used	1,777 AFY	~6% below threshold
Observed residential demand using gpcd average from pulished 2017 water use data	2,484 AFY	~29% above threshold

When corrected outdoor coefficients are applied, the margin below the 1,923 AFY threshold shrinks substantially, and when observed regional residential water-use data are substituted for the statewide indoor benchmark used in the WSA, total demand exceeds the allowable threshold by nearly thirty percent. Read alongside the language of “substantially less,” sufficiency, and compliance, these numbers show how technical calculations and administrative framing work together to produce a convincing appearance of sustainability on paper. In this sense, the issue is not simply that one number may be wrong, but that the numbers and the language surrounding them can be made to tell a reassuring story even when that story depends on uncertain assumptions and selective methodological choices. Had the water demand estimates in the WSA been grounded in coefficients and water-use patterns more representative of actual Coachella Valley conditions, the project’s estimated demand would appear far greater than the planning record suggests. This gap between the appearance of sufficiency in the planning record and the uneven water realities of the region requires analysis that moves beyond technical calculations alone to include community voice and spatial evidence of vulnerability.

Polyvocality and GIS-based Analysis of Uneven Water Realities

A major theme that emerged from this research is that water use at Cotino is not only a technical issue, but also a social and political one. Although the project is justified through quantitative metrics, modeled projections, and institutional language of sufficiency, these forms of technical evidence do not fully account for who bears the consequences of development decisions, whose concerns are recognized in the planning process, and whose realities remain outside the frame of project approval. This is where environmental justice and polyvocality

become essential.

To incorporate community voice into this analysis, I interviewed Michele, a resident living across the street from the Cotino development in Rancho Mirage. She first heard about the proposed Disney community in 2018 through discussions on the Nextdoor app, but it was not until several years later, when fencing appeared around the 618-acre project site, that she brought it to my attention. My initial research led me to the approved EIR, where I was surprised to find that the project centered on a 34-acre man-made lake in the desert. During that visit, the temperature never dropped below 100 degrees, and even Michele's small shaded backyard pool had become unpleasantly warm from the summer heat. The contrast between those conditions and the approval of a massive artificial lake left a lasting impression.

By the time my formal interview with Michele took place, the once empty desert landscape we walked through during afternoon walks had become the site of a 24-acre lagoon with homes already being marketed. She expressed concern about the water required to sustain such a large man-made lake and about what might happen if regional supplies become more strained in the future. I made note of her property and how it reflected visible conservation efforts, including desert landscaping, drip irrigation, a very small patch of lawn for her dog, and low-flow fixtures indoors. Her situation illustrated a household attempting to conserve water while still facing high costs and uncertainty about future supply.

What is particularly striking is that Michele's experience comes from the western Coachella Valley, a part of the region more often associated with wealth and tourism. Yet even there, residents expressed concern about rising costs, high household water use, and uncertainty about future supply. This reality becomes even more troubling when placed alongside conditions in the eastern Coachella Valley, where water challenges extend beyond affordability and conservation burdens to basic issues of water quality and access. Research from the [UC Davis Center for Regional Change](#) found that eastern Coachella Valley communities face overlapping environmental hazards and social vulnerability at levels exceeding those in the western valley and Riverside County overall, including drinking water contamination as a major burden. The report identified wells in the eastern valley with chemical concentrations exceeding state and federal maximum contaminant levels for arsenic, chromium-6, perchlorate, and nitrates, while also noting that limited sanitation infrastructure increases health risks for residents.

More recent state action shows that these problems are not historical background alone, but continuing realities. A [press release by the State Water Resources Control Board \(SWRCB\)](#) has highlighted ongoing eastern Coachella Valley consolidations intended to connect small, failing, or contaminated systems to more reliable infrastructure. In 2023, the Board stated that CVWD had launched regionalization projects that would merge at least 16 small water systems benefiting disadvantaged communities, and that a broader master plan identified 75 small water systems for future consolidation. These efforts are important, but they also reveal the scale of the regional contradiction within a region dependent on the same groundwater aquifer, where luxury development is justified through findings of sufficiency and managed demand while other communities continue to struggle for safe and reliable drinking water.

Coachella Valley Contaminated Groundwater Wells

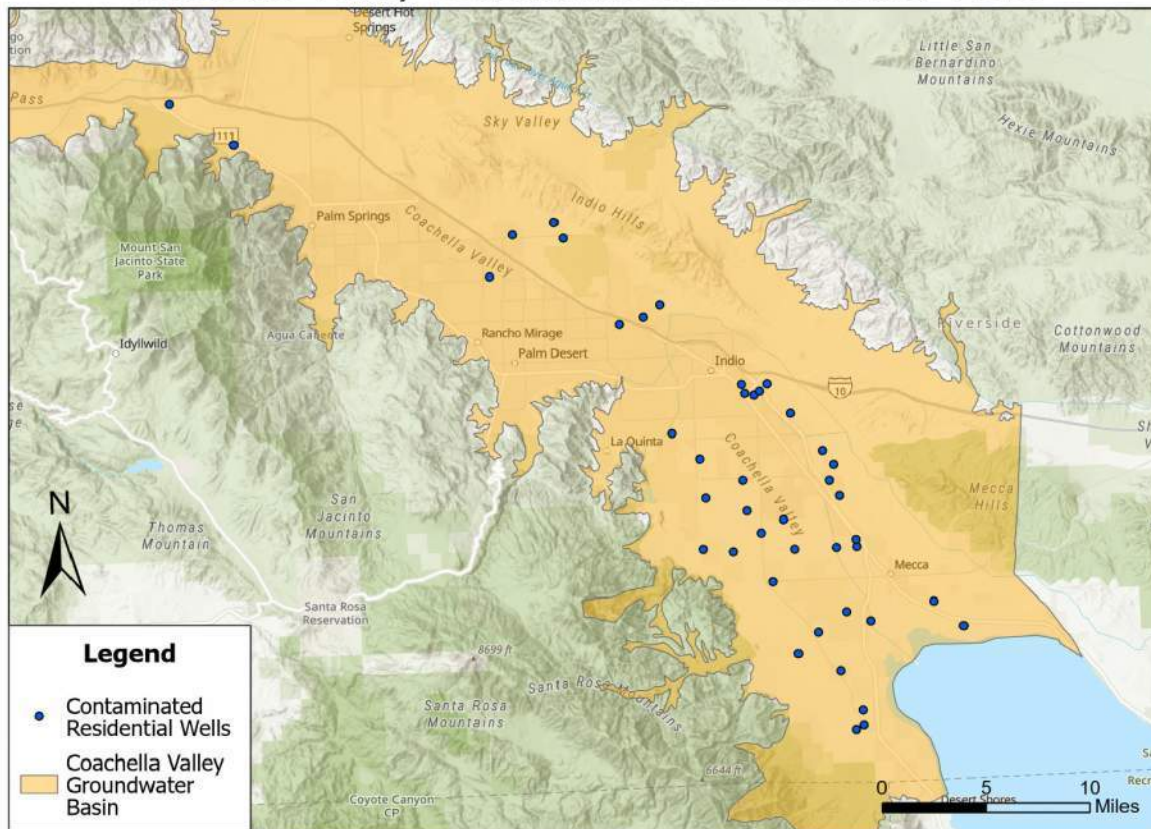


Figure 4
Map displaying contaminated domestic wells in Coachella Valley groundwater basin

Figures 4 and 5 represent the GIS-based spatial analysis portion of this study and serve as an important empirical counterpoint to the project's planning record. Figure 4 maps the Coachella Valley groundwater basin boundary together with the locations of contaminated wells across the region. Figure 5 maps CalEnviroScreen cumulative impact data to show the broader distribution of environmental burden throughout the valley. As a methodological component of this capstone, these maps were used not simply to visualize background conditions, but to spatially test whether the language of regional water sufficiency presented in the planning record aligned with the lived geography of water vulnerability across the Coachella Valley.

Read together, the maps show that water-related burden is not evenly distributed across the region. The contaminated well map reveals that drinking water problems are concentrated in particular parts of the basin rather than spread uniformly across it. The CalEnviroScreen map reinforces this pattern by showing that the eastern valley carries significantly higher cumulative environmental burdens than the wealthier western side of the region. This spatial overlap matters because it demonstrates that the communities facing the most immediate threats to safe and reliable water are often the same communities already burdened by broader forms of environmental vulnerability.

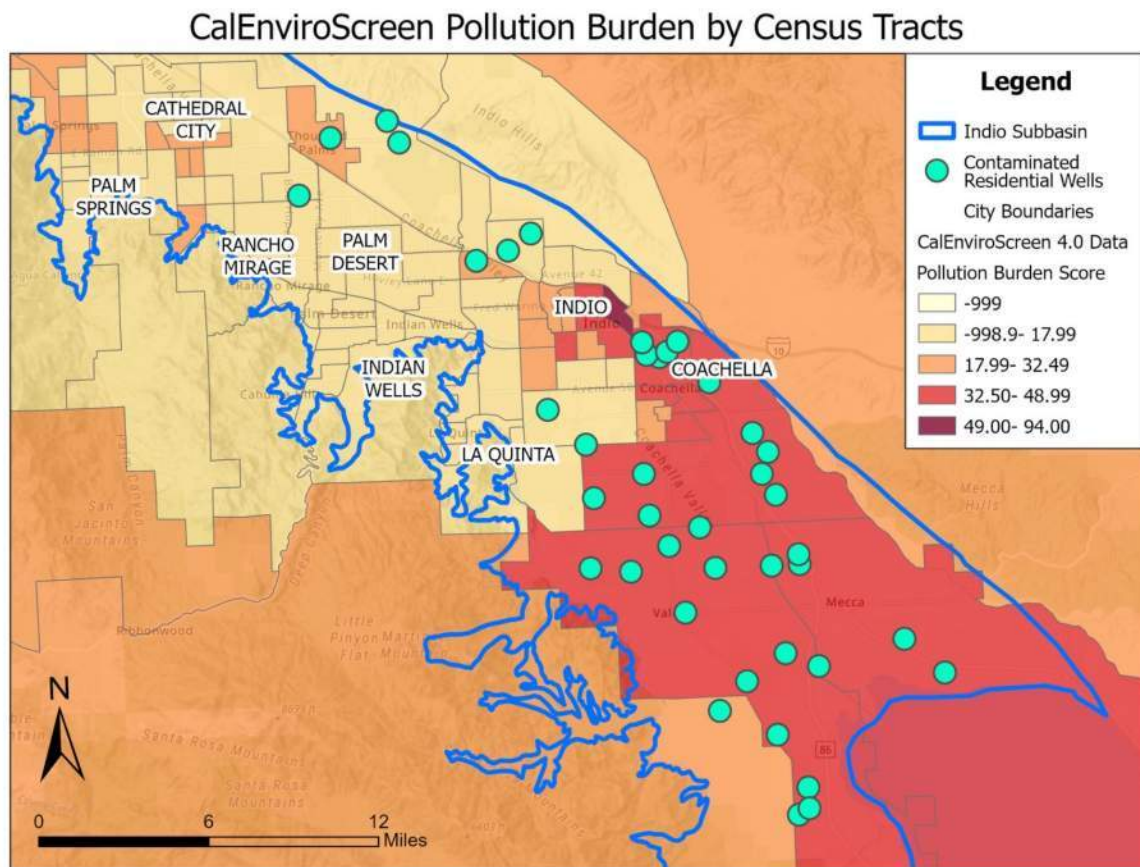


Figure 5

Map displaying contaminated domestic wells in Coachella Valley groundwater basin overlaid on top of CalEnviroScreen displaying areas with greatest environmental burden

This GIS analysis is central to the methodology of the study because it grounds the discourse and policy analysis in material conditions on the landscape. While the discourse analysis showed how the planning record framed water demand as compliant, sufficient, and manageable on paper, the maps show that regional water conditions are experienced through a distinctly uneven geography. In that sense, the GIS portion of the study helps connect the project's technical language to broader questions of environmental justice. It makes visible that "water sufficiency" is not a universal regional condition, but one that is produced and experienced differently depending on location, infrastructure, and cumulative burden.

These findings support the broader thesis of this capstone by showing that quantitative and administrative claims of sufficiency can coexist with highly unequal water realities on the ground. In the western valley, water stress may be expressed through high water use, rising costs, pressure to conserve, and concern over future scarcity. In the eastern valley, many communities face more immediate and structural threats tied to contaminated drinking water, vulnerable small systems, and long-standing infrastructure inequities. By placing the planning record in conversation with spatial evidence of unequal burden, the GIS analysis strengthens the argument that sustainability in this case cannot be evaluated only through projected demand

calculations and regulatory compliance. It must also be evaluated through where water burdens are located, who is exposed to them, and how those uneven conditions are obscured when sufficiency is framed as a shared regional reality.

Taken together, the maps help show why this project cannot be understood only as a technical question of whether enough water exists on paper. They reveal that the same region in which luxury development is justified through findings of sufficiency is also a region where water-related harm is distributed unevenly across space. This is what makes the GIS analysis methodologically important to the study. It moves the argument beyond abstraction by showing that groundwater dependency, contamination, and environmental burden are not shared equally, and that any claim of regional water sufficiency must be read against that uneven geography.

Beyond Cotino

Just as this research demonstrates that the burdens of high-water-use development are not isolated to one side of the Coachella Valley, the concerns raised here are not unique to Cotino but reflect broader regional dynamics. The proposed [Thermal Ranch](#) project offers another example of how large-scale desert development raises questions about water use, environmental review, and who ultimately bears the risks of development decisions. The project proposes a 619-acre specific plan in the eastern Coachella Valley centered on a 223-acre luxury equestrian facility along with residential and commercial uses. Community members filed a [lawsuit](#) against Riverside County arguing that the Environmental Impact Report failed to adequately disclose or account for major environmental and public health risks, including air pollution and manure management. This example adds another layer of polyvocality by showing that skepticism toward large-scale desert development extends beyond a single resident interview or project site. Instead, it reflects a broader regional tension in which development proposals are advanced through the language of mitigation, compliance, and projected sufficiency while communities continue to face uncertainty about long-term water conditions and uneven environmental burdens.

The environmental justice issues raised by Cotino therefore extend beyond whether the project's water demand was calculated correctly. They also emerge from the way technical approval processes can legitimize new water-intensive development in a region already marked by unequal water conditions while obscuring whose risks are intensified and whose burdens remain largely invisible within formal compliance frameworks. This study shows how water-intensive development can be justified through technical projections, regulatory thresholds, and administrative language that present water demand as manageable on paper while masking uncertainty and uneven impacts on the ground.

The contrast between official claims of sufficiency and the realities reflected in community concerns, high regional water use, contaminated wells, and the spatial patterns identified in the GIS analysis demonstrates that these approvals are not purely technical decisions. Rather, they shape how water risks and environmental burdens are distributed across the region. In the Coachella Valley, water insecurity and groundwater pressures intersect with existing social and geographic inequalities, particularly between the wealthier western valley and the more burdened eastern valley where many communities already face contamination, infrastructure limitations, and water vulnerability. At the same time, the findings show that affluent western valley residents are not untouched by these dynamics, but experience them differently through rising costs, conservation pressures, and growing uncertainty about future water availability.

Conclusion

This study examined how projected water demand, policy frameworks, and regulatory processes work together to justify luxury development in a groundwater-dependent desert region marked by uneven water realities. Using the Cotino Storyliving by Disney project as a case study, it combined quantitative review of lagoon water demand assumptions with interpretive analysis of the project record. The findings show that the technical basis for the lagoon demand estimate is less stable than the planning documents suggest. Inconsistencies in lagoon acreage, the use of methods poorly suited to open-water evaporation, and the failure to apply the agency's own open-water adjustment factors all indicate that the lagoon's annual water demand is more uncertain than the final planning record presents. Even so, the broader record continues to frame total project demand as manageable through the language of sufficiency, mitigation, and long-term reliability. Taken together, these findings show that the appearance of water sufficiency is produced through technical calculations, regulatory frameworks, and the language used to interpret them. The Cotino case illustrates how development approval can rest on assumptions embedded in water demand estimates that are then reinforced through planning language and administrative procedure.

By combining quantitative recalculation with qualitative document analysis, this study shows that water sufficiency is shaped not only by how demand is calculated, but also by how those calculations are presented and understood within the planning process. Ultimately, compliance on paper does not necessarily translate into sustainability on the ground. In the Coachella Valley, where luxury landscapes project abundance while other communities face contamination, high water costs, and infrastructure challenges, these findings raise important questions about how sustainability is defined, how technical authority is produced, and whose water realities remain outside formal review.

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STRONG SANDS: AN EXPLORATION OF THE ENVIRONMENTAL, SOCIAL, AND
ECONOMIC IMPLICATIONS OF SAND MINING AND DREDGING IN THE SAN
FRANCISCO BAY AREA

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Abstract

Rapid urbanization and the expansion of global infrastructure has led to the increased demand for sand, allowing sand mining to become a booming industry in recent decades. The associated impact has wreaked havoc on mined coastlines, stripping resilience and biodiversity, imposing serious environmental concern. However, the understanding of the implications on economic and social resilience in Northern California is lacking. This study employed detailed investigations of current environmental impact reports within CEQA guidelines, paired with qualitative methods such as thick descriptions, mapping, informal interviews, and object analysis to explore the correlation of socioeconomic resilience alongside environmental implications of sand mining. The results indicate a weakening of social infrastructure, including a lack of Indigenous consultation, interdisciplinary communication, and the continued exploitation of sand, a revered and protected resource with a long history of religious and societal importance. This is importantly congruent with the prioritization of private interests over those of the public. These results suggest that it is essential to consider social and economic resilience alongside ecological impact when addressing future legislation of sand mining.

Introduction

The looming skyscrapers we drive past on cracked roads, the thick panes of glass we live within, all proof that we live amongst byproducts of sand in every aspect of life. Cities are built of sand, but sand is in limited supply. It must come from somewhere, and someone must pay. Sand mining and dredging are heavily impacting the shorelines of Northern California. The San Francisco Bay has been a leader in sand extraction for local construction and infrastructure for decades, a constant supplier of the desired aggregate for most of the concrete and glass surrounding us. While my initial goal of this study was to point out the flaws and negative impacts of sand mining and dredging in the San Francisco Bay, I quickly realized this topic was far more complex than I initially expected. On paper, sand mining has been streamlined to allow the largest amount of sand extraction at the least amount of cost, parallel to dredging's goal to be the most environmentally productive, at the least amount of cost. These practices might even look like a success story of human innovation and environmental stewardship. However, the real sand story lurks just below this smooth surface. It is a story fraught with urbanization and colonization.

Understanding the current practices of sand mining requires a trip back in time. As rapid urbanization spiked the demand for cheap, reliable building material, the demand for sand skyrocketed, becoming the second most-used resource on earth, after water. Sand mining has since remained the most common practice to obtain this sand. Globally, an estimated [50 billion tons](#) of sand and gravel are extracted each year, surpassing fossil fuels and metals in volume. Sand moves freely between coastal features, from sources to sinks, from dunes to coastlines, from shorelines to sand bars, in what is referred to as a [Sand Sharing System](#). From this term, I find it easy to visualize that any removal of sand from this system will eventually impact all portions of this system.

The feeling of sand scratching on gritty feet, getting stuck between fingers, wedged in the seats of cars, is not unfamiliar for many Californians. And yet, sand plays a much larger role in

everyday life than many realize. The roads we drive on, sidewalks we walk our dogs on, even many of the buildings we live in or frequent are all made of composites that rely on the aggregate of sand. Even glass bottles, windows, and the solar panels our neighbors just installed depend on sand as the primary fine aggregate. Sand is engrained in everyday life, and yet in stark contrast to this truth, sand remains “[largely unregulated, undervalued, and under-researched.](#)”.

While a global phenomenon, California remains a hotspot for sand mining activities. Aggregate mining started in the 1930s in the San Francisco Bay Delta as a lucrative and booming industry, reaching a peak extraction of nearly [two million cubic yards](#) (cy) of sand mined in the San Francisco Bay in the early 2000s. While the public outrage and following legislation tapered the extraction rate, the damage had been done. The ravaged coastline and depleted natural sand reserves had already resulted in this strip of coastline, largely Ocean Beach, having the [highest shoreline erosion rates in California](#).

There are a few key stakeholders I focused on for this discussion. While the practice of beachfront sand mining has largely been terminated in California, state authorities still authorize private sand extraction along select locations. The San Francisco Bay Conservation and Development Commission (BCDC) is a state agency tasked with overseeing development and minimizing impact in the Bay. The California State Lands Commission is responsible for issuing permitting within the Public Trust Doctrine, in accordance with proper environmental impact reports (EIR) and impact assessments. Currently, these institutions authorize an average of 1.14 million cy of sand to still be mined from the Bay annually (an amount that would take roughly 45,600 large municipal dump trucks to carry or fill 11,400 large swimming pools) largely for construction purposes. These permits are largely awarded to two main private construction / aggregate companies named in this study: Lind Marine and Martin Murrieta.

Local organizations such as the San Francisco Baykeeper work tirelessly to keep these in check, despite federal support and copious funding. The surrounding Indigenous and local communities of the San Francisco Bay area, including the Muwekma Ohlone tribe are also integral to this discussion. Finally, the coastline is a key stakeholder in the discussion of her own resource extraction. Ultimately, this project aims to outline how sand mining is irrevocably damaging the resilience of the San Francisco Bay and its surrounding communities, while disrupting the trust and sanctity of protected ecosystems.

Exploring existing literature as it relates to sediment management

The guiding question that led my exploration of the existing literature was ‘how is sand mining and dredging impacting the San Francisco Bay area?’. Overall, the literature strongly outlines negative environmental impacts, while simultaneously upholding the positive need for dredging and mining as tools for environmental and construction purposes, respectively. This was a thin line so carefully tread I was nearly impressed.

[Sand](#) is a type of sediment that forms through natural weathering, erosion, and transportation of rocks, breaking into smaller fragments over time that accumulate across beaches, deserts, and riverbeds, all part of this Sand Sharing System. It is defined by size (0.06-2mm), not substance, and each grain of sand has its own geological story.

Dredging is the practice of excavating sediment, sand, and aquatic beds by specialized machinery. Both dredging and mining are common sediment management strategies and are largely carried out in the same process. While the differences between the two are not often outlined, the fundamental difference between mining and dredging is the intent.

Dredging is relied upon to keep shipping channels open, remove debris, and manage sediment for navigation or environmental goals. Mining uses the practice of dredging to extract sand from coastal and riverine beds, primarily for construction or export purposes.

I. Environmental Impacts

A [2024 review](#) of the Environmental Impacts of Sand Mining stated:

Sedimentation and turbidity resulting from mining activities impair water quality, reducing light penetration and oxygen levels, thereby disrupting aquatic ecosystems and compromising water supply for human consumption and irrigation. Furthermore, the use of heavy machinery and chemicals in sand extraction introduces pollutants such as heavy metals and hydrocarbons into the environment, posing risks to human health and ecosystem integrity.

Dredging (and in turn mining) stirs up the sea floor, increases turbidity which disrupts ecosystem processes, disturbs detritus and contributes to CO2 emissions, and physically harms the seafloor and associated flora and fauna. The removal of seafloor and sediment may also cause draw-down even in cases of offshore extraction, when missing patches of sediment are filled by onshore sediment being drawn down to fill it in. This leads to [coastal erosion, changed wave patterns and then worsening erosion](#).

As this discussion focuses on rhetoric, overall systems of understanding, and social/economic implications, the below table summarizes the well-studied negative environmental impacts of sand mining as will be referenced throughout.

Table 1. Brief summary of environmental impacts of sand mining and dredging practices

Environmental Impact	Description
Changes to seafloor / morphology	Destabilizes seafloor structure, introduces pits, slumps, and structural instability
Sediment mismatch, turbidity, remobilization	Sand is placed in inappropriate areas or detritus is disturbed leading to increased murk, lack of clarity, and worsened quality
Air, water, noise pollution	Dust, metals, and particulates are remobilized into system, impacting human and seafloor health
Loss of biodiversity	Habitats are disrupted / destroyed from physical scraping and sand collapse; system integrity decreases with decreased health and diversity

Loss of carbon sequestration	Sediment and flora trap carbon, which is released through mining activities, which alongside equipment leads to increased carbon footprint
Erosion, subsidence, lack of integrity	As pits form from extraction, sand slides away from coastlines, leaving infirm ground, lack of protection from surges, and risk of seawater intrusion for underground aquifers

In a [2019 study](#), the authors unpack the use of traditional EIAs within the context of dredging. This study compiles numerous alternatives to dredging, while admitting that dredging is a “[well-known, reliable and widespread technology](#)”. They maintain that dredging is the most widely used solution to remove sediment deposits, which dates back to ancient technology on the Tigris and Euphrates River. They compile a list of alternative technology to show the possible improvement to outcomes such as impact on flora and fauna, underwater noise, sediment dynamics, CO2 emissions, and air and marine polluting emissions. This study is proof that dredging is an outdated process with a large margin for improvement, yet it remains the most common method for both beneficial transport (e.g. shipping channels, sediment coastline protection, etc.) and for sand mining.

The [BCBD report](#) outlines two primary methods:

Hydraulic draghead:

This method lowers a draghead from a barge, where it is dragged across like a vacuum. Sand is slurried through a filter through a fish screen and is essentially strained (the large aggregates returned to the bay).

Hydraulic Pipe:

This method has a stationary pipe that is stationed lower in the sand, and slurried sand is sucked through a fish screen and filtered into the barge. In either case these barges may hold up to 2,000 cubic yards (cy) of sand, which is then returned to the facility to be drained of Bay water, washed of salt, and shipped to customer. Most of the sand mined from the Bay is locally used. We will unpack this more later.

II. Sand Mining

Despite these environmental risks, the demand for large-scale urbanization and infrastructure development persists. A 2022 study by the [United Environmental Programme](#) found the global six percent rise of sand extraction to be unsustainable and lacking governance. According to a recent 2023 study, [demand reached fifty billion tons in 2019](#), nearly tripling in the past twenty years. Sand has always been a component of construction, tracing back to ancient times. It has [enabled the construction](#) of wonders around the world including the Great Wall of China, the Burj Khalifa, the Pyramids of Giza, and the Il Colosseo. But with modern technology, the process of modern extraction has been streamlined and has now been deemed a [\\$70 billion](#) industry worldwide, most of which has been derived from coastal or riverine beds. Not all sand is created equal, as the large, sharp granules of beach and river sand is [much preferred](#) for construction purposes to the rounder, finer desert sand that lacks cohesion as an aggregate. It may be easy to consider shifting away from concrete as a primary building material; however, its versatility, strength, and overall cost efficiency makes it an invaluable resource for

heavily industrialized nations. Rapid urban expansion in India, China, and many African nations additionally drove up the demand for sand, proffering a tantalizing opportunity for nations in the Global North, exporting sand to nations where domestic mining could not keep up. The top exporters of sand in 2022 were the United States of America, Netherlands, Germany, Belgium and Malaysia, [making up over three-fifths \(62.5%\) of the total value of natural sand shipped onto international markets](#).

The last large-scale mining plant was located off the coast of Monterey. Although it was shut down in 2020, the effected strip of coastline left behind remains some of the highest erosion rates in California, irrevocably damaged. According to the BCDC's 2021 study, despite the wide concern of the impacts of sand mining, the total amount mined annually is [mainly driven by the demand of the local construction industry](#).

III. Dredging

A large portion of dredging in the Bay area is carried out by the US Army Corps of Engineers (USACE). Dredging has been common practice in the Bay area for navigation purposes. According to the BCDC between [two and three million cy](#) of sediment are dredged annually. The main volume of dredged sediment historically outweighs the volume of mined sediment, meaning dredging has a greater impact in scale as opposed to sand mining. From my research, it seems likely in large part due to the importance of navigation in the Bay. In 2025, San Francisco exported almost [\\$67 billion USD](#) of machine parts, various nuts, computers, etc.

So, while necessary for navigation and economic reasons, the vast majority of this dredged sediment is dumped in the ocean, not even repurposed to restore native wetlands or protect shorelines. Overall, various [studies](#) declare the benefits of dredging (e.g. replenishment projects, removing sediment build-up, etc.) outweigh the negative environmental implications. However, one [study](#) makes the brave argument that beneficial reuse (the means of reusing dredged sediment to replenish stores elsewhere) is 'waste of time'. This study states that natural sorting processes deposit the lighter sediment nearer the coastline while the deeper offshore deposits tend to be more dense. They are essentially arguing the transported materials will simply wash away.

IV. Health and social Impact

In reference to the health impact of heavy metal and hydrocarbon exposure in the atmosphere, a [2023 article](#) discusses bioremediation of heavy metals in the environment. These heavy metals are defined as "[a distinct group of metals that possess comparatively high densities, atomic numbers, and atomic weights within the periodic table](#)". This includes metals such as mercury, cadmium, lead, chromium, and arsenic that can pose threats to both the environment and human health even in low concentrations. Sources of these metals may come from mining activities themselves, e-waste, urbanization, chemical and biomedical industries, etc. Soils (including sand) and water are heavily impacted by these pollutants as well as the risk of concentrated impacts from bioaccumulation. A [2013 study](#) in Crete found that beaches act as a large sources of heavy metal pollution, sand acting as a natural filter or entrapment for heavy metal accumulation. A [case study](#) of the Jialing River in 2022 found that sand mining can not only

release more metals into a system, but will remobilize trapped metals (Lead and cadmium mainly) back into a overlying water.

The historic context of gold mining in the SF Bay and Sacramento area is an additional comment to note in regard to human health implications. As pointed out in a [2020 study](#), even small-scale gold mining in the area is responsible for 37% or 727 tons of industrial contributions of mercury in the air, and cement production is even listed as responsible for 9% or 173 tons.

The high levels in the SF bay area are already concerning, as listed by Frontiers article, “[Because of historic mercury mining, SFB \(San Francisco Bay\) Estuary prey fish have mercury levels three to six times higher than similar species on the U.S. East Coast](#)”. Mercury accumulation is already a concern, notwithstanding the added concern of sand mining exacerbation.

Besides chasing these threads, the literature largely lacks direct studies on the direct impact of dredging on human health. They mainly revolve around the environmental impacts as addressed above, fish, biodiversity, coral health, or even attempts to dredge contaminated sediment. One study by [Sandirasegaran and Manap](#) in 2016 looks at the overall impact of dredging and land reclamation project in Malaysia. These authors used a questionnaire to gauge impact on residents, alongside graphs showing impacts on organisms, economic growth, etc.

The results showed that the reclamation project improved economic growth, however planners conducted this development without “[considering the welfare of the local people](#)”, a trend that will be demonstrated as a clear theme throughout the results and discussion section. When defining the impacts of dredging, the authors mention the associated influence on turbidity and sedimentation (see Table 1) that may impact the way contaminants oxidize and their solubility. Here, there is a brief note that with these disturbed sediments, human health may be at risk of the contaminated water, and the risk of toxic sediments mixing with the water column. One portion of the study mentioned that local residents stated their health was impacted from the mining activities. However, this one line is not extrapolated upon, nor is it defined as to how health was measured. It might be therefore assumed that these impacts are due to the aforementioned concern of disturbed toxic sediments.

V. Historic context and future projections

Understanding the disruption of toxic sedimentation, it is essential to understand the history of ecosystem’s sediment resource and transport pathway, to understand potential exposure risks for both the environment and local communities. One study by the [United States Geological Survey](#) traces the impact of anthropogenic influences on the San Francisco coastline all the way back to the Holocene, considering retreating ice sheets, detritus from the hydraulic gold mining activity, and manmade structures (e.g. reservoirs) that blocked overall sediment transport.

As sand mining and dredging practices (as legally permitted by the BCDC) are not necessarily seen as immediate threats to the San Francisco coastline, there is not much information on how solutions are being addressed of possible disturbed detritus. However, even if this was being considered a concern, a study by Won and Seto (2025), found evidence that when it comes to equity-based adaptation efforts, “[practitioners are mostly focused on addressing procedural and](#)

distributive inequities instead of more complex framings that require meaningful structural change”.

Importantly, as mentioned in the Baykeeper’s 2026 report, the sand in Suisun Bay (Lind Marine) and Central Bay (Martin Marrietta), are relic. Two samples were collected from each site, and yielded results of 3.92 and 4.57 Ka and 1.52 and 0.82 Ka respectively. This means sand in Central Bay ranges anywhere from 800 to 1500 years, while Suisun Bay is anywhere from over 3,900 years to 4,500. This means that this ‘relic’ sand was here long before any European settlers or development occurred in San Francisco.

The existing literature is vast and at times convoluted. However, the emerging trends in the literature seem clear. While much has been done to study and understand the direct environmental implications of dredging and sand mining, the practice persists due to inadequate, direct proof that the cost outweighs the so-called benefit. Millions of cy of sand are mined every year in the San Francisco Bay alone, contributing to coastal weakening, erosion, seawater intrusion, and overall ecosystem degradation. This is well-studied. Yet, what about the social resilience? Indigenous-led voices? Whose interests are being prioritized in these discussions? It is these questions I seek to answer throughout this study, challenging the common rhetoric of ‘sustainability’ in the context of sand mining and dredging. Clearly, efforts are being made to combat this, yet the demands of urbanization and construction remain. This is why efforts such as Bianchini’s report remain crucial to finding feasible alternatives. However, as stated by Makey, et. al, (2021). “there remains a tendency to prioritize science over other ways of knowing.”

Methodology

With this in mind, my first goal with collecting data for this process required a strong epistemological stance, as well as a stable theoretical framework to view this data through. My personal background is environmental science, and I have a strong inclination for enjoying clearly defined boundaries, definitions, and answers (i.e. a positivist framework). However, nuanced issues such as resource extraction must be viewed through an understanding that perhaps there is no one real ‘answer’ (i.e. social constructionism). My decision to center this study around social constructionism was further solidified by the Makey et al’s point above, that there are other ways of ‘knowing,’ that perhaps do not fit into a positivist framework. I gathered the data for this project guided by the question: How are the current practices of sand mining and dredging impacting the Northern segment of the Pacific Coast Highway?

I. Existing Reports and Data

While a personal relationship with this stretch of land is important, it is also paramount to recall that copious amounts of various data and viewpoints exist in regard to this topic, reaching as far back as the 1970s. This process required collecting, reviewing, and comparing a broad scope of this literature, as reiterated in the literature review section, including feasibility studies, EIRs, BCDC reports, USGS studies, and those of independent organizations (e.g. the San Francisco Baykeeper).

The information gathered throughout these steps were then viewed through frameworks that center the lived experiences of the subjects (e.g. communities, coastline, and dependent species), and considered the full scope of impact. As seen in the gaps in the literature above, many of these reports are strictly released within a discipline (e.g. engineering, economics, etc.) but there were few interdisciplinary efforts to align these realities into the complex issue that sand mining poses.

II. Object Analysis

To achieve this polyvocality, a useful method to collect a broader scope of analysis was conducting an object analysis of sand. This method allowed a deeper, more detailed analysis of sand itself, its connection to the earth, communities that live around and upon it, also allowing the socio-religious context of how sand mining to inform the discussion.

III. Mapping

These methods used in tandem paint a picture of the landscape (literally), and zoom in on land boundaries, defining the scope of the concern and the stakeholders clearly. For this method Google Maps and several articles on land sovereignty and permitting reports were used.

IV. Thick Description

This method, often favored by anthropologists, center personal experience and the experience of the subject, within the context of a project. For this study, the subject remains the coastline. This method consisted of a sixty-minute span of time at the coast, considering what was there, how it became, who uses it or depends upon it, and what the subject itself evokes. Nothing was required for this method besides silence and time.

V. Informal Interview

Additionally, several organizations were reached out to for a brief discussion, and the San Francisco Baykeeper responded, offering the opportunity to speak with a senior attorney regarding sand mining in the Bay area. As will be discussed in the results section, the Baykeeper is now in an active legal case with the California State Lands Commission, and the member therefore could not be recorded or speak too specifically on any issues. However, the informal tone of the discussion allowed for more of a conversation that gave important insight and significantly guided the discussion section of this paper.

VI. Frameworks

This study additionally includes discussions of underrepresentation, colonization, and rapid urbanization. These are complex and nuanced topics that require care and attention to the subjects. I was automatically drawn to works such as Verchick's feminist framework, as well as Gloria Flora's understanding of the way our lived experience informs our outlook on the environment. I believe my choice in these underpinnings is due in large part to my personal relationship with science as it pertains to both the environment and women. As a woman in

science who grew up in a strictly anti-climate change, misogynistic home, I resonated strongly with both these frameworks, allowing them to guide these complex discussions.

Verchick presents a three-point framework that probes the reasoning behind policy decisions and engrained biases, that I found to cause friction with the modern rhetoric surrounding sand mining. The questions this framework raises require a closer look at how environmental regulations cause structural harm toward women and social inequities. I was able to use this as a lens in this study to highlight in greater detail the disparities that arise from the current practices of sand mining and dredging. Additionally, Gloria Flora's work, mainly her understanding ecosystem services, truly quantifies our own understanding of what nature owes us, and what we give in return. My favorite of her discussions is the idea of Here, There, and Away. We live Here, while our goods like oil, clothes, technology are produced There, and our trash is sent Away. These underpinnings helped me unpack both my personal experiences within data collection, as well as highlight key phrases in others' reports.

Results and Discussion

Throughout the existing data, an emerging goal is the elusive idea of sustainability. That is, something maintainable. How can this goal be linked to something intrinsically unsustainable? Sand is inherently a definite and nonrenewable resource. The constant removal for any sake directly contradicts this goal. However, constant references to environmental impact reports, monitoring goals, mitigation strategies, imply that mitigating an issue may cancel out the negative impacts. As if to convince the reader that the impact of sand mining is calculated, worth it, and ultimately even sustainable or maintainable.

I. Ecological resilience

The U.S. Army Corps of Engineers

In an effort to further unpack the true impact of mining and dredging in the Bay, I focused on a few key stakeholders to define this region. The U.S. Army Corps of Engineers (USACE) is a government agency operating under the National Environmental Policy Act (NEPA). My initial opinions on the Army Corps were originally rooted in mistrust that stems from my environmental law studies in my undergrad. USACE has a long history of legal disagreements with what is best for our wetlands and waterways. As trusted with these public trust lands they are expected to carry out various environmental impact assessments and mitigation strategies to protect these regions. Historically, this organization has potential to be largely biased toward pro-mining outcomes. An outdated, but scathing investigation of the Army Corps in 2000 by the Environmental Defense Fund corroborated evidence of industry bias, finding ["the Army Corps' planning process is systematically biased in favor of building projects, no matter what the need, and no matter what the cost to taxpayers and the environment"](#).

As of the last few years, USACE has been working on San Francisco Bay Strategic Shallow-Water Placement Pilot Project, alongside several others in the San Francisco Bay area working toward sediment redistribution in the Bay. Not only does this project propose sand extraction and movement within the same areas that Lind Marine and Martin Murrieta are interested in, but it requires permitting from the same organizations that have currently approved the millions of cy

of sand extraction, mainly the California State Lands Commission and the Bay Conservation and Development Commission (BCDC) (See Figure 1).

This impact report does mention consulting indigenous stakeholders; however, it states communication was initiated via email. It does not follow up if all the parties responded, and if so how. To me it seems that an unanswered email is hardly adequate approval for such an invasive project, especially on a subject so long embedded in Indigenous history (see Results section II. Social Resilience).

While the main objective of this project was to improve shoreline and wetland resilience through replenishment of lost sediment in the area, even this [impact report](#) agrees with the literature, concluding this dredging project will include changes to the seafloor, sediment mismatch, as well as noise, air, and water pollution.

Then, they state the impacts will somehow be confined to the duration of the project without providing context on how this may be true. Instead of direct proof, this report then followed their statement with a lengthy noxious emissions chart.

For example, table 4-2 titled Air Quality Analysis Results compares the proposed action plan against an alternative, outlining the peak daily emissions compared to the thresholds to demonstrate compliance. But when looking closely, the EPA Yearly Significance Threshold is 100 tons/year. For context, this is the threshold for major polluters including refineries and plants. So, compliance here does not necessarily mean insignificant impact. Just convenient language that proves compliance if not sustainability.

To further reiterate this idea of ‘sustainable’ rhetoric, several tables use a column titled, ‘insignificant effects because of mitigation’. This seems to write off any severity of problems they are unable to place in the insignificant effects column. These mitigation efforts include one air quality measure, and two aquatic resource quality measures.

For air quality, the report states they will follow CEQA’s Air Quality Guidelines such as Basic Exhaust Emissions Reduction Measures (meaning turning off equipment when idling and ensuring equipment is serviced and up to date.)

For aquatic resource quality, the report states they will follow recommendations given by the US Fish and Wildlife Service as given from informal interview, as well as monitor Eelgrass to ensure best management practices.

I noticed the use of this sustainable rhetoric to be a common crutch used throughout this research. While admitting to negative impacts, the responsible organization then immediately retorts with “but it’s okay because [insert attempt at ‘sustainability’] (e.g. impacts will be confined to duration of the project, impacts will be mitigated by x,y,z, the beneficial implications of this project will be of greater impact than the negative implications). So ultimately, are the interests of the environment and those directly impacted being truly prioritized or are the interests of those leading these projects? This demonstrates the nuanced nature of this discussion, as while the goal of coastline resilience and surge protection is noble, the root problem could be

more directly addressed by regulating the actions immediately stripping the Bay of sediment in the first place. This leads to the second main stakeholder.

The CA State Lands Commission

The California State Lands Commission is a state agency tasked with overseeing sovereign land grants and millions of acres of submerged lands, coastlines, estuaries, navigable rivers, etc. It is tasked as a landowner, to protect and enhance these public trust lands. The Commission oversees sand mining permitting within the Bay area.

In 2012, the Commission proposed permitting over the Central and Suisun Bay for Lind Marine and Martine Marietta. According to my discussion with the Attorney with the Baykeeper, it was during this round of permitting that the Baykeeper became aware of the threat these proposed permits would pose. In *Baykeeper v. State Lands Commission* (2015), the Baykeeper sued the Commission for violation of CEQA and Public Trust standards. While the court found the Commission in compliance with CEQA, they did find them in violation to the public trust doctrine. That is, private interests were prioritized over those of the public.

As of January 2026, the Commission has submitted a second round of permitting, allowing these private companies to mine a combined volume of 1,630,000 cubic yards per year from Commission parcels and 120,000 cubic yards per year from private parcels in Suisun Bay. Again, the Baykeeper has filed against the Commission, this time on terms of [inaccurate data, misleading representations, and out-of-date estimations](#). Similar to the USACE report, the Commission confirmed negative impacts upon Bay morphology, sediment transport, and coastal erosion, as well as simultaneously stating a 5,000-7000 cy (or 14%) reduction of sand transported through the Bay annually, an estimate which both I and the Baykeeper found to be improbable.

In 2012 the State Lands Commission created a baseline by averaging the volume of sand actually mined between 2002 and 2007. However, in 2026 the Commission created a baseline by averaging '[the potential volume of sand mining allowed by the commission under the prior ten leases](#)'. That is, the 2026 baseline averages sand permitted to be mined over a ten-year period, while the 2012 baseline averaged sand actually mined over a five-year period. Of course, using these misleading numbers could then result in the Commission permissibly stating a 14% reduction in sand mined.

Circling back to 'sustainable' rhetoric, the Commission states in their own report that mining is inherently unsustainable, while simultaneously stating that their project will result in a 'less-than-significant impact to mineral resources'. These are contradictory and are likely based on the 14% reduction estimate. If the Commission had used the previous baseline or even average the amount of sand actually mined between 2012 and now, the results may have been considered 'significant'. The Commission also notably downgraded the impact on several endangered species from 'significant and unavoidable' to 'potentially significant', with no further explanation.

This may be explained in one of two ways. This might have been a gross oversight, wherein the Commission must rectify these misleading statements, and both explain and corroborate the

abrupt changes. Otherwise, the Commission blatantly softened the environmental impact of these permits to satisfy private interests above those of the public good in whose defense they are entrusted, both with falsely sustainable rhetoric and misleading estimates. Additionally, it is clear two key stakeholders have been clearly left out of the discussion of permitted sand extraction. That is, impacted communities, and the coastline herself. In seeing this trend, I dove into the social implications of coastal resilience, considering the underrepresentation of critical stakeholders.

II. Social Resilience

The Muwekma Ohlone Tribe

Social resilience predicts a group's ability to overcome and adapt as a community to hardships (e.g. local disasters, etc.). [Determinants](#) of a community's resilience includes factors such as collective vs. individual mindset (e.g. trust in civil defense, governance, social infrastructure, and emergency response), as well as income level and religiosity.

[Verchick's framework](#) was integral to illuminating bias within this context. The first goal in Verchick's feminist framework is unmasking patriarchal systems in local and indigenous communities. This requires questioning nonneutral or male-centric laws/policies. This can be applied to essentially any marginalized group including asking questions such as, are these groups being considered in local governance and policy?

An article titled [The Sand Agenda: Transnational Sand Extraction, Social Injustice, and the Urgent Need for Global Governance](#) in the Michigan Journal of Political Science argues that as women experience disproportionate disadvantages of environmental harm from limited land rights, poverty, resource-based livelihoods (and the associated environmental, health, and economic risk with coastal degradation), so do Indigenous people experience disproportionate effects of sand mining. As the land poses a profound physical space of identity, culture, and spirituality, sand mining and loss of coastline integrity is the loss of sacred spaces and displacement. Villages over recent years have lost hundreds of feet of land to sea levels rising and increased surges, leaving [entire communities constantly forced into relocation](#) to higher ground. There are [ten state-recognized tribes in this region](#), one of the largest being the Muwekma Ohlone Tribe of the San Francisco Bay Area.

Figure 1 provides an outline showing the boundaries of the Muwekma's Ancestral Land, alongside the permitted locations of just a few sand mining sites.

Comparison of Ancestral Lands and Sand Mining Projects

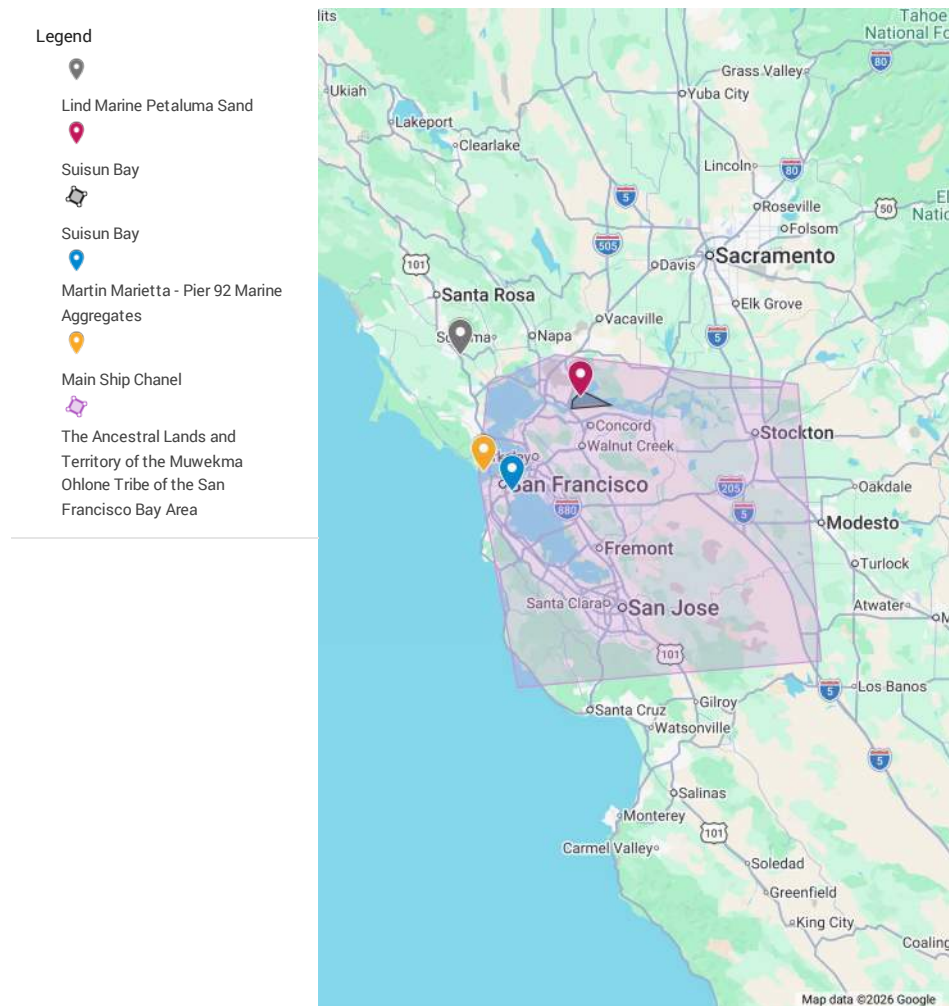


Figure 1. This map contrasts data of ancestral protected sites against the commonly permitted locations for sand mining and dredging in the San Francisco Bay Area.

As with the USACE EIR, it took digging to find any hint that Indigenous leaders were consulted in this permitting cycle. The draft supplemental environmental impact report from September 2025 supplies a list of tribes that were sent notification letters and an invitation to consult to have an opportunity to provide ‘meaningful input’ (i.e. sustainable rhetoric). It is stated that only two tribes responded, not one of them being the Muwekma. As the project moved forward, it is clear their response was not strongly desired, as is mirrored in the USACE report. As these reports continue to mirror weaknesses, I am increasingly aware of the dissonance this creates. While one project aims for sediment replenishment, the other aims for sediment removal, each acting out a

role of sustainability, while actively undermining any real input from the stakeholders. It feels dangerously like prescribing medication with one hand for an injury that is actively being caused by the other. This further substantiates the idea that permitting is often based on economic and private priorities, not necessarily public good (see figure 3).

Verchick's second goal, contextual reasoning, requires considering historical and pre-existing biases toward and around women and/or marginalized groups, including local policies, regulatory standards, permitting, etc. The Muwekma tribe as a recognized group has suffered a decades long struggle for federal recognition and autonomy. The Muwekma website details the long history of antiquated hoops their well-established community were required to jump through, only for disappointment after disappointment.

Our people have suffered long enough under this 'Apartheid system' of government, and from the inequities perpetrated on us as the documented Aboriginal Tribe of the San Francisco Bay Area. Our people are refugees within their aboriginal homeland. We will not stop fighting for our rights or for the rights of the other legitimate historic Tribes in California and elsewhere in the United States! We have suffered enough indignity by being totally disenfranchised within our children and our grandchildren. Regardless of the Federal Government's recalcitrance to restore our Tribe's status as a Federally Recognized Tribe, we will nonetheless persevere as the Aboriginal Tribe of the San Francisco Bay Region. We have lived here in our ancestral homelands within the greater San Francisco Bay for over 10,000 years and we have no intention of leaving, giving up or abdicating our Indian Heritage and Sovereign Rights!

[Excerpt from the Concluding Statement from the Muwekma Tribal Leadership](#)

The Indigenous people of this region have long since struggled with lack of proper treatment and respect, tracing back to the impact of Spanish colonization. The [impact of the Spanish missions](#) in the region were disastrous. The waves of disease, forced displacement, and labor camps were only worsened as new stock animals and new crops invaded endemic species and even physically altered their landscape. This starkly resonates with the way modern sand mining is physically altering their coastline. The Baykeeper's 2014 article states that "[Since the 1980s, erosion has accelerated by 50% from Ocean Beach to Point San Pedro](#)".

The Coastline

As mentioned, sand provides [immeasurable ecosystem services](#). Sand is the integral component making up sand dunes, beaches, and even in wetlands, offering surge and wave defense, habitat for numerous species, carbon sequestration, and recreation. Unfortunately, even with all the benefits sand provides, it is still viewed as a bottomless resource to exploit. It was this exact friction I sat with during my thick description exercise. I was able to take a quick trip to my local stretch of the PCH, a joining between the southern and northern points of the California coastline. Here, I was able to sit in the silence of a beach at 10:00PM, truly hearing the silence, the vastness, and the beauty that inherently resides within our coasts.



Figure 2. Picture overlooking Salt Creek Beach, Dana Point

Gloria Flora's idea of Here, really struck me when seeing this view. My local beach is my Here, where I grew up, where people gather to play basketball, eat together, celebrate birthdays. The glass in my windows, the concrete of my roads is made with sand being mined over There. What if my Here became There? How would that change the way I viewed our infrastructure? And frankly, with this lens, the industrialization of sand is especially difficult to grapple with. Referencing back to Figure 1, it is no coincidence that a heavily colonized region became the chief coastline of sand mining, as "[environmental degradation and loss of biodiversity often result from and reinforce existing patterns of discrimination](#)".

Sand not only provides these ecological foundations to coastal communities, but has long since been embedded within religions, cultures, and practices. A common mindset surrounding sand can be put in the words of The [New Scientist's 2018 article](#), "Despite some 10 per cent of Earth's surface being covered with sand, most of it is useless to us".

This word 'useless' feels strangely demanding. As if sand, or any ecosystem, owes humankind an exploitable resource. Tracing the Indigenous understanding of sand mindfully shifts us away from this worldview. Before late-stage capitalism permeated even our understanding of sand, it was viewed as a source of inspiration and wonder across various cultures. Sand as a subject stands strong as an integral, profound part of human history that can be traced throughout belief

systems, myths, and legends. Besides lore like the Sandman and practices in patience with art like Sand Mandalas, sand is also seen as a part of creation. In many Indigenous cultures, such as the Navajo, is seen as the “[primary matter or mediator](#)” between realms. Sand is a fundamental component of the universe and human cosmology, used as the story-telling component for the renowned Navajo sandpaintings, “[places where the gods come and go](#)”.

Considering religiosity is a determinant of social resilience, it is necessary to ask ourselves, how does social resilience shift when the source of great communal and spiritual importance is the very subject of exploitation? As sand extraction may be viewed as a form of cultural loss, so too may sand polices be referenced as a physical indicator of the priorities between policymakers and the public. The removal of sand via dredging, bulldozing, and coastal harvesting “[constitutes a direct disruption of spiritual, ecological, and custodial responsibilities](#)”. The physical alteration of the coastline now bleeds into the very fabric of an ancient and beloved understanding of our coastlines. I began to see a positive feedback loop emerge between weak public prioritization and loss of social resilience.

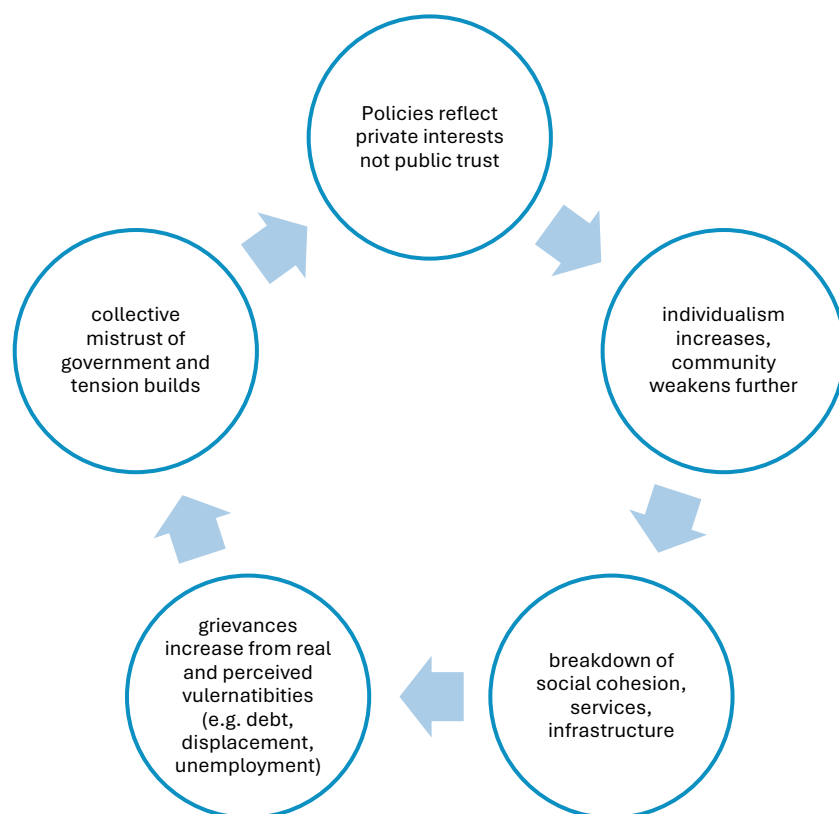


Figure 3. Positive feedback loop showing how the [determinants of social resilience](#) may impact societal decline

This snowballing breakdown of trust is apparent, for even as the conversation of resource sovereignty grows in the context of global extractivism, [sand remains conspicuously absent from most policy and legal frameworks](#).

III. Economic Resilience

My background in environmental science strongly informed my interest in the idea of applied environmental economics and the idea of ecosystem services being quantifiable. Sand mirrors the trajectory of resources such as oil. An irrefutably valuable resource that is nonrenewable and overly consumed. As the world realizes the inevitability of a world where oil runs out, so too must we face the fact that sand will one day be scarce. In oil, we see the desire for alternative fuels, renewable energy, hybrid cars. Diversifying an energy portfolio is much easier in theory than in practice, especially in a world built to run off oil. So, what about a world literally built with sand? The current sand and gravel mining industry in California is worth [\\$1.9 billion](#). The private mining interests, large-scale construction, and state actors play a large role in directing the direction this profit flows. A part of the discussion I had with the Baykeeper attorney revolved around how the economics of dredging and mining differed.

They warned me to use caution with lumping the two into the same category. Sand dredging is entirely critical to the local economy of the Bay. Without regular dredging, the main shipping points would be inaccessible (re: a \$67 billion industry) and there would be catastrophic loss of jobs, and the local economy would plummet (re: the importance of income on social resilience). They also pointed out the least-cost Federal Standard required of USACE. This standard states that even in cases of beneficial reuse, USACE must choose the most economical disposal location (not most environmentally beneficial), within best practice requirements. So, even within projects aiming to benefit the environment, profit is prioritized.

On the flip side of the coin, sand mining companies are private interest, often profiting large corporations and state actors. So, while sand mining lines the pocket of private interest, it also allows state actors to reap some rewards. The [Bureau of Land Management claims](#) that locally sourced aggregates help keep infrastructure and construction costs lower than alternatives. In turn, the Baykeeper Attorney mentioned they are concerned by the lack of action of the City of San Francisco. However to me, the correlation between state complicity and corporate incentive does not seem to be a coincidence. These private companies do little good to local economies (save the small number of jobs that vary in permanence), and while the sand is often used in California infrastructure, this does not mean the Bay itself sees these positive outcomes.

Concluding remarks

This study shows clear patterns of ignoring local and indigenous input, while prioritizing construction and industrial goals under the guise of sustainability. This is reiterated through all the collected data, showing the need for dredged channels, aggregate mining through Martin Murrietta and Lind Marine, and the millions of dollars of associated projects. This income does not flow back into the community or even those who work for the companies, but lines the pockets of industry professionals and state actors.

Sustainable rhetoric is used to green wash large amounts of this literature, and even current sand mining and dredging projects. This is not the same as saying this language is without purpose. However, it does not exist to excuse the negative impacts or provide plausible deniability when harm is caused.

The harm and lack of attention to indigenous, religious, and cultural association with sand alongside the inherent re-oppression of marginalized communities shows the blatant need for societal change. While I was unable to center these voices in the exact context of this study, this is a real opportunity for further impact studies and awareness. This leads me to the third and final point of Verchick's theory, Consciousness Raising. This study and others like it are contributing to just that. Understanding, acknowledging, and sharing information as it regards to sand mining is the first step in collective action. Remember, the American's Disability Act was not signed into effect until the Capital Crawl, the Clean Air and Water Acts weren't passed until the first Earth Day protests, and Workplace safety was not recognized until demonstrations following the Triangle Shirtwaist fire. Policy reform follows the will of the people. We the people, through conscientiousness raising may hold these organizations and institutions responsible, because sand mining in the San Francisco Bay is an imminent liability to the long-term strength and resilience of the beloved Bay.

Summary

Sand mining and dredging in the San Francisco Bay is a lucrative industry parallel to the boom of industrialization and urbanization on a global scale. The question *how is sand mining and dredging impacting the San Francisco Bay* uncovered vast amounts of literature as to the damaging impacts of sand mining and the importance of dredging for economic purposes, as well as strong rhetoric used to promote sustainability in these practices. Data for this study was collected through object analyses, thick descriptions, mapping, and an informal interview with a local organization. This study points out the use of 'sustainable' rhetoric to excuse current sand mining practices in the San Francisco Bay, as well as discusses the impact of dredging. Sand mining is not only irrevocably damaging the ecological resilience of the San Francisco Bay but is also disrupting it's social and economic resilience. Sand holds cultural and religious importance across human history through practices such as sandpaintings or sand mandalas. Additionally, heavy metals may be dislodged, increasing risks to human health alongside increased air and water pollution. Sand dredging is necessary for the Bay's economy, which is highly dominated by navigation (a \$67 billion industry). While dredging allows navigable channels needed for both private and public needs, sand mining benefits state actors and private interests. State actors, including the CA State Lands Commission, are largely responsible for making the decisions to permit the public beaches and sandy ocean floors to private construction and aggregate demands. From all this, there is a clear pattern of private interests being prioritized over those of the public, leading to less trust in local governments and social and civil services, both contributing to weakening social infrastructure. More research is needed into direct impacts, including the complicated factors of global sand extraction (e.g. Cambodia and Malaysia), as well as alternatives to our sand-dependent infrastructure. Current efforts including consciousness raising, strengthening regulations on public goods, and holding organizations accountable are a start into regaining resilience within our communities and coasts.

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Incentives Over Intentions: How Wildfire Resilience is Shaped Over One Year After the Palisades and Eaton Fires

By: Aleksandar Pavlović

Abstract

This article uses an autoethnographic methodology to examine the post-disaster recovery and rebuilding process after the January 2025 Palisades and Eaton Wildfires. The findings show a strong link between climate change and higher frequencies of wildfires in California. Rebuilding the Palisades and Altadena communities with climate resilience to adapt their infrastructure to high fire-risk landscapes is essential to mitigate similar levels of destruction in future wildfire events. The study also reveals that recovery outcomes are unevenly distributed due to insurance limitations, city budget constraints, and complex requirements for aid. Post-fire rebuilding policies are frequently prioritizing faster reconstruction over long-term climate resilience, and Los Angeles' recent policy shifts away from climate-focused initiatives raises concerns about future vulnerability. Using personal and observational insights, the findings also identify a persistent rebuild gap in which homeowners struggle to gather additional financial resources to cover the remainder of rebuilding costs that insurance payouts would not cover. This limits funding options for more wildfire resilient homes and puts immense financial strain on recovery programs hosted by government institutions and nonprofit organizations. While updated building codes improve baseline wildfire resilience, they remain insufficient against increasingly severe, climate-driven fire conditions. Addressing these challenges will require bottom-up advocacy for adaptable, fire-resistant construction materials, and expanded funding efforts from local communities.

Introduction

California is facing a wildfire crisis. [The majority of wildfires that happen in the United States happen in California. Compared to every U.S state, California has the most homes threatened by wildfires, and the top 5 costliest wildfires in U.S history all happened in California.](#) The state has a dense human population which suggests higher risk for human-caused fires. Although numbers vary by year, [humans have contributed to somewhere between 85-90% of all wildfires in California, with natural causes like lightning strikes making up the remaining percentage.](#) Behind the human culprit, [climate change has altered the baseline weather conditions that have resulted in more frequent](#)

[wildfires and a significant increase in the total number of acres burned](#) each decade since records began in the 1950's.

Wildfires alter landscapes and California's ecology, threatening the state's socio-political sphere and economy. Cities like Los Angeles have a lot to lose in a large-scale wildfire scenario, given its status as an international economic hub with a dense human population. This is evident by the sheer destruction of the Palisades and Eaton Fires which are [estimated to cost \\$65 billion in damages and strained \\$40 billion from insurance costs](#).

At this point in time, the question isn't when or where the next wildfire is going to happen in Los Angeles, but what the city is going to do to mitigate and adapt to future wildfires. Over a year since the Palisades and Eaton Fires, progress to rebuild both communities has been slow, and the majority of residents in those communities remain displaced and in a state of economic uncertainty. Support is out there, but impacts remain minimal, and acknowledgment of the underlying factors behind wildfires such as climate change have yet to enter mainstream discussions in both future city planning and recovery.

This capstone will explore this core question: **What are the motivations and constraints shaping recovery and rebuilding decisions among residents, nonprofits, and municipal leadership in the aftermath of the Palisades and Eaton Wildfires, and how do these decisions influence the communities' ability to withstand future wildfires?**

This project argues that post-wildfire recovery in Los Angeles is shaped by financial constraints, institutional barriers, and policy decisions that prioritize faster reconstruction over long-term climate resilience, which ultimately reinforces both communities' vulnerability to future wildfire events.

Easier Said Than Done: My Methodology

To explore these questions, my Capstone project utilized an autoethnographic approach, given my position as both author and subject. [An autoethnography is a qualitative research method that explores the author's own subjective experience while drawing connections to a broader social, cultural, and institutional system](#). I've lived in the Pacific Palisades community my entire life and have firsthand experience with navigating life after the total loss of my home from the January 2025 Palisades Fire. As a wildfire survivor and environmentalist, there is much personal reflection to draw upon, which I embedded with research and data from peer-reviewed literature and collected

news coverage. This helped me zoom out and understand the landscape of policy decisions, financial barriers, rebuilding decisions, and climate change in communities impacted by both the Palisades Fire and Eaton Fires.

Upon choosing to write an autoethnography, I understood that this would be a bit of a challenging undertaking. I needed to revisit and confront anxiety-producing facts and questions in order to retrace my own position as an impacted survivor. Fortunately, this approach yielded interesting results and helped me determine the factors that shape how effective rebuilding will be, and how it may withstand future wildfires—something my community is prone to. Another challenge with this approach was also understanding the full landscape of recovery, given that I was located in Pacific Palisades, and far removed from Altadena. This is where I relied on more research about Altadena to compare and contrast recovery efforts between communities

[“Autoethnography addresses the need and desire to make the human sciences more human by writing in ways that are more poignant, touching, vulnerable, and heartfelt.”](#) I believe an autoethnography is a crucial method for this project because the majority of reports and research on this topic are interpreted from an outside perspective. This limits the potential to paint a fuller picture of the lived realities of the post-disaster landscape. This research method I chose situates me as both the subject and the researcher in this regard because I’ve analyzed my rebuilding process while situating myself in a system.

My methods included personal data collection, through diary-like entries that were pulled from retrospective memory, and entries that were documented specifically during this capstone course. While I am living this experience every day, I selectively pulled the most notable entries that pertain to developing my research questions, because otherwise there would be too much to write. This portion of the writing process was not intended to make up the majority of the research, but to provide context that segues into the government policies and nonprofits that shaped post-fire recovery efforts. My next method used research data consisting of local/statewide government ordinances, news media, and peer-reviewed research articles. Another research method utilized was observational data—what I have seen of other homes and community patterns that I have come across while attending post-fire recovery events in the Palisades and Altadena communities. This data was also documented from my work in disaster case management and volunteer work with a local environmental group in Pacific Palisades.

These research methods visit recurring themes such as communal efforts to mitigate future disasters, the trade offs between cost and resilience in the rebuilding of the Palisades and Eaton Fire communities, and the gaps within how policy is implemented towards resilience.

In writing this, I have felt that I was mindful of myself in a way that was genuine to my emotions, which for a larger part of this recovery, have been intentionally bottled so that I could keep moving forward and utilize a pragmatic, solutions-oriented, line of thinking that I felt was necessary to navigate the evolving unmet needs my family and I have. “I don’t have time to be sad” is what I reminded myself, though I admit this was not the healthiest way to go about things, so for this project, I allowed myself to be vulnerable as I actually sat and reflected internally and in broader scope.

My background growing up in a majority white upscale neighborhood is unique and not representative of all demographics that were impacted by the fires. Nearly [192,000 residents were ordered to evacuate](#) from the January 2025 LA Wildfires, and from that number, I am only one story; however, I share many issues that are typical of the majority of displaced residents: [future uncertainty, tough decisions about moving back, financial instability, and emotional trauma](#). As an autoethnographic study, this raises questions about the credibility of this research due to subjectivity and bias. While these elements are not absent in this research, transparency and rigorous research to compare and contrast my thoughts will be key to bringing the most thoughtful results. Much of the details of my more journal-like entries are drawn from retrospective memory, prior to when I formally began this project, and events that I have documented during my capstone course. I also provided some photos that showcase some of my experiences. In writing this now, my family and I are currently rebuilding our home, and we were among the first wave of residents to receive our permit to start construction in the Pacific Palisades, so we are navigating hurdles that most residents have not yet dealt with, which should provide some helpful insight.

With regards to privacy, I have consented information about my own life, but have not mentioned other individuals by name, other than public figures. To avoid reputational risks and exposing internal dynamics, I chose not to release the names of any current organization I’m affiliated with, nor any names of current occupations. Instead, I tied my description back to the role itself when needed.

Case Study Perspective

Wildfires Prior to the Palisades Fire

My first time experiencing a wildfire was in first grade. It happened before I understood what a wildfire was and the extent of what fires could really do. I have a vivid memory of a large plume of smoke, shaped like a tornado, rising from behind the tall mountains that loomed closely over the Palisades. What I especially remembered about it were the reactions my teachers had—their calmness and assurance to

everyone that the fire is all the way in the San Fernando Valley and won't come over here to the Pacific Palisades. Although the fire never did reach the Palisades, it was a short matter of time before the air smelled of smoke and the ashes started to gently float down onto the playground—a concept I struggled to imagine at the time. How could something so far away bring ash to our town? It was at that point when phone calls were made for parents to come pick up their kids and we left school early.

Since that day, local wildfires always felt close enough to notice but never enough to disrupt my life. It was the smell of the poor air quality that was the most noticeable and it felt more like a short-term nuisance. This is always how I understood wildfires: restricted to their natural habitats and never into the built environment which felt like a safe zone. Fires looked more dramatic in appearance but never threatening... and so there was always some level of dismissal about their impacts, at least until that baseline was broken.

Fast forwarding to the early morning hours of October 29th, 2019, I was asleep in my bedroom, when I awoke around 2:30am from a call on my cell phone—an unknown number calling at such an unusual time, though I had answered anyway. It was an automated message ordering a mandatory evacuation of everyone in my area due to an approaching [brush fire that started near the Getty Museum four miles away](#). I hung up and tried to go back to sleep. Clearly I did not process that information as a real threat. That's when the landline had rung a minute or two later, waking both my mom and my brother up. Then the amber alert screeched with a "MANDATORY: EVACUATE IMMEDIATELY" in all caps. This is the first time in memory that I experienced an evacuation order. We had gotten up out of bed and met in the livingroom, agreeing to go back to sleep and see what happens in the morning. Come morning, the news said it was getting closer to the Palisades, and I remember police cars driving through the neighborhoods ordering people to leave on loudspeaker. I remember most of my neighbors had opted to leave, some who I know either went to a hotel or stayed at a relatives place. Then there was my family, laying low and staying at home while the fire persisted. The fire ultimately never reached the Palisades and life returned to normal after the fire was contained.

At this point in time, I was in the early years of my journey to environmentalism. I had started volunteering at a local environmental nonprofit assisting with part time campaigning and educational workshops in my community. For my full time job, I had worked in case management serving the homeless population with housing. It's strange to look back to see how I took climate change seriously enough to volunteer and do something about it, but had this cognitive dissonance of not taking wildfires seriously, despite knowing that they worsen because of climate change. It highlighted my denial and the reinforced outcomes of "we are safe again, I was never in any danger". Though

dry seasons definitely became something for me to keep tabs on, and I have since wished there were better land management practices in place to prevent overgrowth from getting out of control, which fuels fires.

January 7th, 2025 Los Angeles Fires

January 7th, 2025 was unusual in several ways—it hadn't rained in the previous months, and the weather was unusually dry. It was also unusual because of how seemingly normal the morning was. The routine was normal and was setting itself up to even be a boring day. I was at work the day it happened, in the office, at my desk. I received a group chat text notification from my neighborhood friends around noon, alerting everyone about a brushfire in the Palisades. I texted my mom and asked if she was aware, and she wasn't. She did go out to check and told me she saw lots of smoke, though she didn't sound worried. About an hour later she texted me saying "maybe you should come home", so I did. I remember driving to the town, minutes away from home and seeing the flames on the hillside. It was the first time I had ever seen live flames like that.



Palisades Fire, view from my home. Time—12:17pm.

I arrived home to see my mom watching the breaking news coverage. Evacuation orders were in effect, and cameras were rolling with footage of traffic jams from the highlands where the fire originated, just 5 minutes from my house. The traffic was so stuck that people got out of their cars and walked to the beach, leaving their cars behind in the middle of the road.

My neighbors and friends were texting me, telling me they were leaving. Naturally,

the hesitation was there at first—that denial again. My mom and brother all felt it and were pretty composed, though when my mom and I peeked out our kitchen window and saw neighbors with suitcases leaving. I stepped out and the smoke was much closer. The streets were totally empty—no cars in sight. That’s when the eeriness kicked in and the realization that we had to leave. We packed very few things—a few days worth of clothes, hygiene products, pillow, blankets, phones, our two dogs and two parakeets. Then we left for my aunt’s apartment, a 600 sq ft one bedroom with no room for four people and four pets. The night was sleepless due to the high winds, which were very loud. I knew they were carrying the flames everywhere. I was also glued to my phone looking at the barrage of texts and video news reels showing the embers blowing through the town. I had watched clips of restaurants I used to eat at, totally engulfed in flames. What was also quite unnerving was seeing the local Ralphs Supermarket I used to work at for 6 years, being torn apart by the flames from inside. I then received alerts of another large fire that evening in Altadena, a part of LA that I was not familiar with, and had never heard of before.

Here are the facts of the fires that night. According to the official report of [CAL FIRE](#), the Palisades Fire, caused by arson, burned through 23,448 acres, destroyed 6,837 residential and commercial structures, damaged 973 residential and commercial buildings, and killed 12 civilians. [Another report by CAL FIRE](#) concluded that the Eaton Fire resulted in 14,021 acres burned, 9,414 residential and commercial structures destroyed, 1,074 residential and commercial structures damaged, and 19 civilian deaths, although the cause of the fire is considered undetermined. [The U.S Department of Justice is suing Southern California Edison](#), alleging that their failed power transmission lines ignited the fire during a high wind event. Both fires were not fully contained until January 31st

There were several factors that fueled the intensity of both wildfires on January 7th. The Los Angeles Fire Department (LAFD) has a low staffing crisis, with “[less than one firefighter for every 1,000 residents](#)” and limited manpower to handle larger fires. The rapid spread of the fire was also attributed to [severely high wind conditions, and the mountainous topography which had severe dry vegetation that acted as fuel](#).

[The World Weather Attribution released a report](#) which concluded that climate change influenced weather conditions that increased the likelihood of the Palisades Fire and Eaton Fire by 35%. Prior to these fires, Southern California experienced what was among the [top 10 wettest seasons on record from 2022-2023, followed by a record dry season in 2024](#) with reports of no measurable precipitation. This leads to a climate change-induced “[weather whiplash](#)” effect, in which opposing wet and dry weather conditions rapidly swing back and forth every couple years. The wet seasons lead to

flourishing vegetation, and the following dry seasons dry up the vegetation, leaving the flourished landscape extremely vulnerable to wildfires.

It took a couple of days to get an idea of what the status of my family's home was since the fire had begun. Residents were not allowed to return to either the Pacific Palisades or Altadena for several days as the fire and smoke persisted, but a friend of my brother snuck in somehow and drove through the neighborhood. He confirmed our house, just like everything else surrounding the area, was gone.



The only surviving photograph of my house as it looked.



My house after the Palisades Fire.

As I write the findings of my Capstone research, I am still feeling the fallout of everything, still fresh as it was. Life feels on hold. Most of my friends and neighbors from the Palisades have lost their homes, and they are dispersed throughout Los Angeles County, some moved to other states and have indicated that they may just stay there and aren't yet sure what to do yet with their empty lots. My family remains cramped in my aunt's apartment, sharing a living room, and I was selected to stay at a family friend's condo nearby so that I could have a quiet space to focus on school work. Neither my family nor I need to pay rent, and we aren't required to pay rent, thanks to the kind gesture of my aunt's landlord, who has known her for decades. My roommate is allowing me to stay for free as long as I need, and I have a single bedroom space. Considering the circumstances, these are privileges, as we need to save money for our next living situation and it would be tough to navigate the already tight housing market in LA, which thousands of displaced fire survivors are still currently doing due to the slow progress there has been with rebuilding and moving back.

Rebuilding and Recovery

My mother used to work for a contractor, and when he heard what happened to our home several days after the fire, his sympathy turned into a life-changing gesture. He had offered to work on rebuilding our home and waive the \$50,000 fee for designing the

blueprints of our home—something we let him have major control over as we trusted him and gave some feedback and modifications later.

The majority of wildfires, including large-scale wildfires in California, [start from a human source](#), and Los Angeles has a high density human population. Climate change ensures the scale and intensity of these fires. How Los Angeles responds to these fires is crucial. Forecasting dry weather and high winds is important to develop a plan to suppress the human factors, but these strategies are extremely limited and hard to control in such a large landscape. Climate adaptation and mitigation efforts integrated in the city's infrastructure and rebuilding process are just as important to establish resiliency in preparation for the next wildfire impact. In contrast however, since the January 2025 LA wildfires, the city's elected leadership have been silent on the topic of climate change when discussing the Palisades and Eaton Fires.

California governor Gavin Newsom and LA mayor Karen Bass have concentrated their public communication on debris removal, rebuilding, recovery, and the economic hurdles that residents have faced as they struggle with funds to rebuild after the disaster. Since the fires, officials have quietly rolled back on the city's climate initiatives, as well as dismissing climate change as a factor in the fires. [A recent city budget proposal included cuts](#) proposed by Bass that will eliminate the city's Climate Emergency Mobilization Office and other job positions that oversee the city's oil pollution.

Rolling Back on Clean Energy

To meet reduced emissions goals, the city of Los Angeles introduced a bill in 2023 that [mandated all new buildings to be constructed as all-electric](#). This effectively removes gas-powered equipment and transitions into cleaner energy usage for the city moving forward. This brings many safety benefits because all-electric homes remove risks that are associated with gas leaks and explosions. Gas infrastructure and pipelines can be vulnerable to damage during natural disasters and lead to potential fire hazards. [All-electric homes, especially when they are combined with renewable energy sources and battery storage](#), offer more reliable energy access for heating, cooling, and cooking.

The house I grew up in was built by my grandfather in 1948. It was an older mid-century style house with gas-powered home appliances. While gas-powered homes were the norm and something very familiar that I grew up with, as an environmentalist, I was happy to see the city's stance on the new all-electric homes standard. It felt like a pivotal step in the right direction to phase out energy that wasn't clean with something much safer, cleaner, and renewable for the environment.

The potential silver lining after the Palisades and Eaton Fires is that with much of the existing infrastructure being destroyed, these communities are given a rare opportunity to partake in a rapid, energy-sustainable redevelopment. If the rebuilding adheres to the city's all-electric ordinance, this will accelerate the phase out of gas pipelines and drastically improve energy resilience. However, the post-fire policy landscape was not conducive to such improvements. In response to the January 2025 wildfires, [LA Mayor Karen Bass issued Executive Order No. 1 \(Return and Rebuild\) waiving the all-electric building requirement for rebuilding efforts](#), which allowed property owners to incorporate gas-powered energy sources if they chose. This was in opposition to the all-electric mandate in Los Angeles. This was a major step because this ordinance reintroduces a vulnerable infrastructure that could, in theory, spark a house fire that would put several homes, and the community, at risk if the weather conditions were unfavorable like the night of the Palisades and Eaton fires. However, for several homeowners who may be unfamiliar with an all-electric system, being told to transition away from gas to something that they don't know much about may cause hesitation.

When I asked my mother if she was familiar with all-electric homes, she said she wasn't. She also wasn't too sure that she wanted to make the transition, fearing several potential drawbacks: will an all-electric home raise the electric bill even more? Does this mean we will need to install expensive solar panels? Will an electric stove cook as well as an open flame? Will the water heater be as hot if it's being heated up by electricity? These concerns were valid. [A recent study concluded that homeowners are more incentivized to install gas-fired homes due to low gas price incentives by gas companies, and high installation costs for homes. Interestingly, that same study also revealed that installing electric homes are more economical in the long-term, especially when it comes to heating homes.](#)

On March 21, 2025, Mayor Bass issued [Emergency Executive Order no. 5 \(Return and Rebuild\)](#), which streamlined permitting for homeowners who rebuild with all electric systems and appliances, including solar PV and energy storage. Homeowners can still choose to rebuild with gas infrastructure if they wanted. This decision is likely to have been made to ease affected homeowners who may choose to return to a home with a familiar gas power system, and not feel forced to make changes they didn't anticipate; however, this comes with some criticism to focus on a faster rebuild rather than a more sustainable one in high fire-risk zones.

My family had a big decision to make: go back to gas or switch to all-electric. Before there was much time to have this conversation in greater detail, our contractor had made the decision for us to go all-electric, citing the fact that it is still the new standard of homes, and the rest of the city outside of Palisades and Altadena is developing new homes with all-electric anyway. My family trusted our contractors' judgement, and I was

happy to be a part of an all-new clean energy home. This was just my contractor's call to make, and not every builder may see it the same way. Some contractors may be open to gas or electric in the rebuilt areas. Many of my neighbors said builders they spoke with didn't recommend either for them, which indicates that the decision to go all-electric or gas is still up in the air for many.

Job Shifts and Nonprofits

I've worked for three years serving the homeless population in South Los Angeles. It was a very intense job with an intense population suffering from co-occurring mental health and substance use disorders. With that and school, I took a month long break from work right after the fires. Around April 2025, my mom continued discussing plans for our new home design with our contractor, with the removal of the old foundation and setting of a new one slated to begin by Summer. I had started seeing a therapist to unpack the trauma of everything that happened, as my overall stress and mood swings were taking a toll. Unfortunately my sessions were short-lived, as we realized that they couldn't take my insurance. The confusion was that they only accept Medi Cal recipients, and LA Care is part of Medi Cal, but it can also be a separate and private insurance outside of Medi Cal too. The realization that I had the private version and not the public version made them cut services with me immediately. I tried looking for free therapy that wouldn't require a copay, but that was hard. I found programs that gave limited free therapy sessions for wildfire survivors—which I applied for, but when I was informed that additional sessions would be runned through my insurance, and I would need to put out a copay for each session, I was so frustrated that I ended up telling them I'm no longer interested. My logic was that with the financial strain the fires have given me, paying an extra \$40-\$60 per session was going to add up quickly.

I quit my job in May 2025 after three years. I told everyone I was just burned out. It took me 4 months to find another job. Fortunately, I moved over into what would turn out to be a very rewarding full time job in the field of disaster case management. The job posting said they need a "Resource Specialist", someone who can help find all available resources for wildfire survivors. Resources would be shared with their assigned case workers, and they would then link their survivors with them. I was highly qualified for this role, given my prior work experience, and being a survivor myself looking for resources too. I still remain very happy at my job, and helping wildfire survivors connect with mental health, charitable donations, grants, and legal assistance is not only very rewarding, it makes me resourceful enough to help myself, my own family, and my neighbors.

In summary, our organization's contract to serve wildfire survivors is funded by FEMA, and slated to end in January 2027, pending extension, if the demand for

services is still needed. In seeking out resources, I have found many organizations providing recovery-based services including small grants. Some organizations like the Salvation Army pay for several thousand dollars worth of hardware expenses at Home Depot, and other organizations like the YMCA have paid several hundred dollars for those who have a membership, and were impacted by the fires. Another organization called Wise and Healthy Aging, also gave up to \$500 worth of Amazon orders for seniors, which I happily took my mother to since she qualified. All they needed to do was see her ID and shopping list to cover the expense. I have not only shared these resources with many of our clients, I have shared them with my friends and neighbors, and even utilized them myself. These grants have eased some of the burdens of replacing things that we lost in the fires.

One Year Later - Climate Denial

It's not hard for me at all to say that 2025 has been my worst year ever, and hopefully that remains the case for the rest of my life. When the holidays approached, I would ask my fire-impacted friends what they had planned, and most of them, including myself and my family, agreed that we won't do anything special, even though we used to. It just didn't feel right. Birthdays were small and gifts weren't given. We had all agreed to save up money for the new house.

Christmas has always been my family's favorite holiday, but with all our generational Christmas decorations being lost in the fire, that spirit has faded. We all made an agreement not to celebrate Christmas in 2025. One of my neighbors who loves Christmas even said "we are boycotting it this year". The term boycott resonated with me. Our family didn't want to force ourselves to feel jolly, and we didn't want to sit around together and bring up in conversation all of the antique Christmas decorations and ornaments that once belonged to our ancestors—now all gone from the fire. For us, there was nothing really to feel celebratory about in general. Around the corner came New Years, and seven days after would be the one year anniversary of the fires.

I wasn't sure what to expect on the anniversary of the fires. I decided to attend some public events that would be taking place in the Palisades to mark the one year. I arrived there early in the morning and was very surprised to see lots of parked cars filling the streets. The town had been the most full it had ever been since the day the fire happened last year. This brought a bit of optimism back in me, seeing many familiar faces gathering again. There were two major events going on that day: a remembrance ceremony for the 12 victims of the Palisades Fire, and an organized town protest under the title "They Let Us Burn". I attended both events. I bumped into so many neighbors during the ceremony and had a bit of time to catch up. All of the residents I spoke with were very happy to hear that I was rebuilding and returning to the Palisades. However,

many of them were still trying to figure out whether they will return based on how they can afford it. There were a few in the early planning stages of rebuilding their home who said they will likely just rent it out to someone else and remain in their current living space.

In contrast to the mournful public vigil for the 12 victims, the “They Let Us Burn” protest was loud and full of energy. The organizer of the event shouted many points that the crowd appeared to cheer and resonate with. The biggest takeaway from the organizer’s speech was that the government is to blame for not stepping up to pull fire survivors out of their financial hardships, the city is to blame for not fixing the empty Santa Ynez Reservoir which didn’t have sufficient water for firefighters to put out the fires quicker, the LAFD is to blame for being understaffed and not keeping better tabs on the smoldering hills from days prior, which reignited again from heavy winds and caused the Palisades Fire to happen, and that Karen Bass is to blame for neglecting to focus on recovering the burned communities. Many people in the crowd held picket signs and posters with diverse political messaging: one sign called for Mayor Bass’s resignation, other signs threw praise or dismissal towards the conservative and liberal parties.



One Year Anniversary Palisades Fire Protest.



Picket signs at Palisades Fire Protest.

I remember seeing the City Councilwoman of the Palisades, Traci Park, appear to also deliver a speech to a frustrated crowd. In her speech regarding the Palisades Fire, she uttered this statement: “It wasn’t an act of nature. It wasn’t some ‘storm of the century.’ And it wasn’t climate change, and don’t let anybody try to tell you otherwise.” Not only was this the first and only time I ever heard a politician mention the wildfire and climate change in the same sentence, but it was used in the context to dismiss climate change altogether. As an environmentalist, this was extremely upsetting and discouraging to hear, though the crowd continued to clap. I felt like no one really understood just how heavy that statement was and what devastating consequences would further come if we chose to continue treating these wildfires as isolated events. The failure to integrate climate change into the public discussion about wildfires undermines long-term resiliency planning and creates immense risk that the Pacific Palisades and Altadena will rebuild into the same vulnerable conditions that destroyed them in the first place.

Funding the Rebuild Gap

[The city of Los Angeles is currently dealing with a \\$1 billion budget deficit for the 2025-2026 fiscal year](#), with much of this deficit stemming from [overspending, liability payouts, lower tax revenue, labor contracts, scheduled city official raises, and fire recovery](#). This puts a lot of stress on what amount of spending can be allocated to the

evolving unmet needs of fire survivors. The majority source of funding comes from the federal government through the [Federal Emergency Management Agency \(FEMA\), which received \\$ 3 billion in survivor funds, and the U.S Small Business Administration \(SBA\), which received over \\$2.9 billion in disaster loans for businesses, nonprofits, and residents.](#)

The assistance is not enough though. FEMA grants cover basic needs, but don't cover funding for rebuild gaps where residents are unable to afford covering the rest of the rising construction costs after receiving poor insurance payouts. The term "rebuild gap" is something I have become quite familiar with in the last year. It's a term commonly brought up in the field of disaster case management. It refers to the numerous disaster survivors who are struggling to return to their homes due to not being able to cover the cost of rebuilding it. This is because of the limited-to-no money they received from their home insurance. I will use myself as an example: our family received the maximum payout from California Fair Plan after the total loss of the house, plus a depreciated fund that is set aside once we have started the rebuilding. The problem is, the construction of our house costs more than the amount we received. The rest needs to be covered with out-of-pocket expenses. Our house was insured at \$700k, but actual rebuild costs exceed \$1 million because of construction inflation, labor shortages, and permitting delays. That difference we need to pay out of pocket is the rebuild gap, and so we needed to get creative to fund our rebuild through methods like GoFundMe and seeking loans.

This is why selling the land was a tempting option, but not the most economical choice. [A recent historical housing market analysis in California suggests that property values tend to decline after a fire and take a few years to return back to typical market levels.](#) My family's generational investment in the land, and not wanting to spend money living elsewhere while waiting on our property was what motivated us to go with the rebuilding right away. This is noting how fortunate we were to already have a connection with a trusted contractor who wanted to help from the start and waive a portion of the fee, whereas many other residents didn't have that option.

This also applies to homeowners who did not lose their homes, but were instead displaced due to partial fire damage, and smoke damage inside their homes. [Despite still-standing homes, a large number of residents still can't move back due to the immense smoke damage in their interior walls, floors, clothes, and furniture, which renders the environment highly toxic and prone to several health complications. Many homeowners and renters still struggle to afford smoke testing and remediation due to the high prices and low insurance coverage.](#) Two neighbors of mine in the Palisades were displaced for about a year, and have recently been able to return to their home. They had spent a whole year fighting their insurance to cover the cost of the

remediation and post-testing. While their insurances were able to cover pre-testing and remediation and repairs, they were less generous with post-testing which accrued significant out-of-pocket expenses, and the time spent to get a handle of that and wait for the clearance took about a year.

Similar roadblocks occur for renters in apartments whose buildings didn't burn down. In meetings I've had with our disaster case managers, they report that a significant majority of their survivors in both Palisades and Altadena who rented in apartments that didn't burn are struggling to return to their units because their landlords have not yet gone through the process of hiring a testing and remediation company. This is due to the significant costs of testing and remediation per-unit and falls under the gap funding concept.

City Grants and Financial Assistance

On December 24th, 2026, the [County of Los Angeles launched an emergency rent relief program that would support residents impacted by the January 2025 LA Fires. This financial assistance would pay up to 6 months of rent or cover unpaid rent expenses, with a maximum coverage of \\$15,000 per unit.](#) The application process [required that landlords must apply for this directly; not tenants.](#) While significant in covering rent expenses, this rent relief program did not take into account the social and psychological barriers that prevented eligible applicants from asking their landlords to apply. [Tenants living in low-income areas, gentrified areas, or areas with large immigrant populations report higher cases of harassment, neglect, and eviction threats from their landlords.](#) With this power imbalance, many residents coming from low-income backgrounds and undocumented status (especially common from the Altadena community) may not feel comfortable asking their landlords to fill out an application. Some may not even trust that their landlords would complete the application if relationships are already strained. With that, city relief funds may not be allocated sufficiently throughout disaster populations. The window of opportunity to apply for this was already limited to one month.

[On February 9th, 2026, the County of Los Angeles opened another round of emergency rent relief for tenants with the same funding criteria as the last. This time, tenants were able to apply directly, relieving potential barriers that would have prevented them from requesting their landlords to fill out the application.](#) This marked a notable shift in an application process that was more accessible and equitable for the survivors, giving them more control over seeking help. The application has since closed on March 11th, 2026. My family was not eligible for this, given that we were not paying rent. Regardless, we were fortunate to not need to deal with the burden of paying rent.

[The CalAssist Mortgage Fund is a state-funded program that provides one year of mortgage relief \(up to \\$100,000\) for homeowners whose primary homes were destroyed or rendered uninhabitable by the 2025 LA Wildfires.](#) Its design was to ease any mortgage burdens that homeowners are facing and prevent foreclosure on the damaged properties. While initially the income eligibility limit was \$146,000, it was recently raised to [\\$281,400](#) so that more survivors can apply. This new criteria allowed the program to be more accessible to applicants who previously applied, but were denied due to exceeding their income limits.

My family was not eligible for this fund either, given that we had paid off our mortgage already. To date, we have not qualified for government funds outside of the limited amount from FEMA. Despite the support, these government funds are available more so to cover basic and immediate needs, which provide residents with some temporary relief, but they don't provide long-term aid of rebuild gap funds for residents who lost everything and were underinsured or uninsured. Such funds have not been made available by the city or federal government. These grants also come with constraints, being that they are finite and only serve specific purposes rather than large-scale needs that assist with covering the rebuild gap and helping survivors move back to their homes quickly.

Fire Resilient Homes

What is actually needed are grants that are tied specifically to underinsured homes, rebuild gap funding, and increased construction cost increases. Any type of policy reform for insurance coverage is also a very slow and bureaucratic process which won't help existing disasters quick enough. The rebuilding process is pivoting to speed and not climate resilience. Constructing a resilient home that mitigates and adapts to wildfires, such as defensible, fire resilient construction materials, and landscaping typically falls under optional upgrades which require extra funding. With the rebuild gaps, these options are not viable and this forces homeowners to meet the absolute minimum insurable requirements for fireproofing. This would mean that while new homes must adhere to newer codes and state-wide ordinances as opposed to older generation homes, they are still somewhat leaning towards the minimal requirements reminiscent of building standards prior to the fires.

When coming up with the designs for my family's new home, our contractor expressed his opinion on what he believed was the greatest point of structural vulnerability that let it burn quicker on the night of the fires. He noted the large bushes up against the exterior walls of the front of our home, which likely caught fire first from the windblown embers. The bushes' flames then likely rose upward and into the wooden eaves that protruded from our house, just above the bushes. The exposed wood then

likely caught fire and allowed the flames to enter the space in between the wood and the roof, and inside our home. [Research has shown that vegetation within the first five feet of a home, even when well watered, increases the likelihood of heat exposure and combustion on the outside of a home.](#)

In designing our new home, our contractor made some changes to benefit the structural integrity. He drew plans where there would be no exposed wood outside of our house, and also followed the Zone Zero guidelines which states that homes must not have growing vegetation within the first 5 feet of the home's landscape. These are a couple of steps towards resiliency. He also designed our home to implement fire resistant windows, which our previous home lacked. He explored the opportunity for a steel roof, but with the high construction cost, we instead opted for the more affordable wood roof, but reinforced with an outside non-wood layer that wouldn't expose any wood. Everything really comes down to cost at the end.



Reconstruction of my new home is in progress.

Results and Discussion

The findings and observations suggest that governance in Los Angeles is characterized by the way policies are framed, and that can vary depending on the context of the audience, fiscal constraints, and faster recovery priorities. Councilwoman Traci Park's appeal to anti-climate rhetoric occurred in front of a large crowd of people with very diverse political priorities, despite having [pro-climate](#) campaigning in the past.

This created an uneven and challenging room to appeal to in terms of messaging and blame. Her statement emphasized an immediate and localized explanation for the fire rather than a broader systemic, climate-driven interpretation. Her speech focused on more actionable causes and it highlighted the tension between previous positions she held and careful situational public communication after a major crisis.

[Karen Bass](#) and [Governor Newsom have demonstrated pro-climate messaging and alignment with greener initiatives in the past](#), but are currently at odds with the additional costs of implementing climate/wildfire resilience into post-fire rebuilding. The immense funding that would be required to fill the rebuild gaps for tens of thousands of residents would strain the city's tight \$1 billion deficit and budget constraints. If the local and state governments openly advocated for climate resilient policies in the rebuild, that would expose accountability to add an additional expense to an already strained city budget. Despite that, the decision to cut funds on climate resilience projects is a major blow to the movement and will render the city ill-prepared for future disasters. With regards the Palisades and Eaton Fires, there is no strong evidence to correlate climate resilience rollbacks with local and state government hypocrisy. The available evidence suggests that the system itself encourages inconsistent strategies and intense political pressure which unfortunately leads to real-world consequences if climate change is left unaddressed.

Nonprofits provide extra support that the city doesn't, but are limited by bandwidth and the funding they seek. This means that projects exist under a short timeframe, and not everyone who applies for financial support or rebuild services will receive them if the eligibility criteria is selective or if applications are accepted under a "first come-first serve" basis "while funds last". This is frustrating in my experience because I recall a few times where I've learned about a nonprofit providing grants or donations to survivors, only to learn that these resources had already ended, or that applications are no longer being accepted due to high volume. This left a fear of missing out and wondering if and when another grant I qualify for will appear.

Another theme that is uncovered is that of the insurance companies, which are a major source of the rebuild gap. Their policies to provide inadequate coverage, or no coverage in some cases, are very protected and incredibly difficult to appeal. [As wildfire risks have intensified, major private insurance companies like State Farm and Allstate have reduced or withdrawn their coverage entirely in high-risk areas in California, which leaves homeowners with limited alternatives](#). Most homeowners, including my family, depend on costly alternatives like California FAIR Plan, or deal with having no insurance at all. This is significant because this shift in [insurance companies leaving the state of California is entirely due to climate-driven wildfires, which challenges the traditional insurance model of stable and predictable risk and dispersal of coverages. On top of](#)

[that, the eligibility for insurance coverage is increasingly dependent on the homeowner's ability to afford fireproofing upgrades, which is costly and excludes many residents from affording this.](#) As a result, more homeowners are likely to enter major wildfire events totally underinsured or uninsured altogether.

Insurance is a major constraint for disaster preparedness and limits the feasibility of a community being able to rebuild. The outcome is that the government and nonprofits are dealt with the disproportionate responsibility to provide equitable support to wildfire survivors. Certain populations will require more care for unmet needs than others based on factors like low-income, citizenship status, and the size and circumstances of the families. The variability of funds that would need to be available to account for that is much harder and complex to pull out when finances are already drained. The recovery landscape is characterized by a fragmented and uneven distribution of aid and capacity.

How May the Palisades and Altadena Communities Come Back?

Recovery in the Palisades and Altadena communities is uneven and also strained by financial capacity. Both the Palisades and Altadena have formed long term recovery groups and both communities are actively planning their recovery. Many people are still fighting with their insurance companies and many are still facing significant delays due to high costs. [Over 70% of all residents impacted by the Los Angeles 2025 wildfires are still displaced. The biggest driver is money.](#) Those who can afford to rebuild, likely will, and those who don't have money to rebuild are stuck in uncertainty, or are selling their properties and leaving permanently. Those are the two futures happening right now in the Palisades and Altadena communities.

The Palisades will likely come back but it won't be the same community I grew up in. It will change. All the old generation homes that were destroyed, like that of my own, will be replaced by brand new modern homes. But even with some residents staying and some leaving, the demographics are likely to stay similar, evident to the town's status as an upscale, predominately white, upper-middle class community. Altadena, on the other hand, faces a different issue due to the community's status as a very diverse, historically black working class community. For many residents of low income being forced to navigate post-fire financial strain and rebuild gaps, a significantly larger portion will be forced to sell their homes. When that happens and black generational homes are gone, wealthier buyers will step in and create a real risk of gentrification which is already a major concern to the community. [Prior to the Eaton Fires, Altadena has already been struggling with the pressures of rising rent prices, less affordable housing options, and gentrification. Now this pressure is ramping up, as half of the total properties sold so far in Altadena have been purchased by corporate entities.](#) This

raises concern that the demographics may fundamentally change to a less diverse population.

Compared to my last home, my new home will be more resilient as it follows new defensible zone zero rules, more fire resilient materials, no exposed wood, solar ready systems, and a shift to an overall better and newer design. While this does bring me some comfort, it is resilient to a point, and the catch is that while other residents may be fire conscious about the builds, many people will rebuild to a minimum required standard of resilience because costs are too high and insurance has already fallen short for many. Homes will be newer but not fully fire resilient. Most importantly is that the underlying threat isn't going away at all. Climate change is getting worse and wildfires are getting more frequent, and despite the best efforts, the zones of the Palisades and Altadena communities are geographically locked into high fire risk areas due to mountainous terrain with high vegetation and overgrowth.

Labeling and Excluding Disasters

In my role as a resource specialist, I've formed strong relationships with wildfire recovery organizations. Part of me building those relationships involves me volunteering my efforts to share resources that I find with other organizations too so that word goes around and everyone is in the know. I found a resource for free soil remediation for home owners in significant need. I emailed this resource to many recipients, one of whom, is the board president of a Malibu-based organization. In his email response, while he was thankful for this resource, he mentioned that he was curious about the language I had used, saying that this resource is for "homes in Altadena and Palisades". He had asked me if this meant that Malibu and unincorporated LA county are not eligible, and had reminded me that the fact that the fire was named "Palisades Fire" often leads people to forget the devastation it wreaked upon the city of Malibu and unincorporated LA County between the Palisades and Malibu.

I called him, explaining that I had only copy/pasted the info of the program's eligibility requirements which only mentioned those two cities, and apologized for how it may have come off. Though understanding, further discussion had made me realize the frustration over what Malibu residents impacted by the Palisades Fire lack-recognition. No one typically mentions the neighboring homes outside the Palisades that were also lost, and that the semantics of referring to the impacted communities as only "Pacific Palisades and Altadena" often times leave Malibu residents outside of the range of eligibility for aid or recovery services from some organizations, specifically because they're not from Pacific Palisades, and those programs will interpret that literally.

[After the devastating 2018 Woosley Fires in Malibu, less than 40% of the 488 homes](#)

[that were destroyed in the fires were fully rebuilt by 2025, signalling that a significant majority of residents still haven't returned and are not in permanent housing](#). The psychological toll of Malibu residents facing two major traumas within the span of six years, in addition to many aid support programs being catered to Palisades Fire survivors, and not towards anyone still seeking support from the 2018 Woosley fires, paints an unsettling picture. The greatest worry that still follows me is what if the same thing happens with us just like Malibu? What if the narrative shifts, the news media cycle moves on, and people no longer care about the evolving issues that Palisades and Eaton Fire survivors continue to face, and will be facing for years to come? This observation suggests that the city, state, and government system does not always recognize the impact of disasters, but how disasters are named and categorized, and this reveals that disaster recovery systems often rely on administrative and geographic labeling that can unintentionally exclude affected populations.

Summary

This autoethnographic capstone examined several things about the recovery and rebuilding following the January 2025 LA Wildfires. This was done through the lens of my personal lived experience, observations from engagement with other survivors and recovery groups, research data, and policy analysis. The outcomes of recovery are not determined by the disaster alone, but by an intersection of several factors such as the withdrawal from the state and undercoverage of insurance companies, limited funds and bandwidth within nonprofits, and the uneven distribution of aid due to a tight city budget. Recovery is defined by the rebuild gap which contributes to the displacement of survivors and their delays in returning, and that limits options for upgradable climate resilient homes. Importantly, this is an early snapshot of a very long-term process that will continue for years. A full effort to integrate climate resilient infrastructure is not central to the rebuilding process, though it can still be implemented in incremental phases throughout the years. Rebuilding momentum should not stop once the number of demolished structures rebounds to near pre-fire levels. Adaptability should always remain in the forefront of city planning. This will help avoid future disasters getting near the scale of destruction from the January 2025 LA Wildfires. More research is needed to track the long-term outcomes of recovery and interpret the progress based on the constraints mentioned in this capstone work. There is also a need to analyze policy mechanisms to determine how the municipal government can equitably close the rebuild gaps so that climate resilience takes a greater shape in building back communities.

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Image References

All images used in this project were photos taken by me.

“Do wind turbine technicians at wind farms in Texas understand their importance in wind energy being used to improve energy security and work towards net zero?”

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Abstract

During this MESH capstone project, I reviewed information about wind turbines and wind turbine technicians and their contribution to creating renewable energy generated electricity. Finding how wind turbine technicians work on wind turbines and view their role towards increasing wind energy usage by energy companies is necessary to know how to continue this increase. Wind turbine technicians have hands-on experience of wind energy through working on wind turbines directly. Reviewing these experiences, I found that wind turbine technicians are necessary for the wind energy industry to succeed in generating renewable energy sources. Without the skills and knowledge of wind turbine technicians, the wind turbines can fail and if they are offline then energy is not being generated. This can lead to an interruption in energy security from wind energy because of the decrease of wind energy being available and accessible to the public. A decrease in wind energy generation can also lead to a disruption in reaching net zero with carbon emissions from non-renewable energy sources not being offset by the renewable wind energy source. Therefore, wind turbine technicians are crucial to improving energy security and working towards net zero.

Introduction

If you ever drive through West Texas or South Texas through towns like Abilene or Kennedy, TX, you are guaranteed to see at least one wind turbine farm. Driving from central Texas to Colorado two times in my life, I saw multiple wind turbine farms since a big portion of the drive is through West Texas where there is nothing but hills and wind for miles and miles. To visit the coast of Texas and go to the beach as a child and an adult I have gone to Port Aransas, Texas. There are multiple wind turbine farms on the way to Port Aransas like the Papalote Creek Wind Farm in Sinton, Texas or the Karankawa Wind Farm in Mathis, TX. While I had minimal knowledge about how these wind turbines generate electricity, I had been curious about learning how wind energy contributes to limiting climate change. During my courses through the MESH project, specifically during Sustainable Energy, I have learned about solutions that can limit climate change impacting environments and human populations.

Typically, when scientists plan projects to decrease carbon emissions in the atmosphere when mitigating climate change, the goal the projects are working towards is to reach net zero. [Net zero](#) is when carbon emissions are produced at a certain rate compared to the emissions absorbed by the atmosphere. According to the Paris Agreement set in 2015 by the United Nations, carbon [emissions need to decrease by 45% by 2030 and reach net zero by 2050](#) to be able limit climate change. Although it is discouraging to know how much carbon emissions need to decrease, there are still plenty of options being implemented to work toward the goal of net zero.

When considering options that can limit climate change and reach net zero, transitioning from non-renewable energy sources to renewable energy sources is one of the first options that is brought to mind. Non-renewable energy sources like [coal, oil, and natural gas](#) are used for electricity generation and fuel sources but are known to cause damage to environments from extraction methods and carbon emissions produced. Renewable energy sources like [solar, wind, hydro, and geothermal](#) can be used as alternatives to non-renewable energy sources and work towards the goal of new zero for carbon emissions.

Wind energy is important to transition from non-renewable energy sources to renewable energy sources for electricity generation, but it is also important for energy security. Energy security is defined by the IEA [as the uninterrupted availability of energy sources at an affordable price](#). Energy security relates to the [availability, affordability, accessibility, and acceptability](#) of energy resources to the public. Wind energy contributes to energy security by providing additional options for energy companies to provide electricity to consumers instead of the traditional non-renewable energy sources. Wind energy is one of the highest electricity generating renewable resource and provides an [estimated 10%](#) of the United States electricity. In 2023 wind energy generated about [425 billion kWh](#) which could power about [39 million homes for an entire year](#).

Through this MESH project, I decided to review the core question “Do wind turbine technicians at wind farms in Texas understand their importance in wind energy being used to improve energy security and work towards the goal of net zero?”

Wind turbine technicians contribute to renewable energy generation by providing a service of maintaining and repairing wind turbines that generate wind energy.

This MESH Capstone argues that wind turbine technicians at wind farms in Texas believe their roles are crucial for improving energy security and contributing positively to reaching net zero.

Researching Wind Turbine Farms and Technicians in Texas (Literature Review)

Through my literature review I researched articles and YouTube videos for information about wind turbine farms and wind turbine technicians. Finding information to link wind farm technicians and their role towards improving energy security and contribute towards net zero was my focus during the literature review process.

To obtain information about wind turbines in Texas I researched three wind turbine farms in West Texas and South Texas. I chose wind turbine farms based on the amount of energy generation and the amount of research and articles I could obtain that would be beneficial for results and discussion of the project. Reviewing the technical data of wind turbines and the economic and environmental benefits can provide the importance of wind turbines to the energy industry.

Technical Data of Wind Turbine Farms

[Lone Star Wind Farm](#) in Abilene, TX that is in West Central Texas is 100 northeast of San Angelo, TX. The wind turbine farm generates 386 megawatts of energy which is equivalent to the average consumption of more than [83,700 Texas homes](#).

[Ranchero Wind Farm](#) in Big Lake, TX that is in West Texas is 70 miles west of San Angelo, TX. The wind turbine farm generates 300 megawatts of energy which is equivalent to 177,000 homes' annual energy usage.

[Karankawa Wind Farm](#) in Mathis, TX that is in South Texas is 40 miles north of Corpus Christi, TX. This wind turbine farm has 124 wind turbines and generates 307.06 megawatts of energy. This wind turbine farm has contracts with Austin Energy and Nike to provide clean energy to consumers. Austin Energy provides electricity to more than one million residents in Austin, TX and has worked to provide clean, affordable, and reliable energy to consumers. Nike has partnered with Karankawa Wind Farm to work towards using 100% renewable energy for electricity for their facilities used for producing the companies footwear, apparel, equipment, and accessories.

Economic benefits of Wind Turbine Farms

The Lone Star Wind Farm is under the company EDP through their division EDPR NA (EDP renewables in north America). EDPR NA is quoted to have [created 7400 construction jobs and 610 permanent jobs throughout the wind turbine farms](#). The Lone Star Wind Farm has created hundreds of construction jobs and 44 permanent jobs while the total project impact has generated

\$141.5 million towards the economy. This amount includes vendor spending, property taxes, and landowner payments through 2024.

The Ranchero Wind Farm is expected to generate [approximately \\$57 million of tax revenue](#) for Crockett County, TX over 30 years of the wind turbine farm operating.

The Karankawa Wind Farm had created over 350 construction jobs and 12 permanent jobs. This wind farm is expected to contribute over [\\$125 million in taxes over the lifetime of the wind turbine project](#). These taxes will help provide support for public services to surrounding communities of Mathis, TX.

Environmental benefits of Wind Turbine Farms

Wind turbines impact on the environment in their surrounding areas is limited by being less harmful to land and animals than traditional energy sources. Wind turbines are less harmful to wildlife including causing [less than 0.01% of all human-related bird deaths](#). While a large amount of land is used for operating wind turbines, since the wind turbines, roads, and infrastructure uses 2% of the land, the majority of the land can be used for other purposes like farming, ranching, and recreation.

The Lone Star Wind Farm contributes to the more than [2.6 billion gallons of water](#) saved each year through EDPR's Texas energy projects. The Lone Star Wind Farm saves more than [711 million gallons of water](#) each year.

The Karankawa Wind Farm generation of clean energy represents the offset of carbon emissions is comparable to the [removal of over 34,000 cars from Texas roads](#). The wind turbine project was designed to reduce harm caused to the environment including burying 90 miles of electrical cables to limit injuries to the whopping crane population and other birds.

Energy Security in Wind Energy

Because of issues of energy security through fossil fuels and searching for ways to reduce greenhouse gases there has been an urgency to transition to renewable energy sources to provide a stable, affordable, and sustainable energy supply. Wind energy is one of the most cost-effective and sustainable options when transitioning from non-renewable energy to renewable energy sources. Wind energy contributes to [economic growth, employment, regional development, energy demand, and social services](#) which not only provides energy security to human populations, but also provides socioeconomic benefits. I found a journal article that compares Geopolitical Energy Security Risk (GESR) and Economic Energy Security Risk (EESR) to find their relationship to each other. This journal article discusses comparing these two risks and wind power consumption to find if there is a connection between wind energy and increasing energy security. The results did find that wind energy [reduces economic- based energy security risk and suggests that wind energy can help provide macroeconomic stability](#).

If humans are consuming energy faster than the energy can be generated then it can cause problems in the access to the energy. The goal of energy security is to provide equity to humans towards consuming energy and making sure everyone has access to clean and affordable energy. Investments in renewable energy can offset disruptions in the electrical grid if other energy sources are being consumed at too high of a rate. [Investments in grid infrastructure, advanced grid management systems, and energy storage solutions are essential when using wind energy.](#) If these investments are not made then there can be failures within the electrical grid and can increase reliance on non-renewable energy sources.

Although energy security involves technical or economic challenges, energy security also has social and cultural challenges. If any potential social and cultural challenges are not considered when working towards energy security there can be problems with maintaining the energy security wind energy provides. While there are generally more benefits than negatives with wind energy, there can still be opposition to wind turbine farms because of [visual impact, noise concerns, or perceived impacts on property values.](#) Any community opposition can cause delays in wind turbine projects being started or completed, so including the community in the planning process can help prevent the opposition. Wind turbine technicians can provide insight into wind turbine projects since they are so heavily involved in installing and maintaining the wind turbines. Involving wind turbine technicians in community outreach can be helpful to provide information on how the wind turbines generate electricity and answer questions on potential negatives of the wind turbines. This is where receiving wind turbine technician's perspectives of their roles towards energy security can become effective.

Net Zero in Wind Energy

The renewable energy industry is leading the way in creating sustainable and low emissions process for generating energy. Wind energy is one option within the renewable energy industry that is already being used to decrease carbon emissions being released. Wind turbines have minimal carbon emissions through the lifespan of a wind turbine. Technology improvements with wind turbines have allowed the [global installed capacity of onshore and offshore wind farms to increase almost 75 times over the past two decades, from 7.5 GW in 1997 to 743 GW in 2020.](#) Although wind energy infrastructure is being increasingly built and generated throughout the U.S. and the world, there are still a long way to go for there to be net-zero emissions. From a Global Wind Report 2021, it is stated that there needs to be about [180 GW installed](#) of wind capacity per year to reach net zero. This report also states that in order to have a change to reach the Paris targets set by UN for climate change, [fossil fuel-based capacity needs to be phased out concurrent to an increasingly steep expansion of renewables and related infrastructure.](#) This means that there needs to be a heavier importance placed on decreasing the usage of non-renewable fossil fuel energy to allow for net zero to be reached.

Wind Turbine Technicians within the Wind Energy Industry

Out of all of the jobs that comprise the wind energy industry such as jobs in manufacturing, project development, and operations and maintenance, I chose to focus on Wind Turbine Technicians under operations and maintenance. Although this portion of jobs makes up the smallest percentage, the people in these roles have the most hands-on experience towards wind turbines. Wind turbine technicians work directly on the wind turbines for preventive maintenance and routine checks to limit problems with wind turbines. If a problem does happen with wind turbines the wind turbine technicians will diagnose and fix the problem as quickly as possible. Wind turbine technicians typically need to live close to the wind turbines they work on or need to travel to the wind turbines to be able to inspect and maintain wind turbines. Their job is important to wind turbines running efficiently and preventing the wind turbines from shutting off entirely. If there are not any wind turbine technicians on site at the wind turbine farm it can cause a disruption of wind energy generation and could decrease the amount of electricity generated through clean renewable energy. Wind turbine technicians roles include assisting engineers and ironworkers in installing new wind turbines, inspecting the wind turbine towers, test and troubleshoot wind turbine components and systems, and replace worn or malfunctioning components.

Wind turbine technicians' importance in the wind energy industry led me to focus on their roles and how the roles relate to energy security and net zero. If a greater understanding of how wind energy can lead to energy security and net zero, it can help reach goals towards limiting climate change. Examining the role of the wind turbine technicians specifically can understand their perspective of the part they play towards energy security and net zero.

Methodology

When I began my journey through writing my MESH project, my research question started with the idea of how to decrease negative connotations with wind turbines. Because of the benefits wind energy provides it can be difficult to understand that some people can find negatives with wind turbines being used to generate electricity. I wanted to research what negatives there are towards wind turbines and what could be done to remove as many negatives from wind turbines as possible. During my research with writing my initial case study proposal back in the fall of 2024 I found many reasons why people would think wind turbines could cause more harm than good if they were built in their communities. One of the biggest factors that caused communities to oppose wind turbine projects was due to not being involved in the process of creating new wind turbine farms. This is understandable because if the community is not able to voice their concerns or ask questions on the plans they are not able to potentially change the plans to decrease the community being negatively impacted.

Completing each class within the MESH program I learned about the importance of allowing the public to be involved in the planning process of projects that can impact on the community. I learned about roles the community has to provide their concerns towards projects and that engineers of projects need to take the concerns of the public seriously. I also learned how

necessary it is to find alternatives towards limiting climate change and how to proceed with the plans of it. The class that I learned the most about the topic of was the “transition to alternatives” class because it provided information on the Just Transition movement and ideas of mitigating climate change. [The Just Transition movement can help all communities, workers, and social groups be included in the changes towards a net-zero future.](#)

After obtaining more of an understanding on the goals meant to be completed through the MESH project I wanted to make sure my core question is connected to the MESH program and to engineering, sustainability, and health. Changing my core research question to focus on wind turbine technician perspectives towards their role with using wind energy to obtain energy security and net zero seemed the best way to move forward with my MESH project. Once I decided on my core question it made it more feasible to collect data and find methods to help me write the capstone project.

Towards collecting data on wind turbine technicians, I initially started researching the background of the role and what wind turbine technicians did. Being able to find information on the role of a wind turbine technician was easy enough, but starting to dig deeper into the role to gain perspectives towards energy security and net zero was more difficult. I did most of my research towards different wind turbine farms since I thought it could help me understand the benefits wind turbines have and gain insight of the technicians working on the wind turbine farms. I was able to find reasons why wind turbine technicians would be proud of working on a wind turbine and would think their role is positively impacting energy security and net zero. Finding direct information from wind turbine technicians was not as common as finding information on the background of the wind turbine technician roles. When considering my next steps forward in answering my core question I did start to think about options of completing interviews with wind turbine technicians to receive direct answers I was trying to find in journals or articles. Although I was able to narrow down questions I was wanting answered it was difficult to find ways to contact wind turbine farms to ask these questions. I did try contacting several wind turbines farms but unfortunately wasn't able to obtain any answers to my questions. Because of this happening I decided to shift from relying on the interview process to complete my capstone project and started reviewing YouTube videos and the articles I could find of interviews with wind turbine technicians.

The following were questions that I was interested in find answers on to find the perspectives of wind turbine technicians:

- 1) Are there projects the technicians focus on to improve wind turbines?
- 2) How did you enter the wind energy field and what is any education or job experience towards this same role?
- 3) What do you find rewarding or challenging as a wind turbine service technician?
- 4) How do you feel about working for the wind turbine farm over time?
- 5) What were your motivations for taking the job?

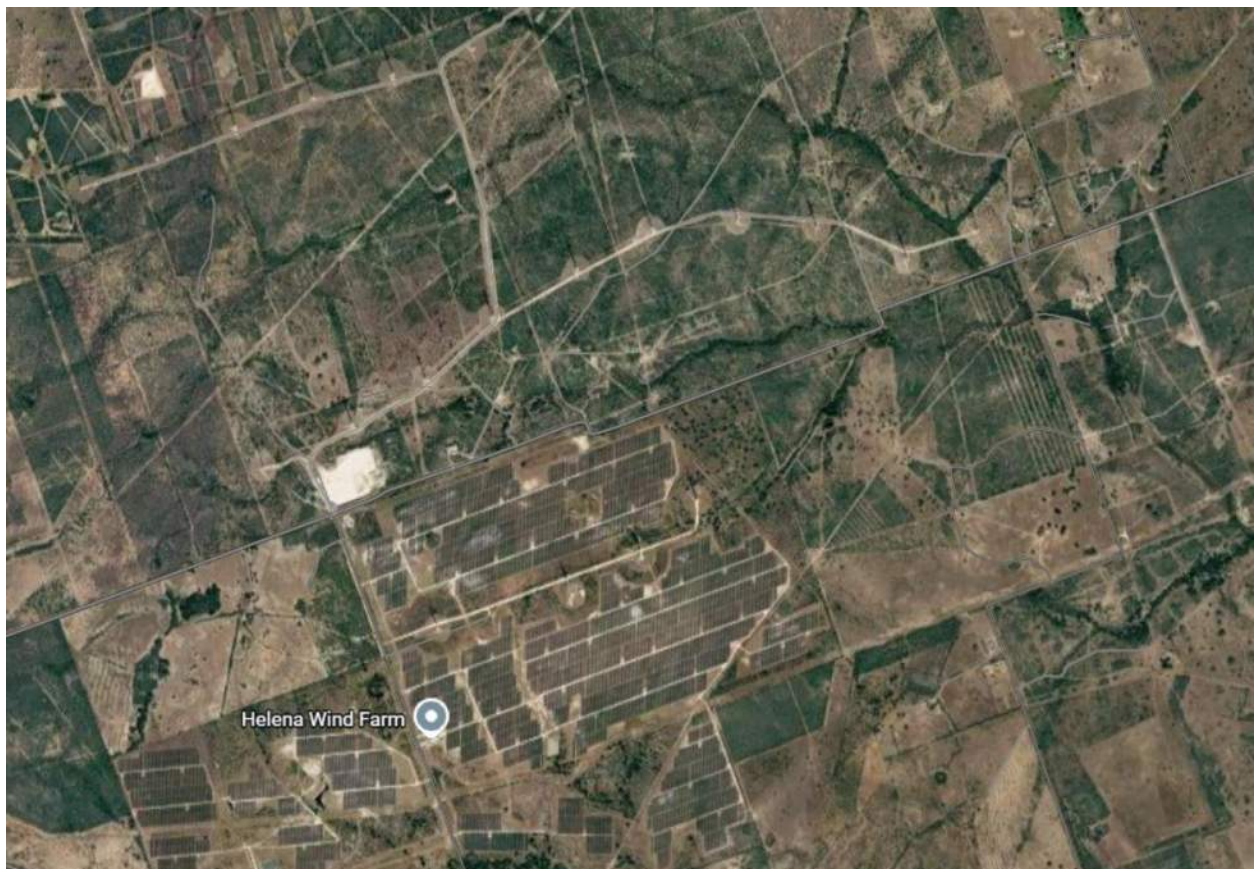
6) How do you see your role impacting the larger overview of the wind energy industry?

Results and Discussions

My main priority with reviewing articles directly about the wind turbine service technicians was to gain their perspectives on how they view their roles in the Wind Energy industry. I wanted to understand the technicians viewpoint on how their role truly impacts the Wind Energy industry and if there can be any changes to improve the Wind Energy industry. While reviewing the research I completed I wanted to use the steel person argument of "While many people assume technicians perspectives of wind turbines are indifferent to how they impact the energy industry and climate change, it can be possible their perspectives are caring towards the impact". Examining the research using this argument has helped me if the answers were not what I expect them to be and use the answers to gain further insight to the technicians perspectives.

I was able to discover the role of wind turbine technicians and their importance towards wind turbine farms. The wind turbine service technician has hands-on experience of how the wind turbines work and what needs to happen to repair the wind turbines. Vestas provides job opportunities with working on wind turbines directly. The posting for a Wind Site Technician position at the Helena Wind Farm on Vestas' career site describes the role as the technician working to "ensure the smooth operation of wind turbines, directly addressing maintenance, troubleshooting, and system issues." This is critical for the technician to resolve any issues and understanding wind turbines to prevent any further issues continuing.

Reviewing how a wind turbine farm is spaced out with the wind turbines helped me complete a spatial assessment of wind turbine farms and how much land the infrastructure uses compared to the total amount of land owned by the wind turbine or energy company. Understanding how a wind turbine is located on a wind turbine farm provides confirmation of my previous research stating that 2% of the land is used by the wind turbines and the other 98% can be used for other purposes like farming, ranching, and recreation. One of the possible concerns communities might have towards wind turbine farms is having their land taken by the wind turbine company and not being able to use the land anymore. Since the layout of the wind turbine farm shows that there is room between each wind turbine, it is evident that the land is available for other uses. The following pictures are of the Helena Wind Farm in Kenedy, TX.



With finding the YouTube videos and article about the wind turbine technicians I was able to obtain perspectives from the wind turbine technicians that I wasn't able to review before finding the videos and article. The video that provided the most helpful information about a wind turbine technician's perspective of their role towards energy security and net zero was the ["I Earn \\$73K In One Of The Most In-Demand Jobs Right Now —I Love What I Do"](#). The wind turbine

technician speaks about what made them interested in the role and how they view their role in the company. They find it important to work for wind energy to help provide wind generated electricity for consumers and continue using sustainable options for energy sources. This perspective helped me understand that the technician does view their role as necessary for renewable energy sources being used for generating electricity. Although they don't specifically talk about energy security or net zero, understanding how they contribute to consumers receiving electricity generated from renewable energy makes me believe that they could think using wind energy would also lead to energy security and net zero.

YouTube video [“A Day with an Invenenergy Wind Technician”](#) under the channel “Invenenergy” has a wind technician working for the company Invenenergy discussing their role and why they chose to work for Invenenergy. The wind turbine farms the person works for is the Bethel Wind Farm in Dimmit, TX. The technician stated they found out about the role through their friend recommending working for the company. They discussed that they received training directly through Invenenergy and worked their way to a leadership position helping other technicians learn the best they can. The wind turbine technician states that he likes collaborating with the other wind turbine technicians to solve issues with the wind turbines.

YouTube video [“Wind Powers Work in Texas Panhandle, Part 2”](#) under the channel “Oncor” has a wind turbine technician working for the Lone Star Wind Farm in Abilene, TX. The technician discusses the reason of why the wind turbine farm is necessary to the Panhandle of Texas. They stated that the wind turbine farm provides energy generation for the surrounding area and the Panhandle of Texas. Besides stating the importance of the employees working together during wind turbine outages to get them back online the video doesn't go into perspectives of how the technicians feel towards energy security and net zero. However, I thought it was important to watch to understand the importance of the wind turbine farm.

YouTube video [“Working as a Service Technician at Vestas | Meet Jennifer Meyers”](#) under the channel “Vestas” is about a wind turbine technician working for the company Vestas. The wind turbine technician discusses enjoying working for the company Vestas and completing a quality job and working efficiently. It was a pretty quick video, but I found that it is helpful to find as many perspectives of people as possible.

Youtube video [“What's it like being a wind technician? Hear from Brandon Lavaque | Avangrid”](#) under the channel “Avangrid” is about a wind turbine technician that works for the company Avangrid. The wind turbine technician discusses what happens during his job and his responsibilities. He goes through how they check the wind turbines that have faults and how they troubleshoot the turbines to fix the problems. The wind turbine technician speaks about his viewpoint on the importance of working on wind turbines and wind energy generating electricity. He states that “America needs clean energy because it can be a sustainable and renewable energy resource. We don't have to take things out of the earth, and we can use the wind in the air that is naturally occurring.”

I reviewed an article that is an interview with a wind turbine technician discussing their role in working at a wind turbine farm in Nolan, TX. [The wind turbine technician states they first started the job as a way for a better life for their family and seeing wind turbine farms around where they live.](#) The article discusses a wind turbine technician that originally had left his job as an electrician to be a stay-at-home dad and chose to become a wind turbine technician once he was ready to go back to work. The technician states that while he and other technicians started working for the wind turbine farm for job security they now do understand the importance of wind turbines for not only the economy, but also the energy industry.

An article under the energy company, [Empire Energy Partners](#), discusses the importance of wind technicians working at Empire Energy. There is an interview with the Senior Director at Empire Energy Offshore who answers questions about how important wind technicians are and how they fit into the future of wind energy. Although I focused on wind turbine farms onshore in Texas and the interview focuses on offshore wind turbines, the answer for how wind technicians fit into wind energy is insightful. The senior director states that wind turbine farms provide projects that inspire innovations to increase wind turbines being built and reduce costs and strengthen supply chains.

Reviewing YouTube videos and articles helped me understand the perspective of wind turbine technicians and how they view their work on wind turbines. The technicians have difficult tasks to complete to maintain and troubleshoot wind turbines, so it makes sense that they put value on the benefits of the job itself at the highest priority. However, seeing the opinions of the wind turbine technicians include that their job is working towards using wind energy for sustainable and clean options of generating electricity brings me hope that they do understand their contribution to energy security and net zero.

Summary

With any efforts towards using renewable energy sources for improving energy security and working towards net zero, it will be a constant work in progress. Although through my research of this project it was easy to get discouraged of being able to have energy security with wind energy and reaching net zero, I am hopeful that in the long term the world will continue to work towards limiting climate change and decreasing carbon emissions. Reviewing the perspective of wind turbine technicians brings hope that there is a fight to lead the world into decreasing non-renewable energy sources being used and renewable energy sources being primarily used. Finding new solutions and ideas of helping the world decrease its impact on natural environments is necessary in order to reduce destruction of ecosystems and human communities too.

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Final Capstone Project
Community Gardens - A sustainable solution to climate change, poverty, social,
and mental health

The local community garden that I have been involved with for the past year and a half has proved to have its own benefits and challenges. When I started the MESH program, I knew I wanted to get involved with a community garden, although I was not sure which one. One of my friends once told me, "tend to the garden you can reach." In other words, we should focus our efforts on our local communities, and projects within our capacity. Thankfully, I was able to get involved with my local community garden and was appointed Vice Chair through the committee in 2025. I want to focus on community gardening as a sustainable alternative to industrial agriculture, and to improve food security. I have a passion for alternative agricultural systems and I view community gardens as a sustainable way to increase food security, nutrition, reduce food waste, and improve social and mental health for our communities. Through an autoethnographic perspective I will dive into my own mental health benefits and volunteering with the garden. I will utilize the environmental justice framework to connect what I have experienced to research findings.

"The environmental justice framework attempts to uncover the underlying assumptions that may contribute to and produce unequal protection. Affected communities should not have to wait until causation or conclusive proof is established before preventive action is taken" (2001, Bullard, p.153).

There can not be a discussion about environmental justice and food security without recognizing the violent oppressive forces at play. On the global scale, true environmental justice then would be an end to occupation, war, and forced starvation. Some of the research will be based on environmental and social cognitive theories. Ecological system theory relates to how the environment impacts our behaviors. Social Cognitive Theory is in regards to more personal factors but sees behavior as a dynamic interaction between our individual selves, the environment, and the impacts of these on behavior. Critical Race Theory centers research on communities of color and challenges white supremacist belief systems. I believe that individuals who spend time in the community garden will experience higher levels of happiness and overall health than those who do not have access to community gardens. I will share personal pictures I have taken over the year, and incorporate some personal gardening perspectives from volunteer members through participatory research. The overall question which may not be answered through my project is, "How can sharing personal garden stories increase local engagement and involvement?"

Ideally, the garden will eventually become self-sustaining through members of the neighborhood. My hope with this project is to raise awareness of the many benefits of community gardening, and to have an ongoing dialogue of sharing personal stories, to increase community building and social bonds. Modern day has disconnected us from our food, and community gardens are a great reintroduction to growing our own food. Research has shown that “chemical fertilizers and pesticides are linked to increased birth defects, cognitive decline, and cancer (2022, Melanda, p. 656).” The current dominant system of industrial agriculture is a leading cause of greenhouse gas emissions and methane emissions from landfills which is far more harmful to our environment than just carbon emissions. Industrial agriculture is also land and resource intensive that degrades the soil and environment. In order to avoid worsening health conditions, improve food security, and limit the effects of climate change, we need alternative regenerative agricultural systems in place. “In 2024 there was a food insecure population of 733 million that is increasing, and a malnourished population of 2-3 billion due to deficiencies of micronutrients, proteins and vitamins caused by food grown on degraded soil” (2025, Lal, p.10). Community gardens alongside small scale and organic farms can help mitigate these concerns. I hope that by sharing my personal experiences with community gardening I can motivate individuals reading to reach out to their local community garden and volunteer their time, to reap their own benefits that will be discussed in this project.

When I was a child, I always loved to play outside, exploring the natural world and neighborhood parks. I felt a sense of freedom outside that I did not necessarily have at home. I grew up in a chaotic and oftentimes stressful family home, with verbal and physical abuse. My neighborhood as a child also experienced higher rates of poverty and crime so the outdoors gave me a sense of safety. I remember my mom planting flowers in our back yard, typically when my brother and I returned from school. She would be outside weeding and watering and I mostly did my own thing. I remember her seeming more calm afterwards, it was like she was refreshed working in the yard. I remember a feeling of inspiration when I saw her carnations growing on the side of the house. I still don't know how my mom balanced working midnights, raising children, going to church, walking the dog, cooking, cleaning, and tending to the yard. My only assumption on how she did all of this as a single mom, was her love for us and her community gave her strength. I would like to think I carry much of her strength within myself and I have immense gratitude for how I was raised, even the most challenging times. I'm glad I witnessed my mom persevere through the hard times and continue to plant flowers in the yard. My mom retired and sold her house during the summer of 2025, and it brings me joy to know the new homeowners will enjoy my mom's handiwork.



My childhood home, JH 2025.

The freedom I felt as a child is something that I carried into adulthood. I moved from Minneapolis Minnesota to the mountains of Western North Carolina in 2021, right after Covid - 19. Previously working in the medical field as a certified medical assistant during the pandemic as well as experiencing the revolutionary protests from the murder of George Floyd was both powerful and overwhelming. I felt I needed to move out of the city and experience a life that is connected to nature, and I wanted to experience outdoor activities year - round. After moving to North Carolina, I transitioned from working in the medical field to working in wilderness therapy, to mentoring young adults, to then working on a small organic farm.



Winter tunnel on the farm JH 2023, Harvesting beans on a beautiful day JH 2023.

Working on the small organic farm for a season was truly life changing. I felt peace and clarity harvesting the vegetables in the field because I was able to mindfully engage in my surroundings. Mindfulness is a positive mental state that leads to reduced

stress and improved focus. Working with my hands, and focusing on harvesting, seeding, and plant transplanting, had a positive mental health impact for me. I truly felt happier. Having seen the positive mental health effects of the environment and wilderness on struggling young adults, I confirmed this for myself working on the farm. Working on the farm was different than working in wilderness therapy, because I was able to tune into my experiences to a greater depth. The farm showed me a different way of relating to our food, and a feeling of being connected to the earth. This feeling is difficult to describe, but generally speaking it is a feeling of being connected to something greater than yourself, a certain type of love and belonging that only the earth can provide. Cultures and societies throughout history have revered this feeling and much of our foundational understandings of the world are based on the earth. For example, the word homo (man) is based on the Latin word humus, which is the decomposed organic matter in soil, which all terrestrial life depends on. The term "Agricultural Spiritualism" is the idea that the spiritual nature of humanity is linked to the production and consumption of food. I personally feel more emotionally and spiritually grounded by growing food. Eating nutritious organic produce is also grounding and beneficial to our physical health.

The mental health benefits have been shown through recent research with soldiers diagnosed with PTSD from the war in Sri Lanka working in a community garden. Being able to engage mindfully in an activity and the surrounding environment, helped participants to cultivate clearer mind states, as their minds were engaged in observing, instead of thinking, as expressed by participant Rehan: "My mind was thinking nothing. It was clear when I was in the garden. I didn't think about anything, I didn't think about anything else. Even my brother, country, nothing. We just enjoyed the garden." (2023, Hiu Lam Yip, pg. 73). This illustrates the positive mental states one can experience by engaging mindfully with gardening. My friend introduced me to the Veterans Healing Farm in a neighboring city that regularly helps veterans struggling from PTSD symptoms.

"They are a wonderful asset for the Veteran Community; they are helping veterans with PTSD by agricultural therapy; they offer free training and fellowship; they give away thousands of pounds of produce and hundreds of bouquets of flowers to veterans every year; and they provide a family to many veterans" (2025, Don, VHF volunteer).

Being able to enjoy a community garden or healing organic farm has provided mental health benefits to countless people struggling. The combination of enjoying the outdoors, the mental health benefits of growing our own food, and being connected to something greater than oneself are some of the reasons why I wanted to be involved in community gardening. It's based more on hope than a feeling of fear for the future, although I still have a growing concern for our environment and food supply. I first became involved with my local community garden by going to its grand opening last year, where I met some of the founding members of the garden. They were very welcoming and invited me to participate. I remember feeling excited that I could make a

difference within our food systems. These pictures,



JH, 2025

are some of the first pictures I took of the garden. The image on the right is spinach. As you can see with the image on the left there is a fence around the garden, which unfortunately is locked. It is locked due to concerns of theft, and the possibility of houseless folks sleeping in the garden. These are not my concerns, but rather previous members' concerns as well as current members on the committee. A few members of the neighborhood believe it still needs to be locked, and we will utilize a free produce stand outside for our harvests. The garden is in a historically redlined neighborhood, experiencing poverty, crime, and can be considered a food desert. The term "food desert" has frequently been used to describe situations in which consumers lack access to affordable nutritious food, typically a populated low-income area with limited access to full-service supermarkets. USDA defines a food desert or "low-access community" as a census tract in which at least 500 people and/or at least 33% of the population reside more than one mile from a supermarket or large grocery store. (2009, USDA). The neighborhood has a higher African American and Hispanic population than surrounding neighborhoods although the exact data for this has yet to be recorded. Some may call it "the hood" although the area is at risk of being gentrified. I do worry that the garden is at risk of being gentrified and the possibility of outside organizations having control. In the recent article of preventing gentrification there are 5 recommended action steps to take which include,

"(1) Co-construct knowledge and share decision-making power, (2) design inclusive community engagement that centers marginalized voices, (3) implement multi-issue interventions, (4) disrupt structural racism and other causes of disparities, and (5) coordinate policies and programs across local, state, and federal scales. (2025, Shusler, pg. 2)"

From what I have experienced working with the committee we are mostly focusing on the shared decision - making power, and designing inclusive community engagement. I had a conversation with the Chair of the garden about matriarchal vs.

patriarchal societies and to focus on including the mothers more in decision making. If we start to unmask the current agricultural sector we can see how it is rooted in the patriarchy. Historically within many societies women were the ones involved in agriculture. Traditionally, indigenous women were responsible for agriculture.

“Agriculture long dominated North Carolina’s economy and society, and women constituted an invaluable source of agricultural labor. Native Americans after about 1000 B.C. developed villages with fields of squash, corn, sunflowers, pumpkins, beans, and other vegetables tended by women. Women provided most of the agricultural and domestic labor, and all residences, fields, and agricultural tools belonged to them” (2006, Crow, pg. 3).

This traditional role has been disrupted by colonialism. In my time volunteering with the garden, I have noticed that women are the majority of bed owners and caretakers. Last year, a group of hispanic women took it upon themselves to make sure the beds are consistently watered. The committee comprises mostly women. I’ve also noticed that men lean more towards infrastructure, while women focus more on the plants and general garden maintenance. In fact, I’ve talked with a few men who are only there volunteering because of their wives. I am not saying that men shouldn’t be farmers or focus on agriculture, but it does appear that women have a more innate gardening ability. This could be due to the biological reason of wanting to provide for their children or the nurturing aspect of caring for other living beings. I personally believe there is also the connection of women being able to give birth and how they have a sacred relationship to bringing life into this world. Even under our current patriarchal systems, I still have hope that women will once again take the lead in agriculture.

It has been brought to my attention by a fellow committee member that volunteer work, specifically labor work or agricultural work, brings up the history of slavery for African Americans, and how this can impact their involvement. This is something I had not previously considered when I started volunteering with the garden, due to my privilege and ignorance. I hope with the help of community involvement to change the narrative from a history of trauma, and racism, to a future of liberation and food security. Great cultural sensitivity is needed in order for this transition to take place with the garden. African Americans have been intentionally left out of land ownership due to systemic racism.

“African Americans are losing this vital resource (land) at a rate two and one half times that of other Americans. Over the fifteen year period ending in 1992, they have lost 55 percent of their rural land base - down from 57,000 farms and 4.2 million acres of land in 1978 to 18,816 farms and 2.3 million acres in 1992. The two million acres lost have a conservative value of one billion dollars and tens of billions in economic development activity” (2000, Pennick, pg.5).

It has been a challenge to disrupt the structural racism and coordinate policies across state, and federal levels. This is due to the community garden being technically owned by the city, and how the city can decide to have their own restrictions. For example, our last donation drive had to have an approved donation amount by the city. Also, the city ended up turning off our water without telling us in November, even though we still had plots growing. We also had to verify that the city would reopen the public restrooms in the spring, because they were locked all last year for reasons unspecified. We speculate it was intentionally locked to discourage people using the bathrooms for drug use and/ or vandalism. This was very bothersome to me because using the restroom is a basic human need. Critical Race Theory reminds us to challenge structural racism and to uplift the resiliency of communities of color. It describes the aspect of cultural wealth through resistant capital. Engaging in the local community garden is a powerful form of resistance which challenges this structural racism. There is so much beauty in resilience, as illustrated in these beautiful pictures I took last season in the garden.



JH 2025

This structural racism is rooted in colonialism, with industrial agriculture and monocultures resulting in corporate profits over the health of our environment and people. Everyone has been disconnected from their traditional food sources by force and are being supplied unhealthy processed food due to displacement and poverty. The Green Revolution in the 1960s took away traditional foods for High Yielding crops and monocultures. Unfortunately, minority populations experience this at higher rates than 'white' or otherwise socioeconomically privileged individuals. We can look at the example of colonization where European foods were looked at as a sign of status in this time period, and traditional indigenous foods were looked at as less than. Dr. Linda Alvarez with the Food Empowerment Project writes,

“Herein began the colonial discourse of “right foods” (superior European foods) vs. “wrong foods” (inferior Indigenous foods). The colonizers considered that without the “right foods,” they would die or, even worse, in their minds, they would become like Indigenous people (2024, Alvarez, pg. 3).”

The author illustrates how food is power and how this power has been taken away from indigenous people. The damage of colonization is indeed history, but the effects have been long- lasting and are still affecting communities today. In regards to the epistemology of this project I am attempting to connect the severed ties that humanity has with their own souls, and hence the soil of the land as well. It can be compared that our soul is the inner work in which those of us who have a growth mentality pursue, and the soil being the outer work which bears the fruits of our labor. The spiritual feeling I have felt while growing my own food leads to greater happiness and I am not alone in this phenomenon. Oftentimes scientific research is simply academia proving what indigenous and traditional folk knowledge has known since time immemorial. However, science can still provide helpful analysis to the many benefits of community gardening.

The benefits of community gardening has to do with working with the soil. Soil contains phytochemicals and mycobacterium which helps boost our immune systems as well as naturally release serotonin in the brain. Mycobacterium can now be bought over the counter as a supplement although I would rather be in the soil naturally and save money. Serotonin is a natural antidepressant and mood lifter, which in today’s world is needed now more than ever. In addition to working with the soil and reaping its benefits, the soil needs to be healthy in order for our minds to be healthy. Poor soil health can lead to nutritional deficiencies, such as those in vitamins B1, B6, and B9, which are linked to mental health disorders such as depression. Iron and zinc deficiencies can lead to poor brain function. This research shows the vital connection of soil for our minds. “There is a link between the soil in which we as a human community live and the mind with which we collectively view our lives and organize our affairs. One cannot be holistic in one’s mind and mechanistic in one’s agriculture” (2014, Franklin, pg.163). This illustrates the desire for holistic health through meditation or otherwise, and the industrial mechanistic agricultural systems.

We can see how it’s important for communities to focus on their soil, something that is not thought about in our modern world. If we look past our modern world and look at the majority of human evolution we will begin to see the importance of gardening and being connected to our food sources. Our ancestors, many of whom were hunter gatherers likely evolved a rush of dopamine after harvesting crops. The same way we can receive dopamine today is by harvesting our hard earned crops. We are being distracted with other means of dopamine that have become an addiction, (social media, consumerism, etc). If we can train our brains to seek out healthy means of dopamine through community gardening, then the closer we are to food security, food sovereignty, and mental wellbeing. Community gardening also improves physical health and nutrition and can also reduce food waste. Research has shown that participating in gardening can increase consumption of fruits and vegetables. “Adults with a household member

who participated in a community garden consumed fruits and vegetables 1.4 more times per day than those who did not participate, and they were 3.5 times more likely to consume fruits and vegetables at least 5 times daily (2021, Savino, pg. 5).” This quote comes from research that was conducted in Flint Michigan where an increase in fruits and vegetable consumption increased due to a community garden. Food waste is the single most common material landfilled and incinerated in the U.S., comprising 24 and 22 percent of landfilled and combusted municipal solid waste. Reducing and preventing food waste can increase food security, foster productivity and economic efficiency, and promote resource and energy conservation. According to the EPA’s data,

“One year of food waste is equivalent to greenhouse gas emissions of more than 42 coal-fired power plants; enough water and energy to supply more than 50 million homes; the amount of fertilizer used in the U.S. to grow all plant-based foods for U.S. human consumption; and an area of agricultural land equal to California and New York” (2026, EPA,pg. 1).

In addition to these startling statistics, In 2018, “335 pounds of food waste per person left the human food supply chain (were sent to landfill, controlled combustion, sewer, co/anaerobic digestion, compost/aerobic digestion, and land application), and in 2019, 349 pounds of food waste per person left the human food supply chain” (2025,EPA,).

Keep in mind that this is the data that’s recorded, and this is limited to food waste lost in production. Community gardens can help reduce food waste by removing the waste from production and having the community eat fresh produce. As I’m sure some of the readers already know, organic produce tends to spoil quicker than the produce bought in stores. So by eating the produce from the garden right after its harvest or shortly after eliminates the possibility of it going to waste. If the produce does end up spoiling then it can be composted at the garden. “Community composting can be considered an ethics of care approach to reducing food waste (2021,Morrow, pg.4).” This can be labor intensive work, so the act of “doing the care” is a powerful step in reducing overall food waste. It is through these acts that individuals begin to care for their waste, compost, and community. The resulting compost is a protected public good that cannot be exchanged for money. Transforming waste into a commons facilitates collective forms of care. This logic stands in sharp contrast to the circular economy discourse of revalorising waste as a commodified resource. This not only reduces food waste but also leads to a more circular economy that local businesses and individuals can benefit from. Compost is regenerative and adds to the overall community wealth. Community gardens offer the neighborhood the opportunity to compost their waste, which would then be turned into organic matter for soil.

The image on the left below shows empty garden beds and healthy soil. Hopefully these garden beds will be filled this year with members from the neighborhood. The image on the right shows the pergola shelter, the children's garden, and the berry house in the back. You can also see the trains that run alongside the garden. I remember one positive memory of the children's garden. One of the committee members is a mother from El Salvador who has two young children. Her husband is from Mexico. They are within walking distance of the garden and she is a dedicated gardener. She stays at home with her two young children and her husband works long hours at a factory job, sometimes working 12 hour shifts and has only one day off. It was on one workday that I remember her children laughing and playing with the water hose, and getting excited when they saw bugs in the garden. This brought me great joy to see and I felt a sense of hope for the future of the garden. The children are the future stewards of the land, and if we can inspire them to garden then we have done our part as garden members. When I asked her what motivates her to be a part of the community garden she said, "because it is in my neighborhood, and I can teach my children." She also said, "I want to be a part of the community."



Community garden beds and shelter, JH 2025.

Her response illustrates how community gardens can increase social belonging. We all met at her house for our last committee meeting, because it was a bit too chilly to meet at the garden. We all brought a food dish to share, and she made us pupusas. They were delicious! This was the first meeting we all brought something to share, and I would like to make a habit of this. I found it to be very connecting and bonding to share food together. We discussed the seeds we needed to purchase for this year and our upcoming goals, as well as approve/ disapprove of new garden members. We chose seeds that the community would like, such as collard greens, onions, and kale. We realized we still had many seeds leftover from the previous year, so we didn't order too many new seeds to try to utilize what we already have. We had plenty of peppers and tomatoes from last year. We also purchased plant starts from our local 4-H club since they were having a plant sale. This felt more aligned with the community rather than ordering things online from a non- local company. We approved all but one garden

member application, and the reason for this disapproval was that the member did not live in the city of our local community garden. We even tried to call this applied member to gauge commitment, and there was no answer, so unfortunately we could not approve their application. However, we all agreed that we need to prioritize the local community, and we felt confident in our decision. I am hoping that the local neighborhood becomes more engaged by utilizing a calendar and a free produce stand outside the garden this year. I also would like to remove the lock this year, however this needs to be voted on with the committee.

I didn't necessarily ask for a garden bed last year, because I wanted the priority to be for the neighborhood, however the committee convinced me to try it out. I am glad I did, and at the same time, I'm glad I chose not to have a bed this year so I can have more time for the communal beds and committee tasks. I shared this bed with another committee member. She grew tomatoes and parsley, which did very well, and also planted broccoli towards the end of the season. We texted each other if one of us was out of town so the other could water and tend to the bed. I grew tomatillos which I ended up giving away to the community and my friends. I brought some of the harvest to work as well.

I took this image below early on in the season, and unfortunately I didn't get another picture when the plant really took off! It gave me a feeling of responsibility to the community, that I will take care of myself alongside this plant, and in doing so I am also taking care of the garden and the neighborhood. This again relates to that indescribable feeling of being connected to something greater than yourself, which is emotionally, mentally, and spiritually grounding. Towards the end of our donation drive last year we had a mother stop by the garden with flyers for a march the next day due to the murder of her son. She explained what happened to some of the committee members and we listened to her pain and struggle. The march started at the park and would go into town to the courthouse to demand justice for her son who was brutally shot and killed in violence, not far from the garden. She felt that the police and paramedics were racist towards her and her child, and was outraged at what happened. There are little words someone can say to a mother that is dealing with the death of her child, but we listened and at the end gave her a hug. I remember going over to harvest my tomatillos growing in the bed after she left. It felt like there was nothing I could do to ease her pain, and I felt sadness and outrage myself. Harvesting and tending to the plant was grounding to the spirit and my emotions.



Tomatillo, JH, 2025.

The beginning of the donation drive was a wonderful time. We had attendance from garden members, members of the neighborhood, and children from the local church. While we were waiting to get started the children helped water all of the beds. The donation drive was late August, so it was still very warm outside. I remember one child exclaiming, "I'm a good citizen!" which I thought to be so funny that I spit my water out onto a garden member. Of course I apologized and we all shared a laugh. Once we got started the committee introduced themselves and the Chair provided translation in Spanish for our Hispanic members. I hope that my español will reach conversational levels to be able to reach our Hispanic community members and agricultural workers that provide the people their produce. The chair also gave the zinnia flowers growing in the front of the garden to the children, so each child got their own flower to take home. After the introductions we then celebrated with delicious cake! The donation drive raised \$800 to be used for garden expenses, so overall it was a great success.

Reflecting back on my involvement with the committee this past year has been a learning curve, and it has had its set of challenges. Some challenges include gathering enough volunteers for the work days, increasing community engagement, and a transition of leadership. I was able to speak with one of the founding members of the garden who wants to be involved again for this season. He helped write many of our grants, and he said a lot of the time grant money has to be used quickly, so the projects had outside volunteers coming in to get the projects done in a timely manner. He said this may have impacted the neighborhood and made them feel like their help isn't wanted or needed. I asked him about the early years of the garden and how we can increase community involvement. He said that in the early building days, before there was the fence and mulch covering the ground, many volunteers became discouraged after ground hogs destroyed all their hard work of removing weeds and brush. He then says, "that's just living with nature." I am very grateful for his down to earth attitude, and I look forward to volunteering alongside him this season.

One of the memories I find to be significant is the memory of one of our first garden workdays last year. The first volunteer workday was a very productive day

constructing the garden beds and laying the mulch ground cover. It was a good turn out, roughly around 10 - 20 people showed up. It was a meeting of strangers, garden members and volunteers, and committee members. The committee members gave direction on tasks to be completed, and worked alongside the volunteers and garden members. Some of the volunteers played music, and talked to friends, or started conversations with strangers. I remember it was a hot and sunny day, but people were ready to work at 8am on a weekend. We worked up a sweat! Towards the end of the workday one of the garden volunteers told me she expected most of the work to be done already. This was a little shocking to hear considering this was the first year the garden was open. Still, I remember feeling inspired by the community working together for the greater good of the garden, and how much we were able to accomplish when we all worked together.

Now with the start of this year's growing season, we recently had our first onboarding welcoming our new garden members. There were a few returning members from last year, and it was awesome seeing familiar faces. The particular returning members I'm mentioning volunteered quite a bit last year, and helped construct our free little library as pictured below. I included literature about Black Food Justice and would like to provide more relevant literature this year. One book I included in the library is *Black Food Matters* which connects food justice to racial justice, as they are deeply intertwined. The book talks about the revolutionary actions of the Black Panther Party. Huey Newton is quoted saying,

"By providing free meals and groceries to people whose wage-based labor was not sufficient to keep food on the table, and offering health services to the sick and uninsured, the Black Panther Party reframed food and wellness as rights instead of commodities. Notably, the Panthers were clear that the food handouts were not, in themselves, the revolution. Rather, meeting the basic human needs of oppressed people was a precursor to the organizing and structured action that revolution required (1972, Newton)."



Free little library, JH 2025.

This quote reminds me of the garden with the surrounding neighborhood having to work multiple jobs due to low wages and families to take care of. Last year I mentioned to some members, we will call them Sarah and Larry to keep their names

confidential, that I wanted to focus on the neighborhood this year and the priority will be given to the direct neighborhood for garden beds. Sarah said she was surprised she was approved for a garden bed again this year because of this statement. I reassured them that yes, while we want to focus on the neighborhood more this season, we appreciate their hard work with the garden last year. It did not feel morally right to deny them a garden bed, when they showed up to almost every workday and constructed our free little library. Sarah said she still feels like they are not doing enough volunteer work for the garden. I empathized with her, as someone who feels similarly. However, I reminded her that we can only do so much with our volunteer time, and I asked if she would like to help with outreach to the neighborhood this year. She is interested in this.

We began our first onboarding day of this year's season with a tour of the garden, as well as its history and mission of providing food security to the neighborhood that is in a low income, high poverty food desert. I made it clear that the priority is to the direct neighborhood. We had a few neighborhood children come by on their scooters, without their parents. Myself and a fellow committee member said we will be their guardians for now, but that we need their parent's permission in case of an emergency. We gathered their names and phone numbers. We also had another neighborhood member stop by and join the garden. This neighborhood member had her house destroyed during Hurricane Helene and left her yard unable to grow fresh produce, so we are very glad she is wanting to grow in the garden this year. After the tour of the garden and going over the rules for membership, we began the workday. The first order of business was to till the cover crops in the beds, this was a mix of peas, clover, and rye. We used cover crops over the winter to add nitrogen into the soil as well as protect from soil erosion, although some beds need to be filled more. George Washington Carver was a pioneer in regenerative farming, one of the first agricultural scientists in the United States to advocate for the use of leguminous cover crops, nutrient-rich mulching, and diversified horticulture. Dr. Carver was dedicated to the regeneration of depleted southern soils and turned to legumes, such as cowpeas and peanuts, as a means to fix nitrogen and replenish the soil. He believed that the cowpea, a crop indigenous to Africa, was indispensable in a crop rotation. Dr. Carver is quoted saying that,

"A soil's deficiency in nitrogen can be made up almost wholly by keeping the legumes, or pod-bearing plants, growing on the soil as much as possible" (2022, Penniman, pg.25). We can all learn more about the history of Black, Indigenous, and People of Color's agricultural expertise and knowledge. This challenges the dominant narrative of farming and agriculture that has been perpetuated by white supremacist views.

Focusing back on the garden this year, we also assigned the beds for those that wanted their own bed. We still have plenty of communal beds for the garden to share, as well as private beds. We also have ADA, (Americans with Disabilities Act) garden beds available for individuals as pictured below. These beds have since been filled with a protective covering on the bottom, mulch and soil. We have one member who applied for an ADA bed this year, and I'm excited for her to be involved. There is still much to do with the garden for it to be fully ADA compliant, such as installing a ramp from the sidewalk as well as a ramp leading into our storage shed. I have a desire to complete

the garden's ADA compliance because I am reminded of my grandmother who used a walker and wheelchair. I know from experience that being in a garden lifted her spirits as she smiled and enjoyed the flowers at home.



ADA garden beds JH, 2025.

One of the highlights of this past workday was seeing the neighborhood children become excited to garden, with one child asking, "Can I plant watermelon?" It brought a smile to my face. I encouraged the children to tell their families about the garden, and invite them to join them in the garden. I heard from another committee member who lives in the neighborhood that the children's parents work on the weekends, and work two jobs, with possible long hours. It would be ideal for the children to be accompanied by their parents, but I would rather have them join in on the gardening fun, then never experience playing in the soil, and learning agricultural tips. Their excitement to learn fuels this project. The Boys and Girls Club is on the same street as the garden, and I found out after talking to one of the founding members, that there was a transition of leadership happening at the club when the garden reached out. I have since reached out to them again this year to hopefully welcome them into the garden. I have to remain patient with myself and remind myself it is the 2nd year that the garden has been operating and there is still much to learn. Community building takes time. Regardless of someone's multiple intersectional identities, we all need to eat. Personally, I would like to see the garden transition from individual private beds to all communal beds. Individualism surrounds us, and this is reflected in our food systems with individual packaging, single serve portions, etc. The earth is regenerative and abundant and provides all our needs if we slow down and allow it.

It takes courage to share our opinions on what we agree or disagree with. It takes emotional labor to share what we believe to be racist, classist, sexist, etc to someone from a different generation or political viewpoint. However, without sharing these vulnerabilities and the fear of being seen and heard, the community garden would fall victim to the same systems of oppression that govern the majority. This is why it's especially important for committee members and garden members to share their stories and vulnerability. This is what builds connection, and without connection we are all struggling alone. We can take lessons from nature, and the symbiotic relationships of plants and biodiversity. Biodiversity increases our chance of survival, both literally with plant life and figuratively with garden members sharing their stories and building

community with each other and the garden. According to organic agriculture activist Vandana Shiva, biodiversity increases genetic diversity, which is indispensable to cope with environmental stresses and is the cornerstone of small farmers' livelihood strategies. It is also the basis for food security as it provides alternatives to fossil fuels and chemical inputs for small - scale and ecological farms (2022, Shiva, pg.75).” We must increase in diversity both through plant life and our viewpoints, to be able to reach people from different backgrounds.

I admit that I did not gather the members' garden stories to the extent that I would have liked. This is due to a few factors, namely not wanting to push my agenda onto the members of my community, as well as recognizing that many are busy working and raising families. One member I attempted to reach out to, but unfortunately he did not respond. I tried to ask the members in the moment either at the committee meetings or the workdays, and it seemed like there were other priorities to attend to. I still have hope that by sharing my experience and perspective will hopefully invite further discussion and participation. The garden was able to produce roughly 50 pounds of produce that was donated to the local community. I have hope that this year we could double this amount. We will utilize a free produce stand outside the garden so the neighbors can take what they would like. The committee will decide which form this project will be shared. I would like to see Spanish and English printed copies in our little library, and we will all need to agree on the format. I look forward to the garden members reading this project and I hope it inspires them to share their community gardening stories.

Pictured below is the squash that grew wild towards the end of the season. We also hosted multiple educational events, and I hope to host more community events this year. The committee will discuss how this paper will be shared with the community. I have an idea of providing copies in both Spanish and English, so the community can freely read if they would like to.



Squash growing in the communal bed JH 2025

The current dominant agriculture system in place is not conducive to sustainable agriculture and without alternative means of farming, billions of people are at risk of food insecurity and starvation. The current industrial agriculture system is resource intensive, extractive, and is degrading our soils. There may be food available in the stores currently, but much of this food is highly processed, full of sugar and chemicals from fertilizers, and lacking vital nutrition for human development. This is important to me to help raise awareness of the positive benefits of community gardening for those that wouldn't normally think about it. It's important not only on a local scale, but a global scale as well as we work to transition to alternative food systems. Small scale farming and community gardening helps society transition away from the dominant systems in place to a more sustainable, local, and ecologically regenerative solution. Community gardens also directly connect people to their food, revitalizing our bodies and ecosystems. The mental, social, physical, emotional, and spiritual benefits detailed in this project will hopefully motivate the readers to volunteer their time at their local community garden. The indescribable feeling perhaps then is a feeling of oneness, with oneself and each other, and a reminder that we all share this earth. We can hope that the people in power will wake up to their devastating actions and somehow grow empathy for the people they are killing, starving, and oppressing. I choose to have a more practical approach and focus my efforts on my community. Tending to the garden you can reach, and experiencing unity through diversity have been my guiding principles working with the garden. May we all remember that food connects us all.

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From 'Feeding the Need' to 'Shortening the Line':

Seeding transformation in Southern California's anti-hunger sector



Photo credit Tracie Barham, Resilience and Resistance Food Systems Conference, Portland, Oregon, June 2025

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Master's of Engineering, Sustainability and Health
University of San Diego
Final capstone paper
April 12, 2026

Dedication

After Tyson Yunkaporta, Kelly Staniunas, Mary Oliver, and El Caballo Trail

May my research be a translation of a fragment of a shadow. May it benefit our ancestors as well as our descendants in the never-ending spiral of time.

May my path be winding, and may I come to trust it as valid and valuable.

May I open to the meaning being made in the meandering paths between the words. May I fully embrace Not Knowing and Bearing Witness *before* I attempt Loving Action. May I let go of any ideas of what *should* be done and honor all experiences of those that give me the gifts of their time and trust.

May I have the courage to begin and to fail, again and again. And when I feel powerless, or rushed to 'make progress,' may I remember that there is time left — fields everywhere invite me into them. And who will chide me if I wander away to look for my soul? For you and I, we are not separate, and it is from that understanding that Loving Action may be taken.

How do I know that there is still time?

Because "that was then, which hasn't ended yet."

And, more formally, I dedicate this work to my husband, Adam, who made it possible for me to dive deeply into my studies each day and then emerge to a delicious, home-cooked meal, to my research participants for their generosity of time and spirit, and to my sangha for their practice.

Abstract

This paper begins by tracing the evolution of my focus from food waste to the food assistance paradigm that repurposes it as a “solution” for hunger. Grounded in a shift from “feeding the need” to “shortening the line,” this research challenges the dominant charity-based food assistance paradigm and examines the structural conditions that reproduce hunger, including low wages, corporate influence, and policy design. Drawing on literature from critical food systems scholars and insights from a boundary spanning selection of local nonprofit leaders and organizers in Southern California, my project calls for a rights-based approach that prioritizes dignity, equity, and long-term root cause solutions.

Guided throughout my process by the Zen Peacemakers’ Three Tenets — Not Knowing, Bearing Witness, and Loving Action — I conclude that there are no easy solutions and that, in the limited time frame of this project, the most Loving Action I could take was to lean heavily on the first two tenets by practicing deep listening, relational inquiry, and community-engaged learning. Through participant observation, group dialogue, and interviews, I honor the lived experiences of those working within and beyond the food assistance sector. Their insights illuminate both the constraints of the current system and the seeds of alternative approaches rooted in solidarity, justice, and cross-sector collaboration to end all forms of economic injustice. To that end, it is my intention to stay grounded in Not Knowing, to continue Bearing Witness, and to keep searching for opportunities to contribute through Loving Action.

Introduction

I began my MESH journey with the goal of better understanding the drivers of, and solutions for, climate change. I have a special interest in the food system because of its connections to climate change and public health, and my part-time job provides firsthand knowledge of the food waste that occurs in the grocery sector. Motivated by the frustration I felt as I witnessed the waste that seems to be taken for granted, I struggled with the question of how we could have both hungry people and wasted food in the richest country in the world.

In my first research paper of the MESH program, I focused on the grocery sector and reviewed the literature for efficiency improvements to prevent waste, as well as ways to get more of the surplus food to those who were hungry. However, as I learned about the difference between charity and rights-based approaches, I began to understand that the connection between food waste and hunger was not as simple as some might have us believe. With my initial focus on reducing food waste, it seemed to make sense to rescue surplus food and donate it to food assistance charities. Fewer greenhouse gas emissions and fewer hungry people, right? Except that the charity model provides a person with food for a day or a week, but does little (if anything) to change the circumstances that resulted in that person needing food in the first place. By contrast, a rights-based approach seeks to identify and change the conditions that lead to food insecurity.

As I continued through the MESH program, I examined the problem of food waste in the United States from the perspectives of impacts to the environment, political economy, governance, individual behavior, justice, and public health. This last perspective, public health, inspired me to learn more about the anti-hunger movement in the United States. I found that, with the possible exception of regions with thriving Farm-to-Food-Assistance programs, the nutritional quality of donated food

In the United States, **one in seven households experienced food insecurity in 2024**, representing 47.9 M people (Food Resource Action Center), 2026).

This figure **has risen overall since the 1980s**, despite the expansion of food banks and pantries.

In my region of Southern California, it was [recently reported](#) (Sharma, A., 2026) **that more than one in four residents are food insecure**, and that ratio is expected to worsen given that an estimated 67,000 people will lose CalFresh benefits due to the eligibility changes in H.R. 1 that took effect on April 1, 2026 (San Diego Hunger Coalition, 2026).



mirrors that of what's available in conventional grocery stores (albeit closer to, or beyond, its Best By date). As a frame of reference, in my Sustainable Food course I analyzed the inventory of a large chain grocery store near my home and found that processed foods (ranging from moderately to ultra-processed) outnumbered whole or minimally processed foods 2:1 in terms of shelf space. Lastly, high consumption of ultra-processed foods is associated with increased risk of obesity and other chronic diseases (Chen et al., 2020), therefore, those who rely on food assistance are among the most vulnerable to the collateral damage of our corporate food system.

The dominant response to hunger in the U.S. includes federal benefit and subsidy programs in addition to food banks and pantries, and it is based on a charity model, rather than the recognition that food is a human right. The Right to Food resolution was adopted by the United Nations General Assembly in 2021, and the United States and Israel were the two lone "No" votes (United Nations, 2021)). As a result of this philosophical orientation, most food assistance programs, as they typically operate, are not addressing the root causes of hunger, such as low wages and economic disparity. Wealth inequality has exploded since the rise of neoliberalism in the 1980s, and working a full-time job no longer guarantees sufficient income to cover the basic necessities of life. Despite helping people to avoid severe hunger by providing ever-increasing pounds of food to never-ending lines of people, food banks and pantries were designed to provide temporary food assistance, rather than ending the problem of food insecurity.

The landscape of food assistance is complicated by structural barriers, funding challenges, conflicting priorities, political ideology, corporate influence and other problems associated with outsourcing the responsibility for basic needs to charities and the private sector in our capitalist economy. These challenges have been well-documented in scholarly and popular literature, and they also appeared throughout my conversations with local nonprofit leaders. Additionally, capitalism's growth imperative enables the problem of surplus food in the production and retail stages of the food chain to be rebranded as a solution to hunger. However, for multiple reasons which will be discussed in the literature review, food rescue is a temporary approach to hunger that is more aligned with the interests of corporate donors than the recipients of their tax-deductible donations.

While I still believe that it is essential that we reduce greenhouse gas emissions throughout the food sector, including keeping food waste out of landfills, I have come to understand that rescuing food for donation does not solve the problem of hunger. Nor does the safety net distribution of purchased and donated food through food banks and pantries. Even as the most common metric — pounds of food distributed — continues to increase, the number of people needing food assistance also continues to rise because the conditions leading to their food insecurity have remained the same, or worsened (Fisher, 2017).

With these understandings, my initial burning question — *How can we have both **food waste** and hungry people?* — evolved, fueled by a simmering rage, into *How can we have both **extreme wealth** and hungry people?* Equally important and elusive, to me at least, is the question of how systems change happens.

Inspired by the Three Tenets of the Zen Peacemakers, a sangha in my Zen lineage, prior to taking Loving Action, I will be leaning into the challenges of Not Knowing and Bearing Witness. There was much to learn through a literature review, and yet, I have attempted to hold that information without believing that I know what should be done, by whom, and most especially, *how* it ought to be done. I invite you to join me on this journey. Together we will explore the problem of food insecurity in the United States and the dominant forms of response over the last 45+ years through the hunger industrial complex, as author and anti-hunger advocate Andrew Fisher describes it. We'll contrast those responses with examples of innovative models that prioritize food justice and sovereignty, and solidarity rather than charity.

While still practicing Not Knowing, we will continue to learn by Bearing Witness. To further refine my wrath and confusion into a proper research question, I looked to the strength and wisdom of my community. Tyson Yunkaporta (2020, p. 20) shares the Indigenous perspective that "solutions to complex problems take many dissimilar minds and points of view to design, so we have to do that together, linking up with as many other us-tuos as we can to form networks of dynamic interaction." This way of thinking aligns with the transdisciplinary foundation of the MESH program, as well as my own personal inclination towards boundary spanning approaches. In his book, Fisher (2017, p. 182) called for broad coalitions between sectors to "counter the power of special interests vested in maintaining the status quo," and Garthwaite (2026) went a step further by naming cross-sector solidarity as a necessary part of addressing the root causes of hunger.

For these reasons, my research was conducted through participant observation, a group dialogue, and interviews with a cross-sectoral representation of local nonprofit leaders. Participants are identified by randomized initials to protect their confidentiality. Accounts of my research process begin in the Moving from (Not) Knowing to Bearing Witness section, and key findings from the group dialogue and interviews are interspersed throughout my literature review and summarized in the Results and Discussion section.

My project has been an attempt to understand the experiences of researchers and practitioners who study and work in the field of hunger relief with the goal of uncovering the next best step that I can take to do the right thing for those who struggle to access and afford nutritious food in my community. Although my literature review highlighted the work of those who are critical of the dominant food assistance paradigm, I've practiced Not Knowing and Bearing Witness by remembering that those doing safety net work are my colleagues and neighbors. This served the important purpose of regrounding me in my community, and it was a practice that I kept returning to as I refined my research methods and communications.

It is my hope that you will come away with a systems-level understanding of how the U.S. response to hunger prioritizes corporate power over human rights and dignity. And, on a regional level, I've endeavored to provide a meaningful glimpse of how local anti-hunger leaders are experiencing their work, the boundary spanning that is being done and the potential for its expansion, and lastly, the understanding that a few seeds of transformation were planted, and it may take some time to discover what they might grow into.

But first, a word or two about positionality

In addition to my perspective as a Zen student, my former professional career as a nonprofit fundraiser and my current employment as a grocery store worker combine to provide the dual perspective of someone who has never previously needed food assistance, but may come to rely on it in the near future. Thanks to my parents' middle class status, I had what I needed as a young person and was privileged enough to graduate from college debt-free. For much of my adult life, as one half of a dual-income household, I also had sufficient income to live comfortably. Now, in the midst of a career change and working very part-time at a grocery store, it is only through school loans, the generosity of my father-in-law, and my employee discount that my husband and I are eating well without federal or charitable assistance. However, if I don't find work soon after my school loans run out, food assistance may be in our future. It's been an interesting perspective to

hold, zooming in from an arm's length moral and academic concern to what may soon become a personal issue. And of course, from my Zen perspective, if one person is hungry, we are all hungry.

Learning from the literature and my own qualitative research

In his book *Big Hunger: The Unholy Alliance Between Corporate America and Anti-hunger Groups*, researcher and anti-hunger practitioner Andrew Fisher explains that the dominant food assistance model in the United States, which has now been exported to other rich-but-unequal countries (Garthwaite, 2026), was created as a response to the poverty that arose as a result of “the loss of manufacturing jobs combined with the recession of the early 1980s and Reagan administration cutbacks in federal programs” (Fisher, 2017, back cover). What began as an emergency response has become institutionalized and culturally normalized, with the side effect of also normalizing never-ending food insecurity.

This response has largely shifted the responsibility of responding to hunger from the government to the charitable and private sectors. Federal programs such as the Supplemental Nutritional Assistance Program (SNAP), donation tax breaks for corporate donors, and the agricultural subsidies in the Farm Bill provide significant funding and incentives, but they are heavily influenced by corporate lobbying power (Fisher, 2017 and 2025; Lohnes, 2020). This influence has far-reaching implications for our food system, the environment, worker's rights, and public health (for everyone who eats, not just the food insecure).

Corporate consolidation and deregulation, combined with massive lobbying budgets, have enabled many industries — including Big Food producers and retailers — to get away with paying workers less than a living wage, resulting in a significant portion of their employees being reliant on food assistance. They have also lobbied to keep ultra-processed foods and sugar-sweetened beverages eligible for SNAP benefits, while also donating them to food banks (Fisher, 2017; Lohnes, 2020, Garthwaite, 2026). In return for their lobbying efforts, corporate profits soar while public health declines and food insecurity remains steady, or even increases, as it has here, where 26 percent of San Diegans are food insecure (the highest since the pandemic) (Sharma, 2026). When asked about the cause of San Diego's high rate of food insecurity, Joseph Kendrick of the San Diego Hunger Coalition replied, “I think it says that we're struggling as a county. I think a lot of this is wages. It means that workers just simply aren't being paid enough, especially with the exorbitant cost of living and the exorbitant cost

of raising children in this county with how expensive home prices are, rent is, gas, food” (Sharma, 2026).

Corporate influence extends beyond lawmakers, impacting program and advocacy decisions by food assistance organizations. Most food bank leaders know that ultra-processed snack foods and sugar-sweetened beverages are not improving recipients’ nutritional status. However, refusing donations of these products is challenging because cash donations from producers and retailers are often of greater value than the donated food, and there is credible concern that these donations would be reduced or eliminated if the food banks were to enact policies to meet higher nutritional standards. Lastly, corporate influence is also experienced as a deterrent to food banks engaging in advocacy efforts such as supporting bills that would make the most unhealthy foods ineligible for SNAP benefits or, addressing a root cause of hunger, joining with labor unions and others calling for higher wages and workers’ rights legislation (Fisher, 2017; Garthwaite, 2026). I learned of corporate influence on local nonprofit advocacy in an interview with the leader of a housing-focused organization. M.W. also leads a nascent cross-sectoral coalition, and in a recent policy campaign that was strongly opposed by a major corporation, two of the members asked for their logos to be removed from coalition materials. It was considered a success that they did not oppose the campaign and merely stayed silent.

Many of these concerns were echoed by another of my interviewees. P.D. worked at a large food bank for several years in the programs department. They, and several of their colleagues, had read Fisher’s book and saw themselves in it. They described the tensions that existed between the community-oriented goals of the programs side of the organization and the corporate-oriented supply side. P.D. also described a “continuous disinvestment in the CalFresh program... even though everyone knows and will acknowledge that it’s, like, the number one way to support people moving out of food insecurity (and) poverty.”

In contrast, the Global Solidarity Alliance for Food, Health and Social Justice (GSA) is advocating for approaches that are based on rights, not charity ([Rights Not Charity](#), 2026). GSA’s founders include prominent food system practitioners, organizers, and researchers such as Fisher, Lohnes, Garthwaite (whose book *Hunger Inc., Building Solidarity Beyond the Food Bank* strongly influenced my research questions), and Alison Cohen, Director of the National Right to Food Community of Practice. Select tenets of the Rights Not Charity philosophy include:

- 1) Food is a human right, 2) Food charity is neither a dignified nor long-term solution to food insecurity, 3) Social and economic oppression lie at the root of food

insecurity, 4) Under-regulated capitalism, neoliberal austerity policies, and persistent inequality lie at the root of food insecurity, and 5) Food waste and food insecurity are separate problems demanding separate solutions (RNC, 2026).

Therefore, the GSA and its members are seeking solutions that address the root causes of hunger at the structural level, rather than continuing the practice of treating only the symptoms through food distribution. The Right to Food movement calls for food to be universally Available, Accessible, Adequate, Sustainable, and for communities to have Agency in their food system. Truly fulfilling these goals will require changes from the grassroots to the systems level, and this understanding fueled my interest in learning how my own community may already be contributing to that change and how our efforts can be amplified.

Revisiting the relationship between food waste and food insecurity

GSA's distinction between the problems of food waste and food insecurity illuminates the false narrative that the charitable distribution of donated surplus food is an equitable solution for the environment and the anti-hunger movement. There was consistent agreement in the reviewed literature that corporate actors throughout the food supply chain have externalized the costs related to surplus food (such as waste disposal) by rebranding it as a solution for hunger, and that our current federal subsidies and tax breaks incentivize this behavior (Fisher, 2017; Lohnes, 2020 & 2023; Garthwaite, 2026; RNC, 2026).

Furthermore, Lohnes (2022) demonstrates that Feeding America (FA), the largest charitable organization in the United States, essentially "owns" surplus food, further solidifying FA and its partnering local food charities (LFC) as both "a critical appendage of the agro-food supply chain" (2023, p. 351) and a long-term food insecurity response. Research participant C.B. leads a food recovery organization, and they described being locked out of grocery stores that had contracts with a food bank. "They (food banks) become the big aggregator of all food, and then the grocery stores don't let (smaller organizations) in." They also expressed serious concerns about what they perceive as "unevenly allocated" money and food going through food banks. C.B. recalled waking up "in tears, angry, depressed...really frustrated by, like, food banking and the distance between that model and community and...all the gatekeeping and roadblocks."

I first became aware of the symbiotic relationship between the corporate food system and hunger relief while researching my initial MESH case study

from the perspective of food waste reduction. Food system researcher Eric Holt-Giménez states, “overproduction is a natural part of capitalism” and food waste is an inescapable result of overproduction (2019, pg. 25, 27). The “scarcity narrative” is an intended explanation for this overproduction, and “scarcity must be created even if it isn’t there” (2019, pg. 27). Food waste researcher and zero waste consultant Marie Mourad quantifies this and names a systemic cause by sharing that “*driven by [government] subsidies*, 3,500 Kcal per capita are produced daily, while a normal adult consumes only around 2,000 to 2,500 Kcal” (USDA and US Dept. of Health and Human Services, as cited in 2015, pg. 30-31). What’s not being acknowledged in the dominant narrative is that there is plenty of food, but the most marginalized among us can’t access it, afford it, or both (2019). This includes many workers throughout the food system, including farms, retail, and food access nonprofits ([Closing the Hunger Gap](#), 2019; personal experience; participant P.D.).

Mourad (2015) and Neff et al. (2015) both point out that, when thinking about reducing food waste, one is faced with conflicting solutions, depending on whether the priority is to reduce greenhouse gas emissions or improve food security and public health. Despite Mourad’s orientation towards food waste solutions, she is in agreement with those who hold the perspective that food is a human right and she explicitly names the inherent injustice in feeding waste to hungry people. The FoodRise movement in the U.K. (2026) also orients their work towards food waste solutions, and they align with the food justice movement by calling for the right to food. Hudak et al. (2022) and Neff et al. (2015) write from the perspective of public health, examining policies that address food waste for their impacts and potential synergies. For example, Hudak et al. found that laws promoting surplus food donation exist in all U.S. states, but *only two* explicitly promote donations of *healthy* foods. Health communications professor and researcher Rebecca de Souza (2019, p. 69, as cited in 2024, p. 1863) makes the food-waste-to-food-assistance pipeline in the dominant paradigm crystal clear by describing the approach as “throwaway food for throwaway people.”

Getting to the root of it through policy advocacy and grassroots solidarity

Researchers such as Garthwaite and Holt-Giménez, along with my own research participants, taught me that the path to a future with greater food security and nutrition with dignity for all is complex, winding, and worth fighting for despite the challenges. It’s not a question of top-down versus bottom-up, or policy versus grassroots solidarity. This is a “YES, AND...” scenario where some will work on reforming the system from within, while others will seek to transform it completely or, “Burn it all down” and start

over, in the words of one of my interviewees. Some organizations may even do some of both, sometimes subversively, as I discovered during a community mapping exercise as part of my group dialogue. In this section I will highlight a few of the alternative approaches that I found inspiring.

As Garthwaite (2026) noted, 'cash first' approaches to addressing poverty have been seriously discussed for many years, and they are being piloted in cities and nation states around the world, such as Belgium and France. Garthwaite (2026, pg. 113) cites research from the Independent Food Aid Network in the U.K. contending that the primary cause of food insecurity is the lack of sufficient income to purchase appropriate and nutritious food, and that ensuring adequate social benefits, workers' rights, and wages, followed by providing cash or vouchers, is the most effective way of making it possible for people to purchase what they need with dignity.

In the U.S., SNAP benefits are an example of this type of approach, although our current administration has restricted eligibility and decreased benefit amounts (while increasing war spending and tax cuts for the rich), rather than expanding them to lift more people out of poverty. Garthwaite describes how the temporary increase of SNAP benefits during the pandemic relieved stress on food banks and food insecurity as an example of the successful use of a cash-first approach.

SNAP (or CalFresh, as the program is known in California) was repeatedly mentioned by my research participants as a solution worth saving, expanding, and improving through a streamlined application process. Participant N.H. shared that "we have academic proof that direct money to people solves problems. It solves their issues. And it's like in the form of just straight cash or in the form of restricted use, SNAP. Like it's still extremely effective. It's the most effective way. But we don't do more of it. We put guards on, like, well, you can only get this much, and you have to be under this salary. And it's like you look at those numbers and it's like, there's no way anyone can exist on that."

SNAP is not, however, without its challenges, such as a potentially daunting application process, susceptibility to corporate lobbying and politically motivated budget cuts, and the potential for limited access to nutritious, reasonably priced, and culturally appropriate food for people in rural areas (Garthwaite, 2026). A related approach that avoids the problem of federal funding uncertainty is that of food banks distributing cash, rather than food. I heard about one such pilot project in a recent GSA meeting. A food bank in Toronto was inspired by Garthwaite's work and together they designed and secured funding for a pilot project that is currently in progress. One early

finding is that recipients are reporting that they are purchasing healthier food than they used to receive through the food bank!

Universal Basic Income (UBI) is another approach that is being piloted around the world, including Stockton, California. Garthwaite describes how UBI is seen by many as a way to end the need for food banks entirely. Reading this section of their book brought *Another Now* (2021) back to mind. Yanis Varoufakis is, first and foremost, an economist, and the alternative present that he envisioned featured a Universal Basic Dividend as a foundational element. Granted, this is a work of fiction, and I had more than one complaint about it, but serious experiments with UBI are real and widespread, and the topic is likely to be discussed with ever greater frequency as artificial intelligence and automation replace increasing numbers of white and blue collar workers.

Similarly, advocates for a living wage and safe, fair working conditions are addressing root causes of food insecurity (Garthwaite, 2026). Participant L.O. (who works in an organization that partners with food banks) spoke of expanding CalFresh as the first of a “two-pronged approach.” Secondly, they said, “if we’re talking about actually making an economy in which people don’t need to always seek out food assistance, I think that we have to talk about the living wage.” They went on to acknowledge that “it’s hard to say certain things...you might lose funding for (saying) certain things.” Participant N.R. (who works for a Southern California food bank) understands that some people say food banks are “a bandaid...(and that) there’s a recognition that, you know, more needs to be done to... improve finances for people.”

These solutions are of great interest to me because the guarantee of economic justice would address not just food, but other basic needs, such as housing and healthcare. This section could’ve been an entire capstone project in and of itself, but for now I must step back from this particular rabbit hole and turn to highlighting a few instances of grassroots solidarity to complement these policy-based approaches.

Policy work requires time and patience, especially when it seeks to change the basic structures that many have come to believe are permanently fixed. In the meantime, however, too many people are hungry now. While I agree with those who are critical of the nonprofit industrial complex that has formed and solidified around the provision of food assistance, I was inspired by the ways that some organizations (both formal and anarchistically informal) are striving to embody dignity and solidarity as they meet emergent needs in their communities. I participated in a distribution of food, clothing, and supplies (sanitary and harm reduction) coordinated by a

loosely organized mutual aid group, which I describe in the Methods section. I also witnessed a Free Store at a recent Earth Day event offering food and clothing to all attendees. These efforts are outside of (and some might say in opposition to) the nonprofit industrial complex, and sometimes they diminish the lines between providers and recipients.

One such example of solidarity that Garthwaite (2026, p. 136) describes is ReFoodGees, an organization in Rome that rescues and distributes unsold food from the Nuovo Esquilino market. Garthwaite explains that they seek “to maintain horizontality between volunteers and beneficiaries, providing food to anyone who shows up at the time of distribution without discrimination.” ReFoodGees’ founder Viola de Andrade Piroli says that “everyone is able to access food, as food waste is a problem for everyone.”

Pioneers from within the traditional food bank system are also working to address root causes at the grassroots level while meeting the current need. Garthwaite profiled Nick Saul and the work that he did at Toronto’s The Stop Community Food Centre as an example of this approach. In addition to food distribution, during Saul’s time leading The Stop, they provided cooking classes, community gardens, and “advocacy programmes that encouraged participants to become advocates for food justice” (Garthwaite, 2026, p. 125). Additionally, the Trussell network of food banks in the U.K. is redesigning their programs with the goal of ending the need for food banks, and programs are customized for each local community’s needs.

As I conclude this literature review I’d like to acknowledge my critical bias and my attempts to work with it consciously and compassionately. My approach to gathering literature could be described as snowball sampling. After looking up a citation of Fisher in a research paper focused on the public health impacts of food donation policies, I read his book and then contacted him for an informal interview. He then referred me to Garthwaite, Lohnes, de Souza, and Cohen, as well as the GSA. As a result, my review is biased towards those critical of the dominant paradigm. However, both Fisher and Garthwaite pay attention to the perspectives of food assistance providers who acknowledge the system’s imperfections while also shining a light on the current need which must be met. Three of my participants expressed some level of support for the food banks in our region, saying that “they are good at what they do,” and one saying they were “great partners.” Comments like these, especially within the larger context of our discussions, point to an understanding of the distinction between the system and the people working in it. In “Seeing human beings, rather than human doings,” below, I share my own experience of this realization.

As will be described in the following section, I encountered multiple opportunities to practice Not Knowing and Bearing Witness through open, curious dialogue with research participants who work within the traditional paradigm. While my efforts were by no means perfect, judging by their feedback on the interview process, I feel that I was mostly able to meet them where they were. For example, these conversations reinforced the literature describing the barriers that food assistance providers face to changing the system, and it was important to hear and reflect these challenges.

Lastly, Fisher and Garthwaite's books described our current food assistance response at the structural level, supported by quotes and examples from around the U.S., Canada, and the U.K. Lohnes also writes about the structural issues, and some of his work focuses on his home state of West Virginia. I have not yet discovered published research exploring the potential for food assistance transformation in my region, so I believe that my research will contribute to the literature and local solidarity by convening local participants, and facilitating critical dialogue and the discovery of shared concerns.

Moving from (Not) Knowing to methods of Bearing Witness

Throughout the MESH program, my top-level take-away has been the systemic nature of the problems that we are facing. Be it climate change or hunger, no complex problem exists in a vacuum, solvable by a technical fix or education alone. Following that understanding was the insight that power determines what is possible within a system or, at least, what we commonly believe to be possible. And finally, for the most part, those with the greatest resources (which tend to equate to power), usually have little motivation to change the system that is benefiting them. This understanding grew heavier and heavier with each passing course (compounded by national and world events, from the re-election of Trump through the first year and a half of his administration). Add to this weight the fact that I am changing careers, rather than seeking to advance within my current field, and it seems that I have been continually wondering, *"What is mine to do here? How will I make use of this information?"*

I found myself at a particularly low point after researching the injustice of rural farming communities in the Central Valley lacking access to affordable, safe drinking water, while powerful interests treat surface water as a commodity, rather than a human right. This updated excerpt from my first blog post after beginning [Another Now](#) by Yanis Varoufakis describes my

state of mind then, and it also serves as a broad answer to what I am hoping to find out, and why this is important, with regards to this project.

... I'll admit that life has been feeling pretty heavy for me lately. All that we have been learning about the scope and scale of the problems we face, and the power that *seems* permanently entrenched in our systems, not to mention the chaos and destruction at the federal level, well — it's been a lot to hold. Perhaps you feel it too. And maybe, like me, you've felt Costa's bitter experience of being "a cog in a process of production that relies on what you do and think while excluding you from being anything but its product."

So, after learning about the problems, I'm more than ready for some solutions that feel accessible to me. *How exactly do we create and nurture the systems we want to see so that they'll be ready to spring forth when our current systems crack?* I could really use some help envisioning "possibilities (I am) incapable of imagining unaided," as Iris directed Yango to facilitate. And beyond the fictional "archeology of the future," I'm craving the tangible steps that I can throw myself into via my capstone and my post-grad work because hope, as the late Joanna Macy said, is an active verb, not a noun. I need to take action, and soon.

"When you join a good struggle you learn to live life in near proximity to giving up without ever actually doing so." - Iris, *Another Now*

I ended that post by sharing what has become a mantra for me. I've heard [Margaret Wheatley](#) (author and more) frequently paraphrase Vaclav Havel (former President of the Czech Republic) by saying that "hope is doing something not because we know it will succeed, but because it is the right thing to do."

My project has been an attempt to understand the experiences of researchers and practitioners who study and work in the field of hunger relief with the goal of uncovering the next best step that I can take to do the right thing for those who struggle to access and afford nutritious food in my community. Although my literature review highlighted the work of those who are critical of the dominant food assistance paradigm, I've practiced Not Knowing and Bearing Witness by remembering that those doing safety net work are my colleagues and neighbors. This served the important purpose of regrounding me in my community, and it was a practice that I kept returning

to as I refined my research methods and communications. The following excerpt from an early post demonstrates the tension that I was working with throughout my project.

Seeing human beings, rather than human doings



A few weeks ago, I attended a meeting of people engaged in food assistance work in food banks, food pantries, and other organizations with feeding programs. This month it was held at a food bank and, as I parked on the street, I could see people lined up outside of the food pantry. The administrative offices were located at the opposite end of the large building, and as I approached the front door, a staffer held the locked door open for me and directed me towards the upstairs conference room. Outside of the conference room, there was a table with Starbucks coffee, bagels cut into small bites, and cream cheese. I had already eaten and caffeinated myself, but I popped one bagel bite into my mouth as I passed by. The first thing that I noticed upon entering was the wall of windows

overlooking the massive warehouse below. Pallets containing cases of nonperishable food, shrinkwrapped and obviously straight from the manufacturer, filled aisle after aisle, with forklifts, neon safety vests, and hardhats completing the industrial vibe. Returning my attention to the conference room, I saw that the meeting was about to begin and the brightly lit room was almost full. Tables were arranged into a three-sided rectangle with a podium and screen at the open end, and I was happy to see that one of the few open seats was next to someone I knew from my prior nonprofit work. M and I caught up quickly before the meeting began with a round of introductions, followed by a presentation and a tour of the food bank.

While I learned many interesting things, what was most impactful to me was how good it felt to get out in the community among the people doing the work after spending so much time reading books and papers about the shortcomings of our charitable food assistance system. I realized that my understanding of the self-perpetuating nature of food banking had tainted my opinions about the people doing the work. Questions like “Why aren’t

they addressing the root causes of hunger?!?” were sitting deep inside of me, not spoken, but influencing me, nonetheless. Critics of the charitable food assistance system often allow that most people doing this work do so out of a deep desire to end hunger, and that they are trapped in a system that constrains their beliefs about what is possible. That being said, the main message I had absorbed up to this point is “This system is wrong and it needs to change NOW!”

As I became aware of these thoughts and feelings, I realized that it was time to reconnect with my goals of Not Knowing and Bearing Witness. I wanted to start thinking about research questions that would open the door for these caring, hard-working folks to share their experiences, challenges, and opportunities, rather than beginning with a solution in mind. As it turned out, several attendees expressed interest in getting involved in advocacy. This arose organically, in response to a presentation by the food bank on the state budgeting process. There was a palpable sense of energy in the room, and the food bank presenter didn’t miss a beat. They sent their laptop around the room for people to enter their contact info if they were interested in helping with advocacy. I got the idea that those who raised the question of “How can we help?” were mostly talking about advancing the food bank’s stated priorities — protecting and expanding existing Federal and State funding — rather than transforming the system, but it could still be the beginning of a grassroots movement that could evolve, and I’m excited that my project may be able to play a small role in that.

Returning to my intention to focus my project on what felt like the right thing for me to do for the remainder of the semester, my project’s purpose went through several revisions, finally evolving into Bearing Witness to the work that is being done locally while providing space for generative, cross-sectoral conversations around what more might be possible. In the end, these questions guided my research:

How do workers, volunteers and other involved community members experience solidarity within and beyond the food assistance sector in this region of Southern California? And what are their experiences of policy advocacy? What potential exists for greater collaboration between sectors (such as housing, healthcare, and energy affordability) to address shared root causes?

On a personal level, I’ll admit that designing a research project around Not Knowing and Bearing Witness, but not including the Loving Action part, challenged the part of me that wants to Get to Work! When considering

research methodologies, I was immediately drawn to the idea of Action Research. However, I realized that this method traditionally unfolds over a significantly longer period of time than a 14-week semester, so I needed to embrace the possibility that action could be seeded through the act of Bearing Witness.

Methodology and Methods

My data collection began with informal conversations with prominent authors, researchers, and organizers within the hunger relief and Right to Food arenas. Somewhat naively, I asked each of them some form of this question: *Knowing all of this, how do we change it?* Something shifted within me after I heard multiple variations of “If I knew the answer to that, I’d be doing it.” Sometimes, it was dropped like a bomb followed by silence, other times they would offer a chaser of a hopeful suggestion, such as “I’d really like to see someone study the potential of activating volunteers for policy advocacy.” But in the end, I had to come to terms with the fact that those who are fighting our oppressive systems are often figuring it out as they go.

The primary methods I used throughout my project were unstructured conversations, structured and semi-structured interviews, participant observation at two meetings of anti-hunger professionals and one mutual aid distribution, and a group dialogue and community mapping exercise loosely inspired by critical transformative theory. My initial interviews and conversations were primarily focused on narrowing down my research focus and identifying additional researchers to follow and/or interview (snowball sampling). Later interviews were guided by more open-ended qualitative questions, and the group dialogue was inspired by Priya Parker’s *The Art of Gathering*, guided by my brief explanation of why I’d brought them together, and then mostly led by the participants. My intention was to include representatives from outside of the food assistance sector in an attempt to foster local solidarity. My boundary spanning approach (as taught in ESH-511) is inspired by calls for unity and solidarity by Holt-Giménez, Fisher, Garthwaite, Lohnes, the Right to Food and Just Transition movements.

Experiences of participant observation

Meeting with food assistance providers

My first participant observation experience was a gathering of food assistance program staff and volunteers that was hosted at a Southern California food bank (described above in *Seeing human beings...*). Broadly speaking, the knowledge that I obtained from this meeting included new insights into the types of organizations that are involved in food assistance

(for example, a local library offers after-school food distributions), a tour of the food bank led by the general manager (resulting in photos and insights into their goals), a presentation on the food bank's governmental advocacy efforts, observation of the attendees' reactions to that presentation, local examples of the criticisms uncovered in my literature review, and short conversations (personal and overheard).

Global Solidarity Alliance meeting

My second participant observation experience was a meeting of the [Global Solidarity Alliance](#) (GSA). This online meeting included researchers from the United States and several Western European countries, and the presenter was a post-doctoral cultural anthropologist whose research is deeply informed by her experience of growing up hungry in Kentucky. Her use of the word 'hungry' rather than 'food insecure' was a key element of her talk and the Q&A, and her research presentation powerfully illustrated the reality of being hungry and the shortcomings of the dominant food assistance paradigm (some generalizable, some more particular to her region). It also provided a remarkable lesson in critical epistemology and positionality. The knowledge that she shared affected me more deeply than all of the papers that I've read combined, as reflected in the following excerpted post.

Earlier this month, I attended a virtual meeting of the Global Solidarity Alliance for Food, Health, and Social Justice (GSA) for the first time. The guest speaker was Alisha Mays, a Postdoctoral Associate at Rutgers University. She describes herself as focusing on the "Political Economy of Hunger, Charity & Care" on her LinkedIn profile, and she also identifies as someone who grew up hungry and still experiences financial uncertainty, despite having earned her PhD.

"Having letters after your name doesn't protect you from poverty."

My experience of listening to (and watching) Dr. Mays present her research on charitable food networks in eastern Kentucky was that of being punched in the gut. Nothing in my reading to-date had prepared me for the experience of hearing a formerly hungry person describe the reality of her early life and the hunger experiences of the Kentucky residents that she interviewed and observed.

In response to some of the questions that she fielded during the Q&A period, I had the thought that debating the differences between "food poverty" and "food insecurity," as well as this model of food justice vs. another, can serve to obscure the insane reality of what we allow fellow humans to endure. Much of what she shared simply stunned me, nothing was sugar coated. I

think my response is both a sign of my privilege and my outsider status, having never received charitable food aid or worked in the field.

(Dr. Mays uses the words “hunger” and “hungry” and defines them as the “embodied description of ‘food insecurity’.” I left that meeting thinking that using “hunger” instead of the more sanitized terms was one thing that I could put into practice right away.)

Lastly, a week or so later I connected with T.X., a food insecurity researcher who also attended Mays’ talk. They described Dr. Mays’ presentation as “too emotional,” and shared that “I try to stay neutral,” while acknowledging that “of course I have my own views.” I found that interesting, and shared with T.X. that it was precisely Dr. Mays’ vulnerability and honesty about her positionality that really grabbed my attention.

As a first postscript to this story, I’ll add that I encountered a range of opinions about the term “hunger” through my research into organizations and the interviews I conducted. Some, such as the [San Diego Hunger Coalition](#), use the term “hunger” narratively and “nutrition insecurity” when a more precise definition is needed. The latter term highlights the fact that simply having adequate calories to keep the body functioning is not enough. Rather, our goal should be to ensure that each person has access to, and the ability and knowledge to prepare, three *nutritious* meals per day. Others spoke of their work in terms of “hunger relief” and/or ending “food insecurity.”

And, secondly, Mays, Garthwaite, and others have highlighted the disparity between how we typically treat donors and volunteers versus food aid recipients. In my own research, when asked if they could wave a magic wand and change one thing about how we address hunger, N.R. said, “I would want to recognize people who access hunger relief with the same amount of pomp and circumstance and recognition that people who donate to hunger relief get. I think there's a lot of celebration, and rightly so, to people who donate money to [a food bank]. Um, but when a person applies for CalFresh... there's less of an enthusiasm to applaud those people. I think, you know, those were, those programs are meant to bring people to a more level playing field to help them advance positively alongside their peers in society, and I think there's an imbalance between one side that gets celebrated and the other side that gets villainized... I think it's very unfair.”

Mutual aid distribution

Having no prior connection to a mutual aid group, I began by attending a meeting of the San Diego Chapter of the Democratic Socialists of America’s

Eco-Socialist Working Group. Food sovereignty was one of their priority engagement areas in 2025, and I'd received a tip from a colleague that some of their members were engaged in mutual aid work. A few days later, I found myself at a weekly distribution at a nearby transit center.



As I pulled into the parking lot shortly after 7:00 PM, a time when the lot is usually pretty empty, I could see right away that the place was buzzing. I followed a line of cars into the main lot by the train tracks, and then followed the volunteers carrying folding tables, bags, and boxes. I was greeted quickly with "Are you here to volunteer?... Great, you can check in with (the one) in the red hat!"

A line of people had already formed, and they seemed to be waiting patiently for the volunteers to be ready to serve them. Later, I learned that they regularly see 150-200 people each week. As the tables were arranged in a line, the offerings were arranged with prepared food at one end, followed by bread, fruit, vegetables, water bottles, snack kits, harm reduction and sanitation supplies, and finally, clothing. I never got a good count of volunteers because people kept coming and going, especially when we received a warning from the transit guards that we needed to move our cars or they'd be towed. I asked one volunteer how their relationship was with the city and transit and they replied, "They hate us!" It was then that I realized that we were on the sidewalk, which is not transit property, so they were begrudgingly leaving us alone (other than threatening our cars), rather than welcoming the service we were offering (and the guests that we attracted).

As the volunteers buzzed around sorting and arranging the goods with great care, the line grew longer and a man at the front cheerily asked me my name. I told him, and he warmly complimented my smile, and then told me his name when I asked. Most of the people in line appeared to be Black or

Latino, demonstrating a higher representation than their overall population in the city, and they ranged in age from a few young children with their parents to older folks that I'd guess were in their late 60s or 70s. I was told that there would be a later wave of people when the next train arrived, so apparently some people come from other cities along the transit line specifically for the distribution. Food was limited to one serving per person to begin with, but they were allowed to go to the back of the line for a second serving. Some were just there for a warm meal, others "shopped" the donated clothing and other items. It seemed that the guests had a mix of housing statuses. Some had the carts or large bags that you often see with people experiencing homelessness, but many did not. The fact that we were distributing uncooked potatoes leads me to believe that there was the assumption that at least some of the recipients would have access to kitchen facilities.

My first volunteer role was to help unpack and arrange the prepared food. The offerings ranged from packaged and labeled food to trays of cooked food that was served as the guests came through the line. I later learned through observing the group's Signal chat that the prepared food is sometimes donated by businesses and sometimes cooked by members. Nothing was hotter than lukewarm, but everything was covered and the volunteers were wearing gloves, so it's clear that food safety was being considered. I found myself thinking about the prepared food that is wasted daily at the grocery store I work at, and probably most others, because the stores refuse to devote staff time to storing it safely so that it can be donated and/or the feeding organizations don't have the capacity to come get it. This frustrating observation was what drove me to study the problem of food waste and recovery in my first MESH course, and I never did uncover a successful example of a solution. Seeing this food being distributed in this way made me resolve to see if I could help them gather more of the food that's being wasted as a post-grad project, once I learn more about what they're doing and what they've already tried.

Concluding my observation, I'll say that the energy was something that I hadn't experienced before. Despite the unwelcoming presence of the transit security guards, the volunteers were joyful and they put great care into serving their guests. It was organized chaos at its best, and it felt good to know that this kind of mutual aid exists while others work for change at the structural level.

The next day I found that I had a lot of questions and I was hopeful about including one of their volunteers in my group dialogue or an interview. 'Red Hat' added me to their group chat so that I could extend an invitation to participate. My post was met with multiple ❤️s, but no one accepted my

invitation, or even asked for more information. I followed up a few days later, this time only crickets. Later, I checked in with the colleague that had helped me connect with this group, and I got this response:

Glad to hear you connected with [redacted] and I'm sorry to hear there's no takers. That group is very anarchistic and sometimes sort of closed off to outsiders. They may just be distrustful of someone they don't know is my read of the situation. Philosophically they'd probably be very interested in what you shared with me and I think they're missing out!

While I had already self-identified as an insider/outsider in relation to nonprofit workers engaged in food assistance (insider because I have an extensive background in nonprofit fundraising in this region, but outsider because I haven't worked in food assistance), my colleague's response helped me see that there are multiple levels of "in" or "out." I had a professional reputation and relationships with other nonprofit workers, but these mutual aid volunteers didn't know me from Eve, and therefore, had no reason to trust me. At the time, I didn't really understand their reasons for requiring higher levels of trust, but since they let me stay in their group chat, I

was able to learn more by observing their communication. As it turns out, the conflict between the group and local authorities continued to escalate and, as of this writing, they are planning ways to creatively serve their regulars while they secure a new location for their distribution.

I have observed that some nonprofits serving people experiencing homelessness and/or behavioral health issues, even when their services are officially sanctioned, are not always welcomed in the neighborhoods they serve. But the nonprofit workers aren't threatened with arrest for doing their jobs. Here, perhaps because of their anarchistic approach, these volunteers who are only trying to meet the basic human needs of others, are facing citations and threats. So, their distrust is not surprising, and yet, I do still find it saddening. I wonder, if I had more time to get to know them through volunteering, would they ever be interested in exploring collaboration or engaging in collective advocacy? Also, I do realize that this is just one group, and that there are others that may be more open, so I want to be careful not to generalize. This is an area that I may continue to explore post-Capstone, and I'll stay open to the possibility of getting to know them and their experiences of solidarity on their terms.

Group dialogue

The group dialogue was inspired by an approach to community-engaged research that combines critical reflexive interviewing and knowledge co-production with the intention of prompting paradigm shifts (Joyner et al., 2023). This approach was developed to be capable of both "honoring and

uplifting” the important work that is already being done, while also “moving the needle towards an increasingly radical approach to food sovereignty” (Joyner et al., 2023, p. 4). In the context of my study, this meant honoring the work of feeding hungry people now, while also providing space for participants to envision and dream about the next steps that we might take to move towards an approach based on rights, rather than charity. Additionally, this approach supported me in analyzing my own assumptions and positionality, with the intention of “unsettl(ing) the idea that there is any singular ‘correct’ solution” (Joyner et al., 2023, p. 4).

Critical reflexivity felt appropriate for this project because it aims to “embed social impact in the research process itself” (Nardon et al., 2021, as cited in Joyner et al., 2023, p. 4). Their process described participants engaging in “self-questioning, talk repair, and transformation” (Tracy and Rivera, 2010, as cited in Joyner et al., 2023, p. 5). For example, one participant began to respond to a question by saying that they were doing all that they could, but as they continued to talk, they came up with small steps, or “flickers” (Tracy and Rivera, 2010, as cited in Joyner et al., 2023, p. 5) of what more might be possible.

My choice of the critical transformative paradigm was strongly influenced by my positionality as both a former nonprofit leader and a leadership coach. In my experience and that of my group dialogue participants, scenarios that both honor the present and create space for generative dialogue are rare in the nonprofit sector. Likewise, transformative personal coaching results from an intricate balance between honoring what is while creating the conditions for new ways of being to emerge through practices and reflection.

Lastly, Dwyer and Buckle’s (2009) conceptualization of the researcher as an “insider-outsider” feels appropriate because of the nature of my relationships with some of my potential participants who know me from my prior nonprofit career. I also feel like an “insider-outsider” when it comes to the academic realm and, as I suspected, I related more to some of my participants as a colleague than a researcher. I believe this was a strength, and I explicitly named this positionality throughout my research and analysis.

Participant identification

I began to identify participants by first listing the types of organizations and perspectives that I would like to include. Following a best practice of community-based research, I then reached out to two respected community groups to explore the potential of collaboration, which could’ve ranged from session co-design and co-facilitation to identifying and connecting with specific participants. Both potential partners were delayed in responding, but

in the end, both contacts were supportive and helpful. Both were willing to make introductions and/or invitations on my behalf, one attended and spoke movingly of their reason for engaging in the project, and the other planned to attend, but was unable due to illness, and so they instead participated in a long and fruitful one-to-one interview. Lastly, as an insider/outsider, I personally contacted those potential participants with whom I had some connection.

One goal of my research was to uncover existing examples of cross-sectoral advocacy and solidarity in my region because the folks who are struggling to afford food are likely to also be challenged by the costs of housing, energy, healthcare, and other basic needs. For this reason, I cast a wide net for my research participants, inviting representatives from multiple branches of the food system, as well as people from adjacent sectors whose work addresses shared root causes. My intent was to provide the space for a transdisciplinary conversation around “shortening the line” that would not normally be prioritized during the usual course of “feeding the need,” and to foster solidarity between groups that may normally operate in a more siloed manner.

Table 1 shows the perspectives that were considered for this project and their responses, or lack thereof. Also listed are potential perspectives that I was unable to invite, as well as some that I chose not to include at this time in order to cultivate a confidential dialogue space. Finally, recognizing that I would not be able to herd all of these cats into one room with relatively short notice, I offered one-to-one interviews as a secondary method of participation to those who demonstrated interest but could not attend the group dialogue.

Table 1: Participant identification			
Perspective	Invited	Interested	Attended or Interviewed
Boundary spanning: community-owned energy advocate			
Boundary spanning: general solidarity advocates and an alternative fundraising model (separate groups with cross-over members)	2	1	
Boundary spanning: Just Transition movement			
Boundary spanning: multi-sectoral coalitions	2	2	1 Attended, 1 Interviewed
Boundary spanning: Universal Basic Income advocate			
Democratic Socialists			
Farm-to-food assistance worker			
Farmer co-op			
Food assistance and nutrition education provider			Attended
Food bank worker			Interviewed
Food bank volunteer			
Food justice social impact organization, workforce development			
Food producers / growers	2	2	
Food rescue worker			Attended
Food sovereignty worker	4	2	
			One holds dual perspectives and is represented elsewhere as attending. Interviewed two others, one of whom identified as having grown up in a poor household without enough healthy food.
Hunger and food system/policy alliances/coalitions	3	3	
Kumeyaay (local Indigenous) perspectives			
	100+ members through group chat		
Mutual aid			
Public Health			
Unable to connect with potential representatives, or chose not to include. Would consider including in a future dialogue.			
Boundary spanning: anti-poverty advocates			
Boundary spanning: labor coalitions			
Boundary spanning: racial justice advocate			
Food assistance recipients (happened unintentionally, see above)			
Food retailers			

Results and Discussion

Prior to analyzing the data, I will describe my approach to the group dialogue and how it unfolded. Two aspects of my positionality strongly influenced my use of this method. Having spent nearly 20 years as a nonprofit fundraiser and leader, I have direct experience of how rare it is for colleagues to have the opportunity to engage in extended, generative conversations about their shared challenges and visions for the future. It has also been my experience that cross-sectoral conversations of this type occur even less frequently. Nonprofit workers (and small farmers/business owners) are often stretched so thin that their 'To Do' lists appear to be never-ending, leaving little space for something that is not deemed essential. Knowing this, I put a significant amount of time into following up with, and answering questions for, potential participants. And, despite knowing this on a rational level, I was still very grateful for the kind reminders from two participants that non-responses and declinations likely had more to do with limited bandwidth than interest.

For this reason, I was deeply honored by the gifts of time and insight that were shared with me by those who chose to participate, and I wanted to create a space that had the potential for reciprocity. I chose to do this by only loosely guiding the conversation and spending minimal time on the community mapping exercise (the design of which turned out to be somewhat confusing due to my inexperience with this tool). I invited my participants to use our time together to share experiences and challenges and, if it arose organically (which it did), as a space for sowing seeds of change and brainstorming next steps.

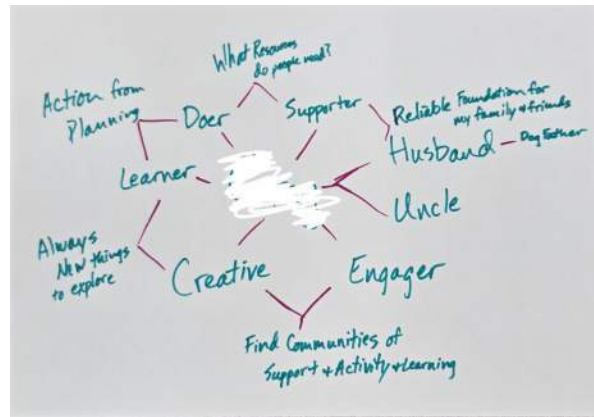
Returning to the second influential aspect of my positionality, my experience as a life and leadership coach helped prepare me for holding space for whatever might emerge. Deep listening and highlighting key themes are core practices of coaching, as is relinquishing control and embracing Not Knowing. Having only engaged in one-to-one coaching, I must admit I was not fully prepared for the flood of dialogue that flowed over those two hours. Sometimes I got so immersed in listening that I forgot to interject where it might have been helpful, such as drawing out a more soft-spoken participant, but for the most part, the participants took care to draw each other out. Additionally, one participant was an educator, and I was grateful for their skilled interjections and support.



Lastly, the coach in me invited all participants (group and individual) to speak from their whole selves, rather than simply their official roles. To model this invitation in the group dialogue, I began with an exercise that I described as a positionality intro. I briefly showed them my diagram and invited them to create their own versions, including any aspects of themselves that influenced how they thought about hunger and their work, as well as how they were showing up in that moment. Then we took turns sharing these aspects of ourselves with each other, and the result was beyond my wildest dreams. Participants shared so deeply that the process took nearly 20 minutes for only four people, emotions flowed freely, childhood selves were introduced, and one participant



expressed, "It's just, but this is amazing because, like, I will never look at the three of you the same again. Right? And you need more of that, I think. Yeah, how do we, like, yeah... I mean, I don't know. I don't know how you do it, but I think it would help."



This was the first of multiple confirmations that we were co-creating something special and valuable. In fact, completely unexpectedly, how we meet and interact became the most-discussed theme of the whole dialogue. I will return to it in greater detail after introducing the rest of the key themes.

Thematic Analysis

As previously stated, the group dialogue lasted two hours and included three participants. Four subsequent one-to-one interviews, lasting between 29-53 minutes each, resulted in nearly five hours of recorded conversation. I analyzed this data by coding the transcriptions for key themes, tallying the number of times each theme arose, and combining related themes into groupings. My original tally was by hand and was color-coded to indicate in which interview/dialogue the theme was raised. This source coding is not reflected in the following list in order to preserve confidentiality. Figure 1 shows the theme groupings in descending order of occurrence.

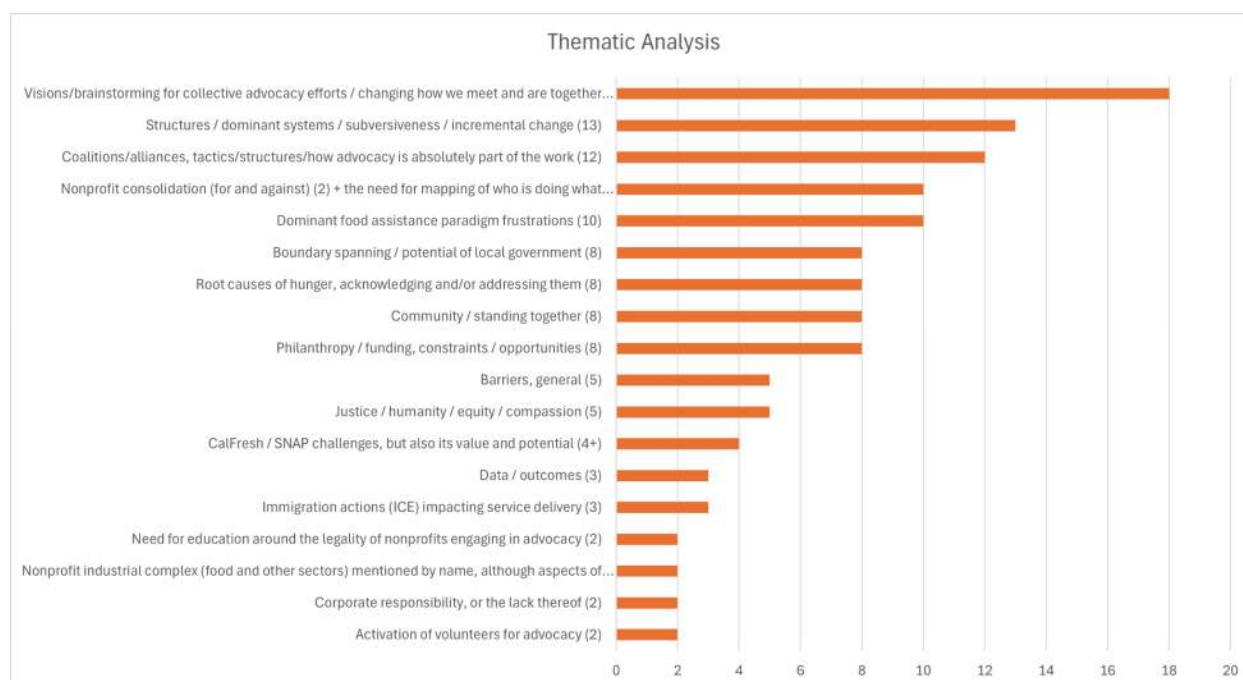


Figure 1: Thematic Analysis

The length of this list demonstrates the breadth of sub-topics covered in the group dialogue, and three quarters of the theme groupings also arose in at least one of the structured interviews. The depth and richness of the discussion is only hinted at through the quantitative summary of theme occurrences. Had it been my intention to conduct a more rigidly facilitated dialogue, this list would've been shorter, and I suspect that my data analysis process would've been much easier. However, attuned to cautions received about academic researchers often being perceived as operating in an extractive manner, I made the decision to allow the group dialogue to emerge with minimal intervention so that it would be more likely to result in lasting value for my participants.

Diving deeper into the top themes

I believe that opting for a participant-led group dialogue, combined with the trust and connection that was seeded during the positionality introductions, contributed to the depth of the top theme grouping — Visions/brainstorming for collective advocacy efforts / changing how we *meet* and *are* together / mutual support. Within this topic, comments ranged from the macro — “we need more of this” — to the micro, in the form of sharing and brainstorming specific actions to enhance the quality of our interactions and shift groups toward more meaningful work. The remainder of this paper is my best attempt at weaving a narrative, one of many that could be told, from the elements that were most present in the group dialogue and interviews. To conclude this journey, we'll wind through the topics of how we meet, the

need for greater unity within hunger relief, the need for more collaboration between sectors to address shared root causes (and that there is no shortage of people wanting to do this work), funding challenges, and lastly, the importance of engaging in policy advocacy.

Within the moments of tactical brainstorming, group dialogue participants discussed the power inherent in the locations that we choose for meeting (at least two of us had read Parker's *Art of Gathering*) and considered how to change course when meetings default to providing updates rather than coordinating action. N.H. shared that one recurring community gathering "has become a meeting where we're just getting updates sometimes. And I don't want that. I want the system to change... I want action."

One powerful element of the group dialogue was how expressions of mutual support arose organically. There were times when one participant diminished their own leadership abilities and potential, and a second participant interrupted them to say "I want to encourage you not to... limit yourself by negativity and stuff, because that's what the system wants. It wants us to think, 'Oh, we could never really do that,'" followed by a third person saying "It wants us to give up, literally." During the community mapping exercise, participants supportively challenged each other about how they saw their organizations in comparison to others, saying, for example, "I felt like you weren't giving yourself enough credit for as much of the work that you do."

There was also a fruitful discussion about the power of bringing our whole selves to the table, and how "we don't do enough of this kind of stuff [talking like we were in that moment]." C.B. shared frustration about how "nothing ever goes below the surface, which I hate." As an antidote, L.O. offered examples of how their movement intentionally schedules time to "relax together" so that they can "really get to know people...their struggles, everything that's going on in their lives." They made the point that "if we want to move towards a society that's more democratic, that's more communal, that's more equitable, we really have to be intentional about that community part, right? Like, it can't just be building community around the work. Like, our whole lives can't revolve around work. Like, that's super capitalist in and of itself. We always have to be doing and producing and all of that sort of stuff. We need to just... be together, like, centering care."

In a follow-up conversation a few weeks later, N.H. reported feeling supported in the "safe and vulnerable space" that we co-created, and "motivated and positive about what we could do coming out of that conversation." They also found it "eye opening" to hear from a participant representing a cooperative housing perspective. As I had hoped, there was value in taking a boundary spanning approach due to the structural

challenges that our causes share. I believe that if we can center relationships and the co-production of knowledge, our movements will be stronger together.

This is not a new insight, however. There are local organizations and movements that do this well, and some were represented by my participants. (I'm not naming the organizations here out of an abundance of caution, given that I promised participants that they would remain anonymous.) Rather, what I'm offering here is a snapshot of how these participants are currently experiencing connection and disconnection in our region. During the dialogue and interviews, we identified strengths, challenges, overlaps, and gaps, as well as potential ways to fill some of those gaps.

I found that there are multiple advisory boards and committees throughout the region whose areas of concern include hunger and whose purview extends beyond a single organization. It is unclear from my limited research how much communication there is between them. One participant asked, "Who is kind of overseeing what's happening and having an influence and thinking of our ecosystem together, as opposed to just a bunch of individuals all competing for limited resources?" and later asked again, "How do we shine a light on all of these grassroots efforts and how do we come together?"

Participant L.O. described a "lack of unity" in the anti-hunger space, and a proliferation of organizations in "silos." They felt that consolidation would be helpful, and spoke of a desire to share information freely, rather than needing to charge for what they do. Other participants felt ambivalent about consolidation and shared stories of mergers and pressure to consolidate that they've faced. They could see benefits to doing so, but they also feared losing their ability to "get things done" within larger structures.

Many have described the nonprofit sector in our region as "small town," and yet, much of our work is disconnected. L.O. commented that the problem of infighting seems worse in our region than in others where they have lived. There, "if something went down, like, everybody was there. If there were arguments about stupid, petty stuff, when it came to, like, fighting against the system, it was like, let's put all that aside and get together, you know? Here in (our region), we let it get so in the way sometimes that I'm like, it's wild to me, like how hard it is sometimes."

That being said, another participant shared stories of a successful cross-sectoral coalition that formed organically when it was noticed that several of the same groups were showing up to advocate for local policy

solutions that affected their interconnected causes. One organization realized that they had an annual opportunity to garner significant media attention, so they decided to share the stage because, "given all of the things that were happening last year, the incredible, erratic, destructive actions at the federal level, that we all had more common interests than before, and we needed to stand together."

All participants acknowledged economic disparity as a root cause affecting individuals' inability to access basic needs such as food, housing, and healthcare. L.O. spoke of how "we also need to start thinking across sectors," because "all the worker co-ops are doing their own thing, and the food co-ops are doing their own thing in conjunction with other food people, and the (community land trusts) are more living in the housing space at the moment. It's like, we should all be having conversations about how we can support each other and all that and... you know, cooperatives have this set of cooperative principles and one of them is to support other cooperatives, right? So we should be thinking about the kind of intersections of all of our work and, even if there aren't intersections, how can we support each other and how can we help move all this forward, right? Because like you're always saying, people that have food issues aren't just dealing with food issues... Because it's all inequitable."

This boundary spanning work excites me the most, yet its entry points also seem to be the most elusive. Throughout my conversations, sustainable funding was named as a serious challenge for coalitions and alliances, and this finding aligns with my past fundraising experience. The trust-based philanthropy movement is working to change this, but the dominant preference in philanthropy is to fund direct program services, rather than operating costs. Donors like to hear that their gift made X number of meals possible (C.B. quipped, "Oh, did you know that two cents will feed 10,000 people?"), but most are less interested in paying the office rent or the salaries of staff who aren't directly putting food in people's hands.

For coalitions and alliances who support the work of other organizations, finding sufficient funding gets exponentially harder if the work that they are doing is attempting to change the dominant system (which is likely benefitting potential corporate donors). As participant P.D. said, "you're crossing so many barriers in terms of education. The amount of education we have to do... for funders is like, tremendously more than something like a food bank, or something like food recovery, which is tangible and easy to see." It's a lot harder for these organizations to demonstrate their impact, especially if they are consciously avoiding taking credit from other organizations.

It also became clear from these conversations that there is no shortage of people in our community that want to do the work of systemic change, both within and beyond hunger relief. P.D. said “We’re not alone. Like, there are so many people... that are ready to work on systems change. And the sheer lack of opportunity and space and funding to do that is... is like... heartbreaking.” And yet, they went on to say that “there is a really beautiful movement in (our region) that has gotten stronger.” Sometimes, success looks like getting “people to move in the same direction,” and that is happening, sometimes slowly, but surely.

Finally, one tool for getting people to move in the same direction is advocacy. C.B. shared the challenge that “some people think you can’t even talk about policy (as a nonprofit)... which is, of course, not true.” This is a common misperception within the nonprofit sector. In addition to confusion about legality, there is also a need for more education about the importance of advocacy work. N.H. described how their feelings about advocacy have evolved. Early in their nonprofit career, they would say that there were two types of work that they didn’t want to do. The first was fundraising, and “the second part was... advocacy because I want to do work. I want to do action.” I can relate to this completely, because I left fundraising because I wanted to get more involved in the work! However, N.H. and I both know that these tasks ARE part of the work. N.H. went on to say, “Oh my God, has my view of that changed so dramatically, because it’s just like, we are so limited in what we can do based on advocacy. Because if you’re not advocating for the people you serve... you can’t get the work done... You can’t remove the bars on the system.”

Conclusion

As we near the end of this journey, I want to pull back the curtain one more time. I must confess that I sat with the coded transcripts of the group dialogue and interviews for roughly one month, repeatedly finding other parts of the paper to work on, and other assignments to complete, rather than finding a way to succinctly share this information. So many important perspectives were shared, so much emotion flowed, and in the end, I was forced to accept that I couldn’t do it justice in one semester. It is my hope that I have conveyed a systems-level understanding of how the U.S. response to hunger prioritizes corporate power over human rights and dignity. And, on a regional level, I trust that you have received a meaningful glimpse of how local anti-hunger leaders are experiencing their work, the boundary spanning that is being done and the potential for its expansion, and lastly, the understanding that a few seeds of transformation were planted, and it may take some time to discover what they might grow into.

As N.H. said, “this is why I want to be in on this, not just this conversation, but like, what’s the next conversation? What are the next steps?”

No easy answers were uncovered, most likely because none exist for complex structural problems such as hunger and economic inequity. As such, this project raised more questions for me than it answered, as has most of my MESH experience. My group dialogue and interview transcripts are filled with “Post-grad To Do” flags, and most fall under the following categories of **Areas for Future Work/Research:**

- Summarize the tactical brainstorming discussion and help actualize it (I have volunteered to do this).
- Learn from coalitions and alliances in other regions that are doing what we’d like to be doing here, especially with regard to funding.
- Make cross-sectoral introductions between group and interview participants, as mutually desired, and nurture the new connections that were made.

Lastly, I will admit to feeling some uncertainty about the impact of my work. While feedback from the group dialogue participants was positive, the lasting measures of this project’s impact won’t necessarily be clearly connected to the dialogue. All too often, annual strategic planning retreats and conferences include sparks of transformation or paradigm shifts, and then those sparks fizzle out during re-entry due to the aforementioned never-ending ‘To Do’ list. I’ve offered my on-going collaboration to my participants, I intend to follow-up as much as seems appropriate, and I’ll keep my eyes open for future opportunities, but it’s impossible to predict where it will go from here. Loving Action requires letting go of the idea of “being in control,” so this will be an ongoing opportunity to practice.

Postscript to a “Conclusion” to a story that hasn’t ended yet

Just this morning, I gave into the urge to take in one more webinar before finishing this paper. [The National Right to Food Community of Practice](#) hosted “Lessons from Brazil: Hunger is a Political Choice,” and I couldn’t resist the opportunity to learn from a country that has once again “fallen off the hunger map.” The [Hunger Map](#) is a live, interactive dashboard maintained by the World Food Programme that tracks acute food insecurity globally. I had two key takeaways from this talk, and both relate to the topics discussed throughout my research findings.

First, I was reminded by M. Jahi Chappell, author of *Beginning to End Hunger*, and Elisabetta Recine, advisor to the Brazilian National Food and Nutrition Security Council, that progress is not linear. Chappell shared a favorite quote, which has been attributed to multiple people, “No permanent

victories. No permanent defeats,” to describe how Brazil has moved off the Hunger Map, back on it, and then off again. The quote brought to mind the “never-ending spiral of time” from my dedication, and it is especially relevant for those of us in the U.S. and beyond who are fighting for democracy and justice during the Trump administration.



Related to the first take-away, Chappell urged viewers to strengthen their capacity to organize within a movement so that they could work in synchrony, rather than just sympathy. This immediately reminded me of our discussion of connecting grassroots efforts. Just agreeing with each other is not enough, we need to synchronize our efforts to fight for the actualization of the right to food and end all forms of economic injustice. To that end, it is my intention to stay grounded in Not Knowing, to continue Bearing Witness, and to keep searching for opportunities to contribute through Loving Action.

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All photos by Tracie Barham, with the exception of “Stronger Together,” which features the author and was taken by Adam Knowles.

Seeds in Resistance: Preserving Indigenous Food Systems as a path towards Liberation



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Capstone Project

Flor E. Hernandez Zarate

April 13th, 2026

Agradacimento:

Este proyecto fue creado en colaboración con mi comunidad transnacional. Desde Oaxaca a California, seguimos floreciendo. Para la gente de las nubes y la lluvia. Para mi familia Hernandez, que la memoria de Juana Muñoz Aguilar y Bonifacio Hernandez Garcia viva en nosotros. Y por último, para todos mis paisanos especialmente los de La Asunción. Que un día lleguemos a ese mundo donde existen muchos mundos.



Bonifacio Hernandez Garcia and Juana Munoz Aguilar. Source: Hernandez Family Archive.

Abstract: According to the Mixteco Indigena Community Organizing Project (MICOP) “California is home to an estimated 170,000 Indigenous migrants from the Mexican states of Oaxaca, Guerrero, and Michoacán, including Mixtecs, Zapotecs, and Purépechas,” (MICOP, n.d.). Within the context of the food system on the Central Coast of California, these people and their stories have long been invisible amongst larger conversations about food production. While they create the booming economy of the Central Coast region, they are often faced with compounding hardships. They are disproportionately impacted by socioeconomic factors including access to housing, healthcare, and education. Being able to bear witness to their stories is part of the justice work that must be done especially in seeking to move academic research as a tool to achieve environmental justice. Through a series of testimonio, interviews, photography, oral history, collective memory, ethnographic methods, and storytelling, this captures Indigenous farmworkers’ refusal, resistance, and experiences with the food system. It explores their dreams for what an equitable food system could be. These dreams include participating in agriculture on their own terms through ancestral methods and having guaranteed access to food.

Introduction: From strawberries to wine, the climatic conditions make California's Central Coast the perfect place for food production. This comes at the cost of both the environment and its people. My parents migrated and began their life here as farmworkers in the later part of the 1980s. They endured long days in the heat, short days in the rain, and low wages for their efforts out in the fields.



My mother working in Santa Maria, CA in the late 1980s. Source: Hernandez-Zarate family archive.

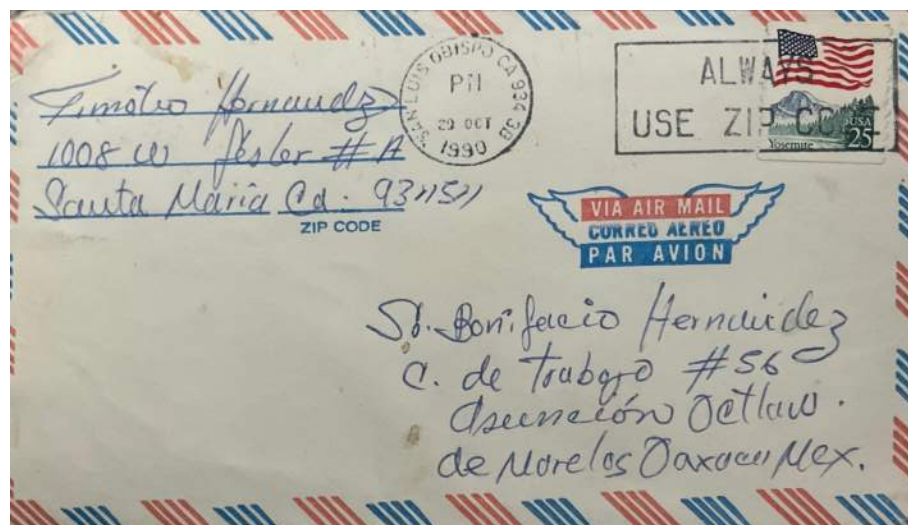
The current food system does not work. It is unsustainable from several angles ranging from the ecological impact of industrialized monoculture agriculture to the amounts of food waste in Western countries to the exploitative labor practices in food production. The cost of such agricultural practices is further discussed in Ursula Franklin's book *Ursula Franklin Speaks: Thoughts and Afterthoughts* (2014), where she explains, "In the case of agriculture we know where monocultures led; they led to an enormous dependence on fertilizer, a depletion of the soil, and the realization that pesticides are not just beneficial and that soil erodes" (p.164). The majority of literature and case studies that have been done around farmworkers, specifically at the intersection between Indigenous people and food systems, has been limited or focused on other aspects beyond food like health impacts or socioeconomics.

This capstone project focused on capturing those stories that are otherwise missing within the literature on food systems and sustainable agricultural practices in order to serve as a map for the future and a tool for empowerment. This idea has been emphasized by scholars Sam Marullo and Bob Edwards who wrote in their paper *From Charity to Justice*, "Justice work is empowering in that the poor or those in need are treated as equal partners in the determination of what services

or resources are needed and how they can be attained” (2000, p. 901). Farmworkers understand the food system from their own histories, contexts, and relationships which makes them knowledgeable about where changes can be made to create more equitable food pathways.

Historical Context:

In my family’s history, we have stuck to oral storytelling as ways of preserving the essence of our ancestors. I have been able to track my own histories of ancestral migration throughout time through stories at the dinner table or in the kitchen. My parents came to the United States to live in the late 1980s during Regan’s amnesty which allowed a pathway to citizenship for immigrants while also tightening security at the southern border (NPR, 2010). This gave them greater mobility even as farmworkers to dream of traveling across borders back and forth from Santa Maria to Oaxaca. These stories are intertwined with our paisanos and remind me of the necessity in being able to document our personal histories so that in collective memory we can trace where we have been as well as where we are going.



Letter from the 1990s from my father to my grandfather. Source: Hernandez Family Archive.

Current Literature: The epistemological assumptions that have informed my work have been a combination of my own lived experiences along with research from academics on this topic. Dr. Linda Tuhiwai Smith in her book *Decolonizing Methodologies: Research and Indigenous Peoples* wrote that “Participatory action research, oral histories, critical race theory and *testimonio* are just some of the examples of methodologies that have been created as research tools” to work in ethical partnerships with Indigenous participants (p. 205). This has served as the guide to understanding how to best approach the storytelling as a part of this project.

Storytelling is an integral part of the food system because of the woven stories about health, community, migration, labor practices, and ancestral knowledge. In being able to connect these points we can ask the biggest question of all which is *what can we do about it?*

Existing research analyzes different components of social justice and the food system. One assessment which looked at the approaches of food sovereignty and environmental sustainability. The literature “is limited, with this review identifying 34 peer-reviewed articles from only nine countries. This highlights that the identified Indigenous food sovereignty assessment approaches may not be representative of the global First Nation populations” (Abdul et al., 2023). This demonstrated the need to capture opinions, stories, and qualitative data on Indigenous peoples in regards to food systems. Other research includes case studies about policy action when regarding the food system such as Marylynn Steckley et al’s paper ***Food sovereignty for health, agriculture, nutrition, and gender equity: Radical implications for Haiti*** which covers the creation of policy around the food sovereignty in Haiti and the impacts of changes in the food system on health, nutrition, and gender equity. Esteli Jimenez-Soto et al’s paper titled ***Agriculture Against the wall: barriers and opportunities for agroecological transitions in California’s industrial agricultural landscapes*** delves into the challenges for farmers on the Central Coast capturing some of the stories about attempts in transitioning farming practices to be more sustainable. This is the closest academic paper I was able to find that aligned with the type of research that I carried out, but the notable absence within this paper was the lack of farmworker voices and the focus on small to medium sized farmers on the Central Coast.

I reference here other academic journals, articles, and studies that focus on the oral histories of farmworkers throughout this paper. One of these papers was Esteli Jimenez-Soto et. al’s paper ***Food sovereignty among migrant farmworkers: The role of agrobiodiversity for autonomy and resistance in a Mexican coffee plantation***. This look into Mexican farmworkers highlights stories within the coffee industry as sites of history, resistance, and stewardship for people. One of the aspects of this that greatly appealed to my own approach to this project was the use of photography and poetry as well as incorporation of interviews conducted. All these aspects help to develop a story that honors and respects the communities whose stories are being shared. In ***Hunger amidst plenty: farmworker food insecurity and coping strategies in California*** by Laura Anne Minkoff-Zer, there are several oral interviews conducted that focused on the northern part of the Central Coast which includes places like Watsonville and Salinas also known as farmworking communities. This paper does focus on Mixtec and Triqui communities sharing about poverty and hunger and Minkoff- Zer highlights opportunities like social service programs and community gardens to fill in the gaps. She does an excellent job of framing the conditions that led to Indigenous farmworkers ending up on the Central Coast to begin with which includes dispossession, border politics, and global trade policies like NAFTA.

Addition to the Literature:

Migration of Indigenous peoples, such as Mixtecos and Zapotecos has always existed. Their presence shapes and makes the booming economy of agriculture in California possible. Considering this, how do Indigenous farmworkers on California's Central Coast understand their own experiences with industrial food systems? How can they imagine alternate food systems and how do those dreams interact with migration, dispossession, and borders?

My core interview questions were shaped by my own community's experiences with food precarity and my own commitment to food sovereignty. The following were some of the questions asked during the series of interviews I conducted.

Interview Questions

1. Can you tell me about your journey to the Central Coast? How did that lead to working in agriculture?
2. What is something you would like to share about your traditional farming practices?
3. How has your diet changed since living in the United States?
4. How are farming practices in the United States different from your traditional farming practices?
5. What is the most unseen aspect of your job that you want people to know about?
6. What does a sustainable food system mean to you?
7. The food system as it exists today, does not benefit farmworkers. What would a system rooted in justice and equity look like, taste like, feel like, sound like, smell like?

These questions serve as an entry point for the interviewees. It is not often that farmworkers are offered the space within academia to be able to unpack these issues. I am not the first to think about food insecurity or the issues with food production in Santa Maria. Instead, I am extending this ongoing conversation. In both academic and governmental spaces, this is a topic that is being considered across development programs on agricultural production. Food sovereignty in particular is something that has not been as heavily discussed as it applies to diasporic Indigenous groups. I focused on this topic as envisioning the possibilities that could exist. Similar concepts that fall under western frameworks are food sovereignty, food justice, environmental justice, social justice, equitable food systems, and so on.

Focusing on the concept of food sovereignty specifically, it refers to the ability of people to grow culturally relevant foods on their own terms. This term was popularized through a global movement group known as La Via Campesina. More importantly, food sovereignty takes food security one step further. It acknowledges that food security is not enough because it is not enough for people to have access to food. It pushes the bounds by moving forward the concept

that people should have access to healthy food from a sustainable source. I have spent so much of my life thinking about food equity. I have seen first hand the importance of access and the necessity of non profits and mutual aid as life sustaining work for the communities and places I call home. It is an inherent human right to have access to healthy food. That human right is intertwined with so many other things involving social, economic, and environmental factors.

I prioritized researching 1) historical data about farming through research conducted from 2000 to the contemporary year of 2026; 2) conducting interviews to collect oral histories about farming practices and experiences; 3) local and other news coverage from the last ten years about food sustainability and food production throughout the Central Coast. Through these methods I have gained an understanding of what is currently happening with the food system as well as where there are opportunities to disrupt the mainstream agricultural practices. This has allowed me to see what aspects of this conversation have already been developed and where I can intervene in this research area. Oral histories are the main focus of this project with analysis grounded in social justice and decolonial frameworks from other academics researching this topic.

Methodology: Other gaps when it comes to this type of research come down to the methodology. There are contemplations from academia itself on the ethical approaches when it comes to researching Indigenous communities. While some scholars debate who is best suited to do this type of work, there are also arguments that Indigenous people should be able to create their own case studies from frameworks that are culturally appropriate including relationship building and reciprocity. This capstone's methods sought to lessen the gaps in the literature through praxis focused on the methodology as well as the final findings being property of the communities researched.

When it comes to the methodology of this capstone, there are several approaches that have been included such as the work of scholars like Linda Tuhiwai Smith and Eve Tuck. There is an existing understanding within Indigenous communities that research has historically been extractive. The extraction comes from academics profiting off the research done on the practices and knowledge of these communities. Collaboration with academic researchers has been difficult because of the lack of access to the eventual end product as well as the notoriety that is gained by academics in the process of disseminating their research. As someone who would be considered an outside insider to the community I researched, there is a level of understanding that I approach this work with. Raised with the values of reciprocity and community building, I sought to build alongside the communities I researched to give them the lead within an academic exercise. By doing this I created something that is diverting from "the fixation [within] social science research has exhibited in eliciting pain stories from communities that are not White, not wealthy, and not straight. Academe's demonstrated fascination with telling and retelling narratives of pain is troubling, both for its voyeurism and for its consumptive implacability"

(Tuck, 2014). While Indigenous farmworkers' stories can include hardship, they are more than those stories.

Additionally, this goes into the agency of being able to give Indigenous people control in how they are represented. This is a part of decolonial work. In Tuck and Yang's paper ***Decolonization is not a Metaphor***, they cover how decolonization is an action rather than a theoretical framework. They write, "Decolonize (a verb) and decolonization (a noun) cannot easily be grafted onto pre-existing discourses/frameworks, even if they are critical, even if they are anti-racist, even if they are justice frameworks... We, at least in part, want others to join us in these efforts, so that settler colonial structuring and Indigenous critiques of that structuring are no longer rendered invisible" (2012, p. 3).

If decolonization is to be a verb, an action, then it must be decided from within oppressed communities. Indigenous people have entire structures around food production from within their own territories. Upon forced migration and dispossession which has led them to the farms of the Central Coast in California, they are forced to contribute to mainstream monoculture practices to survive (Remigio Ortega, 2020). As Tuck and Yang suggest then, within conducting research in these groups, it must be done with the intent of uncomfortable solidarity in order to secure sovereignty to Indigenous people. While this capstone project is focused on food systems and Indigenous farmworkers, it is also about the greater goal of ensuring the future of these communities through collective memory.

Finally, as covered in ***Pedagogy of the Oppressed***, by Paulo Freire, he suggests that "**the great humanistic and historical task of the oppressed: [is] to liberate themselves and their oppressors as well**" (1968, p.44). This falls in line with other popular Indigenous liberation frameworks like the Zapatistas who famously state the construction of "**un mundo donde quepan muchos mundos**" or simply put, a world where multiple worldviews fit within each other. To be able to capture these stories on Indigenous peoples terms is to be able to work towards their own humanization bringing us all closer to a more equal world. All of this intersects too with bringing us to a world with better food systems based on equity.

The data collected from the interviews I conducted will be laid out to highlight different portions from different interviews. This will follow a similar format to other scholars such as Estelí Jiménez-Soto and Laura Anne Minkoff-Zer. These papers serve as examples of how to intertwine oral histories and interviews with academic analysis. I accompanied these interviews with photography snippets. Some of these images come from my own family archives while others were taken across the different interview sessions I conducted. Through incorporation of pictures, their stories are represented beyond words. Most of these pictures do not feature their faces or any other identifying characteristics. My cousin, as well as all other participants, have verbally consented to document certain aspects of their interviews.

Most of my interviews ended up feeling informal. I asked interviewees my questions, but I remained hyperaware of the communal trauma which has skyrocketed with ICE raids. The world has given them no choice, but to be resilient. I sat with folks under their fruit trees, I ate their home cooked meals, I nodded along touching the same plants I have grown up eating, and I listened and took notes, but more than anything I made sure to thank people at the end. I offer them thank you in my variant of Zapoteco with full eye contact so they know I mean it from the depth of my soul.

Spaces for Dreaming

Once interviews were completed, I sorted through endless amounts of data. All this will be compiled into a zine. Zines “have roots in the informal, underground publications that focused on social and political activism in the ’60s” (University of Texas Libraries, n.d.). These are self published works that are distributed for free or at low cost in order to make the content accessible. The intent of this project is to be able to make this information accessible to the communities from which this research was derived in the spirit of praxis.

Since the beginning of the MESH journey, I knew that the final product would result in a zine. As the founder of a zine distro called Cempazuchitl’s Library, I have used zines as a form of memory building with the stories of my family and other Indigenous people. In connection with my capstone project, I will release this research to the participants and they will collectively decide what to do with it outside of immediate community circles. This decision will be made as a way to reaffirm their sovereignty as storytellers. They will be the ultimate authors and owners of this work. Considering that their stories are deeply personal, this process is to empower them to tell their own histories, memories, and stories.

This zine creation will follow a similar approach to other workshops with Indigenous youth. This process will ensure that interviewees will have a creative process of imagination to co-create the final product. This final zine will be translated into Spanish and it will be distributed amongst key community based non-profits and collectives that support Indigenous diasporic communities in the area. Although it is not completed at this time, the first round of zines will be printed for distribution in the summer of 2026.



Indigenous youth making a zine. Source: Cempazuchitl's Library archive by Flor Hernandez Zarate.

On being the insider/outsider:

My positionality in this is an insider/outsider academic. I have drawn my methodology heavily from scholars like Linda Tuhiwai Smith. Her book on ***Decolonizing Methodologies: Research and Indigenous Peoples*** has been foundational in establishing the boundaries of ethics. She explores the role of research in Indigenous communities. She explained the position I am coming to this research with quite well citing that,

“For researchers who come from the communities concerned it may also be understood as ‘insider’ research... Some of these approaches are also referred to as critical research, as social justice research, or as community action research. There are also specific methodologies that have been developed out of the work these approaches have initiated. Participatory action research, Kaupapa Maori research, oral histories, critical race theory and testimonio are just some examples of methodologies that have been created as research tools that work with marginalized communities, that facilitate the expression of marginalized voices, and that attempt to re-present the experience of marginalization in genuine and authentic ways.” (2012, p. 205).

Although I approached this research as a graduate student, I am also a community member in this process. My grassroots approach comes from my years in community organizing. Having this background is foundational to understanding how my research unfolded. Community led research as oral histories has been really crucial to being able to tell stories from marginalized communities. My stake in this work is as the daughter of two Zapotecos, gente de las nubes, from los valles centrales de Oaxaca who settled in the Santa Maria Valley to raise their family.

My parents were farmworkers until the late 1990s when they began their own businesses. They taught me the importance of reciprocity and community which is essential in ethical research frameworks. Farmworkers in Santa Maria by majority are part of the Indigenous diaspora south of the border and they shape food production in the region. This research has to be meaningful to my understanding of the needs of my community and my responsibility as a community member and academic.

Memory Marking the Spot:

As I began the interview process, I slowly connected with possible interviewees to gain further familiarity into the farm working part of their lives. Although I am related to some interviewees, I also made time to connect beforehand engaging in some of the cultural customs that allow the “insider” portion to bridge with the “outsider” status as I conducted this research. Some of these aspects I shared in my introduction to interviewees were community standards where I listed off my pueblo, family, and personal ties to the diaspora on the Central Coast. From there I guided them to talk about their lived experiences in the food system. I was prepared to sit with all the stories they shared with me both about the food system and not. This was an important part of memory keeping not only as an assignment, but as a collective memory of Indigenous people from southern Mexico.



Hernandez family out in the grape vineyards in the 1980s in the Santa Maria Valley. Source: Hernandez-Zarate family archive.

In December 2025, I reached out to my cousin. I came to him with my project timeline and end goals to gain a deeper understanding into his life as a farmworker. My family has long been farming as a way of life that continued even as they crossed borders. My cousin and I spoke about the ways in which food memory exists in both the knowledge our elders have over the land and keeping personal gardens even while not having access to huge swaths of land. I suggested that he keep some stories for himself too as Eve Tuck explores, “We carry the proof of oppression on our backs, under our fingernails; and we carry the proof of our surveillance in our photo boxes, our calluses, our wombs, our dreams. These stories, too, are not always ours to give away,” (p.234).

I spoke with my cousin about the necessity for stories from farmworkers on their own terms. Although he was born and raised on the Central Coast as a Zapoteco and Mixteco in diaspora, he understood the dynamics of being from here, the United States, and from a pueblo originario. At first he was uncertain of his knowledge, an uncertainty that Paulo Freire discussed in *Pedagogy of the Oppressed* that outlines that “self-depreciation is a common characteristic of the oppressed, which derives from their internalization of the opinion the oppressors hold of them” (p.63). This attitude was not unique to him, but one that many interviewees held. As time passed from December to March, he seemed more excited about the prospect of being able to have a published product that he can share to be able to talk about these larger ideas.

Personal history is important as it is inextricably linked with other histories of policy, food systems, and migration. These interviewees served as an active exercise in pushing back against the assumptions about farmworkers by going to the source directly and amplifying those narratives. This allowed them to reclaim their own agency over the stories told about them and tell us what the current food system could transition into.

Aaron’s parents entered the United States between the late 1990s through the early 2000s. This can be directly traced to international policies being enacted that were far beyond their reach. As Michele Vazquez Ruiz outlines “In 1994, farming communities were pressured to immigrate to the United States for work due to the North American Free Trade Agreement (2021, p. 4). Our family continued to work in agriculture here. It is important to note how that shift altered their way of life going from decision makers as part of the food system to being seen as cheap labor. This experience is not only unique to my family, but it is something felt by so many Indigenous farmworkers who dealt with the same switch.



Aaron showing me around the farm. Source: Flor Hernandez Zarate.

“You will travel through the membrane of death, smell cooking
from the encampment where our relatives make a feast of fresh
deer meat and corn soup, in the Milky Way.

They have never left us; we abandoned them for science.

And when you take your next breath as we enter the fifth world
there will be no X, no guidebook with words you can carry.”

- Joy Harjo’s *A Map to the Next World*

There is a necessity to honor both the past, and also the present. In being able to hold that multiple truths exist at the same time, we understand that there might be contradictions in this collection of stories shared by interviewees. What may seem clear cut to the interviewees, might

be not as clear cut in their responses. While I detail certain traditional food practices as forms of “food sovereignty”, my community would not call it by that name. This idea is supported by researcher Marisa Elena Duarte [et.al](#)’s *Of Course Data Can Never Fully Represent Reality*. They wrote about how “With regard to Indigenous peoples, uses of the terms “data” and “knowledge” are strongly influenced by differences in disciplines and fields, with ecology and environmental studies relying on the term “knowledge.” “Indigenous knowledge” and “traditional knowledge” function as paradigmatic boundary spanners, allowing for convergences across disparate research areas” (2019, p.170). These are the types of small discoveries that I was able to make throughout this research. This active reframing occurred several times throughout my conversations with different community members about the same research.

A part of these interviews focused unintentionally on the elephant in the room: Immigration and Customs Enforcement. Most of the people I interviewed had their life altered in some way in the last year because of the presence of ICE within their communities. A local nonprofit, 805 UndocuFund shared with me that they estimated that 739 people have been detained by ICE since January 15th, 2025 with 472 people being from Santa Maria where this research was carried out. As Linda Tuhiwai Smith puts it, “Many of the social issues and challenges that confront marginalized communities will also be part of the biography and social network of an insider indigenous researcher,” (2012, p. 208). Collectively, we have endured so much. During the transcourse of this project, a family member was detained and deported. I allowed the interviewees and myself time to process some of this heartbreak- even if it is only for a few moments, we carried the grief together.

I asked about migration experiences because it is directly tied to working in agriculture and captured a different side to food systems. As written in *Measuring Indigenous food security—A case for Indigenous designed tools*, “Any instrument should assess all culturally and contextually relevant domains recognising that Indigenous food systems are inextricably connected to land, which in turn is interwoven with issues of self-determination, livelihoods, health, cultural and spiritual heritage” (Deen et al., 2014). Through this project, I navigated this connection to land as more than a site for food production, but as a site for nostalgia, a longing for ancestral land, people, and as Lesandro Meza sang in his cumbia song Lejania, “Y por dentro, yo siento el llamado que me hace la tierra mia”.

Seeds in Resistance:



Pepper and squash seedlings at Aaron's family's greenhouse. Source: Flor Hernandez Zarate.

Aaron's interview was across an entire Saturday at work. At 23 years old, my cousin is still learning so much about industrial agriculture. In his words, he still feels like "the body and my dad is the brain". My uncle watched him carefully as my cousin worked on a plow. They need to fix it now while they still have time. By May, the season will be in full swing until September.

Aaron explained that his family is the middlemen between the larger company they lease land from. They are told what to grow, where to grow it, and they get a cut from the final profit. It is not an effective system for anyone except the companies which have monopolized the food system.

The rows and rows of seedlings drew me back to the reflections of Ursula Franklin speaking on the dangers of monoculture. She went as far as to name monocultures as being, "so totally unprotected from sudden invitations of insects, [it] should give us a lot of cause to think about violence. Why is our society so susceptible to violence?" (Franklin 2014, p.166). In both the treatment of the land and the workers, I kept this question in mind.



Aaron working on the plow. Source: Flor Hernandez Zarate.

Throughout the day, I wove in and out of taking different combinations of digital photos, audio, and notes throughout the. Our conversation took many turns. We began with my cousin's earliest memory out in the fields.

“Los Alamos... Foxen Canyon. I remember my sister and I, we were playing in the mud. Then [I remember] us getting washed down by a metal pump and my mom getting mad at us for getting dirty. Working? I guess like I remember my dad driving when he was on the tractor. I would sit right next to him and just chilling with him while he is discing the field. Really working? When my mom told me to plant frijoles (beans) and then I remember doing a whole acre by myself. I listened to Mac Miller's GO:OD AM [album] probably ten times that day.”

While he has good memories of being out in the fields, this is not the common experience. My second cousin's daughter, Rose, recounted, “Yo recuerdo a los 12 años fui al ejote. Sábado y domingos en Los Alamos. Cuando se ponía muy caliente me mandaban a sentarme.” She began working in green beans helping out her parents. Although her parents didn't force her to fully work, they still wanted her to grasp the difficulty of their lives and encourage her to work hard in school. The potential of heatstroke was also something which also came up frequently amongst

interviewees. The weekend before these interviewees were conducted saw major heatwaves in San Luis Obispo & Santa Barbara Counties with “valleys and interiors stay hottest until Friday [March 20th]. All areas remain well above normal highs that are usually in the 60s for March.” (KSBY News). The changing climate wasn’t the only thing highlighted as an issue with the current agricultural system. Deep systemic issues seeped through every interview I conducted including Aaron’s.

While in the car Aaron opened up about what he has seen firsthand.

“I’ve seen it twice where we throw out vegetables because the price isn’t any good. We didn’t even bother harvesting it all, it was just left out there.” Aaron looked regretful as he added, “There was so much that not even the workers can take it all home.”

This is the extent of the neo-empire, a concept which Garrett Graddy Lovelace discusses in *“The coloniality of US agricultural policy: articulating agrarian (in)justice”*. Agribusiness is not only cruel in the sense of land and worker exploitation, it also encapsulates the “coloniality of US agricultural policy [which] expressly links structural racism to corporate consolidation in agribusiness sectors” (Graddy Lovelace 2016, p.11). Big corporations set prices, they control the market so smaller farmers and contractors are left to follow.

He showed me the packaging of the seedlings which they spend thousands of dollars on for one season. The seeds can only be used once. This is another impact of monopolization by big agribusinesses which seek to control the entire market. We agreed on the urgency of seed keeping and continuing to ask our elders questions about our traditional foods. This refusal even as Aaron engages with industrialized agriculture echoes Sylvia Mendoza Aviña and Dolores Delgado Bernal’s work which outlines memory work and by extension “oral history research with the communities that we come from relying on the guidance and knowledge of ancestors” (2025, p. 1158).



Later in the day, he brings up that he looked up food sovereignty the night before to prepare for the interview. I asked him about his thoughts on the matter.

“It’s totally possible. Cultural food should be available. We don’t grow those types of foods. So these companies tell us what to grow and that’s what is available in the market. I know my mom grows chayote (type of squash). Some of the workers will be like “Can I buy some of that?”

He paused to think before he continued.

“Sometimes my dad’s sister will come over here. We’ll have a garden and she’ll work on it with her husband and kids. My mom will do her garden. She grows frijoles (beans) and tomatoes and other stuff. I don’t think they (his auntie) have their own space to garden.”



My Tia Claudia's garden outside of the greenhouse. Source: Flor Hernandez Zarate.

In just the span of a few minutes, my cousin reminded me of the ways that even in these rigid industrialized agricultural systems, our people are resisting the loss of their original food pathways. As Minkoff-Zern wrote, “farmworker gardens, although not a systematic solution to food insecurity, present an alternative path to access for some of the most marginalised” (2014, p. 205). Even if it's just a small corner of an industrialized field, they are growing culturally appropriate foods. It didn't matter that the global food supply chain didn't bring their food all the way here, one way or another they found a way to recreate their traditional food pathways.

A few days later I was over at my cousin Jasmine's home. She welcomed me in and immediately offered me a meal. We catch up for an hour before I finally ask if it's okay for me to hit record and ask some questions.

Jasmine was not shy of the camera or the recorder at all. She proudly showed off her garden tucked away in the right corner of her backyard. A few steps outside and I felt a knot in my throat. It's as if I were standing in our pueblo. Jasmine hasn't been to Asunción in over 20 years, but she recreated it here. I can easily recognize some things like yerba santa, guava, nopales, ruda, perejil, and chayote. It is a physical recreation of space across borders that has tied into Zapotec *survivance*, a concept discussed by academics Gerald Vizenor, Eve Tuck, and Wayne Yang. They describe this memory and embodiment as “an intergenerational connection to an individual and collective sense of presence and resistance... particular(ly) through stories” (Vizenor, Wayne, Yang 2013, p. 107). The pueblo doesn't only live in Jasmine's garden, but in the stories she shares with her children and with myself at her kitchen table that day.



Jasmine's home garden. Source: Flor Hernandez Zarate.

“Ya me salí de la fresa. Donde trabajo es compañía. Yo ya me canso.”

Jasmine talks a lot about her work in strawberries. To her, it's the most backbreaking job which is why she switched a few years back to blueberries and raspberries. She has continued to work while she can, but she hopes that one day she can rest. She pondered over opening a restaurant or food stand since she loves to cook.

We were in the middle of a story when a big knock came at the door. It's the people from the mutual aid group with the bi-weekly grocery delivery. Jasmine's husband was deported in the middle of 2025. A few months ago, I had connected Rose back to resources so that the family could have extra wiggle room since they had been so tight on finances. As Minkoff-Zern expanded in her research, “food assistance programmes, which included food banks and food pantries, often fail to assist those most in need, either due to government regulations barring undocumented persons from receiving assistance, a deficiency in resources in rural areas, or a lack of language and cultural awareness” (2014, p. 212). This was filling a gap that until then hadn't been met by the institutions. I carried the grocery box inside and snapped a picture of some of the items they received which included pantry essentials and fresh produce.



Local mutual aid group grocery delivery. Source: Flor Hernandez Zarate.

Later that day, I interviewed an auntie on my dad's side. Tia Dahlia talks to me about when she first got here. She was around high school age.

“Tu abuelita se enojó con el abuelo porque no estaba yendo a la escuela.”

My grandfather was not sending my auntie to school and instead opting to keep her out in the fields since at the time they were also leasing land from a bigger company to grow zucchini. She went on to later complete high school. She recounted the early days of being in the United States as a struggle to mix Zapotec traditions with new ones in order to survive.

We sat under her avocado tree as she showed her yerba santa. My Tio, her brother, and her were working on making fertilizer for the plants. She spends her free time selling herbs, fruit trees, and house plants. When I asked about her dream, she told me about having her own nursery so she can expand her offerings to the community.



Natural fertilizer made from charcoal. Source: Flor Hernandez Zarate.

Aaron also expanded on what he is still developing. Time and time again we acknowledged how much our parents, like Tio Alfonso, and grandparents have different spiritual relationships with the land. He wants to nurture this in his work too.

“[I want to] Know how much sodium is in the dirt, know how much salt, how much of x is in the dirt, [and] learn what the dirt needs. Just by looking at the plant knowing what it needs. My dad knows. He could just take a look at the plant.”

I asked him if the sky was the limit, what his dream would be. He took time struggling to find the words, but eventually he shared.

“I would have my own shop (farm stand) there (pointing at open land). A space where I could fix our machinery and like a big ass sombra (shading)... somewhere where the workers could hang out and not be rushed or limited to 30 minute breaks. A stand so that when we have

excess produce and people can pick it [out] if they want to. It would be cool...Yeah, that would be really cool.”

Asking each interviewee about their dreams was essential to this project. It demonstrated to myself that as bell hooks wrote about “Language is also a place of struggle. The oppressed struggle in language to recover ourselves, to reconcile, to reunite, to renew. Our words are not without meaning, they are an action, a resistance.” (1989, p.16). This question was posed so that we could collectively reclaim ancestral places, practices, and experiences that could be transformed to form new realities and by extension new food systems.



The land that Aaron and his family farm on. Source: Flor Hernandez Zarate.

I had a follow up call with Rose a couple of weeks after her initial interview. I asked about her understanding of the word sustainability. She took a brief pause before rushing out her thoughts as if they would escape her if she didn't finish fast enough.

“I think of it like how sometimes we share food with the neighbors. Our neighbors reciprocate by bringing other food back. We trade for services too... Food is valuable. Everyone has the right to food. It’s helping each other out. I think that’s sustainable. It’s about putting in time or reciprocating it back with something you have so it stays in the community. Or knowledge too. We give out gardening tips with our neighbors. Like hey try this or that and having *una platica*.”

In true Zapotec fashion, Rose reminded me of the practice of *comunalidad*, a term coined by Jaime Martinez Luna. Martinez Luna’s understanding of *pueblos organarios* is based in the collective over the individual (2010). This is an extension of our understanding of belonging within our communities. *Guelgetz*, from where the popularized festival in Oaxaca is derived from, is the Zapotec word for reciprocity. By joining the collective struggle, these communities continue to endure across borders. It is how they have preserved their essence as Indigenous peoples.



Jasmine picking the stem of Yerba Santa that some people use to cook traditional meals. Source: Flor Hernandez Zarate.

Towards the end of the phone call, Rose shares with me how she believes the next food system will be like. Drawing from the senses, Rose creates an image of the future rooted in justice and care for the land.

“It would taste like my grandma’s and my mom’s cooking. It would look like comfort or safety. It would smell like rosemary after it rains. The feeling of the sun. The clinking of spoons and plates and laughter at the table.”



Rose’s grandmother cooking at my grandfather’s home in Oaxaca. Source: Flor Hernandez Zarate.

In being able to imagine alternative food systems, we can help to build them. The current status quo cannot continue for much longer. In listening to these stories, we can outline what potential pathways to food systems are possible centered in the experiences and understanding of those who make the current food system possible. A better future is coming. It is inevitable.

Summary:

Oral histories are inherent to collective memory amongst diasporic Indigenous peoples. Collecting these stories, I was extremely conscious of the manner in which these communities operate. In being able to document these stories, there is an underlying understanding that as Tuhiwai Smith has outlined, “One of the most difficult academic arguments for indigenous scholars to make has been the very existence of indigenous knowledge as a unique body of world knowledge that has a contribution to make in contemporary disciplines and institutions,” (Tuhiwai Smith, 2012). This is the heart of the intended research to be able to give validity to Indigenous knowledge. So many of our communities, elders, and people have held stories about

the land and all our non human relatives. This is an opportunity to put down those stories into the academia not because they need it to be valid, but because the stories and dreams for a future food system deserve to be shared with others.

The core of what I found was the memory keeping, resistance, and refusal of Indigenous farmworkers despite systemic racism, violence, and colonization. This has not been widely represented in academic research. When farmworkers have been represented it falls under the stories of hardship as academics Eve Tuck and K. Wayne Yang wrote in their paper ***R- Words: Refusing Research***, “We observe that much of the work of the academy is to reproduce stories of oppression in its own voice” (2014, p.227). In order to disrupt this, I included oral histories that capture not solely the oppression aspect, but also hopes and dreams for the future.

Over the MESH program, I have critically analyzed food systems and agriculture as it relates to Indigenous peoples, specifically diasporic Indigenous migrants. The contributions of Indigenous people within the food system has been often overlooked. This capstone project collected stories of those contributions, the state of the food system, and the possibilities that can exist given diasporic Indigenous farmworkers’ perspectives and imaginations. This research will continue with the funding [UC Reimagine Refuge Network](#) under the title “Somos Seillitas Floreciendo” which will allow community members to continue to engage with their narratives and shape future research. For updates on this continued effort, please feel free to stay connected through the following [series of links](#) and social media page [@Cempazuchitls library](#).

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By: Melissa Galanty

The Meat We Don't Eat: How Processing Decisions Produce Food Waste in the U.S. Beef Industry

Abstract

This study examines how food waste is produced within the United States beef industry, with a specific focus on the processing stage of the supply chain. While food waste is commonly framed as a result of consumer behavior, this research asks how institutional, regulatory, and economic decision-making processes shape what is considered edible versus inedible meat within processing systems. Using a qualitative approach grounded in document analysis, this study draws on academic literature, policy frameworks, and industry materials from organizations such as the United States Department of Agriculture, the Environmental Protection Agency, and the Food and Agriculture Organization.

The findings reveal that while regulatory frameworks such as the Federal Meat Inspection Act clearly define food safety boundaries through the classification of adulterated meat, they do not govern the majority of decisions that occur during processing. Instead, everyday practices such as trimming, grading, and classification are shaped by economic incentives, production efficiency, and market expectations. These decisions play a significant role in determining how much edible product enters the food supply.

By applying systems thinking and environmental justice frameworks, this research demonstrates that food waste in the meat industry is not simply a downstream issue, but is structurally embedded within industrial production systems. This has important implications for how food waste is understood and addressed, suggesting that meaningful reductions will require not only changes in consumer behavior, but also greater attention to upstream decision-making processes within food systems.

Introduction

Food waste is widely recognized as a major sustainability challenge due to its environmental, social, and economic impacts. In the United States, approximately [one-third](#) of all food produced is lost or wasted, contributing to greenhouse gas emissions, inefficient resource use, and the loss of food that could otherwise address food insecurity. This contradiction highlights a fundamental issue within modern food systems: while food is produced in abundance, a significant portion never reaches consumers.

Much of the existing conversation around food waste focuses on individual responsibility, particularly at the household level. Consumers are often encouraged to reduce waste by improving purchasing habits, better managing food storage, and understanding expiration labels.

While these actions are important, this perspective overlooks the structural factors that shape how food is produced, processed, and distributed before it reaches consumers.

The meat industry represents a particularly important context for examining food waste due to its scale and resource intensity. Meat production requires substantial inputs of land, water, energy, feed, and labor, meaning that inefficiencies within this system carry significant environmental and social consequences. Despite this, there is limited research examining how food waste is generated within meat processing systems, where key decisions are made about how animals are transformed into food products.

This study investigates how food waste is produced within the United States beef industry, with a focus on the processing stage of the supply chain. The central research question guiding this project is: how do institutional, regulatory, and economic decision-making processes shape the classification of edible and inedible meat, and what environmental and social consequences emerge from these decisions?

By applying systems thinking and environmental justice frameworks, this research seeks to shift the conversation around food waste away from individual behavior and toward the structural conditions that shape waste production. In doing so, this study aims to contribute to a more comprehensive understanding of food waste as an outcome of how industrial food systems are designed, governed, and maintained.

Literary Review: Looking at Gaps

2.1 Dominant Narratives of Food Waste

Food waste is widely recognized as a major sustainability issue due to its environmental, social and economic impacts. In the United States alone, approximately [one third of all food produced is lost or waste](#), contributing to greenhouse gas emissions, inefficient resources use and the loss of food that could otherwise contribute to food security. These contractions, where food waste and food insecurity exist simultaneously, has become a concern within sustainability research.

Much of the existing literature on food waste focuses on downstream consumption, particularly household-level waste and individual behavior. Scholars often emphasize the [consumer's](#)

[decisions making](#), including acts of over purchasing, improper storage and general confusion around date labeling, as primary drivers of food waste. Dates such as [“best by” or “use by” are not federally standardized](#) and are often influenced by liability concerns from companies rather than clear food safety guidelines, which can lead consumers to discard food prematurely.

While this body of research provides us with important insights on how waste can occur at the consumer level, it tends to frame food waste as an issue of individual responsibility. This perspective overlooks how upstream systems, including production, processing and distribution all shape the conditions under which waste occurs before food ever reaches the consumer.

2.2 Industrial Meat Systems and Waste Production

The meat industry plays a significant role in discussions of food waste due to its scale and resource intensity. Meat production requires [substantial](#) amounts of land, water, feed, energy and labor, making inefficiencies in food product and usage consequential from an environmental perspective. Globally, it is estimated that approximately 23% of meat produced is lost or wasted across the supply chain, with a notable portion occurring during [processing stages](#).

Industrial meat production systems are structured around efficiency, scale and economic output. As demand for meat increases, particularly in more industrialized and higher income countries, production systems are designed to maximize yield and meet market expectations. This often results in surplus production and standardized processing practices that prioritized consistency, speed and profitability.

Within this context, waste is not simply the result of inefficiencies, but is embedded within the operational logic of the system itself. Decisions made during slaughter, fabrication and classification determine how much of an animal ultimately enters the food supply. However, despite the importance of these processes, there is limited research examining how these everyday decisions contribute to food waste within meat processing environments.

2.3 Labor, Environmental Justice, and Power in the Meat Industry

Labor conditions and environmental justice concerns are also central to understanding how industrial meat systems operate. Research has shown that meat processing facilities are characterized by high line speeds, repetitive labor and elevated rates of [workplace injury](#). Reports from [Human Rights Watch](#) highlight unsafe working conditions and the vulnerability of workers, many of whom are immigrants or from marginalised communities.

These labor conditions are closely tied to production pressures and efficiency demands, which can influence how work is performed, including how quickly and precisely trimming and classification decisions are made. This suggests that labor dynamics are not separate from waste production, but may actively shape how waste is generated within processing systems.

From an environmental justice perspective, the impacts of meat production are unevenly distributed. Processing facilities and concentrated animal feeding operations are often located near lower-income communities and communities of color, exposing these populations to environmental hazards such as air and water pollution. At the same time, these communities often have limited influence over regulatory decisions and industry practices.

Despite these connections, there is limited research that explicitly links food waste production to labor conditions, regulatory frameworks and environmental justice concerns within the meat industry.

2.4 Gaps in the Literature and Contribution of This Study

While existing research has made significant contributions to understanding the scale and impacts of food waste, important gaps remain. Much of the literature focuses on quantifying waste or analyzing consumer behavior, with less attention given to how waste is produced within industrial processing systems

In particular, there is limited research examining how decisions about trimming, grading and classification shape what is considered edible versus inedible within meat processing environments. Additionally, there is a lack of interdisciplinary analysis that connects food waste to labor conditions, environmental justice and regulatory structures.

This capstone project addresses these gaps by examining food waste as a byproduct of institutional economic and operational decisions within the U.S. beef processing system. By applying systems thinking and environmental justice frameworks, this study aims to provide a more comprehensive understanding of how waste is produced, justified and normalized within industrial food systems.

Methodology

This capstone project examines how food waste is produced within the United States Beef Industry, with particular attention to the processing stage of the supply chain. The central research question guiding this project is: how do institutional, regulatory, and economic decision-making processes shape the classification of edible and inedible meat within processing systems, and what environmental and social consequences emerge from these choices? Rather than approaching food waste primarily as a problem of consumer behavior, this project investigates how waste is generated through the design, governance, and incentives embedded within industrial food systems.

This research is motivated by the recognition that meat production represents one of the most resource-intensive sectors of the global food system. Meat waste therefore carries significant environmental and social implications, including the loss of land, water, energy, labor, and

animal life embedded in production. At the same time, food waste exists alongside persistent food insecurity in the United States, raising broader questions about the efficiency and equity of the current food system. Understanding the processes through which edible meat is discarded is therefore important not only for environmental sustainability, but also for food justice and social equity.

The research for this project relies primarily on qualitative, interdisciplinary methods. A central component of the methodology is document analysis of academic literature, policy frameworks, and industry materials related to food waste and meat production. Peer-reviewed journal articles on food loss and waste, life cycle assessments of meat production, and sustainability analyses of food systems provide the foundation for understanding how waste is measured and discussed within existing research. In addition to academic literature, this project also examines policy documents and institutional reports from organizations such as the United States Department of Agriculture (USDA), the Environmental Protection Agency (EPA), and the Food and Agriculture Organization (FAO). These sources provide insight into how food waste is defined, measured, and addressed within regulatory and policy frameworks.

Through this review of literature and policy materials, patterns and assumptions within dominant food waste frameworks were identified and analyzed. In particular, this analysis compares the priorities of global sustainability frameworks, which emphasize reducing food loss and waste, with regulatory frameworks governing meat safety and inspection. This comparison helps reveal an analytical gap: while food waste reduction is widely promoted as a sustainability goal, existing frameworks rarely examine the everyday decision-making processes within meat processing plants that determine how edible products are trimmed, classified, or diverted during production.

To interpret these findings, this research draws on systems thinking as a foundational analytical framework. Systems thinking allows the meat supply chain to be examined as a complex network of interconnected processes, incentives, and actors. Rather than isolating food waste as a single point of failure, this approach considers how waste emerges through interactions between regulatory structures, industry practices, economic pressures, and production standards. This perspective also helps identify feedback loops and unintended consequences within industrial food systems.

Environmental justice theory also plays an important role in shaping the interpretation of this research. This framework highlights how environmental harms and resource inefficiencies often disproportionately affect marginalized communities, including workers within meat processing facilities and communities located near large-scale industrial operations. Applying this lens helps situate food waste within broader questions of labor, environmental exposure, and structural inequality within the food system.

One limitation of this study is that the available data is heavily rooted in institutional and expert perspectives, including academic research, government reports, and sustainability assessments. As a result, the voices of processing workers, small-scale producers, and communities directly impacted by meat production are less visible within the data. Recognizing this imbalance is an important part of the research process, as it reflects broader patterns in how knowledge about industrial food systems is produced and circulated. Future research could expand upon this work by incorporating interviews, ethnographic observation, or worker perspectives to better understand how classification and trimming decisions are made in practice within processing environments.

By combining document analysis, systems thinking, and environmental justice perspectives, this methodology aims to examine food waste not simply as a technical inefficiency but as an outcome of broader institutional and economic structures. This approach allows the project to explore how decisions about what counts as edible or inedible (waste) are embedded within industrial food systems and how these classifications shape both environmental outcomes and social impacts.

4.1 Regulatory Boundaries: What Counts as “unsafe meat”

Federal meat inspection systems establish clear and highly regulated boundaries between meat that is considered safe for consumption and meat that must be removed from the food supply. In the United States, this process is governed by the [Federal Meat Inspection Act](#) (FMIA), which is enforced by the United States Department of Agriculture (USDA). The FMIA focuses primarily on food safety, inspection authority, and regulating how meat enters the commercial food supply.

Under this framework, postmortem inspection of all carcasses is mandatory. During these inspections, USDA inspectors evaluate carcasses for a wide range of conditions, including visible contamination (such as fecal matter), tumors, parasites, bruising, and organ abnormalities. When localized contamination or defects are identified, the affected portions are typically trimmed and removed, while the remaining carcass may still be approved for consumption.

In cases where contamination exceeds acceptable thresholds, the carcass is classified as [adulterated](#). Adulteration is a legal designation indicating that the meat is unsafe for human consumption due to factors such as disease, pathogenic contamination, unsanitary processing conditions, or the presence of harmful substances. When a carcass is determined to be adulterated, it must be condemned and cannot enter the human food supply.

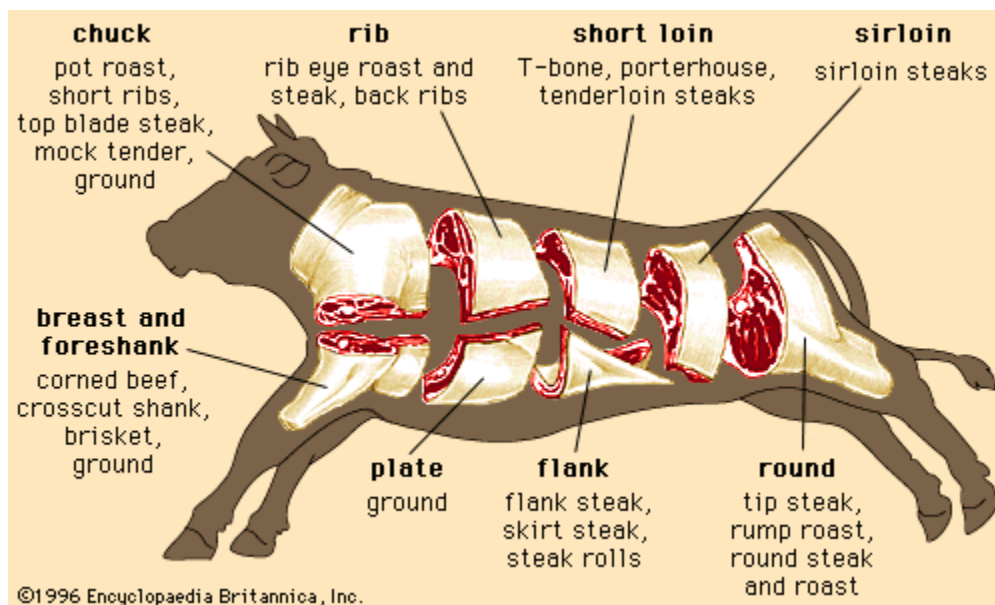
While this regulatory system provides a clear and enforceable framework for identifying and removing unsafe meat, it applies only to a small proportion of total production. Most carcasses are not classified as adulterated and therefore proceed through the processing system. As a result, the majority of decisions that influence how meat is sorted, trimmed, and classified occur outside this strict regulatory boundary.

With this said, although the FMIA clearly defines when meat must be removed for safety reasons, it does not regulate the majority of decisions that occur during processing, particularly relating to trimming, classification and product quality.

4.2 Hidden Losses in the Processing Stage

Beyond formal condemnation decisions, significant material losses occur throughout the slaughter and processing stages before meat reaches us consumers. There are significant portions of livestock biomass that are removed throughout the production process.

The first reduction of biomass occurs during slaughter and dressing stages, where non-carass components are removed. These include the hide, blood, organs and digestive contents. As a result of this dressing stage, only about [60-64% of a live animal's weight](#) becomes the weight of the carcass. Some of these materials are repurposed and used for other purposes. Examples of how some byproducts of cow carcasses are used are as follows; hide/ skin is used for leather production, bones and hooves are used to make collagen and gelatin, intestines can be used for casing for sausages, and fat (tallow) can be used in beauty products. It is positive when these products are used and not simply wasted, but for the case of food production, this is an important distinction to note that about 40% of the carcass does not enter the retail meat supply and represents an early point of divergence between total production and edible output.



Further losses happen during carcass fabrication, which is when carcasses are broken down into retail cuts. At this stage, about [55-75% of the carcass weight moves](#) on and becomes retail meat, with the remaining 25-45% consisting of bone, fat trim and other materials that are removed during processing. Another thing to note is that when carcasses are chilled, they typically lose about [2-5% of their weight](#) due to moisture evaporation. This is referred to as shrink in the meat industry.

These numbers illustrate that a substantial portion of the animal is removed from the retail food supply through routine processing practices rather than as a result of regulatory condemnation. These food losses occur upstream in the supply chain, before products ever reach retail or consumers. This suggests that food waste is not solely a downstream issue driven by consumer behavior. Instead, material loss is often embedded within the structure of production itself, shaped by the technical and operational processes of the industrial meat processing system.

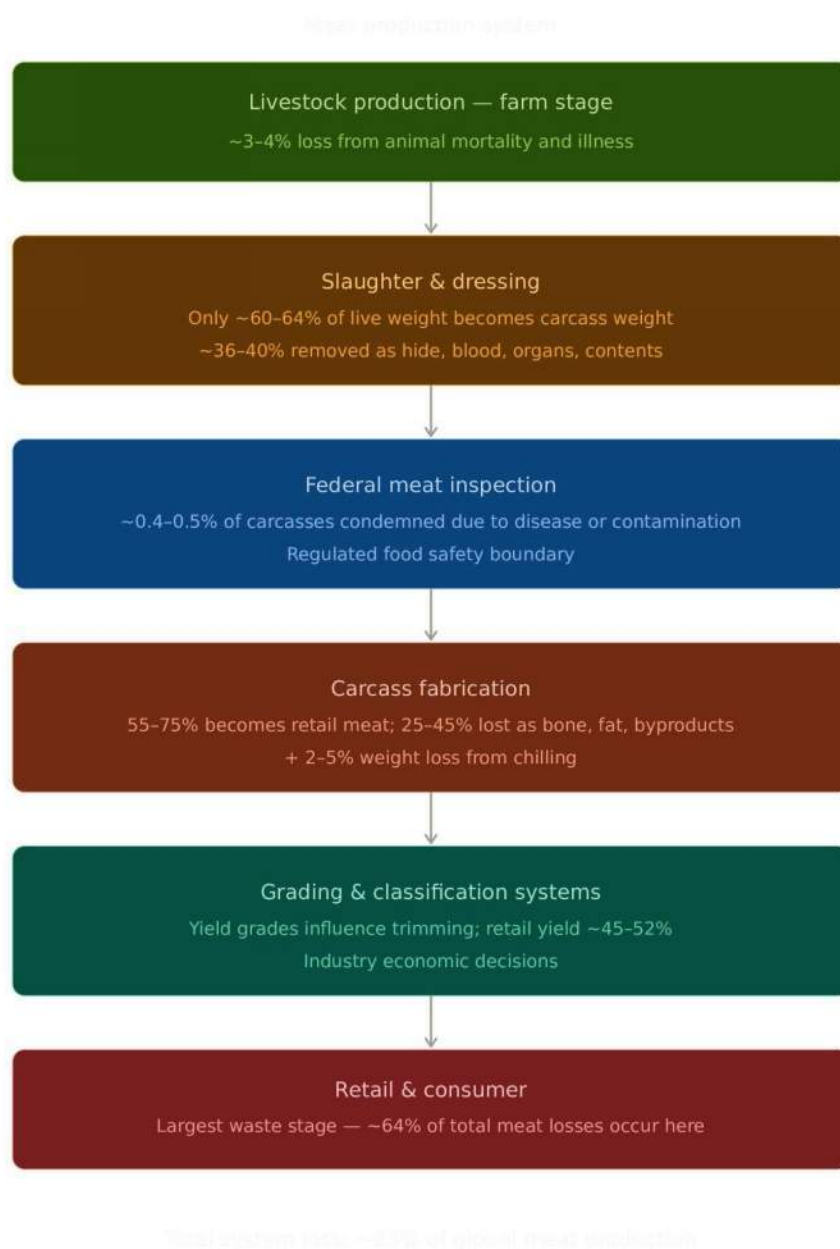
4.3 Classification Systems Shaping Meat Yield

A key finding of this research is that the classification systems within meat processing facilities play a central role in determining how much of the animal becomes a product for retail. Regulatory frameworks such as the FMIA clearly define when meat must be removed for safety reasons, but they do not govern the majority of decisions made during the fabrication stage, specifically relating to trimming, grading and deciding product quality.

Carcasses are evaluated and sorted into grading systems that are used to estimate the expected yield and quality. As an example, [USDA yield grades are used to](#) determine the proportion of closely trimmed, boneless retail cuts that can be obtained from a carcass. Higher yield carcasses might produce over 50% retail meat, while lower yield carcasses will fall below 45%, depending on factors such as fat content and the overall composition of the carcass. These grading systems are tied in with economic value, which influences how cuts and the overall carcass is priced and processed within the supply chain.

In addition to yield grading, quality grading systems illustrate how the classification of meat shapes the distribution and the value of meat within our supply chain. As a consumer, you have probably noticed different meat grades, specifically [Prime, Choice and Select](#). In the United States, only a small portion of beef is graded as Prime, estimated to be only 2% of all beef production. Next we have Choice, which about 10-15% is graded this level. The majority of beef falls into the category of Select, looking at roughly 65%-75% of total production. The entire animal will receive the same grade, not based on separate pieces cut from the carcass, and this is determined by cutting and examining the muscle between the 12th and 13th rib. These gradings

are determined by marbling and fat distribution of the whole carcass, which influence the perceived quality, tenderness and its market value. Higher grade cuts are more likely to be preserved and marketed as premium products and lower grade meat will be directed towards lower value markets.



Although grading systems follow standardized criteria, these assessments ultimately involve human judgment. This introduces variability into how carcasses are classified and processed, which can influence trimming decisions and the amount of material removed from the retail

supply. As a result, waste outcomes are not only shaped by formal systems, but also by subjective decision-making within processing environments.

An important thing to note is that these grades are not regulated, but instead completely up to the judgement of the inspector at each processing plant. These classification systems extend beyond simple labeling, and they play an important role in how carcasses are physically processed. Trimming practices, fat removal, defect trimming and aesthetic standardization further shape how much material is considered acceptable for retail markets. Some trimming is necessary for safety and quality, but additional cuts often happen as a reflection of market expectations of uniformity, lean meat and having visually appealing cuts. These expectations are shaped by consumer preferences, retail standards and industry norms. These are not strictly regulated.

What we see here is that unlike condemnation decisions, which are clearly defined and enforced through regulatory systems, further classification and trimming practices are largely decided as a result of economic priorities and production efficiency. They determine what parts of the animal are considered edible and mandible versus expendable and waste, even when the material is not legally classified as being unsafe. We can see that the separation between edible product and waste is not fixed in place, but produced through a combination of institutional standards, economic incentives and human decision making within processing plants and environments.

These specific findings are critical for understanding meat waste outcomes. These classification systems play a critical, but underexamined role in shaping what is determined as waste or not. Food waste is often framed as a downstream issue that happens at the consumer level, but the decisions that are made during grading and fabrication significantly influence how much edible product actually enters the food supply. Understanding the steps and elements of these processes are essential to understand in order to develop a more comprehensive and system oriented view of food waste within the meat industry.

4.4 System-Level Meat Waste

When we consider waste at the scale of the entire food system, the effects of processing and classification decisions extend beyond individual facilities and contribute to broader patterns of meat waste. Globally, it is estimated that approximately [23% of total meat production](#) is lost or wasted across the supply chain, with roughly 20% of these losses occurring during manufacturing and processing stages. These figures indicate that a significant portion of waste is generated before meat reaches retail markets or consumers.

This challenges dominant narratives that position food waste primarily as a downstream issue driven by household behavior. While consumer waste remains a substantial component of total food loss, the data suggests that upstream processes, including slaughter, fabrication, and classification, play a critical role in shaping how much edible product ultimately enters the food

supply. Losses that occur during processing are therefore not incidental, but structurally embedded within industrial production systems.

The implications of these losses are particularly significant given the resource intensity of meat production. Livestock systems require substantial inputs of land, water, feed, and energy, meaning that inefficiencies at the processing stage represent not only material loss but also the loss of embedded environmental resources. Even relatively small reductions in yield at this stage can result in disproportionately large environmental impacts when we look at the bigger picture and scope across national and global production systems.

Taken together, these findings suggest that food waste in the meat industry cannot be fully understood without accounting for the cumulative effects of upstream decision-making processes. By situating processing-stage losses within the broader food system, it becomes clear that waste is not confined to a single point in the supply chain, but rather accumulates across interconnected stages shaped by regulatory structures, economic incentives, and production practices.



4.5 Environmental and Justice Implications

The production of meat waste within processing systems also carries significant environmental and social implications. Because meat production is highly resource-intensive, material losses at the processing stage represent not only physical waste, but also the loss of the embedded resources, including land, water, energy, and feed. When portions of an animal are removed during fabrication or diverted away from the retail food supply, the environmental costs associated with producing those materials are effectively wasted as well.

In addition to environmental impacts, meat processing systems are closely tied to labor conditions and broader questions of social equity. Research has shown that slaughter and processing facilities are characterized by high line speeds, repetitive physical labor, and [elevated rates of workplace injury](#). Reports from organizations such as Human Rights Watch and the [Occupational Safety and Health Administration \(OSHA\)](#) document unsafe working conditions and highlight how these industries rely heavily on marginalized labor, including immigrant workers and communities of color. These conditions are important to consider, as production pressures and efficiency demands may influence how work is performed, including how quickly and precisely trimming and classification decisions are made.

From an environmental justice perspective, the impacts of meat production are not evenly distributed. Processing facilities and concentrated animal feeding operations are often located near lower-income communities and communities of color, exposing these populations to air and water pollution, odors, and associated health risks. At the same time, these communities frequently have limited influence over regulatory decisions and waste management practices. This uneven distribution of environmental burdens raises important questions about power, access, and whose interests are prioritized within the food system.

Taken together, these dynamics suggest that food waste in the meat industry is not only an environmental issue, but also a matter of labor, equity, and justice. Waste is produced within systems that prioritize efficiency, scale, and risk management, often at the expense of both environmental sustainability and worker well-being. Understanding these broader implications is essential for developing more just and sustainable approaches to food production.

4.6 What This Reveals About the Meat System

Taken together, the findings of this study reveal a critical gap between how food waste is commonly understood and how it is actually produced within the meat system. While regulatory frameworks such as the Federal Meat Inspection Act clearly define the boundaries of food safety through the identification of adulterated meat and condemnation processes, they do not govern the majority of decisions that shape operational outcomes that occur during processing.

Much of the determination of what becomes edible product versus trim, byproduct, or waste occurs through everyday classification practices within processing facilities. These decisions, including trimming, grading, and aesthetic standardization, are shaped by economic incentives, production efficiency, and market expectations rather than explicit regulatory guidance. As a result, the boundary between edible and inedible material is not fixed, but constructed through institutional practices and human decision-making.

This insight challenges dominant narratives that position [food waste](#) primarily as a result of consumer behavior or individual choice. While downstream waste remains significant, this research demonstrates that waste is also produced upstream through the design and operation of

industrial food systems. In this way, [food waste](#) can be understood not simply as a technical inefficiency, but as an outcome of how systems are structured, governed, and valued.

By identifying the role of classification systems and decision-making processes within meat processing, this study contributes to a more comprehensive understanding of food waste and its underlying drivers. Addressing waste within the meat industry therefore requires not only changes in consumer behavior, but also greater attention to the institutional, economic, and operational factors that shape how food is produced, categorized, and distributed.

Conclusion

This study set out to examine how food waste is produced within the United States beef industry, with a focus on the processing stage of the supply chain. While food waste is often framed as a result of consumer behavior, the findings of this research demonstrate that waste is also generated upstream through the design and operation of industrial meat systems. By analyzing regulatory frameworks, processing practices, and classification systems, this study shows that the boundary between edible and inedible meat is not fixed, but actively constructed through institutional, economic, and operational decisions.

A key insight from this research is that existing regulatory frameworks, such as the Federal Meat Inspection Act, are primarily focused on food safety rather than waste reduction. While these systems clearly define when meat must be removed from the food supply, they do not govern the majority of decisions that shape how meat is trimmed, graded, and categorized during processing. As a result, significant amounts of edible material may be diverted away from the food supply, not because it is unsafe, but because it does not meet market expectations or production standards.

This study also highlights how food waste is embedded within broader systems of production that prioritize efficiency, scale, and economic value. Classification systems, including grading and trimming practices, play a critical role in shaping how much of an animal becomes retail product. These processes are influenced not only by formal guidelines, but also by human judgment, market preferences, and institutional norms. This reinforces the idea that food waste is not simply a technical inefficiency, but an outcome of how food systems are structured and maintained.

Importantly, the findings of this research extend beyond environmental concerns to include issues of labor and environmental justice. Meat processing systems rely heavily on marginalized labor and are often located near communities that experience disproportionate environmental burdens. Understanding how waste is produced within these systems requires attention not only to material flows, but also to the social and political conditions that shape decision-making within the industry.

By shifting the focus from individual behavior to systemic processes, this study contributes to a more comprehensive understanding of food waste within the meat industry. Addressing food waste will require not only changes at the consumer level, but also greater scrutiny of the institutional, economic, and operational factors that shape how food is produced and classified. Future research should build on this work by incorporating worker perspectives and examining how alternative processing practices or policy interventions could reduce waste at the source.

Ultimately, this project demonstrates that food waste is not simply a downstream problem, but a structural outcome of the systems that produce our food. Recognizing this shift is essential for developing more sustainable and equitable food systems moving forward.

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MESH 540 Final Draft
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Abstract:

This project examines consumers and professional group perspectives of conventional and organic agriculture using a combination of semi-structured interviews, photo and archival evidence, and secondary data. Semi-structured interviews were conducted with nine different people across Southern California with various backgrounds and personal identities, while photo materials and newspaper articles were analyzed to provide additional information. Peer-reviewed literature was used to provide a professional perspective. The project uses comparative, stakeholder, and policy analysis to provide an in-depth evaluation. Comparative analysis between consumers and professionals indicates that there is overlap in perspectives; however, the differences come from the level of understanding. Stakeholder analysis identifies farmers, government, and the common man as key groups, each with a variety of priorities such as affordability, profitability, and availability. Policy analysis highlights the role of government policy in the shaping of conventional and organic agriculture practices. Findings reveal that while perspectives of consumers and professional groups have a similar understanding of conventional and organic agriculture practices, with topics such as cost, environmental impact, and sustainability, there are differences in topics such as health benefits and the necessity of pesticides. Based on these findings, this project proposes several different policy changes to improve sustainable and health outcomes. Recommended policies include an increase in research funding, an increase in SNAP benefits, a transition to fully organic, and the phasing out of pesticides.

Introduction

The 3rd agricultural revolution, also known as the Green Revolution, forever changed how we grow food in the United States. The Green Revolution was initially seen as the solution to eliminate world hunger through the usage of pesticides, fertilizers, and machines to grow more food ([“Green Revolution,” n.d.](#)). While the intentions of the revolution were noble, the Green Revolution created a form of agriculture that is entirely dependent on pesticides and fertilizers. This form of agriculture is known as conventional agriculture. Enter J.I. Rodale, who is often viewed as the founder of the Organic Movement in the United States. In the 1940s, he began to raise awareness about the impact that the chemicals have on the environment, produce, and human health by advocating through books and magazines about organic agriculture. Some of the agriculture methods he advocated for include homemade composting and humus, a layer of soil made from produce scraps and animal waste ([O’Sullivan, 2015, Chapter 1](#)). In the 1960s, organic agriculture became a key part in the founding of the environmental movement of the 1960s/1970s, eventually merging with a broad movement focused on addressing the degradation of the environment due to human activities. By the 1970s, more people started to become environmentally conscious, which led to a demand for organic agriculture; however, there was still no national certification for the label ([O’Sullivan, 2015, Chapter 2](#)). The 1980s led to the first time the federal government acknowledged organic agriculture. The USDA released its first report on recommendations for organic farming ([O’Sullivan, 2015, Chapter 3](#)). In the 1990s the USA would finally create a law to regulate the organic industry allowing for a federally recognized definition/practice of organic agriculture and the creation of the label Organic USDA. This label refers to the denotation of organic agriculture which differs from the connotation of Organic. The conversation surrounding chemicals in agriculture rages on within pop culture trends such as the Make America Healthy Again Movement, Environmental Working Group, commonly known as the EWG, the annual Clean Fifteen & Dirty Dozen list, and the Crunchy Mom archetype.

The public concern about chemicals in agriculture has only increased, with over [70% of American adults](#) having some concerns about exposure to toxic chemicals via food and drinking water. These chemicals are regulated through the farm bill, which was created under President Franklin D. Roosevelt, FDR (1933), as a policy to help with the effects of the Great Depression (1929-1939) and the Dust Bowl (1930-1936). Almost 95 years later, Farm Bills are still the leading legislation for agriculture in the United States, with a new one being passed every several years. In addition, the farm bills also regulate SNAP/WIC, research grant money, and regulations of water/air quality in relation to agriculture ([National Sustainable Agriculture Coalition, 2024](#)). The farm bill that is currently proposed is titled the Farm, Food, and National Security Act of 2026, which is currently reported to the floor with members of Congress having the intention of passing the bill before the extension of the previous farm bill (Agriculture Improvement Act of 2018) expires. Additionally, legislation that governs agriculture that is relevant is the Organic Food Production Act of 1990 and the Strengthening Organic Enforcement Rule.

As the farm bill sits in the house, we should take the time to reflect on the ways the bill can be improved before it moves to the next chamber of congress to better serve the general public. Oftentimes, the intended impact of a piece of legislation differs from the real life consequences.

My capstone project question is:

How do Southern California residents who consume or produce agriculture and those who research it perceive the advantages and disadvantages of organic agriculture compared to conventional agriculture and how can these points of view improve federal policy?

The purpose of this paper is to analyze the different advantages and disadvantages of conventional and organic agriculture through the lens of the common man, professional groups, and the federal government. The findings of this research discover three common themes throughout the different groups: the impact of pesticides on the environment and human life, the cost of organic compared to conventional from the buyer and producer point of view and the potential health benefits of consuming organic produce. The research was conducted through a combination of qualitative data collected through semi-structured interviews, policy, peer-reviewed articles, photos, and secondary sources. The research was then analyzed using three different methods: the first is competitive analysis of the common man and professional group, the second is the stakeholder analysis, which addresses who influences these perspectives and the effects it has on the key players, which include the public, professional groups, which include farmers and researchers, and lastly, the government. Third is policy analysis, which will evaluate the present policy and make recommendations based on the findings of the research.

Literature Review:

In order to better understand this topic, I first need to have an understanding of what the word organic " actually means. *American Organic* by Robin O'Sullivan provides me with a historical understanding of what the organic movement is, from the origin of the movement to the different ways the movement has changed over time, until we get to the present day. In addition to like most things in life organic/healthy eating is connected to politics in one way or another, in order to get understanding of the issues from a political point of view the [New York Times](#) provide a breakdown of how healthy food has been politicized, how despite this policies it is it struggle to come over the polarization of the political landscape in the United States.

The impact of pesticides on the environment and human life theme

A common theme that was featured across the literature is the focus on pesticides, framing organic agriculture as being better because of the lack of pesticides. Newspaper articles and books emphasize the negative effects of pesticides, including focusing on the first-hand experience of farm workers, the lived experiences of those who live near and in communities where agriculture is the top industry, specific pesticides, for example, Roundup, and the way the government reacts to pesticides. For example, [a Los Angeles Times article](#) that reports on how pesticides have been found in the air in different farming communities throughout the state, which the state assures is safe, environmentalists and anti-pesticide activists have different opinions. Additionally, [Capital and Main, a nonprofit publication](#), has a two-part investigative report on the condition of child farmworkers, with part 2 focusing on the exposure and impact that pesticides have and how the state of California is addressing this situation. On the peer-reviewed aspect of literature, they also support the dominant trend of the negative effects of pesticides and provide in-depth analysis on the potential ways that pesticides affect human and

environmental health. For example, pesticides' [impacts on human health and the environment, with their mechanisms of action and possible countermeasures](#), address the health of both human and environment and explore the issue from a breakdown of the different categories of pesticides. While [A comprehensive review on environmental and human health impacts of chemical pesticide usage](#) covers a similar topic, it does lean heavily on the environmental impacts of the pesticides compared to the human side of the issue.



The cost of organic compared to conventional from the buyer and producer point of view theme

The second common theme that was featured across the literature was the role of finance, whether it was the profitability of organic agriculture or the higher cost of organic agriculture on both sides of the issue, from consumers to farmers. The [food and wine magazine](#) provides a comparative analysis of the difference between conventional and organic produce, providing a list of which produce has the largest gap between the prices, with some of the produce featuring two different types of lettuce, collard greens, and sweet potatoes, to name a few. While [Understanding organic pricing and costs of production](#) is a peer-reviewed article that explores organic agriculture from the perspective of the farmer, getting to the root cause of why, on average, organic produce costs more money than its conventionally grown counterparts. On the other hand [Financial competitiveness of organic agriculture on a global scale](#), offer a glimpse into the future of organic farming by offer a way forward on how organic farming can competitive with conventional on a financial scale which is relevant because of the barrier for farmers is a financial one, with many farmers not having the means to be able to many the jump from conventional to organic. Which leads into the next article a [New York Time Opinion piece](#) which offer a alternative solution to allowing an increase in organic farming coming from an unlikely source investment group, who buy the land and allow farmers to rent sections of it, however what makes this so special is that the investment group handles the certification process for organic which offers another key barrier for farmers.

The potential health benefits of consuming organic produce theme

A third trend in the literature is the worthiness of organic produce, whether it be from a financial perspective or from a health perspective. [The New York Times looks](#) at this issue not from the health of the people who are consuming the food, but more so from the health of the people who have to work with the food, such as dayworkers and farmhands. By changing that focus, it turns the question from an open-ended answer into one with a clear, correct answer. Comparatively, [A Systematic Review of Organic Versus Conventional Food Consumption: Is There a Measurable Benefit on Human Health?](#) A peer-reviewed article gives a more inconclusive perspective of the issue because of how many things can also affect human health, such as living environment, family history, and stress levels, to name a few.

Policy Section

The first act that will be featured in my capstone project is [the Farm, Food, and National Security Act of 2026 \(Farm Bill\)](#). Farm bills are bipartisan pieces of legislation passed usually every five years; however, currently, the last farm bill (Agriculture improvement act Of 2018) was passed in 2018, making it one of the longest gaps between farm bills. The relevant section of the Farm, Food, and National Security Act of 2026 for my project is *Title IV- Nutrition: SEC 4302 Buy American Requirements for Certain School Meals, SEC 4303 Reauthorization of the Gus Schumacher nutrition incentive program and Title X: Horticulture, Marketing, and Regulatory Reform: SEC.10201 Exclusion of Certain Substances, SEC.10205 Uniformity of Pesticide Labeling Requirements, and SEC.10206 Authority of States.*

[The Organic Food Production Act of 1990](#) is bipartisan legislation that created the organic industry. Prior to this label, there was no standard definition/ guidelines for what organically produced food would look like. In addition to the act, while it does create guidelines that all states must follow, the states are able to impose stricter regulations on top of the Federal ones. Currently, only one state has decided to pursue this, which is California, which is not only the biggest consumer of organic food but also the top grower of organic food.

[The Strengthening Organic Enforcement Rule](#) is a policy that was created as a way to update and enforce the previous law. The Strengthening Organic Enforcement Rule was implemented 22 years after the original set of rules for organic products in the United States was implemented. Unlike the Organic Food Production Act of 1990, the Strengthening Organic Enforcement Rule was done by the USDA and not Congress. These three policies were chosen because the contents of these policies directly relate to what my research uncovered.

With the chosen bills section either directly or indirectly touching on themes seen in both groups, additionally, a key element of my results is advocating for the alternating of some sections with the ultimate goal of improving the bill for the people. The purpose of the policy selected is to be used as a policy analysis in my results and discussion section, which advocates for policy changes based on the results of the research that I was able to gather.

Identifying gaps in the literature

My capstone project is to address the gap in the literature when it comes to bringing together professional groups and public opinions. When reviewing the literature, I was able to come across literature that either addresses one or the other, never both. Additionally, my

capstone is addressing the gap between how the general public understands an issue and how professionals understand an issue. This gap between these different groups leads to confusion, misinterpretation, and most importantly, distrust. My project is designed to add to the research that already exists by offering a different way of understanding the topic. Instead of trying to disprove one or the other, my research simply acknowledges how people are currently feeling about the topic. It is important to take into consideration and respect people's feelings when addressing an issue because for many people, their lived experiences heavily impact how they process any information on a subject, regardless of the data presented to them. The best way to communicate is to come from a place of understanding as it prevents people from feeling spoken down to.

Methodology

My capstone project is based on offering different perspectives on the same issues to look for common themes throughout to help create better policy. Because of this, I used a multitude of methods such as semi-structured interviews, photo essays, archival research, and secondary sources. This capstone project employed three different analysis methods: comparative analysis, stakeholder analysis, and policy analysis. The comparative analysis focuses on the differences and similarities between professionals' and the general public's sentiments towards organic and conventional agriculture

.A comparative analysis is defined as a relationship between two or more different data which then break down into coordinate, subordinate and hybrid methods. In my paper a coordinate approach will be utilized . A coordinate approach uses two or more data compared to each other over a shared theme (*Comparative Analysis | Gen Ed Writes*, n.d.). In my paper the shared themes are the concerns of the impact of pesticides on the environment and human life, the cost of organic compared to conventional from the buyer and producer point of view and the potential health benefits of consuming organic produce. The comparative analysis method of analysis was selected due to the analysis ability to highlight the similarities between the interview responses and the peer-review viewed articles .Additionally this method of analysis allows, for the best way in my opinion to present my findings from the the research conducted.

Stakeholder analysis, which will focus on what different groups, farmers, general public, government, and Agrochemical companies want. Stakeholder analysis is a practical tool used to define different groups' powers, positions, and interest towards a specific issue within a policy or business setting (Balane et al., 2020).

The term power in this analysis would refer to a group's ability to influence the price, usage and legislation around the topic .Interest in this analysis refers to a group's overall interest in this topic. The consumers/public in this analysis refers to the group of people who are dependent on grocery stores, farmer markets and/or markets for the purchase of food. The government refers to the federal government of the United States of America. Grocery stores are defined as businesses that have a produce section and fresh meat department. Farmers are defined as people who grow crops or raise livestock. Agrochemical companies are referring to companies that sell chemical based products used in agriculture such as pesticide or fertilizer. The Stakeholder analysis was selected to the analysis ability to showcase how this theme affected different groups, and how much power they can control allowing for a better understanding of how to create policy to address these findings .

The last method of analysis is policy analysis which is defined as “ the examination and evaluation of available options to address various economic, social, or other public issues”(What Is Policy Analysis? A Critical Concept in Public Administration, n.d.). The findings of this result allows for new policy to be created or change already existing and proposed policy . The policy analysis will be used to evaluate the *Farm, Food, and National Security Act of 2026 and the Organic Food Production Act of 1990*. The *Farm, Food, and National Security Act of 2026* which was selected to be analyzed because some of the proposed legislation directly counters the finding of my research. Additionally, this method was selected because of the practicality that it offers.

Semi-structured Interviews

The original scope of my research was focused on the city of Temecula; however, after interviewing people, a common theme I noticed was that while they shop and sell in Temecula, they do not necessarily reside in Temecula. Because of this, I expanded the area of interviews to those based in Southern California. When it came to the selection of whom to interview, the intention was to interview an even number of men and women, but I ended up with nine interviewees, five men and four women. Additionally, I set out to interview at least one person who is dependent on SNAP benefits and one person with an alternative diet to have a diverse set of interviews, along with food business owners and farmer workers/owners. I was able to achieve that goal. How these interviews were conducted was in two different ways over the course of several weeks: the first was in-person interviews, and the second was over the phone, both being recorded on Voice Memos; these methods were selected to accommodate the interviewees best. The purpose of these interviews was to get a better understanding of how the common man and professional groups understood organic and conventional agriculture, on top of understanding what shaped the food they chose to buy and where to buy it. Additionally, the interviews helped to identify the key themes that I would later investigate using a peer-reviewed article and the area of policies to address. The selection of choosing to interview came from my background in anthropology, and I have prior experience conducting interviews.

Interview Questions

- How do you define organic?
- How do you define conventional?
- Do you usually buy organic or conventional?
- What made you start to buy organic/conventional??
- Does cost factor into your decision?
- How long have you been buying organic/conventional?
- Do you believe that conventional food is less safe than organic ??
- Do the dirty dozen and the clean 15 mean anything to you?
- When you think of organic, what words come to mind?
- Do you think organic is related to the environment?
- What are some of your worries about conventional?
- What are some of your concerns when it comes to conventional and organic human health?

- What are some of your concerns when it comes to the environment and sustainability?
- What are some reasons why you decided to start growing your crops organically? What are some of the benefits of that decision?
- What are some of the reasons why you decided to grow your crops conveniently?
- What are some of the factors that made you decide on which style of farming?
- Do you believe there is a cost barrier to organic farming?
- What would you want the everyday consumer to know about organic vs conventional?
- Is sustainability a factor in your decision?
- What are some misconceptions about organic?
- What are some misconceptions about conventional?

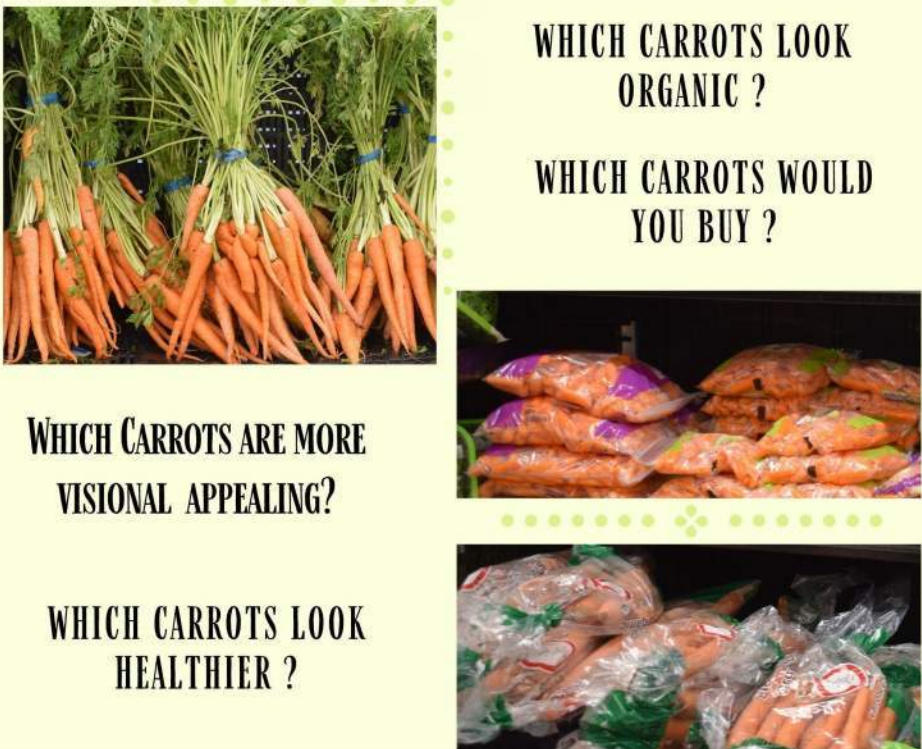
Photo Essay of Fresh vegetables and fruits produced in different methods.

Providing photos of produce grown in different ways offers a first-hand look at whether or not different growing methods affect the aesthetic of the produce, which is important to address because in the United

States, produce is expected to look a specific way. When it fails to meet those standards, the food is often left to rot on the shelf or not sold at all. The research took place over the course of a month, with photos taken at the farmer's market, Walmart, and Albertson's. How I went about this is using my D3300 Nikon camera to take photos at the local farmers market and at different grocery stores throughout Temecula. The photos have not been edited to provide an authentic viewpoint of what the produce looks like. In

addition I want the photo section to serve as a brainstorm section so you the reader can decide how you view these issues before view results and discussion . The reason why is the food we choose to purchase and then consume is a personal decision, but how do we come to make those choices based on being organic? Pesticide free? Or is price the main driver? or the looks?



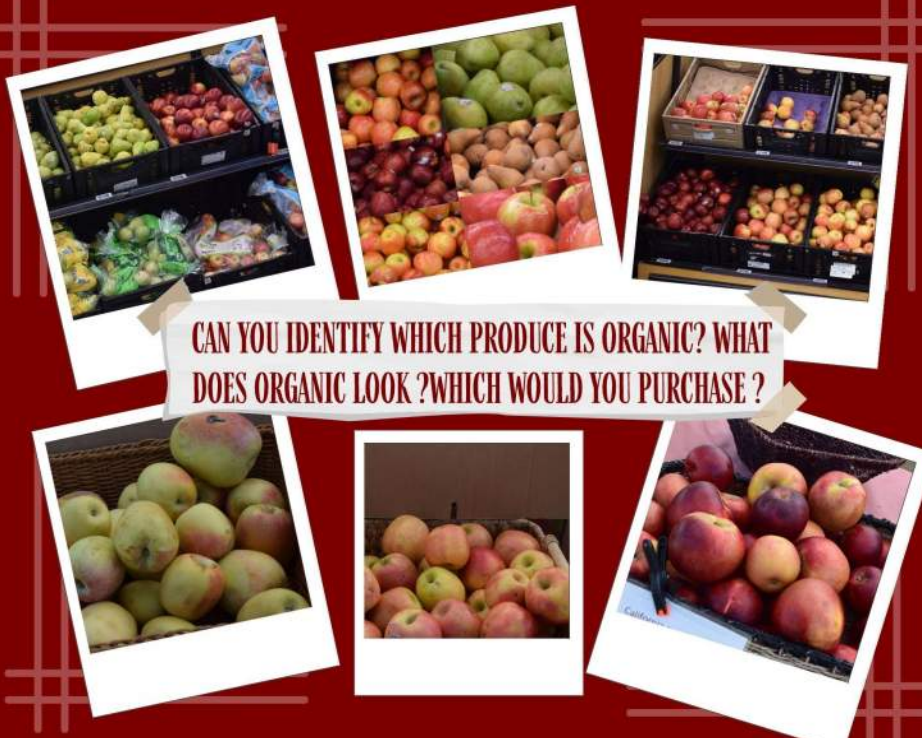


WHICH CARROTS LOOK ORGANIC ?

WHICH CARROTS WOULD YOU BUY ?

WHICH CARROTS ARE MORE VISIONAL APPEALING?

WHICH CARROTS LOOK HEALTHIER ?



CAN YOU IDENTIFY WHICH PRODUCE IS ORGANIC? WHAT DOES ORGANIC LOOK ? WHICH WOULD YOU PURCHASE ?

Archival Research

The Archival Research in this case focuses on three specific pieces of legislation: the Farm, Food, and National Security Act of 2026, the Organic Food Production Act of 1990, and the Strengthening Organic Enforcement Rule. The reason is that my capstone project intends to

improve existing policy; in order to do so, there has to be an understanding of what currently exists. When it came to the interview, because I am based in Southern California, so were my interviews. Because of this, I want to be able to understand how people around the country feel about these same issues. The secondary sources serve as a way for me to bridge the gap in my interviews by providing a voice for the whole country, not just Southern California. The reason is that the farm bills affect all Americans, not just those who live in agriculturally heavy states such as California, Iowa, and Texas. In addition, some of the secondary sources provide statistical data that is relevant to my project. Some of the key terms that were used during my research process include keywords such as: consumers, grocery stores, farmers' markets, organic, and health benefits. These areas of research took place twice, the first prior to the interview and the second after the interview. The reason is that after the interviews took place, some of the articles were no longer relevant ([Archival Research, n.d.](#)).

Secondary Research

This area of research was created to provide a professional understanding of the three common themes mentioned in each interview. The purpose of this section is not to disprove what the common man believes, but instead to provide a professional understanding of the issues. These peer-reviewed articles employed different sets of research methods to provide an understanding of the issues, which I feel allows for a comparative analysis with the common man's thoughts on the very same issue. Furthermore, policy is created by a combination of professional groups such as lobbyists, researchers, government employees, and elected officials, leading to policy not being reflected in what the common man desires or, in some cases, needs. Thus leading to the people feeling unheard by their representatives. The secondary research process was the last area of research to be done; the reason for this is that the peer-reviewed articles selected were entirely dependent on the responses that came from the interviews. The reason is that this is a broad topic that has several paths it could go down, and by allowing the interviewee to speak freely. It created a narrow topic organically. Some of the key terms that were used during my research process include keywords such as organic, conventional, pesticides, human health, and farmers. These words help to guide me to articles that are related to my capstone. ([Understanding the Value of Secondary Research Data, 2023](#))

Limitations in my methodology

My capstone does work with a level of privilege. The reason why I say that is because the conversation surrounding conventional or organic is irrelevant if the community you live in does not have access to grocery stores or farmers' markets, which is a very real reality for many Americans. Around 19 million Americans live in what is considered a food desert. A [food desert](#) is defined as "reliable access to healthy food that's also affordable." Food deserts can be found in different environments, from the city to the suburbs, and most commonly in rural areas. Race and socioeconomic status played a role, with areas with high populations of Latino and Black /African Americans having a high chance of living in a food desert. Low-income areas also have a high chance of being food deserts.

Triangulation was used in the research project to allow for a deeper analysis of the perception around organic and conventional agriculture. I used semi-structured interviews with residents of southern California to discuss their point of view along with photography to allow the reader to engage in experiences similar to the ones the interviewee engaged in. Furthermore, secondary research allowed for peer reviewed articles to provide a different perspective of the findings of the people that were interviewed. By combining different qualitative research

methods, my study was able to compare and contrast allowing for a broad understanding of the conversation around organic and conventional agriculture. By using the triangulation method, I was able to utilize various research methods to overcome the limitations that come with using one source of qualitative data. ([Valencia, 2022](#))

Results & Discussion

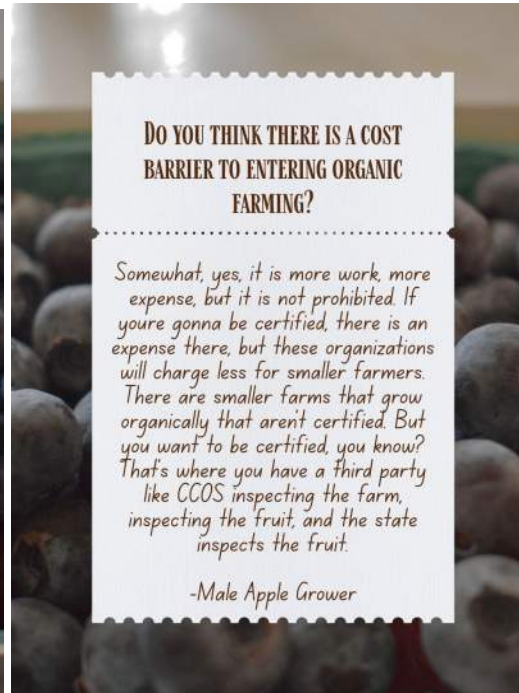
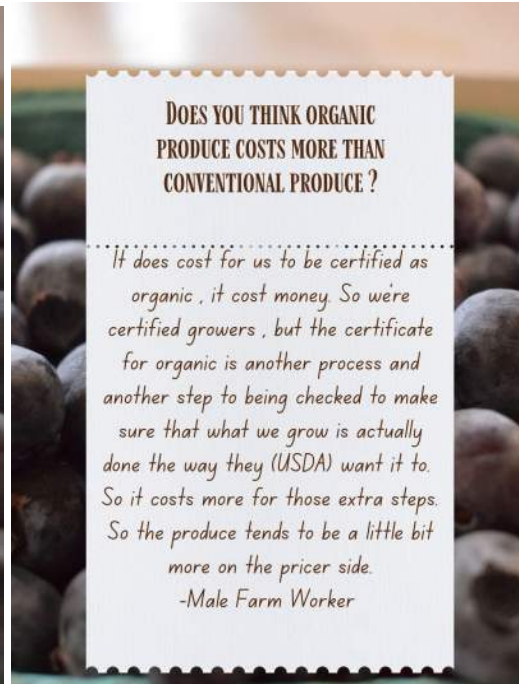
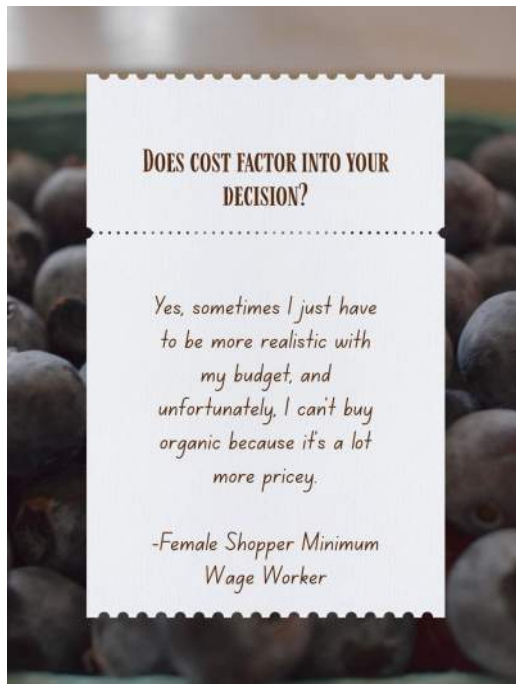
My research addresses the question:

How do Southern California residents who consume or produce agriculture and those who research it perceive the advantages and disadvantages of organic agriculture compared to conventional agriculture and how can these points of view improve federal policy?

Three themes emerged from my interviews which then guided the rest of my research, the first theme is cost, every single interview touched on the topic of the higher cost of organic produce, whether that made it unaffordable, affordable due to where it is purchased, or sometimes affordable, with a few of them providing an understanding of the cost from the farmers side of the issue. The second theme was pesticides, which, in many of the interviews, the interviewee had a negative connotation of pesticides. The main points concerning pesticides always start at the environment and then ends at human health; however, the levels of impact on human health vary, with some believing it contributes to the imbalance of hormones and others believing pesticides cause some forms of cancer. The last theme to emerge came from health, which was one of the three themes that had the most differentiating opinions among both groups. Health benefits are broken down into three different threads. Organic food is better for you than conventional food. It does not matter if the produce is organic as long as people are consuming more whole foods. It depends on which fruits and vegetables you are talking about.

Theme one: Cost of Organics

On the professional side, the peer-reviewed articles address the question of whether organic agriculture causes more financial compared to conventional agriculture; what these agricultural findings reveal is that, in some ways, they do cause more money. One of the key areas of the increase in cost came from labor costs. Without the use of pesticides, it means that farmers must deploy alternative methods for addressing the issues that were once taken care of by pesticides. In addition, the harvest cost for organic produce is higher, while at the same time, organic agriculture is cheaper on some fronts because it uses less pesticides, which eliminates the cost associated with that, and they use less nonrenewable resources. While my interview revealed that every single interviewee associates a higher cost with organic produce, with some even revealing that they have wanted to buy organic for things such as berries but have been financially unable to. The price difference between organic and conventional produce is around 50%; however, it can sometimes be higher or lower due to three factors: the specific type of produce being purchased, such as berries or oranges; location, such as California or New York; and where the produce is being purchased, such as grocery stores or farmers' markets.



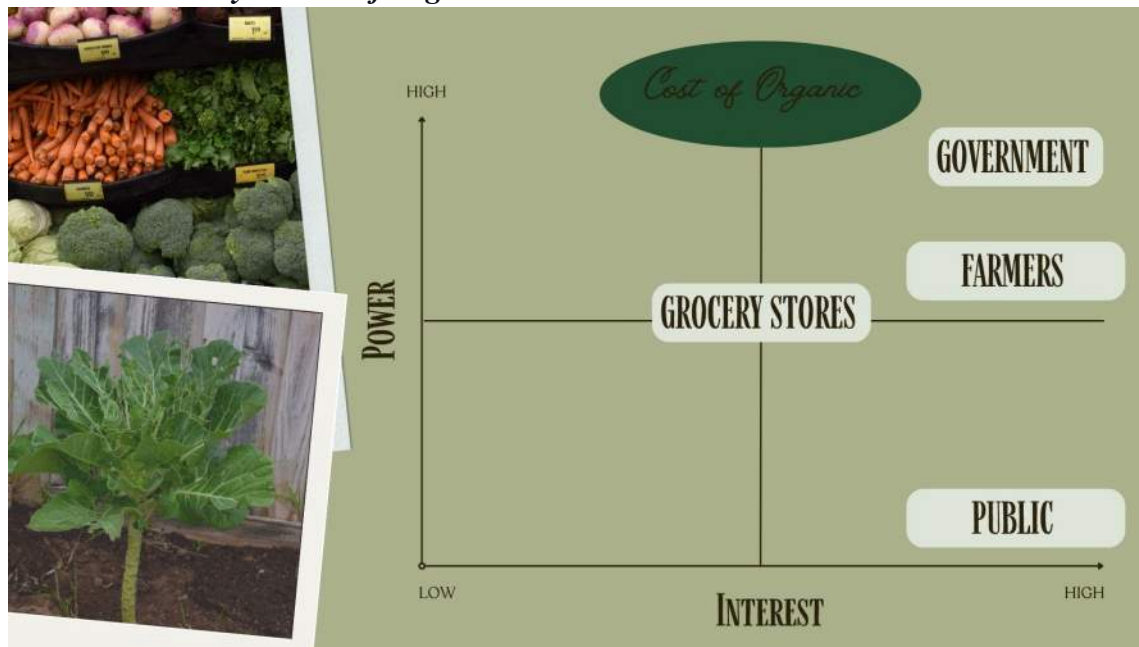
Comparative Analysis Cost of Organics:

A comparative analysis of the cost of organic produce from the viewpoint of professional groups and the public reveals similarities in correlation between organic and expensive, and affordability. Conventional agriculture is dependent heavily on pesticides, can be done anywhere, and is currently the standard method of agriculture. In contrast to organic farming, which uses little/ to no pesticides, has limited availability, and is competing against the norm. This difference leads to the price difference between organic and conventional agriculture. In terms of

affordability in both the public and professional groups, conventional agriculture does have the advantage. The treatment of pests (weeds, insects, and rodents) may take more physical labor at an organic farm compared to a conventional method that completes the same task with the use of pesticides in half the time and half the labor. This high cost of production leads to a high cost for consumers, with the increase being passed down to them. Thus, creating a correlation with a higher price tag and the public. This then leads to the next similarity between these groups, which is location. Not everyone lives in communities where the option to buy organic is even offered, so if they want to purchase organic, they would have to travel, which would contribute to the high cost.

Similar to farmers who want to farm organically, they cannot if the land has been used with conventional methods in the years prior. The last similarity is affordability, due to the higher production cost, not every farmer can even afford to farm organically, similar to how not every consumer can afford to shop consistently organic. For consumers, this is emerging into two distinct thought patterns. The first is that the price difference between organic and conventional is not significant enough to make a difference to one person's budget, or I simply can not afford it, so it is better to buy conventional produce compared to no produce. The first thought pattern has a level of privilege that is important to acknowledge, especially with the fact that many Americans live paycheck to paycheck, so a few extra dollars at the grocery store is the difference between whether they can afford rent that month. The second thought pattern reveals that not everyone who is buying conventionally grown agricultural produce necessarily wants to buy those products.

Stakeholder Analysis Cost of Organics:



The primary stakeholders when it comes to the cost of organic would be farmers, public/customers, grocery stores, and the government. Farmers hold moderate power and high interest. Farmers are responsible for the production of the produce and are expected to be fairly compensated for their work. They hold medium power because they are not responsible for the high cost of production; instead, that comes from the increase in farm workers, the cost of fees associated with the USDA organic labeling, and the compliance with the standard laid out in the Organic Food Production Act of 1990. The public represents a stakeholder group with high

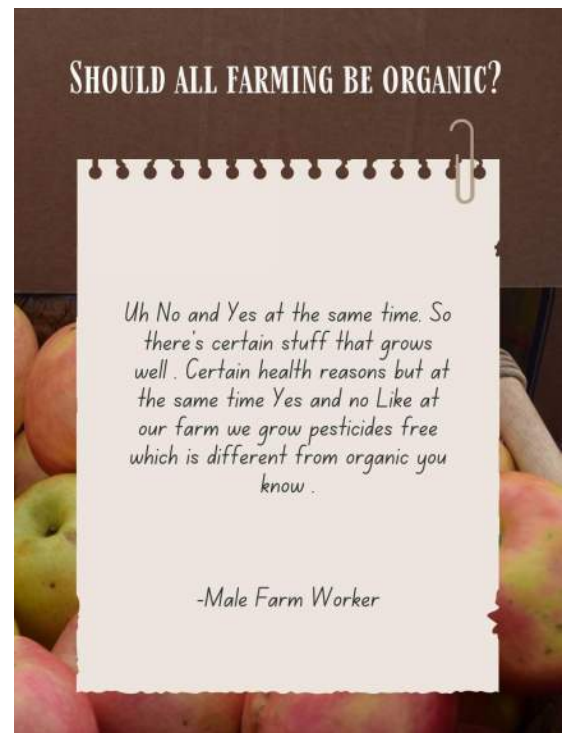
interest; however, their power is low. Their power is low because they have no control over the price of organic produce; instead, they are allowed the choice of whether the price is not only worth it but also within their budget. Their primary concern is about the affordability, healthiness, longevity, and accessibility of organic products. Despite their low power, they play a key role in organic agriculture because their demand is essential to the profit of organic agriculture. The next is grocery stores, which have a moderate power and moderate interest. The reason is that grocery stores are in competition with each other, which causes some to price their products lower than others as a business practice. For example, Walmart and Costco both have some of the lowest prices in the grocery industry. To a certain extent, grocery stores do have complete control over the prices of their products; however, outside factors such as rising diesel costs, inflation, and tariffs have the potential to affect that control. The moderate interest comes from an increase in buyers wanting organic products, being driven by several different health lifestyles movements. The last stakeholders would be the federal government, a high power; however, they have a moderate interest, due to the multitude of areas they must address. The federal government plays a vital role as it is the one that is responsible for the subsidies, indirectly influencing the cost of production through different federal decisions, and the creation/amending of regulations.

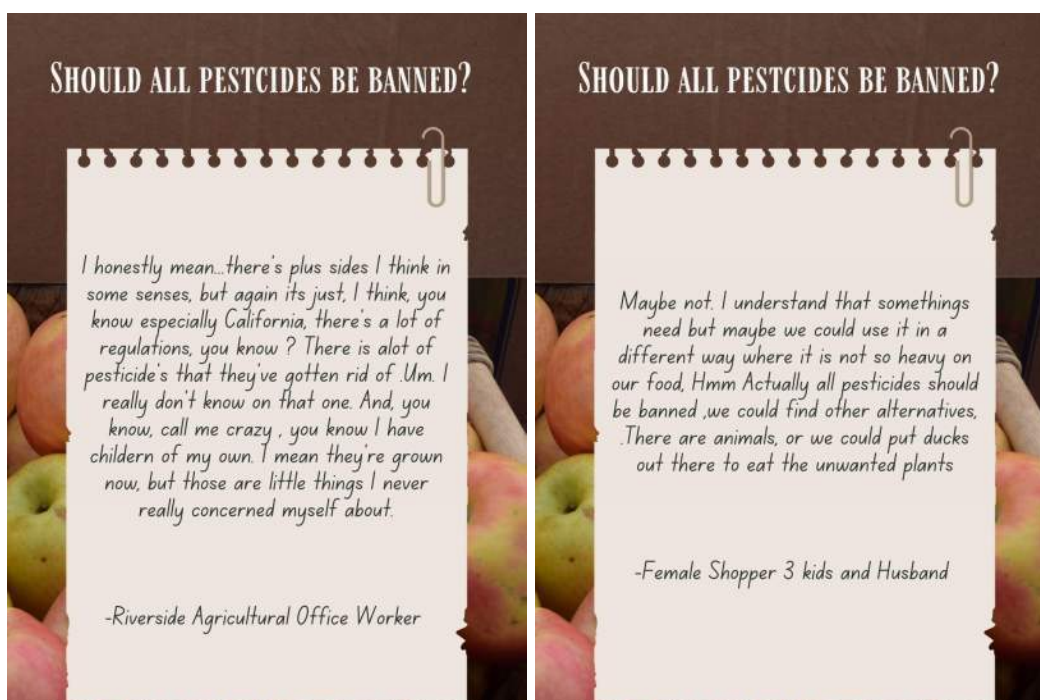
To address the need of these stakeholders several changes must be implemented, changing the fees associated with become USDA organic which those fees include inspection which are onsite visits which happen at least once a year and certification application which is a one-time fee, yearly renewal fee, increasing the amount of subsidies provided to organic farming, and lower the cost of organic seeds which on average cost more than their conventional counterpart. Having the government address the concern of the farmers would affect the other stakeholders because it addresses the roots of the higher cost of organic.

Theme Two: Pesticides, the good, the bad, and the ugly

The usage of pesticides in the United States took off after World War 2 however, early on, people started to raise concerns about pesticides. Rachel Carson, famed author of "The Silent Spring," raised the alarm about pesticide-specific DDT, which was later banned, making DDT the first pesticide to be banned in the United States ([O'Sullivan, 2015,](#)).

Since the ban on DDT, the general public's feelings around pesticides have only trended towards a negative opinion, which was present in most of my interviews however when it came to people who are directly involved in the agricultural industry they're opinions start to vary. But for the non-agricultural workers such as shoppers their opinions on pesticides were all negative. Some of the top concerns about pesticides are the effects on human health, soil, and water.





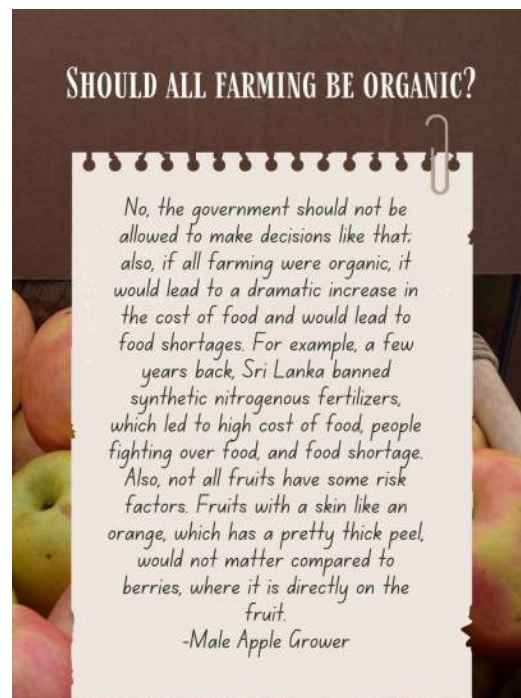
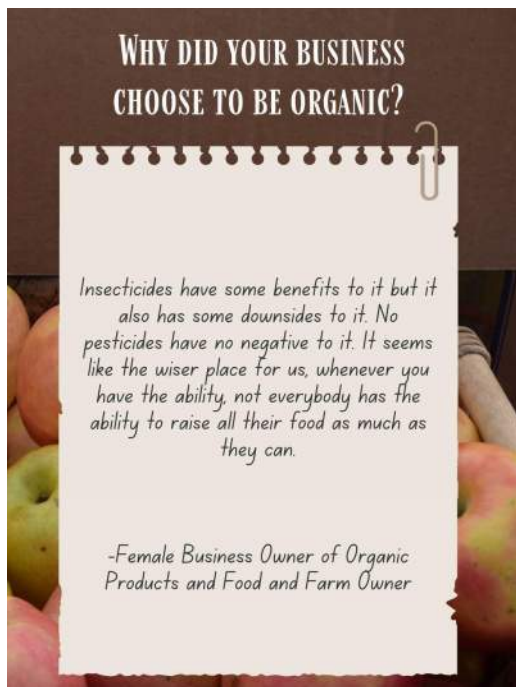
In the United States, there are [over 50 pesticides](#) that have been banned in at least one country that are still in use, on top of the pesticides that the WHO (World Health Organization) considers moderately hazardous that are still in use. When it came to the professional groups, it resembled the same sentiment as the common man, with a key difference being that they provided in-depth information on the different ways that pesticides can affect human health, soil, and water systems.

Alzheimer's disease, which is a neurological disease that has been on the rise for at least the past decade, has been linked to exposure to pesticides. However, this link comes from long-term exposure to pesticides. Along with children dealing with neurological issues from exposure to pesticides during the prenatal and postnatal period, these issues are cognitive issues, which can include disorders like ADHD, learning disabilities, and developmental issues, to name a few, in addition to having children who fall on the autistic spectrum. Parkinson's disease: 15 out of 26 studies have showcased that there is a link between Parkinson's disease and pesticides; however, similar to Alzheimer's disease, long-term exposure is key to this link. The next area that pesticides have been linked to is 6 different types of cancers: breast, liver, leukemia, brain, bladder, and colon. When it comes to breast milk, they have found pesticides in it. However, I think it is important to address that the research is not saying that pesticides are causing cancer, but rather that they increase your risk of developing some cancers. Fertility is the next area that pesticides affect, with women who work directly with pesticides having a harder time conceiving. In contrast, for men, consumption of vegetables with pesticides has been linked to a reduction in sperm count. The next areas are respiratory disorders and type 2 diabetes, which are similar to cancer; exposure to pesticides increases your risk of developing those disorders/diseases. ([Ahmad et al., 2024](#))

Pesticides have two effects on the soil: they disrupt the chemical makeup of soil, which includes key chemical elements such as oxygen, iron, and carbon, to name a few. The second effect comes from disrupting the physical makeup of soil, leading to a domino effect, with the next domino to fall being the plants and animals in the area. The combination of those three

elements affects soil health. The health of soil plays a huge role in the quality of produce grown in said soil, with poor soil leading to a decrease in nutrients in the plants grown in said soil. The way pesticides affect water is by ending up in the water system, which they end up in the system through a couple of avenues, such as overuse, mismanagement, and floods. Air is affected by pesticides, decreasing the air quality, which is a problem because pesticides have the ability to travel 100km away ([Zhou, W. et al., 2024](#)).

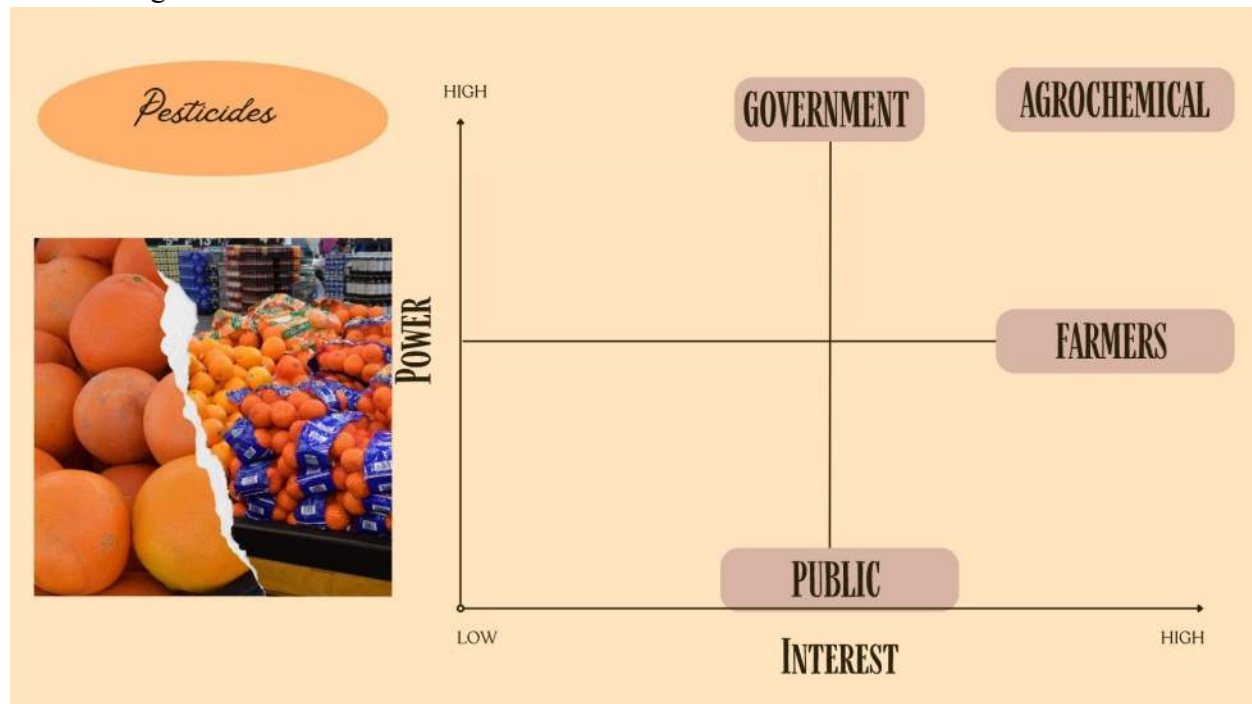
The focus on pesticide ties into my capstone project because one of the key differences between organic and conventional agriculture is the amount and type of pesticides that are used in the process.



Comparative Analysis: Pesticides

A comparative analysis of different groups' understanding of pesticides revealed a significant similarity. Both groups agree that some pesticides do harm human health and the environment, where these groups differ is in exposure level, necessity, and specification. Consumers focus on second-hand exposure, such as when you purchase produce, the leftover pesticides. In contrast, the professional group focuses on direct contact, such as people who work and live within a specific distance of these farms. It is relevant to acknowledge that the spraying of some pesticides does require the farm workers to wear protective gear due to the negative health side effects that it can potentially cause. The specification is another key difference between these groups. At the same time, when the public talking about pesticides, they are address pesticides as a category comparative to professional groups when talking about pesticides they break it down to specific pesticides / specific pesticides groups for example [Paraquat](#) which is herbicide that has been used in the United States since the 1950s has banned in dozens of countries include all of the European Union and China over the past two decades. The last difference is the necessity of pesticides, with many of the interviews believing that it is possible to once again farm without the usage of pesticides, compared to the professional side,

which communicates that without pesticides, the amount of food that is grown would not be possible. The sudden removal of pesticides would lead to an increase in food prices on top of food shortages.



Stakeholder Analysis: Pesticides

The primary stakeholders when it comes to pesticides would include farmers, the government, consumers, and agrochemical companies. Agrochemical companies have high power and high interest, they want to earn a high return on their investment, are responsible for contributing a significant amount of money towards lobbying the government in their interest, and provide a necessary good to farming. Farmers on the other have high interest but moderate levels of power, because while they are interested in pesticides they are subjugate to the agrochemical companies who control the supply of pesticides and the price of selling pesticides. Compared to the consumers who represent a stakeholder group with moderate interest but low power, this low power comes from how removed the everyday person is from the food system, with most people's interaction with produce coming from the grocery stores or farmers' markets. However, the majority of people could not tell you which farm grew the crops they were eating. The moderate interest comes from the fact that there is a significant number of people who do want to eat pesticide-free.

However, because there is no government certification, the person must conduct their own research to find it. Not everyone has the means to do that. The federal government has high power but low to moderate interest which is evident in the pesticides that they continue to allow to be used despite other western countries having a ban on said pesticides in addition, historically the federal government has been slow to act on the banned of pesticides that have scientific back evidence that they are having a negative impact to human health, the environment, and in some case both.

To effectively address these stakeholders, a number of strategies must be used. The agrochemical companies that are high power, high interest need to transition to low power, high interest. The reason is that they have high power; their voices are the dominant narrative in the

conversation surrounding pesticides, which is evident in the policy that is proposed/ and has been implemented in the past. In addition to having high power, it continues to add to the distrust among the consumers, the government, and professional groups. When it comes to government by them becoming high power and high interest it would improve both the farmers and consumers by creating regulations: strictly regulate prices that the agrochemical companies can charge farms, reduce price so it only takes up around 3-12% of the farms annual operation cost depending on the farm size, and consumers change the process for how pesticides are allowed onto the market instead of proving that the pesticide does not cause harm, it would instead follow a path of trying to disprove that the pesticide is harmful. It shifts the burden of proof.

In addition to operating this way, it does a better job of ensuring that no chemicals are entering the market that are potentially harmful. In conclusion, the conversation around pesticides is not as black and white as it may seem because, while there are many drawbacks, it is an undeniable fact that pesticides have helped to reduce the number of people who are food insecure and have created a surplus of food grown in some countries. The sudden removal of pesticides would lead to an increase in food insecurity. However, while that is all true, it is also an undeniable fact that pesticides are negatively impacting the environment and human health.

Theme Three: Health Benefits?

Lifestyle disease, also known as non-communicable disease, is defined as a condition that tends to be of long duration and is the result of a combination of genetic, physiological, environmental, and behavioural factors. Some of the most common forms of lifestyle disease in the United States would include obesity, type 2 diabetes, and high blood pressure(high tension). These diseases tend to cause people to spend hundreds, if not thousands, of dollars annually in medical costs from medication and doctor appointments. Additionally, malnutrition, which is defined as an imbalance between the nutrients your body needs to function and the nutrients it gets. To clarify, there are two different forms of malnutrition with two subcategories: Undernutrition and Overnutrition.

Lifestyle diseases and malnutrition are affecting millions of Americans, which leads to many Americans wanting to be as healthy as possible to improve their quality of life. This is a section of my capstone project that I have firsthand experience with, as someone who has a lifestyle disease (High Cholesterol) and many family members who also have non-communicable diseases (high tension and type 2 diabetes). My personal understanding is that organic food is more nutritious because the soil it is grown in is healthier. In addition to the fact that there are fewer pesticides, the negative health effects that come from pesticides are lessened. Additionally, in my own life, when I made the switch to eat more organic produce, especially the ones that are on the EWG dirty dozen, I did feel better, which in my case meant less swelling of my knees & face and reduction in chest pain caused by inflammation compared to when I went back to eating the conventional produce.



Comparative Analysis:

While researchers have recognized a pattern that people who eat organic food tend to be healthy, they also acknowledge that other factors can influence this outcome, for example, living conditions, exercise, genes, and a general increase in the amount of produce consumed overall. Furthermore, professional groups want people to eat more produce in general, no matter if it is organic or conventional, frozen, fresh, or canned, as long as people are eating fruits and

vegetables, that is all that matters. Because of these factors, the professional perspective on this issue is that more research must be done before a conclusion on the topic can be made in one way or another. However, professionals of the past had rejected the claims that organic produce is healthier, specifically that organic food is more nutritious when compared to conventional food. This is related directly to the response of three of my interviewees, who all had mixed thoughts on the healthiness of organic .

The last element, taste, with several interviews mentioning that they feel organic produce tastes better, because taste is such a personal preference. I offer no professional perspective. Instead, I ask you, the reader, do you notice a difference in taste between organic and conventional?



Stakeholder Analysis:

The primary stakeholders in the healthiness of organic compared to conventional are the public audience and the government. The government holds high power, and high-interest medical debt is the top cause of bankruptcy in the United States. At the same time, healthcare is the second top source of spending for the United States government, so it is in the best interest of the government to make change to help create a healthier population which is evidence with the make American healthy movement which is a focus of the current director of united states secretary of health and human services Robert F. Kennedy Jr. and the recent changes made to SNAP benefits to prohibit the buying of junk food. The high power comes from the fact that the United States government is the regulatory force in the United States, creating the dietary guidelines for the United States with items like the plate and food pyramids. It is within the government's power to make meaningful changes to policy in order to better serve the needs of the public.

However, it is important to acknowledge the power that lobbying has on the United States government, swaying the government in the interest of those with high financial means. The public audience has a high interest and moderate power. Many people, if in their power, try to

live a healthy lifestyle, meaning eating healthy food and exercising. But it is important to acknowledge that being able to do that does come from a level of privilege, such as having the time to exercise, access to a place to work out in a safe public space or gym, access to information on how to eat healthily, and access to grocery stores. Access is a key theme in the ability to live a healthy life.

Policy Analysis:

SEC 4302 Buy American Requirements for Certain School Meals, and SEC 4303 Reauthorization of the Gus Schumacher Nutrition Incentive Program are 2 different sections of the nutrition area of the farm bill that grant money to create projects that improve low-income families' ability to buy fresh produce, and lastly regulate the type of food that can be purchased for schools. From an economic perspective, SEC 4303 provides the community with the financial ability through grant money to help mitigate the lack of access that many low-income families face due to the lack of resources available. While SEC 4302 from an economic perspective ensures that American agriculture will have some form of revenue in the form of providing lunches for school children in some states, they also provide breakfast. Socially, both policies play a role in fostering community, with SEC 4303 working with community leaders and local community non-profits to better one community, instead of having outside organizations come in to address the problem. The federal government is working with the community to provide them with the tools needed to fix their own community, creating long-lasting change ([Farm, Food, and National Security Act of 2026, 119th Congress \(2025-2026\)](#)).

A way to address the low-income communities' lack of access would be the creation of a secondary card; however, with this card, it would be loaded monthly and can only be used for the purchase of organic fresh/frozen produce. The reasoning behind only organic fresh/frozen produce is that the purpose of the card is to allow consumers who would not be able to afford them consistently the support to purchase only whole foods. Whole food refers to food that has had zero to very little processing and is free from things like additives and preservatives. However, going a step further to address all communities, because, instead of requiring people to be low-income, you just have to prove that you would be unable to purchase food due to financial strain. I decided to set it up this way because making more money does not always mean you have more spending money; things like living location, debt, student loan repayment, and the number of people depending on you financially play a huge role in the amount of money you have to spend.

Additionally, I think pregnant people and people with children under 3 should be prioritized. With the data I see, there is a link between the food you eat and how it affects one's pregnancy and the development of one's child, so I think we should do everything we can to try to ensure a healthy pregnancy, a healthy delivery, and, lastly, healthy babies. After the prioritization of those two groups, I believe it should be families with children next. The reason why is that the length of the exposure was a common theme in the research, so by focusing on children, I am hoping to break this generational chain of consuming potentially harmful pesticides. Focusing on school lunch, instead of continuing the current policy where 51% of the product and produce must be from the United States, it would go a step further, where 100% of the product and produce must be grown in the United States. That produce would have to be organic. The reason is the link between pesticides and human health. Creating a partnership

between organic agriculture and the school provides a guaranteed revenue stream, which could then attract more farmers to organic agriculture.

SEC. 10201 Exclusion of Certain Substances, SEC.10205 Uniformity of Pesticide Labeling Requirements, and SEC.10206 Authority of States is three sections that affect the pesticide industry, which would allow for some chemicals to bypass safety testing, allowing them to get the go-ahead without having the testing that is done in protection of people and the environment ([Farm, Food, and National Security Act of 2026, 119th Congress \(2025-2026\)](#)). In comparison, the second two sections work together to limit the amount of information that pesticide companies have to provide, allowing them to remove warnings. This would allow pesticide companies to bypass some state laws, for example, California Prop 65, which warns consumers about potential risks.

Economically, looking at all three sections would provide agrochemical companies with a financial boost because it reduces the amount of safety checks, which often cost agrochemical companies money and time. Moreover, by changing the label, it could potentially lead to people purchasing chemicals with health risks that they would typically avoid, leading to new business. Socially, this change in policy SEC.10205 & SEC.10206 is to reduce the amount of information being provided to the public, in addition to reducing the states' and courts' ability to provide that information to the public ([Farm, Food, and National Security Act of 2026, 119th Congress \(2025-2026\)](#)).

This aspect of the policy is being widely criticized for being counterintuitive to the Make America Healthy movement and to the many concerns being voiced by the public surrounding the usage of pesticides. It is seen by many as a way to support the desire of agrochemical companies over the needs of the American people. Additionally SEC.10201 has also met steep criticism of the potential damage it may allow agrochemical to get away which leads into the Environmental impact SEC.10201 has the potential to allow chemicals to skip necessary safe review on not only the environment but also human, by allow chemical to bypassed this safety measure it has the potential to harm hundreds and cost lasting damage to the environment.

The policy change that would need to be made here is the complete removal of the SEC.10201, SEC.10205, and SEC.10206 the reasoning on why is these section going directly against what my research was able to reveal about the perspective of both professional group and the public, who are both concerned about the chemicals that used in the agriculture industry, these policy would be favoring the wants of agrochemical companies by allowing them to escape accountability for the potential impacts that there chemicals can have ([Farm, Food, and National Security Act of 2026, 119th Congress \(2025-2026\)](#)). Instead, the proposal policy would focus on one thing: the phasing out of pesticides in agriculture. The phasing out of pesticides would need to be a policy that would take place over the course of two decades, starting with the banning of pesticides that are banned in both China and the EU, and followed by the immediate halt of the approval of any new pesticides. From that point over the course of twenty the number of pesticides being used in the industry must be reduced by 5 % every year, started with the pesticides that are the most harmful to the environment and human health, the slow reduction rate will cause farmers and agrochemical companies alike to adjust their business practices with the threat of fines for failing to meet that goal.

Summary:

Throughout this project, I was able to conduct research through the usage of semi-structured interviews, photos and secondary research to two different perspectives. I addressed the perspectives of the public and professionals regarding organic and conventional agriculture. Through this research, I was able to conclude that the perspectives have more similarities than differences. By understanding these perspectives in their entirety, I was able to make sustainable agricultural policy recommendations. After reading this paper, I hope it is clear that my intention is not to change anyone's mind. Instead, I would have you come to your own conclusions on organic and conventional agriculture. This paper serves as a way to start a much needed conversation around our food system that too many of us are far removed from. It is to fully understand the power that we, the people, have in impacting legislation that not only has the ability to improve our direct communications but make the world a better place overall.

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Building Trust in Water:
What Employees Taught Me About Advanced Water Purification

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Abstract

Advanced Water Purification (AWP) is increasingly positioned as a critical solution to water scarcity in arid regions, yet its success depends not only on technical performance but also on public trust and social acceptance. This Capstone project examines how a dialogue-driven training approach can support water utility employees in communicating about AWP and engaging with the community. Grounded in Freire's critical pedagogy and Ostrom's commons governance framework, this study uses qualitative, practice-based methods including focus groups, interviews, and community mapping to explore how employees understand, experience, and communicate about water reuse. Findings reveal a gap between technical confidence and communication readiness, highlighting the relational nature of trust, and positioning employees as key intermediaries in shaping public perception. By treating training as praxis, this project demonstrates how dialogue can function simultaneously as a learning process and a form of knowledge generation. The results suggest that building trust in water reuse requires not only technological innovation but also participatory, reflective, and justice-informed approaches to workforce development and community engagement.

Advanced Water Purification: Training and Public Trust

Water scarcity in the Southwestern United States has become an urgent and defining challenge, one that is increasingly shaping policy, infrastructure, and everyday life (Williams, Cook, & Smerdon, 2022). In the greater Arizona region, this reality is not abstract. It shows up in drought conversations, long-term planning, infrastructure investments, and the growing pressure to secure resilient water supplies for desert communities living through climate uncertainty. Within this context, Advanced Water Purification (AWP) is often introduced as a solution grounded in engineering, focused on treatment trains, advanced technologies, and system performance. Yet, over time, and through both my professional role and my studies in sustainability, I have come to understand that AWP is not only a technical challenge. It is also social, ethical, and educational. In practice, the success of AWP depends not just on the science behind the system, but on the trust people place in it, the stories they tell about it, and the relationships that shape whether a community accepts or resists water reuse.

I care deeply about this topic because I work inside the system that must carry AWP forward. As a water training superintendent in a large desert-city water utility, I oversee training and development for employees across many roles, divisions, and experience levels. Every day, I see how much of our work depends on knowledge transfer, not only the transfer of procedures and compliance requirements, but the transfer of meaning, responsibility, and confidence. In the water sector, employees do not simply “follow steps.” They protect public health, often in invisible ways that the community never sees. And when a utility introduces something as emotionally charged and socially contested as water reuse, public understanding depends heavily on the people who represent it. In many ways, the first line of public trust is not the technology itself, but the employees who can explain it clearly, respectfully, and honestly.

This Capstone project explored AWP as a sustainability strategy in a desert-city context while intentionally centering the human side of implementation: education, communication, and trust. More specifically, the project examined how employee training shapes understanding and engagement around AWP, and how training can support employees as they become stronger communicators and bridge-builders between technical systems and community concerns. My approach to training was not rooted in the idea that information alone creates trust. Instead, I viewed training as praxis, something that connects reflection, dialogue, and action, and evolves through real learning experiences rather than ending when a class concludes.

The guiding research question for this project asked:

How a dialogue-driven comprehensive training program in AWP might impact water utility employees' ability to educate and engage with the community around water reuse?

This question mattered because public acceptance of water reuse is not guaranteed, even when science is strong and the need is urgent. Decades of research have shown that acceptance of recycled or purified water is shaped by trust, perceived risk, emotions, and social narratives, not only by technical facts (Po, Kaercher, & Nancarrow, 2003). Communities may express concerns that appear to be “misinformation” on the surface but are actually rooted in history, political power, past institutional failures, or experiences of being ignored. In that context, public resistance should not automatically be labeled as irrational. Sometimes resistance is a signal that trust is fragile, communication is incomplete, or decision-making has not felt transparent or inclusive.

Rather than asking whether AWP is scientifically viable, this project asked what it takes for AWP to become socially viable. AWP may be a key part of the water future in arid communities, but it will only be sustainable if people believe in it enough to support it, especially in moments of uncertainty, rumors, or fear. This is why training matters. Employees are often among the most trusted messengers in a community because they carry lived expertise and are responsible for water safety every day. The deeper question became whether we are preparing employees not just to understand the technology, but to communicate it in ways that build credibility, empathy, and clarity.



*Figure 1: Site visit to an AWP facility in California view of the RO system. September, 2024.
Credit: Roberta Santos*



*Figure 2: Site visit to an AWP facility in California. September, 2024.
Credit: Roberta Santos*

To explore that question, I used a mixed-methods and practice-based research design grounded in my professional training role. My methodology was informed by action research because this project did not happen from the outside looking in. It developed inside a real operational context, where training systems had to adapt while meeting urgent needs. My mentor's feedback strengthened this approach by encouraging me to treat employee focus groups not only as a data collection tool, but as the first stage of the training program itself. In other words, the dialogue created through these sessions supported learning in real time while also producing insights that shaped the curriculum.

My methods included developing an AWP curriculum outline with employee input; conducting interviews and focus groups with employees involved in training, operations, or public engagement; collecting knowledge-check and survey data related to understanding and confidence; analyzing workshop feedback; and situating findings within peer-reviewed literature on water reuse, sustainability education, environmental justice, and public trust. These methods were an appropriate fit because the research question focused on meaning, communication, and readiness. Surveys can help reveal patterns, but dialogue reveals values, tensions, and concerns that may not surface through quantitative approaches alone. Importantly, this combination of methods allowed me to explore not just what employees knew about AWP, but how that knowledge was framed, shared, and experienced within a real institutional setting.

At the same time, this project required intentional reflection on positionality and epistemology. One of the key lessons from this work is that research can never be fully neutral, and the goal is not to erase bias but to recognize where our identities and assumptions shape what we notice, what we prioritize, and whose voices may be unintentionally overlooked. As both the researcher and a leader within a water utility, my positionality mattered. I was not disconnected from the institution. I cared deeply about its success, and I strongly believed in the power of training. That belief was one of my strengths, but it also shaped my approach. For example, I might assume that more training always increases confidence and acceptance, or that employees want to take on the role of public educators. Those assumptions had to be tested with humility. Some employees may feel anxious about public dialogue, unsure how to handle conflict, or concerned about being placed in difficult conversations without enough support.

Epistemology also mattered because it clarified what kinds of knowledge I valued and what I counted as evidence. My project was grounded in a belief that technical science and human experience both matter. In water reuse research, studies have found that perceived risk is strongly connected to trust in institutions and to the credibility of information sources, reinforcing that the social dimension of acceptance must be treated as real evidence, not a secondary issue (Siegrist, Keller, & Kiers, 2005).

This project leaned toward a social constructionist lens: there are “knowledges,” not only one knowledge, and people’s understanding of water reuse is mediated by culture, history, and lived experience. This stance does not weaken science; it strengthens implementation by acknowledging that facts become meaningful through relationships and institutions.

As the project developed, I broadened my assumptions by intentionally integrating multiple ways of knowing: structured employee feedback, informal reflections, lived experiences, and my own learning process through journaling and observation. I also remained aware of the voices that may be missing if I relied only on leadership perspectives or formal workgroup discussions. If AWP is truly part of the long-term future of arid-region water systems, then it must be supported not only by engineering excellence but also by human-centered education that builds trust across differences.

Ultimately, this Capstone became my effort to contribute knowledge that strengthens both workforce readiness and public confidence. I wanted to generate insight that helps employees feel prepared, not just to operate advanced systems, but to speak about them with honesty, clarity, and respect. At its best, this project supports a culture where technical expertise and community trust are not treated as separate goals, but as interconnected responsibilities.



Figure 3: Roberta by the Salt River. November, 2024.
Credit: Roberta Santos



Figure 4: Acequia fed by Gila River.
Yuma - AZ. April, 2025.
Credit: Roberta Santos

AWP can help secure the future water supply of desert communities, but only if it is carried forward through training that is dialogical, reflective, and grounded in equity, so that the people who protect public health every day are also supported to lead meaningful conversations with the public they serve.

Expanded Problem Statement

The Southwestern United States faces worsening water scarcity driven by climate change and prolonged drought, requiring sustainable and resilient water supply strategies (Williams, Cook, & Smerdon, 2022). This region has experienced one of the longest and most intense drought periods in recent history, creating an urgent need for sustainable, resilient, and locally controlled water strategies. While this crisis is often framed as a purely environmental or technical challenge, the reality is more complex: water scarcity is also a governance challenge, a public health responsibility, and a trust issue that directly affects how communities respond to solutions.

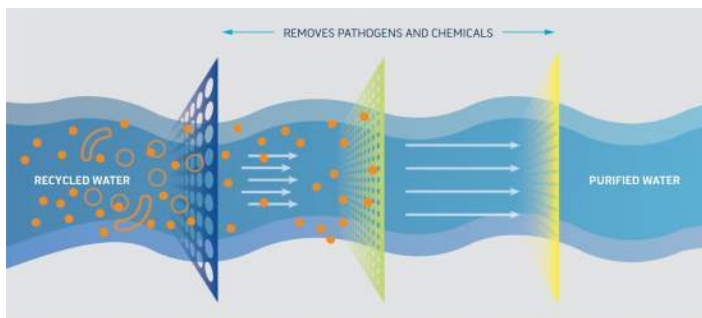


*Figure 5: Illustration of the reverse osmosis (RO) process in an Advanced Water Purification (AWP) system, showing recycled water passing through membranes to remove contaminants and produce purified water. October, 2024
Credit: City of Phoenix.*



*Figure 6: AWP facility in California: view of the reverse osmosis (RO) system. September, 2024.
Credit: Roberta Santos*

At the center of this problem is the growing mismatch between what water systems must become and what people feel prepared to accept. Advanced Water Purification (AWP), the process of treating wastewater to a highly purified level for reuse, offers a promising pathway to strengthen long-term water security. AWP can reduce dependence on shrinking surface water supplies, diversify the region's water portfolio, and provide a drought-resistant source of supply. However, AWP is not only a technological upgrade. It is a major public-facing shift in how water is understood, valued, and trusted. In practice, even the most advanced water treatment system cannot succeed unless people believe in it enough to support it. This project is about who carries AWP forward and who is affected by it. It is about the water utility employees who operate, maintain, and protect water quality every day, often without

public visibility. It is also about the community members who will ultimately judge AWP through the lens of trust, perceived risk, past experiences, and whether they feel respected and included.

Water reuse can trigger discomfort, misinformation, or emotional resistance, not necessarily because people are irrational, but because water touches health, identity, and history. Communities may ask hard questions such as:

- Is it safe?
- Who decided this?
- Why should we trust it?
- Who benefits?
- Who is taking the risk?

These questions make public acceptance a central part of implementation, not an optional “communication step.”

This problem is happening now, during a time when drought conditions, changing regulations, and long-term planning are forcing desert cities to prepare for a more uncertain water future. The urgency is not just climate-driven; it is institutional. Decisions made in the present will shape infrastructure investments, workforce readiness, and public confidence for decades. At the same time, the window to build understanding and trust is limited: trust cannot be rushed, and it cannot be manufactured through messaging alone. It must be earned through transparent education, consistent communication, and credible relationships.



Figure 7: Exposed riverbed in a dry section of the Colorado River. Utah, May 2025.
Credit: Roberta Santos



Figure 8: Roberta by the Colorado River. Utah, May 2025.
Credit: Roberta Santos

Ultimately, the core problem that this Capstone addressed is this: AWP may be scientifically and technically viable, but its long-term success depends on social viability. If water utility employees are not fully prepared and supported to communicate about AWP with clarity, empathy, and confidence, and if community members do not feel informed, respected, and included in the shift toward reuse, then AWP risks becoming misunderstood, resisted, or politicized. For this reason, the challenge is not only building an advanced purification system. It is building a shared foundation of understanding and trust strong enough to sustain it.

This is why a comprehensive, dialogue-driven training approach mattered. Training is not simply a method for transferring information; it is a mechanism for building internal confidence, strengthening communication capacity, and preparing employees to serve as credible bridge-builders between technical systems and public perception. By treating AWP implementation as both an engineering and an educational challenge, this project supported a path forward where water security is strengthened not only through technology, but through transparency, workforce preparedness, and community trust.

Literature Review

To move from the problem itself to a deeper understanding of why it matters, I turned to the literature. This review helped me situate AWP within a broader conversation about engineering, governance, justice, and education, while also showing where important gaps remain.

Advanced Water Purification, Governance of the Commons, and Critical Dialogue in Environmental Education

The dominant literature on Advanced Water Purification (AWP) has historically framed water reuse as a technical and engineering problem, emphasizing treatment processes, contaminant removal, energy efficiency, and regulatory compliance (Shannon et al., 2008; Bellona et al., 2019; Li et al., 2024). While these studies provide a critical scientific foundation, they often understate the social, educational, and governance dimensions that ultimately shape whether AWP projects succeed in practice.

This review builds on that foundation by positioning AWP not only as a technological intervention, but as a collective governance and learning challenge. Drawing on Paulo Freire's critical dialogue pedagogy and Elinor Ostrom's theory of commons governance, it situates AWP at the intersection of infrastructure, public trust, environmental justice, and participatory decision-making. In doing so, it highlights key gaps in the literature and frames this Capstone as a contribution that centers employee

knowledge, dialogue, and community trust as essential components of sustainable water reuse.

Dominant Trends in Advanced Water Purification Literature

A substantial body of peer-reviewed research focuses on the effectiveness of advanced treatment technologies used in potable and indirect potable reuse. These studies document the ability of multi-barrier systems, including reverse osmosis, advanced oxidation processes, and membrane filtration, to remove pathogens, emerging contaminants, and PFAS to levels that meet or exceed drinking water standards (Li et al., 2024; Bellona et al., 2019).

Large-scale reviews position AWP as an inevitable evolution of urban water systems facing scarcity, emphasizing its role in closing the gap between wastewater generation and reuse (Shannon et al., 2008; Jones et al., 2021). International case studies from Singapore, Israel, and Australia further reinforce AWP's technical feasibility and reliability under drought conditions (Tortajada & Joshi, 2013; Tal, 2016; Freeman et al., 2008).

While these studies establish the scientific legitimacy of AWP, they frequently assume that once safety is demonstrated, acceptance will follow. This assumption reflects a broader trend in environmental engineering literature that treats social resistance as a knowledge deficit rather than a governance or trust issue (Moesker, Brown, and Rogers, 2024).



*Figure 9: AWP facility in California: view of the ultraviolet (UV) disinfection system. September 2024.
Credit: Roberta Santos*

More recent scholarship has reframed water reuse within the circular economy, positioning wastewater as a recoverable resource rather than a disposal problem (Voulvoulis, 2018; Fernandes et al., 2023). This literature emphasizes reducing waste, recovering energy and nutrients, and integrating water reuse into broader sustainability strategies. Studies examining residuals, brine management, and treatment byproducts complicate overly optimistic narratives of “green” reuse by revealing hidden waste streams and long-term environmental risks (Xu et al., 2013; Murray et al., 2024; Tsangas et al., 2023). These findings underscore that circularity is not automatic. It depends on governance choices, infrastructure design, and institutional capacity.

While this literature advances sustainability thinking, it still tends to prioritize system optimization over social participation, often assuming that utilities and policymakers will drive circular transitions without sustained public engagement.

Environmental Justice and Water Governance

A parallel body of literature highlights persistent inequities in access to safe water and sanitation in the United States. Research shows that low-income communities and racially marginalized populations are more likely to experience contaminated drinking water, chronic underinvestment in water infrastructure, and disproportionate exposure to environmental hazards (Leker & MacDonald Gibson, 2018; Schaider et al., 2019; Karasaki et al., 2023). These disparities are not accidental. They reflect long-standing patterns of political exclusion, economic inequality, and uneven resource allocation.

Environmental justice scholarship builds on this evidence by arguing that meeting technical or regulatory standards alone does not guarantee fairness. Instead, it emphasizes that water outcomes are shaped by historical, political, and social conditions, including who has decision-making power, whose concerns are taken seriously, and whose communities absorb the risks associated with infrastructure systems (Medina et al., 2022). From this perspective, trust in water institutions is not simply a matter of water quality metrics, but a reflection of past experiences with governance, transparency, and accountability.

This framework is especially relevant for AWP. Research shows that even when water reuse technologies are demonstrably safe, acceptance is not automatic. Communities with histories of water contamination, institutional neglect, or exclusion from prior decision-making often approach reuse initiatives with skepticism rooted in trust and governance concerns rather than technical risk alone (Moesker et al., 2024; Wilson et al., 2025). Environmental justice scholarship emphasizes that how decisions are made, including who is meaningfully consulted, whose knowledge is recognized as legitimate, and how risks and benefits are distributed, can be as influential as system performance in shaping public responses. However, much of the AWP literature

continues to treat equity and justice as secondary considerations, addressing them through downstream outreach or messaging rather than embedding them into project design, workforce training, and governance structures. As a result, water reuse initiatives risk reproducing existing inequities if justice, trust, and participation are not treated as foundational elements of implementation rather than supplementary concerns.

Critical Dialogue and Collective Stewardship in Water Governance

Paulo Freire's (2005) *Pedagogy of the Oppressed* offers a theoretical foundation for rethinking how knowledge is produced and shared in environmental decision-making. Freire rejects the "banking model" of education, where knowledge is deposited into passive learners, and instead advocates for dialogue-based, participatory learning where learners contribute their lived experience and critical insight.

In environmental and public-sector contexts, critical dialogue has been shown to support deeper understanding, trust-building, and collective problem-solving (Gockel et al., 2022; Frantell et al., 2019). Focus group and dialogue-based research methods align closely with Freirean principles by valuing participant narratives, co-creation, and reflection (Kevern & Webb, 2001; Gjessing et al., 2023).

This literature challenges dominant assumptions in water communication that public resistance stems from ignorance. Instead, it reframes resistance as a rational response to uncertainty, power imbalances, and historical exclusion (Rozin et al., 2015; Barnes et al., 2023; Moesker et al., 2024).

Elinor Ostrom's work fundamentally challenges the long-standing belief that shared resources are inevitably overexploited without centralized control or privatization. Through extensive fieldwork, Ostrom demonstrated that communities managing shared resources, such as water, often develop locally adapted rules that promote sustainability, equity, and long-term stewardship (Ostrom, 2009).

Ostrom's framework emphasizes collective decision-making, trust, transparency, and rulemaking by users themselves, offering a powerful lens for understanding water reuse governance. Rather than viewing water utilities as sole decision-makers, this perspective recognizes water systems as institutional commons shaped by relationships among operators, regulators, and communities.

Applied to AWP, Ostrom's work suggests that long-term success depends on building shared norms, clear communication, and mutual accountability. This stands in contrast to technocratic models that emphasize expert control while marginalizing public participation.

This Capstone integrates Freire's theory of critical dialogue with Ostrom's framework for governing the commons to reconceptualize AWP as both a technological and social system. Freire's rejection of the banking model challenges conventional approaches to water reuse outreach that treats employees and the public as passive recipients of expert knowledge. Instead, his approach emphasizes dialogue, mutual learning, and recognition that participants bring valuable experiential knowledge to complex problems. When applied to AWP training, this perspective reframes focus groups and interviews not as extractive data-collection tools, but as collaborative spaces where water professionals actively shape understanding, meaning, and trust around water reuse. Ostrom's work complements this pedagogical approach by demonstrating that sustainable management of shared resources depends on locally grounded rules, shared norms, and collective stewardship rather than top-down control alone. Viewed together, Freire and Ostrom offer a powerful lens for AWP implementation: Freire provides the educational framework for how knowledge about water reuse is co-created through dialogue, while Ostrom provides the governance framework for how that knowledge informs collective decision-making around a shared resource.

Gaps in the Literature

Despite a growing and interdisciplinary body of research on AWP, significant gaps remain in how water reuse is conceptualized, implemented, and studied. While the technical performance of AWP systems, regulatory frameworks, and public risk perceptions are well documented, the literature continues to privilege engineering solutions and top-down governance models over the social processes that enable long-term sustainability.

While some studies acknowledge the importance of trust and public engagement in water reuse (Moesker et al., 2024; Wilson et al., 2025), these considerations are often framed as external to system design, addressed through outreach rather than embedded within training, governance, or operational practice. Even when the literature recognizes trust as a determining factor in acceptance, it rarely examines how trust is cultivated internally within utilities or how employees are prepared to participate in that process. This reveals a critical disconnect: the literature identifies trust as essential, yet offers limited insight into how institutions actively build it through workforce development and dialogic engagement.

A second gap lies in how education and communication are conceptualized within the literature. Educational efforts related to water reuse are frequently framed as one-way information transfer, rooted in the assumption that public resistance stems from a lack of knowledge. Few studies engage with dialogic or participatory educational

approaches that recognize learning as a reciprocal process. As a result, the literature rarely explores training models that invite employees and community members to contribute their knowledge, question assumptions, and collectively shape understanding. This gap limits the potential for education to function as a tool for trust-building rather than persuasion.

Additionally, there is a notable absence of scholarship that integrates governance theory with pedagogical theory in the context of water reuse. Ostrom's work on commons governance and Freire's theory of critical dialogue are each influential within their respective fields, yet they are seldom applied together in water management research. As a result, governance is often discussed without attention to how people learn, communicate, and negotiate shared meaning, while education is discussed without grounding in institutional structures and resource governance. This separation reinforces siloed approaches that fail to account for the relational and institutional dimensions of shared water systems.

Finally, environmental justice considerations are frequently treated as secondary or external to AWP planning and implementation. While a growing body of literature documents inequities in water access and exposure to environmental risk, these concerns are often addressed separately from infrastructure design, employee training, and operational decision-making. This separation risks framing justice as an afterthought rather than a foundational principle, overlooking how trust, historical inequities, and community experiences shape perceptions of water reuse. Without explicitly integrating environmental justice into training, governance, and communication strategies, AWP initiatives may unintentionally reproduce existing inequities even as they seek to address water scarcity.

Together, these gaps suggest the need for research that moves beyond technical feasibility and public messaging to examine how dialogue, governance, and justice intersect within water utilities themselves. Addressing these gaps requires an approach that centers employee voices, treats education as a collaborative process, integrates governance and pedagogy, and embeds equity into the core of water reuse planning, an approach this Capstone project seeks to advance.

Methodology

I designed this project to study AWP not only as a technical water supply strategy, but as a social, educational, and governance challenge. Grounded in the context of a desert city facing intensifying drought and climate uncertainty, this project investigated how employee training can influence the social viability of water reuse. Rather than treating public acceptance as a downstream communication issue, this

research centered training as a critical site where meaning, confidence, and trust are constructed.

This project sought to understand how training can function as praxis, connecting reflection, dialogue, and action, rather than as a one-way transfer of expert knowledge. By examining training as a dialogical and participatory process, this Capstone generated insights that support both workforce readiness and more equitable, trust-centered approaches to water governance.

To date, this project relied primarily on qualitative, practice-based methods grounded in reflective inquiry, literature synthesis, and professional observation. These methods generated several interrelated forms of knowledge.

First, I conducted an extensive literature review across water engineering, sustainability, environmental justice, governance, and education scholarship. This review established that while the technical safety and feasibility of AWP are well documented, there is a persistent gap in how social trust, dialogue, and workforce readiness are addressed in both research and practice. Integrating Freire's theory of critical dialogue with Ostrom's framework for governing the commons helped me conceptualize AWP as both a shared resource and a shared responsibility, one that requires participation, transparency, and collective learning.

Second, I engaged in sustained reflexive journaling as part of my Project Diary. These reflections documented my evolving understanding of AWP, my positionality as both researcher and water training superintendent, and the tensions inherent in implementing socially contested infrastructure from within a public institution. This reflexive practice generated narrative and experiential data that informed how I framed research questions, interpreted employee responses, and identified implicit assumptions within institutional training models.

Third, my professional role allowed for informal observation of training environments, employee questions, and patterns of communication related to water systems. While these observations were not treated as formal data collection at this stage, they contributed contextual knowledge about how employees currently engage with complex water topics, where uncertainty arises, and how training spaces function as social learning environments.

Together, these methods produced conceptual, contextual, and reflective forms of knowledge that shaped the methodological design moving forward. Rather than beginning with data extraction, this project intentionally began with sense-making: clarifying what kinds of knowledge matter, whose voices are often centered or excluded, and how meaning is constructed within institutional settings.

Dialogue-Based Focus Groups

The primary qualitative method involved structured focus groups (Appendix A) with utility employees involved in operations, training, or public engagement. Participants were selected to reflect a range of roles, experience levels, and relationships to public-facing communication, with the goal of creating heterogeneous dialogue spaces rather than homogeneous expert groups.



*Figure 10: Community Mapping session. March 2026.
Credit: Roberta Santos*

Importantly, these focus groups were not treated solely as data collection tools. Following my mentor's guidance, they were intentionally framed as the first stage of the training program itself. This aligns with Freirean pedagogy, which views dialogue as both a learning process and a site of knowledge creation. Focus group sessions incorporated prompts, images, scenarios, and short storytelling activities to support reflection and equitable participation. Sessions were recorded and documented with informed consent, and attention was given to creating respectful dialogue spaces where multiple perspectives could surface without pressure to conform to institutional narratives.

Individual Interviews and Reflective Dialogue

To complement the focus group discussions, I conducted individual interviews (Appendix B) between the two sessions. These interviews created space for participants

to share their thoughts independently, without the potential peer pressure that can emerge in group settings. They also served as an opportunity to reinforce that each participant's voice mattered and was being heard. Rather than measuring "acceptance" in a reductive sense, the interviews helped surface patterns in understanding, comfort levels, and participants' perceived capacity to communicate about AWP. This approach allowed for deeper reflection and provided more nuanced insight into how employees are making sense of AWP in relation to their roles and experiences.

Training Design and Curriculum Development

In parallel, I developed an AWP training outline informed by employee input. This outline evolved iteratively as dialogue sessions surfaced questions, concerns, and areas of confidence or uncertainty. Training content intentionally balanced technical accuracy with space for values-based discussion, risk perception, and ethical considerations.

Ongoing Reflexive Journaling

Throughout the dialogue sessions, I became increasingly aware of my dual role, not only as a researcher, but as someone embedded within the system being studied. There were moments where I noticed myself anticipating certain responses or feeling a sense of validation when participants affirmed the importance of training. At the same time, I also felt moments of discomfort when participants expressed uncertainty or hesitation, particularly when those reflections revealed gaps in how we currently prepare employees for these conversations. These moments became important data points, not only about participants, but about my own assumptions. My reflexive

journaling allowed me to pause, document, and critically examine these reactions, reinforcing that praxis requires not only facilitating dialogue, but also being transformed by it.

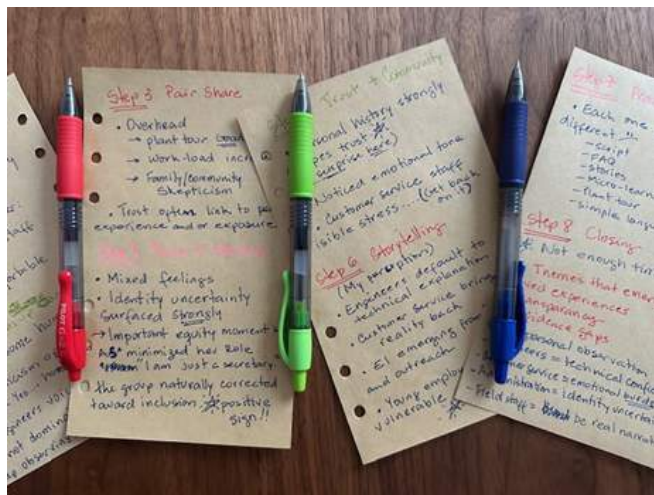


Figure 11: Roberta's journal entries documenting reflections throughout the project. January 2026.

Credit: Roberta Santos

Data Analysis

Theoretical Lenses, and Epistemological Assumptions

Data analysis in this project followed a qualitative, interpretive approach informed by critical pedagogy, social constructionism, and commons governance theory, recognizing that knowledge is situated, relational, and shaped by power. Employee dialogue, interview transcripts, and written feedback were analyzed thematically to identify recurring narratives, values, concerns, and communication challenges, with particular attention to how employees discussed trust, risk, responsibility, and their role as intermediaries between technical systems and the public. Survey data was used descriptively to contextualize these findings rather than to produce generalized claims.

Epistemologically, the project recognized multiple ways of knowing, including scientific expertise, professional experience, institutional memory, and lived experience, and rejected the assumption that technical knowledge alone ensures implementation. Freire's concept of praxis guided interpretation by emphasizing reflection, dialogue, and action, while Ostrom's common governance framework provided a lens for understanding how trust, shared norms, and communication shape collective stewardship of water as a shared resource.

Voices Present, Voices Missing, and Critical Reflection

At this stage, the most prominent voices in the dataset are those of water professionals, researchers, and institutional actors. While centering employee perspectives intentionally addressed their absence in much AWP literature, it also introduced limitations, as community voices, particularly those of residents most affected by historical inequities or most skeptical of water reuse, were not directly included in this phase of the project. Additionally, my positionality as a leader within a water utility shaped access, interpretation, and power dynamics, which may have influenced how freely employees expressed doubt or critique. To address this, I aimed to create dialogue spaces that prioritize psychological safety and treat uncertainty and disagreement as valuable forms of knowledge. This reflection underscores that methodology is inseparable from ethics: who speaks, who listens, and who determines what counts as evidence are all methodological choices.

Introducing Greater Polyvocality

Polyvocality is central to this project's methodological commitment. Rather than reinforcing a single story of AWP as a technical inevitability, this Capstone sought to surface multiple narratives, including confidence and concern, expertise and uncertainty, and institutional responsibility alongside public accountability. As the project

developed, I deepened polyvocality by designing dialogue spaces that invited storytelling rather than scripted responses, broadening the literature to include critiques of technocratic governance, treating disagreement as data rather than resistance, and remaining open to findings that challenged my assumptions. In this way, the project acted as a “hair in the flour,” gently disrupting dominant narratives that frame public skepticism as a deficit and training as persuasion, and instead positioning dialogue-driven training as a foundation for trust, shared understanding, and long-term water stewardship.

Location Selection

I selected the space intentionally. The round table allowed us to sit as equals, without hierarchy, podiums, or barriers between us. In a project centered on dialogue and shared meaning-making, the physical arrangement mattered. Sitting in a circle reinforced that every voice carries value and that this is a space for co-creation rather than instruction.

The large glass windows overlooking the desert landscape also felt symbolic. We were discussing water, scarcity, resilience, and the future of desert communities, and the landscape outside reminded us why this conversation mattered. The natural light softened the room and created openness, inviting reflection rather than defensiveness.

This space supported the tone I hoped to cultivate: transparent, grounded, and connected to place. It was not just a meeting room. It was a setting that reflected the kind of dialogue this project sought to foster, equitable, thoughtful, and rooted in our shared environment.

This methodology reflects my belief that sustainable water futures depend as much on education, trust, and dialogue as on infrastructure and technology. By grounding AWP training in participatory, dialogical, and justice-informed approaches, this Capstone seeks to contribute knowledge that supports both institutional learning and community confidence. Ultimately, this project was not about convincing people to accept water reuse, but about creating the conditions under which trust, understanding, and shared responsibility can grow.

Results and Discussion

What Employees Revealed About Trust, Communication, and Advanced Water Purification

With the methodology in place, the project moved from design into lived dialogue. This section brings together insights from the first focus group, the individual interviews, and the final community mapping session. While each method created a different type of space, collective dialogue, individual reflection, and systems thinking, together they revealed a consistent and meaningful pattern. What emerged was not simply a set of opinions about AWP, but a deeper understanding of how employees experience their role in relation to public trust, communication, and responsibility.

Before the first question was asked, there was a moment I did not expect. As participants settled into their seats around the table, there was a quiet pause, the kind that sits somewhere between curiosity and uncertainty. Some leaned back, arms crossed at first. Others glanced at each other, waiting to see who would speak first. I could feel the weight of the topic in the room. Water reuse is not just technical, it carries emotion, responsibility, and, for some, discomfort.

I remember wondering at that moment: Will this feel like training, or will it feel like a conversation?

What unfolded over the next sessions answered that question in ways I could not have planned. As dialogue began, the room shifted. The hesitation softened. Participants leaned in, not just physically, but intellectually and emotionally. They began building on each other's thoughts, questioning, reflecting, and, at times, challenging assumptions. By the time we reached the mapping activity in the final session, I was no longer guiding the conversation. I was witnessing it. This shift, from hesitation to ownership, became one of the most important findings of the project.

Confidence Before Communication: Belief in the System, Uncertainty in the Conversation

One of the most consistent themes across the focus groups and interviews was the gap between understanding AWP and feeling confident explaining it. Many participants expressed trust in the science and reliability of the system, especially those with operational experience. However, when asked to imagine real-world conversations with the public, that confidence often shifted.

Several participants described situations where they might be asked about water reuse by friends, family members, or community members. While they felt comfortable

with the technical side, they did not always feel equipped with the language to explain it clearly or respond to skepticism. As one participant shared, “I believe in the [AWP] technology. I just don’t feel ready to explain it if someone stops me in the grocery store and asks.”



*Figure 12: Water station at a AWP California treatment facility illustrates the process from untreated water (right) to AWP-treated drinking water (left). September 2024.
Credit: Roberta Santos*

This theme also appeared during the focus group dialogue, where participants moved from technical explanations toward acknowledging uncertainty. Moments where individuals admitted feeling unsure became turning points in the conversation, inviting others to share similar experiences. Rather than weakening the dialogue, these admissions created connection and reinforced that confidence is not evenly distributed across roles.

Participants expressed a clear need for practical communication tools, including simple language, relatable examples, and guidance on how to respond in everyday conversations. This suggests that training programs must move beyond technical content and address how employees experience communication in real contexts.

Trust Is Relational, Not Just Technical: Beyond Information Toward Experience and Meaning

Another key theme that emerged is that trust in water systems is shaped by more than scientific knowledge. While participants recognized the importance of treatment processes and regulatory standards, they consistently returned to the idea that trust is personal, emotional, and shaped by lived experience.

During both the interviews and group discussions, participants shared stories that connected their perspectives on water to personal history. Some described growing up in places where water safety was uncertain, while others reflected on how seeing treatment processes firsthand increased their trust. These experiences influenced how they think about water reuse today.

One participant explained, “Where I grew up, people didn’t trust the water because they got sick. Seeing how the treatment plants work here helped change that for me.” Another noted, “People don’t just want facts. They want to know someone is taking care of the water.”

These reflections highlight that trust is not simply a matter of providing more information. It is shaped through relationships, transparency, and the perception that institutions are acting responsibly and with care. Participants recognized that public concerns about water reuse are often rooted in emotion and experience rather than misunderstanding alone.

This insight challenges the assumption that education should focus primarily on correcting knowledge gaps. Instead, it suggests that communication strategies must engage with the human side of water, how people feel, what they have experienced, and what they need in order to feel confident.

Employees as Informal Ambassadors: Role Clarity and Invisible Responsibility

A third theme that emerged across the data is how employees understand their role in relation to public communication. Participants expressed a wide range of perspectives on this question. Some saw themselves as potential educators, while others felt their role was more indirect.

Despite these differences, there was a shared recognition that all employees represent the department in some way. Even those who do not interact with the public regularly acknowledge that conversations about water can happen anywhere, at home, in the community, or in casual interactions.

As one participant explained, “Everyone represents the department, but that doesn’t mean everyone needs to be the expert.” Another reflected, “I may not explain the science, but I’m often the first person someone talks to. That still matters.”

This theme became even more visible during the community mapping activity, where participants placed employees within the broader “AWP trust ecosystem.” Rather than positioning communication as the responsibility of a specific role or department, the map revealed that trust is distributed across many points of contact.

Participants also emphasized that without confidence, this informal ambassador role can feel uncomfortable. One comment during the mapping discussion captured this clearly: “If we aren’t comfortable explaining it, people can feel that.”

This suggests that role clarity is essential. Employees do not need to become technical experts, but they do need to understand what is expected of them and feel supported in those interactions.

AWP as a System of Relationships: From Individual Perspectives to Collective Awareness

The final focus group session, centered on the community mapping activity, revealed a broader systems-level insight. Participants moved from thinking about their individual roles to recognizing the network of relationships that shape how AWP is understood.

The map included a wide range of stakeholders, such as families, schools, hospitals, businesses, legislators, and media platforms. This expanded view highlighted that conversations about water reuse are not confined to technical environments. They occur across social spaces where meaning is shaped collectively.

Participants also identified key factors influencing perception, including cost, taste, stigma, and transparency. The presence of these concerns on the map reinforced that public understanding is influenced by both information and narrative.

the same time, this study extends the literature by centering employees as key actors in this process.

While much of the existing research focuses on public perception, this project highlights the importance of internal readiness. Employees are not just messengers of information; they are participants in shaping how that information is understood.

This reinforces the need to view training not as a one-way transfer of knowledge, but as a dialogical process that builds confidence, meaning, and shared understanding.

Ethics and Tension

This project also surfaced a set of ethical questions that cannot be treated as peripheral to the research design or its outcomes. Rather, they are central to how this work is understood and to the contributions it seeks to make. Throughout the dialogue sessions, I was continually aware that I was not entering these spaces as a neutral facilitator. As a leader within the organization, I carry institutional authority, whether explicitly acknowledged or not. This raises an ongoing ethical tension: to what extent are participants speaking freely, and to what extent might their responses be shaped by perceived expectations, organizational culture, or my role within the system? While intentional efforts were made to create psychologically safe and dialogical spaces, I recognize that power does not disappear simply because it is named. This awareness complicates the interpretation of the data and reinforces that knowledge produced through dialogue is always shaped by relational and institutional dynamics.

At the same time, this project required me to hold a second, equally important tension related to impact. I believe in Advanced Water Purification as a necessary and promising strategy for water sustainability. However, I am also cautious of how training can be used, intentionally or unintentionally, as a tool for persuasion rather than as a space for inquiry. This tension challenges the purpose of training itself: is it designed to build understanding, or to drive alignment? In practice, these goals can blur, particularly within institutional contexts that must move forward with decisions and timelines. Rather than resolving this tension, this project embraces it as a critical insight. Ethical practice, in this context, is not about eliminating discomfort, but about remaining accountable to it. Holding space for uncertainty, disagreement, and multiple perspectives becomes essential not only for participant trust, but for the integrity of the work itself. In this way, “holding the tension” emerges as a central takeaway of this study, a reminder that building trust in water systems requires not only technical rigor, but ongoing ethical reflection.

What This Means Moving Forward

As I reflect on this project, one of the most meaningful outcomes is that the work did not end with the final session. The dialogue that began in these spaces continues to shape how I think about training, leadership, and my role within the organization. I now notice conversations differently, how employees talk about water, where hesitation appears, and where opportunities for trust-building exist in everyday interactions.

This project also revealed the potential for ripple effects. Participants were not only engaging in dialogue; they were experiencing a model of praxis that they may carry forward into their own interactions. The same principles: listening, reflecting, and co-creating understanding, have the potential to influence how they engage with colleagues, community members, and even their own families.

Looking ahead, this work opens possibilities for expanding dialogue-driven training across other areas of the organization, integrating praxis as an ongoing approach rather than a one-time intervention. It also highlights the importance of continuing to bring in community voices, particularly those historically excluded from water decision-making, to deepen polyvocality and strengthen trust.

Ultimately, this project reaffirmed that the future of water is not only technical. It is relational. And the work of building trust is not a final step in implementation; it is the foundation that must be continuously cultivated.



Figure 14: Roberta drinking purified water during a visit to a California Advanced Water Purification (AWP) plant tour, September 2024.

Credit: Roberta Santos

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Appendix A

Facilitator Guide (Replicable) Advanced Water Purification (AWP) Focus Groups Week 7 & Week 9

Objective: This guide allows any facilitator to run and replicate both focus-group sessions while preserving psychological safety, consistency, and data quality.

Project Context

These focus groups support development of an employee training program on Advanced Water Purification (AWP). The goal is to understand employee experiences, trust narratives, communication confidence, and training needs so the curriculum can be co-developed with participants.

Facilitator – Read before each session

- Container for dialogue, not the expert voice.
 - Curiosity over correction.
 - Slow pace; silence is productive.
 - Invite disagreement respectfully.
- Balance voices (prevent dominance, invite quieter participants).
 - Validate emotion without forcing disclosure.
- Invite play, movement, and storytelling to build connection.

Session Overview	Participant Mix
• Number of participants: 18 total (one focus group cohort) • Session length: 100 minutes each session • Recording: Audio recording + facilitator notes • Tone: Reflective dialogue with practical application • Room setup: Round table, equal seating, no podium; visible natural light preferred	Operators: 1 Water Treatment, 1 Wastewater Treatment • Supervisors: 2 (any area) • Field staff: 1 Water Meters, 1 Water Distribution, 1 Wastewater Collections • Administrative support staff: 3 • Customer service staff: 3 • Engineers: 2 • Training & Outreach staff: 3

Dialogue Material

- ☐ Timer
- ☐ Sticky notes and markers
- ☐ Prompt cards (optional)
- ☐ Audio recorder on center table
- ☐ Index cards for anonymous reflections
- ☐ Volunteer Participation Agreements and Ethical Guidelines

Opening Script (Read aloud)

“Thank you for being here. This is not typical training; it is a dialogue session. There are no right or wrong answers. Today I am here as a listener and co-learner. Participation is voluntary, you may pass on any question, and disagreement is welcome. We are interested in themes, not individuals, so no names will be used in reporting.”

Pause:

- Questions about recording
- Voluntary participation
- Anonymity

Add equity framing: “Because we have different roles represented here, every voice carries equal value in this space.”

Ground rules: speak from experience; listen to understand; make space for all voices; assume positive intent; confidentiality.

Equity Strategies

- Begin with low-risk prompts.
- Use short pair-share moments before whole-group discussion.
- Rotate who speaks first.
- Invite practical examples from different roles.

Session 1 – Week 7: Exploration Dialogue (90 Min.)

Objective: Surface perceptions, emotions, trust dynamics, and practical communication needs related to AWP.

Step 1 (10 min): Welcome and psychological safety framing.

Step 2 (10 min): Warm-up prompt:

“When you hear Advanced Water Purification, what first word, image, or feeling comes to mind?”

Optional playful variation: participants place their word on the center table before sharing.

Step 3 (5 min): Pair share - “Share one experience that shaped how you think about water reuse.”

Step 4 (15 min): Role & identity prompts.

- “How do you see your role in relation to the public on water topics?”
- “What role do employees have in community education about AWP? What role do you imagine employees could have?”

Step 5 (15 min): Trust & communication prompts.

- “What makes conversations about water reuse easier?”
- “What makes them harder?”
- “Where do you feel most confident? Least confident?”

Step 6 (20 min): Scenario storytelling.

Read: “Imagine a resident says, ‘I don’t trust reused water.’ What happens next?”

Follow-ups: Can you think of a real moment, where trust around water or public communication felt challenged? Would anyone be willing to share a brief example of a conversation where trust played an important role?

Reflection: What was going through your mind at that moment? What do you think the other person needed in order to feel more comfortable or understood?

Step 7 (10 min): Practical bridge - “If a future training included one practical tool, what would you want?”

Perspective: What do you think the other person needs in order to feel more comfortable or understood?

Step 8 (5 min): Closing reflection - “What is one thing you want this project to understand about your experience?” Collect anonymous cards.

Session 2 – Week 9: Reflection & Community Mapping (90 Min.)

Objective: Validate themes from Session 1, co-interpret meaning, and map the community trust ecosystem around AWP.

Step 1 (10 min): Welcome/Opening and recap of themes from Session 1.

Step 2 (10 min): Theme check-in - “What resonates? What is missing?”

Step 3 (10 min): Small groups (6 groups of 3) list stakeholders connected to AWP and community trust.

This small-group activity is intended to broaden participation and reduce hierarchy before moving into the full-group mapping exercise. Participants work in groups of three to identify stakeholders connected to AWP and community trust, writing one stakeholder per sticky note. The goal is to generate diverse perspectives and encourage shared ownership of the dialogue. This step helps participants move from individual viewpoints toward systems thinking, creating a stronger foundation for the collective community map that follows.

They are answering:

- Who is part of the AWP trust ecosystem?

Not just obvious stakeholders, but anyone who influences trust, perception, or communication.

You are helping them move from:

“I think about my role” to “We are part of a larger system.”

You might say:

Before we build one shared map together, I want us to start in smaller groups.

In your small group, talk about this question:

Who is connected to conversations about Advanced Water Purification and community trust?

Think broadly, not just internally. Consider people, groups, organizations, and systems that influence how AWP is understood or discussed.

There are no wrong answers. The goal is to generate as many perspectives as possible.

Your Role During this Step: Walk around quietly

Ask gentle prompts:	Avoid:
• “Who else influences trust?” • “Who talks about water even if they don’t work in water?” • “Who might shape public perception?”	• Correcting • Suggesting too much • Leading them toward your expected answer

Step 4 (25 min): Community map on shared poster.

Say:

Let’s bring our perspectives together.

Each group will place their stakeholder notes onto the shared map. If you see duplicates, that’s okay. It tells us something important about shared understanding.

- Center label: “AWP and Community Trust.”
- Place stakeholders
 - Which of these stakeholders feels closest to us?
 - Which feels farthest away?
- Draw relationships and trust strengths/fragilities
- Place employee roles on the map
- Movement moment: invite participants to stand and observe the map together.

Step 5 (20 min): Reflection dialogue.

- “What surprises you?”
- “Where are opportunities for stronger dialogue?”
- “What should future AWP training include?”

Step 6 (15 min): Appreciative close - “What are you leaving with today?”

Support Information

Facilitator Troubleshooting

- Dominant voice: “Thank you - I want to make space for others.”
- Looking for the right answer: “I’m staying in listening mode; I want your perspectives.”
- Hierarchy tension: “Every role sees something important.”
- Technical drift: “How does that show up in real conversations with people?”

Data Capture Checklist

- ☐ Audio saved and labeled
- ☐ Facilitator reflective notes completed
- ☐ Photos of community map (Week 9)
- ☐ Anonymous cards collected

Keep in Mind

Session 1 = stories

Session 2 = systems thinking

You are moving participants from:

personal experience → collective awareness.

That is praxis!

Appendix B

After the Focus Group: Individual Interview

Advance Water Purification (AWP)

An individual interview may be conducted in person, by phone, or virtually. Please schedule at least 30 minutes for the conversation.

Opening

Thank you again for participating in the focus group. I really appreciate the time and perspectives you shared.

As I continue developing this project, I'm having short follow-up conversations with participants to better understand their individual reflections after the session.

This conversation is voluntary, and there are no right or wrong answers. My goal is simply to learn from your experience and perspective.

With your permission, I will take notes to help me accurately capture your thoughts. Your responses will remain anonymous and will only be used to identify general themes for the project.

Do you have any questions before we begin?

Interview Questions

1. Reflection on the Focus Group

After participating in the focus group, what thoughts or reflections have stayed with you about Advanced Water Purification or the conversations we had?

2. Role and Identity

How do you see your role, or possible role, in helping the community understand or feel more comfortable with Advanced Water Purification?

3. Trust and Communication

When you think about conversations with the public about water reuse, what would help you feel more confident or supported in those interactions?

4. Experience and Perspective

What personal or professional experiences have shaped how you think about water reuse and trust in water systems?

5. Training and Support Needs

If we were designing a learning experience or support program for employees around AWP, what would be most helpful for you to include?

Optional Follow-Up Prompts (Use if needed)

- *Could you tell me a little more about that?*
- *Can you share an example?*
- *What makes that important to you?*

These help deepen responses without leading participants.

Closing

Thank you for sharing your perspective. Your input is helping shape how this project develops.

If any additional thoughts come to mind later, please feel free to reach out to me.

I truly appreciate your time and your willingness to contribute to this work.

Optional Facilitator Note (for yourself)

After each interview, capture:

- key themes
- notable quotes
- emotional tone
- connections to focus-group themes.

Exploring Hybrid Structures: Living Coastal Infrastructure in Southern Louisiana

By: Amber George

ABSTRACT

Tropical storms threaten coastal communities and marine life every year, and traditional coastal infrastructure is failing. City planners and engineers tend to think that hard stone or concrete structures should be used to defend tropical storms, but climate disasters have proven their methods ineffective, dangerous and counterproductive. *My case study* proposes a green design approach combining black mangrove restoration and recycled oyster shell reef efforts to pursue sustainable and ethical coastal infrastructure in southern Louisiana. I would like to explore how community-led programs and the distribution of local knowledge can be integrated into this design for improved resilience and maintenance to counter the “slow violence” of coastal land loss. In an act to restore the coast, young mangroves are being planted along vulnerable shorelines susceptible to land loss, sea level rise and tropical cyclones, however, the young trees suffer the risk of storm damage when they stand unprotected; my study considers the black mangrove’s potential to reclaim shorelines with additional green design methods. In a hybrid structure, oyster shells will act as a semipermeable dam and function as the first level of defense to protect young mangroves as they grow to become the second level of defense as mature trees for coastal communities. After reviewing “Mangrove Ecological Restoration” methods, I explored the feasibility of a multi-level defense structure along the coast, sought expertise from LSU researchers on mangrove behavior, and developed a model to portray its effectiveness. It is my intention to partner with NGOs and local communities rather than engineering firms for the development of my design to include the unique and underlooked perspective of the local coastal communities and their needs. I realize that a lot of engineering projects are imposed upon communities rather than collaborating with them. Place based knowledge and participation before intervention was highly sought after to support the feasibility of a multilevel structure and community participation for volunteer-led projects. When I traveled to southern Louisiana to volunteer with the CRCL, I discovered how my project could promote community engagement through their execution of a volunteer-led planting event. Their methods were effective and built on trust, empowering the volunteer to feel competent and confident in ecological restoration work. In other words, the use of volunteers would be feasible in the production of a hybrid shoreline structure, building an oyster reef and planting black mangroves. I have used my experience and engineering knowledge, my epistemology, to influence my green infrastructure design - a design that mimics and meshes well with its counterpart and surrounding ecology.

INTRODUCTION

Civil and environmental engineering is such a unique field of engineering because it is not an isolated one. It is a field that requires the designer to engage with their community and environment. However, some of the largest civil engineering projects never consult the local communities. Sadly, the locals are the ones left with the negative consequences when the infrastructure fails or interferes with their daily living. In southern Louisiana, coastal engineers might be an even further source of hurt for a lot of marginalized communities when we think about what happened during Hurricane Katrina. The [levees built](#) by the army corps of engineers failed and caused more than \$100 billion in damage and killed nearly 2,000 people under flood and storm damage. While there were a lot of politics and unforeseen weather events at hand, the simple facts remain. [A low income, black community](#) resided within weak levees, ones that were left ignored when the threats of Katrina came. It makes sense that those in authority, the engineers responsible for building and leaving them weak, do not hold a lot of trust in the victims eyes after such a tragedy.

Being an engineer who wants to implement a project might be a source of hurt for a lot of marginalized communities. I believe that civil and environmental engineers should be civil servants, so my project attempts to lower the shields of authority and diminish the power imbalance between engineers/city planners and community members.



Lower 9th Ward Survivors During Katrina
Credit: [Marko Georgiev](#)/Getty Images

I realize that a lot of engineering projects are imposed upon communities rather than collaborating with them. It is my intention to partner with the Coalition to Restore Coastal Louisiana (CRCL) to explore my case study design further. ***My case study*** proposes a green design approach combining black mangrove restoration and recycled oyster reef efforts to pursue sustainable and ethical coastal infrastructure in southern Louisiana. I would like to explore how community-led programs and the distribution of local knowledge can be integrated into this design for improved resilience and maintenance to counter the “slow violence” of coastal land loss.

The CRCL is a local NGO that has already identified land loss as an intensifying threat in coastal Louisiana. Their Oyster Shell Recycling Program (OSRP) for coastal land loss and shoreline defense is an inspiration for my semipermeable dam design, so I find their collaboration valuable. Additionally, their connection and involvement with the community through their volunteer events gives my project perspective. Their experience offers context to how locals would engage with my design proposal, and if they would be willing to participate in plantings and reef placement. The oyster bags are a feasible choice to protect young mangroves, but additional research will be pursued on their pairing with mangroves and Louisiana's shoreline.

I care about this project because its goal is to protect vulnerable communities, predominantly of the minority class, from climate disaster events that put their homes and lives in danger. I grew up close to the Gulf, where I am extremely familiar with preparing for hurricane season every year. As New Orleans residents know from Hurricane Katrina, flood events and land loss are detrimental to coastal communities, and can be unfairly burdened on a community based on their color, gender or economic status. My minority status and values shape my positionality where I believe every person has the equal right to know that their home will be safe regardless of their socioeconomic status.

LITERATURE REVIEW

When reviewing my case study's literature, I identified the following questions to be evaluated:

- What social literature is there on racial discrimination & coastal boundaries in southern Louisiana and throughout the United States?
- How do mangroves play a role in southern Louisiana's coastal ecosystem/marine life?
- How are plantings being measured as a success? How have they failed in the past? Who makes these decisions?

A few articles gave me some necessary background information on southern Louisiana’s culture and ecology while other articles served as reported studies.

Social Literature

Louisiana’s barrier islands and marshes are disappearing where Cajun, Native American, Black and Black Creole, Asian, and Hispanic people have [historically resided](#). In her thesis on [power and hegemony injustice](#) in coastal Louisiana, Simone Domingue explains the risk that communities of color are facing along the coast of the United States. Racial groups are displaced to coastal areas by environmental factors and the migration of affluent whites. The uneven geography of wealth and environmental risk by racial land grabbing is called “[racial coastal formation](#)”.

[Dominique](#) tells that the citizens of the Pointe-au-Chien Indian Tribe and the Grand Caillou/Dulac band of Biloxi/Chitimacha-Choctaw were relocated to the Terrebonne parish bayous on the coast by the forceful push of European settlers in the early 19th century. Even further, when tribes are [denied recognition](#) as official “American Indian” Tribes by the federal government, it jeopardizes them from receiving possible funding or support for their land’s rights and protection. The tribes remain, but their population only continues to drop by the [continued loss of wetlands](#) and hurricane damage to their raised homes along the coast.

At the same time, the segregation of children and society, and the control of jobs and power available for black people has contributed to [modern systematic segregation and racism](#). Black people were [pushed south along the coast](#) in low elevation areas, areas prone to flooding, or near oil and gas industrial operations. Communities of color still face racial discrimination in many forms. In 2020, [Hurricane Laura evacuees](#) were denied shelter for the concern that the mostly black evacuees were “threats” to locals in Lafayette.

Colonialism, native American relocation, slavery, segregation, redlining, discrimination, and resource extraction have built the structural inequalities that keep vulnerable communities at risk along the coast. Fear of yearly storms, their position in society and lack of funds keeps residents in a position of vulnerability that does not allow them to fight for their own justices.

According to White et al., in “[Feeling the pain of my people](#)”, Black Americans shared their concern for modern racial discrimination and its role during Hurricane Katrina and its aftermath. These discoveries are astounding and telling of our nation’s status on social inequality:

Table 1
Perceived Racialization of Hurricane Katrina

	<i>Blacks (%)</i>	<i>Whites (%)</i>	<i>Difference</i>
Government response would be faster if victims were white	70.68	17.88	52.82
Disaster shows that racial inequality remains a major problem	76.16	36.78	39.38

Table 1 adapted from “[Feeling the pain of my people](#)” compares national responses of White and Black Americans when asked if the government would have responded faster to white victims after Hurricane

Katrina and if the disaster was indicative of current racial inequality problems. Of those polled (*all of whom live outside the hurricane-affected areas*), the majority of Black Americans felt that if the [victims of New Orleans](#) were predominately white, the government would have responded faster with aid. I am blown away by the gap in responses between the White and Black Americans, but the gap only makes it more clear that inequality is present in forms of ignorance.

“The horrors experienced by New Orleans residents stemmed not only from the hurricane but also from decisions we have made as a society” - Belkhir & Charlemaine

While many believed that the federal government was slow to respond and unable to understand the needs of the victims in New Orleans, many in the community stepped up. According to [Belkhir & Charlemaine](#), “many ordinary citizens commandeered boats, offered food and shelter, and did whatever else they could to help their neighbors.”

As mentioned previously, the levees weren't in a reliable condition to withstand the impact of Hurricane Katrina. Consequently, the city's [poorest and most vulnerable](#) neighborhoods below sea level experienced intense flooding. Areas were told to evacuate the day before, however, [112,000 of the 500,000](#) living in New Orleans did not have access to a car. Reflecting on how racial coastal formation has led to the relocation of many citizens now living in New Orleans, it seems majorly unjustified to segregate a group of people to an area of land that has risks associated with it. Moreover, consider that a majority of that population does not have the capability to pack a bag in their car and leave when that risk presents itself. As a result, a lot of residents stayed home or [sought shelter at the Louisiana Superdome](#). Those [who were turned away](#) at max capacity started to break into facilities to seek shelter and/or any resources they could find to survive.

“Seeing Black folks criminalized for trying to survive, punished for being poor, left to suffer in plain sight, that shifted something in me” - Freeman, 2025

Racial inequality was portrayed in the media for everyone to witness for themselves. In the events following the devastating hurricane, news outlets who [depicted black New Orleanians](#) described their survival necessities as “looting grocery stores”. In the meantime, similar photos of white New Orleanians seeking resources were [described by the media](#) as “finding bread and soda from a local grocery store”.



A young man after looting a grocery store in New Orleans.

Credit: [The Society Pages](#)



Two residents after finding bread and soda from a local grocery.

Credit: [The Society Pages](#)

Since the history of coastal Louisiana is rooted in social inequality and resource exploitation, I am determined to focus my project on nature based solutions that incorporate community-led programs and local knowledge. Since marginalized groups can have difficulty trusting entities of power, I will seek a partnership with the CRCL, an NGO that is already established within the community to reach locals and understand social injustices firsthand. With that being said, community members who were once victims don't need to hold that title anymore, they can be part of rebuilding their community in a sustainable and ethical way to protect their land and feel safe. Victims who were once worried about where they would have to relocate to can now be equipped with the right tools and be empowered to build up their communities.

Methodology & Reported Studies

Since my case study proposes a green design approach involving black mangrove restoration, my background research began with identifying and analyzing southern Louisiana's native vegetation. Black mangroves, [avicennia germinans](#), appear on the shorelines of Louisiana at their northmost, making their integration within existing Louisiana marshes new territory to be monitored.

Fortunately, the use of mangroves for [storm buffer, sedimentation build up and land loss prevention](#) are more substantial than the common reed, roseau cane, alone. The communities and governments of Louisiana agree; over the last three years, their planting programs consisted of over [16,000 black mangroves](#) along Port Fourchon. A three-phase project of this caliber raised my eyebrows, so I wanted to make note of those who collaborated on this large-scale black mangrove replanting.

The project was completed by the [Ducks Unlimited/ConocoPhillips Louisiana](#) partnership with collaboration efforts from the National Fish and Wildlife Foundation and other Gulf Coast Initiative sponsors. This list of organizations provides a thorough net of groups that provide checks and balances for infrastructure and the ecosystem's health. With the [LA CPRA](#) and [LA Department of Wildlife and Fisheries](#) involved, I can identify that experts were consulted in the decision to plant black mangroves at a scale this large, so there must be data and planning that went into their decision. I have been using the LA [CPRA](#)'s website to view GIS and data from their active stations, so I have identified this organization as a group of credible researchers who actively participate in monitoring coastal trends and fieldwork. Since I have had to research Louisiana's governmental organizations in previous courses, I have gotten familiar with their programs and projects. As a result, I have familiarity with their departments, and I am moved by their efforts and values. I will be aware of this potential bias and ability to sway my opinion.

Although the Port Fourchon planting asked for volunteers to sign up for the labor part of the initiative, I assume that there was no direct communication between the project planners and the community during the mangrove terrace design/planning process. Even though there were great partnerships included in this project, I think that moving forward, our communities need to include local input and feedback before, throughout and well after the project has settled. I think there is still a gap and lack of acknowledgment for Traditional Ecological Knowledge (TEK) and place based knowledge (PBK), especially when nature and the community could thrive from it. While both are important there is a distinction between the two. Those with PBK are usually those familiar with their ecology/community because their heritage, studies or career have kept them in close proximity to their environment. Those with TEK are also familiar with their ecology and community due to their proximity to their environment, however, their ancestral knowledge and traditions have been passed down for generations with possible spiritual meaning attached. It is a step in the right direction that our local NGOs have staff that possess TEK and PBK, but indigenous tribes and local communities need to be consulted and

partnered with before changes to their city are made. Not only does this increase the project's success and enhance environmental stewardship, but it also builds a community around trust, transparency and equality.

Project Metrics

Nevertheless, mangrove replantings have been known to fail in the past. [Large scale replantings are sometimes discouraged](#) to avoid losing money, resources, and consequential environmental damage. As part of my case study, the success of community-planted mangroves can be measured by its criteria compared against unsuccessful replantings and their common mistakes made. Sometimes more harm can be when a planting goes wrong rather than if you just let nature run its course. Smee et al. present that mangroves can alter landscapes, collect sediment and make their habitat suitable for predators to close in on their prey. Additionally, the mature mangrove has the ability to tower over neighboring or lower vegetation like smooth cordgrass or roseau cane, [blocking out vital sunlight](#) for their survival and the species dependent upon them.

Understanding the ecology along the coast is very important when introducing a new species, even as it slowly encroaches in the gulf. Plantings may never appear inherently “bad”, but there’s a reason that we need to keep asking ourselves, “[Who benefits? Who pays?](#)” As Smee et al. presents, the black mangrove may dominate where smooth cordgrass is abundant and alter the flora and fauna as a consequence. However, [Katarina Zimmer](#) brings up an interesting point when we think about the alternatives.

Zimmer agrees that communities and governments prefer to [replant mangroves on mudflats](#), probably similar to what is seen at Port Fourchon at the constructed “terraces”. Mudflats, which are exposed at low tides, are often chosen as the [ideal spot for replantings](#) because they have little competition for vegetation real estate. Of course, this would make our aforementioned cordgrass evasion problem go away, but would this sort of environment be suitable for young mangroves? Zimmer claims, “In a survey by Wodehouse and colleagues of 119 restoration projects in Thailand and the Philippines, about a third took place on mudflats, where only an average of [1.4 percent of plants survived](#).” It is important to note that the *Rhizophora* species was used and the location for the [Wodehouse study](#) was in a different region than this study will take place. Since the only evidence of black mangrove planting has only happened so recently in Louisiana, it is difficult to confirm if the methods used for its location are to be repeated for my case study.

As part of my study, I will need to further my research and discover why the planting wasn't done in an upper intertidal zone. I will be questioning their reasoning by investigating the characteristics of the black mangrove and its possible boundaries. I am hoping to learn more about the black mangrove species once I talk to the staff members at the CRCL and a Louisiana State University (LSU) researcher through interviews.

For the integration of young mangrove trees and recycled oyster reefs, I found Zimmer's concept of “[ecological mangrove restoration](#)” helpful for laying the foundation for my project. Ecological mangrove restoration is a method reserved for [habitats that are degraded](#) or in the case of southern Louisiana's coast, rapidly facing land loss. Zimmer mentions the use of [semipermeable dams in Indonesia](#) where Wetlands International workers built them to restrict sediment flow and gain enough sea floor to grow their mangroves back.



Semipermeable Dams to Restore Mangroves in Northern Java, Indonesia

Credit: [Kuswantoro/Wetlands International](#)

If I were to partner with the CRCL, I would adopt their reef structure which uses [bags or baskets of oyster shells](#), usually lined up to make a wall. Their traditional gabion baskets would make an ideal candidate for a “semipermeable dam” for ecological mangrove restoration since it would allow water to flow through.



CRCL Oyster Shells in Plastic Netting
Credit: Amber George



Oyster Shells in CRCL Wire Material
Credit: Amber George

METHODOLOGY

I have used my knowledge of [failed man-made coastal structures](#) to influence my choice in shoreline structure design. Since studying for my undergraduate degree, I have seen the damage that seawalls, sea dikes, groins, or levees have done, if not at the direct impact of an intense storm, at least over time. I have been influenced by my time in school studying to be an environmental engineer, and upon graduating working as a civil engineer, to use a green design approach- one that mimics and meshes well with its surrounding ecology.

The peer-reviewed academic journals I have identified and experts in the field of ecology I have interviewed provide a good understanding of the black mangrove’s migration pattern, moving north towards the coast of southern Louisiana in the past four decades. The black mangrove’s patterns and behavior among the gulf’s coastal ecosystem supports my case study by providing its potential to live as a harmonious counterpart in a hybrid shoreline structure.

My decision to use recycled oyster shells as the first level of defense in my shoreline defense design was informed by my intention to reduce waste during construction. Everything I have gathered on the collection and deployment of oyster shell reefs has been gathered from the CRCL's [Oyster Shell Recycling Program](#) (OSRP). Their reef's success as a coastal storm buffer is detailed through Coalition interviews and metrics. I found their work compelling because they have created over [8,600 feet of living shoreline](#) with their recycled oyster reefs while fostering amazing relationships with restaurant owners, patrons, and community members as a whole. I value the connections that the CRCL has already made with the locals, and I am eager to learn more about the needs that they have gathered from their [6,000+ engaged volunteers](#).

Method Generation

I spent some time exploring the possible physical design of the hybrid structure. My methods included research on the black mangrove, planting best practices and restoration techniques to propose an ideal location to place the black mangrove in tandem with the oyster shell baskets. I consulted experts with place based knowledge to fulfill this research.

To begin, I contacted coordinators at the CRCL and researchers from LSU's Department of Oceanography & Coastal Sciences. Face to face interviews were an important part of my research because I value information that can be gained through experience and be shared by forming relationships with others. Moreover, by pursuing staff at an NGO and an academic researcher, I had the opportunity to identify experts under my own criteria, not remain limited to the criteria that modernized standards present 'experts' or 'successful people' as. I wanted to set up an interview with each of these organizations within a month to discuss their work and introduce my project. Inspired by some of Karen Roulston's methods for [Considering 'Quality' in Qualitative Interviewing](#), I knew that I wanted to start my interviews by building a genuine rapport and empathic connection. I drafted the following interview questions to prepare.

[Coalition to Restore Coastal Louisiana Interview Questions](#)

[LSU's Department of Oceanography & Coastal Sciences Questions](#)

For my interview with the CRCL, I planned to ask a few questions about their planting & reef programs, their experience with community-based projects, and instances where their community has felt burdened by environmental injustices. Their place based knowledge is valuable for the application of my design and their connection with the community of New Orleans gives my project more perspective. When I interviewed LSU's Department of Oceanography & Coastal Sciences, I was prepared to hear from experts in the field on the black mangrove's behavior specific to southern Louisiana, and I wanted to ask for their perspective on the feasibility of my proposal in this region.

As a result of interviewing these two groups, I intended to discover if the CRCL in New Orleans would consider collaborating with LSU's research near Port Fourchon to build a hybrid defense structure. Since the CRCL's website notes that they are starting to plant mangrove seeds at their headquarter farm, I was curious at this stage if they were considering hybrid projects in the future. I also wondered if they were already partnered with the University and their mangrove research. I asked myself: could the CRCL gain knowledge on how the black mangrove could be integrated within their living shorelines from LSU's existing research? Furthermore, the CRCL's Leeville Living Shoreline lies near the University's black mangrove collection site near Port Fourchon; I anticipated that this location, where the black mangrove is already naturally occurring, could be a great place for the CRCL to build a multi-level defense structure in early stages of implementing a hybrid structure.

Would the combination of two dedicated organizations come together and create an even stronger influence on protecting their coastal community?

I had no trouble reaching out to the lead professor of the Wetland and Aquatic Biogeochemistry Laboratory. He put me in contact with Nico Longergran, a masters student who examines the biogeochemical cycles of the black mangrove ecosystem. We connected for a video interview for 30 minutes. My luck wasn't that great when it came to contacting the CRCL. I slowly found general and coordinator emails through the CRCL website, but I never found luck hearing back from any. Finally, I decided to sign up for one of their upcoming events, a tree planting. Through the sign up page, I was able to contact the event manager, and I immediately found the right people to talk to! I was encouraged by my tenacity to connect with this organization, and I got to meet many staff and volunteers through my time planting trees in the Central Wetlands Unit. Afterwards, I got the chance to connect via video call for a 45 minute interview with Fey Kind, restoration field coordinator for the OSRP.

Present & Missing Voices

The voices from academia were most present in my methodology, and my perspective was extremely active since my personal epistemology serves as a foundation for my green design approach. I was missing some first hand experiences and stories from individuals who fall risk to land loss or losing their homes. The real life stories are what really matter in a project like this, and they are what truly encourage me to pursue a career in green infrastructure design.

I also wanted to remain aware of my potential bias as a student under direct instructions from a university's curriculum. Does our position as students and educators make us more biased to peer-reviewed articles over reviewed and fact checked news sources, or testimonies from primary sources? Does remaining heavily influenced by peer-reviewed articles limit our perspective and bias by missing the perspectives and voices of those who possibly can't afford to attend university or progress their education due to their socioeconomic status?

I wanted to have the chance to empathize with residents of southern Louisiana and their experiences by interviewing them to understand how coastal devastation has impacted them. As I learned through the supporting literature, there were indigenous tribes present along the coast. I identified TEK as a valuable resource for public infrastructure, so I wanted to understand how indigenous communities felt about coastal restoration projects near their villages. The CRCL has built residential community reefs that protect homes along the coast from the risks of land loss. They have been responsible for building at least four of these projects, as I learned from their [project map](#). These projects have been important for protecting residential areas along the coast that risk losing their homes to land loss. Among these communities mainly include indigenous tribes, while those who deploy the reefs include any volunteers willing to help. I planned to learn from the CRCL in how they have been able to work with members of the community well, and it was my hope to experience conversations with community members myself. In a previous course, we were advised to approach community members through a trusted, respected individual in the community when pursuing Community-Based Participatory Research (CBPR). It was my number one goal to treat all who I talked to with respect, so I looked forward to establishing a connection with the CRCL before making any contact with potential community members. Since I had the chance to interview a staff member that coordinated with indigenous tribes, I focused on learning more about how TEK was pursued and respected during their projects.

RESULTS AND DISCUSSION

Mangroves are some of the best trees to plant along the coast to restore weak shorelines, and their structure is tougher than traditional herbaceous marsh plants and they serve as natural carbon sinks. However, their structure at 1-2 years old is not comparable to their adult capability to stand against tropical cyclone waves. The following graphic depicts my proposal of a multi-level shoreline design using recycled oyster shells as the first level of defense to protect young mangroves as they grow to become the second level of defense as mature trees. Using the CRCL's reef structure, metal baskets would be lined up as an oyster reef wall to act as the first line of defense against ocean waves. Simultaneously, the oyster reef wall will serve as a semipermeable dam to protect young growing mangrove from strong waves and allow low levels of water to flow through.



Proposed Hybrid Shoreline Graphic

Graphic Credit: Amber George, Created with Canva by layering elements

A large percentage of mangrove plantings have failed across the world, however the black mangrove is unique. As temperatures warm, the gulf has made way for a truly tough mangrove that has the ability to absorb a larger quantity of salt than its relatives. Additionally, the black mangrove has pneumatophores, which are characteristically unique to its anatomy. These vertical roots can grow up to 18 inches tall and allow for the mangrove to breathe in oxygen even during flooded conditions. After reading more about how robust black mangroves are and Port Fourchon's lack of tidal range, it became clear why the Ducks Unlimited/ConocoPhillips Louisiana plantings were done on terraces at that location.



Salt Excretion
Credit: [Ulf Mehlig](#)



Pneumatophore Roots
Credit: [Christopher Gonzalez](#)

However, from my conversations with staff members of the CRCL, I am not confident in the federal or state regulations required for monitoring planting success rates. Since plantings are only monitored for five years, it's difficult to conclude if mass plantings for black mangroves in the United States should be replicated at the current rate without any other levels of defense.

Hybrid Structure Proposal

The ecological feasibility of community-planted mangroves can be measured by its criteria compared against unsuccessful plantings and their common mistakes made.

According to [Zimmer](#), common replanting mistakes or failures result from the following:

- Wrong location,
- Incorrect species chosen,
- *Not enough maturity reached in a nursery prior to planting,*
- *Intense storm damage,*
- *Lack of monitoring, no accountability or care.*

The final three common events lead to planting failures that could be avoided by adding an additional level of shoreline protection.

Mangrove Background - LSU Researchers

My conversations with Professor Ken Rivers and his team within the Department of Oceanography & Coastal Sciences, are used as a reference of expertise on the black mangrove. Professor Rivers' team of researchers have been making note of the black mangrove's encroachment into salt marshes along the coast as it travels north in the Gulf of Mexico. A summary of their work can be found on the following site entitled: [The March of The Mangroves](#). Since the team of researchers have place based knowledge of the species in coastal Louisiana, I asked for their experience with mangrove restoration to support my design.

I originally sent an email to Professor Ken Rivers, the head of the Wetland and Aquatic Biogeochemistry Lab, expressing my interest in interviewing him or anyone on his team. He responded with eager interest to help me and cc'd his student researcher who specialized in black mangroves. I found this extremely generous. I had the opportunity to interview Nicholas Lonergan, a M.S. student and member of the Wetland and Aquatic Biogeochemistry Lab at LSU.¹ As a researcher under Dr. Rivers, Lonergan's graduate research focuses on black mangrove growth in dredge sediment and monitors their biogeochemical cycles in southern Louisiana.

Place Based Knowledge

My interview started with questions to get to know Nico and his passion for this research. Like I had anticipated, we became two students passionately talking about our individual projects, yet uniquely where they intersect. I found the quality of information much more valuable from our 30 minute conversation than I was able to learn in my research from articles, journals and simple internet searches during my time learning about black mangrove & coastal restoration. During my conversation with Nico, he organically mentioned that the black mangrove has migrated over to southern Louisiana in the last 40 years. Subtle facts like these were ones that I couldn't find through my times researching the black mangrove, and if found, they were different on every source.

I had made a note while conducting research that during a search of the black mangrove, *Avicennia germinans*, top articles display contracting facts about the mangrove's height. Here are the top three examples that I pulled:

- The [USDA plant guide](#) claims that the black mangrove height will vary from 4 to 9 feet.
- Professors and scientists of the School of Forest, Fisheries, and Geomatics Sciences of The [Institute of Food and Agricultural Sciences](#) claim that black mangroves can reach heights of 40 to 50 feet.
- The [San Diego Natural History Museum's field guide](#) claims that the black mangrove can grow up to 24 feet high.

The species name of the black mangrove was the same on each of these sources, the *Avicennia germinans*, and the same regions, *along the Pacific and Gulf in the Americas*, were described for where they can be found. I mention these details because they were details I thought to check when I first noticed the disparities.

I was inspired by the power of place based knowledge and the transfer of knowledge that the internet simply only reaches limits of. Later on in the interview, I thanked Nico for his willingness to share his research and expressed my amazement for the type of information that wasn't readily available or contradicting depending on the website. I exclaimed, "online can only get you so far. Like searching for the black mangrove- Everything I found on it, the height - like you said - was different on every single listing. Now just talking to you, you casually said they've been migrating for 40 years, and I couldn't find that anywhere!" I continued to express how I often found myself running in search engine circles just to find myself with the mangrove height facts bulleted above.

During the second half of the interview with Lonergan, I became aware that I had the amazing opportunity to "peer review" my work, in a sense, through conversation with someone from a different university. I began to feel inspired by [Karen Roulston's](#) *transformative conception* of interviewing. While hours apart, we still had the capacity to meet in ways such as this, a virtual interview between students, to pick each other's brains until we've come up with innovative solutions.

I spent some time sharing my proposal with Nico and then gave him the chance to respond to my question, “do you think this design is feasible in southern Louisiana?”

Nico: “I think it's a good idea, I think oyster reefs are one of the best ideas to come out of this restoration stuff because it is so weirdly practical, especially living in Louisiana, we eat so many oysters”

“if [mangroves] are super young, and not into the substrate as much as they should be, a hurricane is gonna mess with them. I think this is where using oyster reefs can really come in to attenuate the waves, and I think that is super helpful.”

“Where my work is, they are pretty well established areas, but like these terraces these new spots where they do mangroves, they're really not well established so far. It's pretty much open water. It's just really shallow, so they're able to do it. Honestly yea, I think oyster reef pairing with that is a pretty good idea.”

I was thrilled to receive feedback from Lonergan since his position reflects an understanding of the black mangrove species and how their habitat behaves in coastal Louisiana. It was also insightful that he mentioned how the new terraces built for young mangrove plantings could benefit from this multi-level design approach. I wondered why Ducks Unlimited/ConocoPhillips Louisiana had chosen to plant so many young mangroves out in the open on this kind of terrain. However, Nico mentioned that this area didn't experience a tidal range, so it makes sense why they didn't plant the mangroves in the intertidal zone, it doesn't exist. While a tidal range isn't present, hurricanes are their greatest threat. I would propose an additional level of protection, an oyster shell reef, to support the young mangroves against storm damage as they mature and root into the built terraces.

Coalition To Restore Coastal Louisiana

While hours away from the coast of Louisiana, I planned to visit the Coalition to Restore Coastal Louisiana (CRCL)'s restoration quarters. Their oyster reef work was an inspiration for my project's semipermeable dam design in ecological mangrove restoration (EMR).

As I mentioned previously in my methodology, I struggled to contact the CRCL, but I didn't give up and found the right people to talk to by volunteering for one of their events. Through additional conversations with Judy, the Coastal Programming Senior Coordinator, I got to tell her about my project proposal. Since my project took inspiration from their recycled oyster reefs, she invited me to come to their restoration headquarters after the tree planting event to see their oyster shell operations. I was incredibly grateful for their correspondence, their willingness to interview me, and the invitation to their facilities while I visited. I think that I learned something valuable from this experience because I allowed myself to become part of this community only by putting my agenda aside and being willing to serve. I had to take a step back and realize that this is the foundation of my entire project. If I want to be a civil servant and explore sustainable and ethical coastal infrastructure, I should be willing to serve in the communities I want to help! Participation before intervention is a powerful theme I want to highlight in my project, and this experience made me reflect on my initial concern for volunteer based plantings. It was a worry of mine that agencies or firms would initiate projects before engaging with the community. However, for my proposal, partnerships, feedback and participation are integral.

Place Based Knowledge

Place based knowledge was extremely important in my findings. During my visit to New Orleans, I volunteered with the CRCL to replant bald cypress in their [Bayou Bienvenue Central Wetland Unit](#).

This experience was incredibly valuable to my studies, providing me with knowledge and access to experts in proximity to their area of study.

Our team of 15 volunteers planted roughly 300 trees in a marshy swamp. After one of the volunteers asked, we were told by the staff that the survival rate of the trees planted was between 70-80%. I found it interesting that these metrics were based on 10% of trees marked during the planting that day and 10% of the trees planted on any other given planting day. Additionally, trees were just monitored after two years. Anything after that was not regulated or funded, so there is no way to know the official replanting success data. This fact was a little disheartening, however I was encouraged by the amount of trees that have been planted in the last three years at this location. Even though the CRCL will not have concrete data on replanting success, the bayou is large and abundant with alligators and small critters excited to get their ecosystem back. The location itself is viewable from a large levee, so progress from the eye is easy enough to witness if the CRCL, you or I wanted to stop by in 10 years.



Planting Supplies
Credit: Amber George



Planted Bald Cypress Tree
Credit: Amber George

The entire volunteer event gave me insight to how my project could promote community engagement and execution which was the social feasibility aspect of my case study. The CRCL staff provided all of the tools, demonstrated a tutorial on how to plant a tree with their supplies, then sent us off in pairs to get the job done. Their methods were effective and built on trust, empowering the volunteer to feel competent and confident in ecological restoration work.

A couple of my interview questions were: what makes a volunteer qualified? What does the sign up process look like? Those questions were answered when I volunteered and showed up; the volunteer looked like me and those to my left and right: ordinary people with unique backgrounds, not necessarily in the environmental field. The sign up process basically came down to searching up CRCL volunteer opportunities, clicking an event on a date that I was available, filling in my basic information, and

showing up. Yet, after a simple tutorial and the right tools, people who were just willing to show up were able to complete a complex restoration project: planting 1-2 year old bald cypress trees, wrapping them with a plastic nutria guard, and securing them with a rod of bamboo and zip ties. Even when a pair of volunteers was spotted to be following instructions incorrectly, the staff was quick to assign someone to guide the group with a few trees until they could adjust their mistakes.

I even found this delegation effective in its execution: “Could I get a staff member to help Paul and Jacob with a couple of their trees? They're trying a creative approach that might need some adjustments.” I even heard another volunteer member say, “That’s a nice way of putting it.” under their breath. My partner even noted that the CRCL staff could have probably gotten the planting done in a couple of hours, but that wasn’t the point. They noticed that providing the community with the right tools to participate in restoration together was the important part of these events.

I also had an eye opening time working alongside these community members and learning about their stories. Trevor, a local from New Orleans who volunteers with the CRCL regularly, shared the experience of seeing his own home on TV during Hurricane Katrina. Judy, the CRCL program coordinator, shared that the events of Hurricane Katrina shaped her career more than she would have thought possible when her family had to leave the state back in 2005. I was inspired to see these members of the community now holding the power and influence in their hands to build back the ecosystems that were destroyed during the storms they reflected on. It was not lost on me that the neighborhoods closest to the levees around town were those in poverty, with a few streets separating them from more affluent communities. I was saddened by the quick shifts in infrastructure closest to the areas largely at risk of flooding. However, the power to make these areas strong again lies in the hands of community members when they volunteer in these events and have the opportunity to rebuild the coastline.

As I visited the CRCL headquarters and received a tour of their facilities, I continued to ask the staff all of the questions that I could think of. One of the staff members showed me their baby mangrove nursery and expressed their excitement for this new development. Since we were on the topic, I asked if they ever did plantings on the coast. They shared that they used to but are mainly focusing on restoring the central wetlands right now. One of the staff members offhandedly said, “Aren’t you doing your research on mangroves and oysters? You should come to our first planting event in the spring where we plant mangroves behind our oyster reefs!” I found this exchange quite humorous because there was no way for me to have discovered this evolution in their organization unless I was standing right there and asking the right questions. I jokingly said, “Well I guess I don’t have to ask if you think my proposal is a good idea.” I continued to explain what my case study proposed, and how I valued community participation as much as they did. We sat there on park benches outside of their facility as I talked to five staff members about my passion to create a blueprint for coastal restoration along the east coast.



Mangrove Nursery
Credit: Amber George



CRCL Headquarters
Credit: Amber George

We discussed how volunteer events have their downfalls, how federal funding can sometimes be unreliable, and how the coast and its ecosystem varies along the east coast. One of the staff members even encouraged me to look into the [Billion Oyster Project](#) which uses recycled oyster shells to restore the New York Harbor from storm damage. I was further inspired by my hybrid coastal infrastructure proposal since discarded oyster shells were abundant and effective as shoreline defense in New York as well. Like Nico mentioned in our interview, many east coast towns are shell food enthusiasts, so I am encouraged by the potential of oyster shell use in coastal infrastructure and their pairing with tree restoration.

When I finally had the chance to interview a staff member of the CRCL, I knew that I needed to learn more about their experience working with indigenous residents and volunteers. Leading up to the interview, I studied a phenomenon described as “racial coastal formation”, the forceful push of racial groups to the edge of the shoreline by European settlers in the early 19th century. As if the forceful push itself wasn’t a great enough threat, groups were left to survive along the coastline exposed to a greater risk of environmental damage and land loss. During my interview with Fey Kind, the CRCL’s Oyster Shell Recycling Program (OSRP) Coordinator, I asked if any of their tribal partners ever express experience with environmental or social injustice.

“In our partnership builds with indigenous tribes, the tribes identify sacred locations that they want to protect and then we deploy our oyster reef bags along these locations to protect what's important to them. The tribal leader shared with us how generations before him were not used to living this close to the shoreline. They would visit these lands seasonally to steward the mounds and fish, but it was never supposed to sustain their homes full time. He shared that settlers forced their tribe to move closer and closer south, and now they are facing the consequences as sea level rises and land loss continues.” - OSRP Coordinator

I didn't realize that the CRCL coordinator would share an anecdote from her experience with their tribal partners that resembled "racial coastal formation". Moreover, it was insightful to learn that indigenous communities were always familiar with shoreline stewardship, but never intended to make it their permanent dwelling place. I also found it compelling that I received this context from my interviewee, when I didn't necessarily bring up racial coastal formation in any context. Her story was genuine, real and relevant to my research study in its revelation. Her experience confirmed the supporting literature I came across in my studies, but also provided additional context and gave voice to why tribes in Louisiana specifically struggle to live on disappearing land. During our interview, I also had the chance to mention that the CRCL's Leeville Living Shoreline lies near LSU's black mangrove site near Port Fourchon. I asked if they were already partnered with LSU and Fey responded that they were not. I shared that I anticipated this location, where black mangroves naturally occur, as a great place for the CRCL to build one of its multi-level defense structures during its early stages of implementation. Fey was surprised by the connections the black mangrove already had to their living shoreline, and she was interested in the potential for a hybrid project in the future.

While I was looking to the CRCL to adopt oyster shell reefs as a second line of defense for coastal infrastructure, I also looked to their community-led projects as an inspiration for my community-led hybrid design. I found the use of volunteers would be feasible in the production of a hybrid shoreline structure, while the structure itself is supported. Instead of acting as a typical civil engineer who imposes infrastructure on a community, I propose a type of project that could be built by Nico, Judy, Fey, you and me.

SUMMARY

My study explored place based knowledge to connect with experts in southern Louisiana and discover more on local ecology. Nico Lonergon, an LSU researcher, and the CRCL team supported my proposal for a hybrid coastal design through the interviews I conducted with each. In seeking to determine if my design would support coastline resiliency, I learned that the CRCL plans to deploy their first oyster reef in tandem with a young mangrove planting this spring. Since the CRCL has planned to use this approach, I view my design as feasible. I have been partnering with their outreach coordinator to include my infographic on their social media platforms to promote the event. Since I didn't discover that the CRCL was planning to do a 'multiple lines of defense' project until I talked to them personally, this is a great opportunity to educate the public on the great things that they are doing and have planned. Participating in volunteer-based work before intervening gave me the unique opportunity to engage with communities and serve the city. I learned that volunteer-led projects are feasible when volunteers are given the right tools and encouragement to feel competent in restoration work. While my study explored oyster reef and mangrove seedling design as a "hybrid" structure, the CRCL talked about this kind of approach as a "multiple lines of defense strategy". I love the subtle differences in our language, since I subconsciously decided that the reef and the mangroves were different - thereby hybrid and almost separate. I found it profound to discover that all along the reef and seedlings can also just be viewed as levels; their differences and multitudes make them stronger, intertwined in their layers.

COALITION TO RESTORE
COASTAL LOUISIANA

MANGROVE & OYSTER SHORELINE BUILD



Recycled Oyster
Shell Reef



Planted Young
Mangrove

CLIMATE DISASTERS

SEA LEVEL RISE

LAND LOSS



**JOIN US FOR THIS
VOLUNTEER EVENT!
MAY 20, 2026**

Shoreline Build Promotion Poster for the CRCL
Graphic Credit: Amber George, Created with Canva by layering elements

1. The interviewee was asked for their consent to be interviewed and recorded for the use of my MESH case study. This included specific permission to use the interview in my assignments for ESH 540's classroom audience. When given the opportunity to use their name, use an alias, or remain anonymous, the interviewee chose to remain mentioned by their name.
2. All member and volunteer names associated with the CRCL have been changed to protect their privacy and anonymity.

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Cultivating Eco-Consciousness Through Teacher Dialogue

How can dialogue with and among teachers help to find ways to engage young students in critically conscious actions around environmental issues?

By: Pooja Dissanayake

Professor: Willy Oppenheim

MESH Magazine - Master of Engineering, Sustainability, and Health - University of San Diego

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Abstract -

Environmental consciousness is not enough of a priority in our societies. There's a lot of hope and possibility in encouraging the youngest members of society to be environmentally conscious. My project sought to understand how dialogue with and among teachers can help to find ways to engage young students in critically conscious actions around environmental issues. I conducted dialogue based interviews with five different teachers, in person and remotely and also observed in a few different classroom settings. According to the teachers with whom I spoke, not only are children interested in environmental issues, but the teachers are eager to teach about them. I found that there is hope in dialogue, and this is important because I believe children are the future to leave this world better for the next generation.



On the left : My Montessori school picture in Sri Lanka, 2003; on the right: My mother in her Montessori classroom in California, 2008, used with permission.

Introduction - When I was a child I attended Montessori school in Sri Lanka and while my mother also studied to be a Montessori teacher. When we moved to the U.S, I often spent time in my mom's Montessori classroom and volunteered there after school. For example, the amount of trash I witnessed on a recent trip to a national monument hike in Sri Lanka was an unbearable sight to see. I quickly compared this to the amount of respect I have seen hikers have for our earth each time I visit a National Park in the U.S. Environmental awareness seems to be an ongoing conversation in science class but I feel like if it was deemed as an important topic in all subjects in school, it can have a stronger impact on students. This sparked my interest in diving in a little deeper to open up a dialogue space among teachers, and gain their opinions about environmental consciousness in ties to the children in their classrooms .

The main reason why this topic is interesting to me is because of the trash management problem in Sri Lanka. For example, this has been a problem for many years - especially when the world over produces and over consumes. This topic will start with interviewing my mother, who has been a Montessori teacher for over 20 years and got her credentials in Sri Lanka to become a

teacher here in the U.S. The main reason I care about this topic is to create a conversation about change, to create a foundation that can become easy for children to implement in their daily lives. Many adults are faced with numerous responsibilities packed into their lives, which may result in not having enough time to make small changes in their daily lives. This lens could be shifted towards children. With my background in Child Development, I have come across some ideas why I believe teaching kids how to be more environmentally aware could have a positive impact. In the beginning of the MESH program, my topic focused on waste management but more importantly for my capstone project I wanted to specifically address and keep the conversation going among teachers about encouraging their students to be more environmentally aware. My research question is: *How can dialogue with and among teachers help to find ways to engage young students in critically conscious actions around environmental issues?*

The main reason why this topic is interesting to me is because of the trash management problem in Sri Lanka. Even as a country, if you work hard to keep your beautiful island clean, there is the big apparent issue of environmental injustice, “who pays and who benefits?”. In the article Sri Lanka to the U.K.: Here’s your waste back. And there’s more to come, the author Malaka Rodrigo points out Sri Lanka’s active stance in social injustice, “Sri Lanka has sent back the first batch of hundreds of containers of waste to the U.K., becoming the latest nation in the Global South to push back against abuses of a worldwide recycling framework by exporters in the West” Rodrigo et al, 2020.

When my MESH mentor suggested integrating my BA in Child Development was a choice I had with my final project, I immediately thought of my mom. Everything I know about kids and the love I have for them was because of her. My relationship with my mom was not so strong growing up. But over the years, the closer I was to ending my 20s, it had become easier to understand her. We really connected with the building of this project, whether it was going out to interview or asking her about her personal life and why she got into teaching; I truly saw a part of her I never knew existed. The main reason I chose to interview my mother as the first individual was because of her experience in education.

Since I know I had enough professional and personal experience with kids, enough to study them a little further, integrating them into the world of being sustainably aware; I thought this was a great idea. In the beginning my idea was to interview Sri Lankan primary school teachers. But I further thought about the goal of my project- to start a dialogue that teachers and students no matter where they are in the world can benefit from. I hope to contribute to the action of hope that is not a reality people have to accept in their own country just because they see it everyday. I believe children are our hope for the future and as curious as their minds are; enough to see there are options on the right path and hopefully when time comes, they can influence their own children. I believe when a concept is being introduced to children in classrooms, we are not forcing an idea, but simply introducing certain types of values and a route towards a better

future. This time I have decided to dive into something I can make an impact in, and hopefully influence young minds to be more environmentally conscious.

Literature Review:

Here I explore the literature on how environmental consciousness and social change may be embedded in early education experiences with young children. As a Sri Lankan American living in the U.S with a bachelor's degree in Child Development and having a Montessori teacher as my mom, I wanted to explore the side of early childhood education that can create initiatives in sustainability awareness. Looking up further research on what truly influences children to act toward sustainable actions, I came across a paper where researchers conducted a study of 760 Swedish students and concluded it is possible to know that ESD (Education for Sustainable Development), has a direct correlation with this type of teaching in school. This type of result is not something that can be done overnight and can take several years. Olsson's paper also highlights the need for longitudinal research in this particular field ([Olsson et al, 2022](#)). A teacher (Kathleen McLean) at Great Falls Public School comments on how she exposes her students to our planet's current issues, "I am inspired by their creativity and persistence in finding solutions" ([Aada, 2024](#)). This teacher-student experience can be tied back to when I interviewed my two teacher friends and one teacher stated how upset her 2nd grade classroom was when they found out how much danger we are in as a planet. And even more upset that when they found out that there is no solution to fix everything at this moment. Education has tremendous value and promise to motivate students and the society around us and most importantly understand the 'delicate balance' between human actions and environmental health ([HawkWatch International, 2025](#)). Studies have shown the education system has an important influence in changing a child's concept of reality, higher income and a better understanding of who they are in the world ([Milligan et al, 2025](#)). If researchers have found that for every year of schooling for a child, contributes to the country's GDP every year by .037 cents, I believe the same type of mindset can be achieved when it comes to influencing a child to make better choices in their everyday life, which will also have a great effect in their adult life. The U.N made a strong statement stating how vital education is when it comes to understanding the SDGs, "Education is the key that will allow many other sustainable Development Goals (SDGs) to be achieved" (in [Milligan et al, 2025](#)).

Comparing the two studies above, another study researchers have noticed is that after discussing this with teachers in groups, they have concluded that teachers have suggested to influence kids on environmental health that needs to fit into their already established curriculum. And one place where researchers think this topic might do well is in after school activities - led by teachers who are already excited about this topic. This can also create the space where students and teachers can be more creative outside the classroom without sticking to a set curriculum ([Keselman et al, 2011](#)). Not only can sustainability be embedded in after school programs but also in science classes throughout the year, learning about the health of our planet, "By integrating sustainability

into the curriculum, students gain not only theoretical knowledge but also develop a holistic understanding of their role in preserving the environment” ([Aada, 2024](#)). Students who are exposed to this, with this type of sustainability learning in their curricula, students become Eco-literate. This means they know exactly what their role is and what skills are needed in protecting the planet ([Aada, 2024](#)).

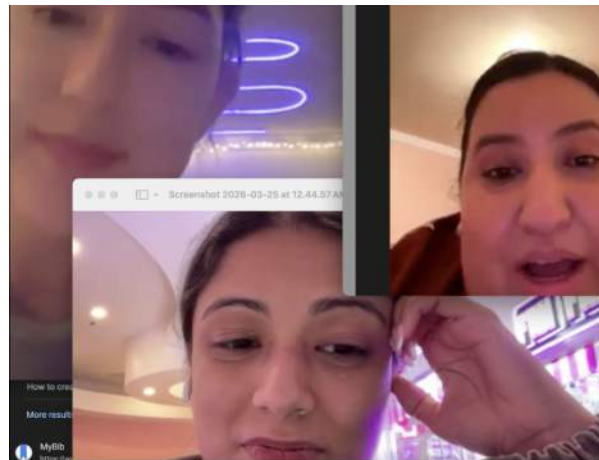
Being environmentally conscious is becoming acknowledged worldwide but is often not taught in school. It appears learning about our planet is not something that becomes apparent unless we are exposed to it outside of school ([Keselman et al, 2013](#)). The reason why I see education as something so valuable is because of the country I am from. In Sri Lanka the education system is very competitive and highly respected ([Amarathunga et al, 2024](#)). The danger I see in a country valuing education so highly (like many countries in Asia), is the possibility of ‘more important things’ like vital components of environmental literacy being ignored, “Modern education systems and international development have predominantly focused on access to education, literacy, and numeracy skills in relation to economic development, neglecting ecocentrism and a focus on holistic well-being for every child” (Ehrenzeller, 2023 & Patel, 2023). Even with the many environmental health problems that Sri Lanka experiences, environmental concerns are not considered rigorous enough to be taught in schools, because the subjects that will earn money are prioritized ([Kandangama, 2018](#)). But the problem is not the teachers. As a result of not having the correct resources to teach environmental awareness outside science classes, educators have been obligated to take matters into their own hands, “ A survey by University College London, UCL19 discovered that teachers in Great Britain — not just those teaching geography and science — would like to include climate change in their classes. But of those who had started doing this, 70.5% of them had been forced to train themselves on the subject rather than receive formal training” ([Coon et al, 2024](#)). While we have seen education initiatives such as celebrating earth week to try and get children thinking about the well-being of our planet , these actions might not solve all our environmental problems but hopefully it might encourage young students to think about the impact they made ([Boss, 2016](#)). Unfortunately there have been only a few studies about how teachers’ dialogue influences a path towards long term pro environmental behavior ([Portus et al, 2022](#)).

One study has also shown compassion is a vital characteristic to make more sustainable driven decisions ([O’Sullivan et al, 2025](#)). Using my own observation while my mom used to be a Montessori teacher - I have witnessed the Montessori method relies heavily on being compassionate to one another, inside and outside the classroom. One study surrounding a collaborative river conservation program in Indonesia drew attention to the importance of education - based community development; the program took place 2024-2025, and included over 100 students, who planted 500 Kirai trees by the riverbanks and participated in activities along the bank that cleared over 1.2 tons of recyclable waste ([Heriyati et al, 2025](#)). This type of student involvement increases one’s environmental literacy, compassion for their planet, opens

communications among peers and lastly awareness. I feel that children as the youngest members of society have a lot of possibility to create change. Research demonstrates that education has a big contribution that can also have a significant impact on economic growth ([Özbay & Duyar, 2022](#)). Studies have also shown that when teachers introduce children to activities involving environmental problems and exposing them to nature they are more thoughtful to the environment and show environmental self-awareness ([McClain & Vandermaas-Peeler et al, 2016](#)).

Dialogue is a vital element for teachers to come together and create holistic lesson plans involving culturally relevant curricula that also engage environmental issues in approachable ways ([Chiles et al, 2023](#)). There is a danger of introducing climate change in a way that may scare children when talked about ([Kamenetz, 2023](#)). Students, especially young children can take this in a way that can stress them out and make them see no long term solution, which can lead to disengagement ([Helm et al, 2025](#)). We might think children do not know the negative effects of climate change, but they are very aware ([Melson, 2015](#)). To describe the types of consequences that come with feelings of anger due to solutions to environmental issues not coming quickly enough the term eco-anxiety has been used. There have been multiple studies on adult experiences with eco-anxiety but little has been done on how children feel and their experiences with eco-anxiety ([Leger-Goodes et al, 2022](#)).

Methodology:



Picture of the zoom interview with two teachers

Since my research paper focuses on the dialogue among teachers, I decided to implement CBPR (Community Based Participatory Research) in my capstone paper. I interviewed people individually, organized a small group interview, and observed a classroom. All of these encounters are critical opportunities to include vital material. I introduced Polyvocality within my project which included a diverse range of voices. A way I used Polyvocality is grabbing direct quotations of teachers and including their individual experiences. I believe this will add a

unique type of evidence my research paper will benefit from. First, I wanted to interview my mother and her collective thoughts about why she got into teaching and what differences she has seen between the education here in the U.S and Sri Lanka when it came to children being environmentally aware. This gave her the chance to explain the ways her students in the classroom were engaged/exposed to being environmentally conscious at a very young age.

Secondly, I organized a zoom meeting between my two teacher friends (Jessica) , a 5th grade teacher and (Christine), a 2nd grade teacher. This zoom experience went very smoothly. I reached out to them individually and organized a date and time. One thing I was looking forward to in this zoom is my two friends both processing the same profession and teaching similar ages . In the beginning of the interview I asked them if it was okay if I recorded our meeting, and they both gave me their consent. I started to ask my list of questions, and they both took their turns answering. I was glad a lot of their answers were very similar because this made it effortless for them to bounce off each other's thoughts and ideas. Even though I had a lot of questions written down to ask, it seemed like we were racing through the interview and I only wished that the conversation flowed more organically. But on the brighter side, I was able to gain a lot of insight on what a group of older children thought about the crisis we are in as a planet. Both teachers were able to give me their own thoughts and stories about how the kids in their classrooms reacted to the topic of climate change. They also told me this allowed them to give them suggestions on how to be more environmentally conscious even at home. Lastly, one part of the zoom I appreciated the most is where they made it a priority to make me understand that they too think teaching environmental health in the classroom regularly was important to them, and they see a great benefit in their students learning about it. I left the zoom fortunate because I was able to connect with two of my friends and we got to talk about something that I hold great value in.

There was a time during the process of wiring my capstone paper, where I solely wanted to focus only on my mother and her stories. But I chose to include others in the process. Besides my mother, I had realized I was familiar with a few day care teachers that were friends with my mother. This get together was hosted at one of the teacher's houses, where she also ran her day care. Right when you enter the house, your eyes are drawn to the baby cribs and the colorful fish stickies pasted on the wall. I was the first one to sit down as I waited for my mother's two friends and my mother to come join me. The moment they all sat down, there never was an awkward moment. It was as if we just sat down to talk about our day and rewind. One of my mothers friends was very nervous, she was worried if she didn't get the chance to answer my questions in the perfect way, so I reassured her that there was no perfect answer, and just to be herself. She started to answer my first question I asked the group. And I realized the more she spoke, she became more and more comfortable. She had gotten so comfortable to the point another teacher told her jokingly, " Hey! Save some of the answers for us to answer. You're saying everything! Haha". The whole room bursted in laughter. Echoing through the walls and the different corners of the house. Throughout the interview they all took turns answering all of my questions. They

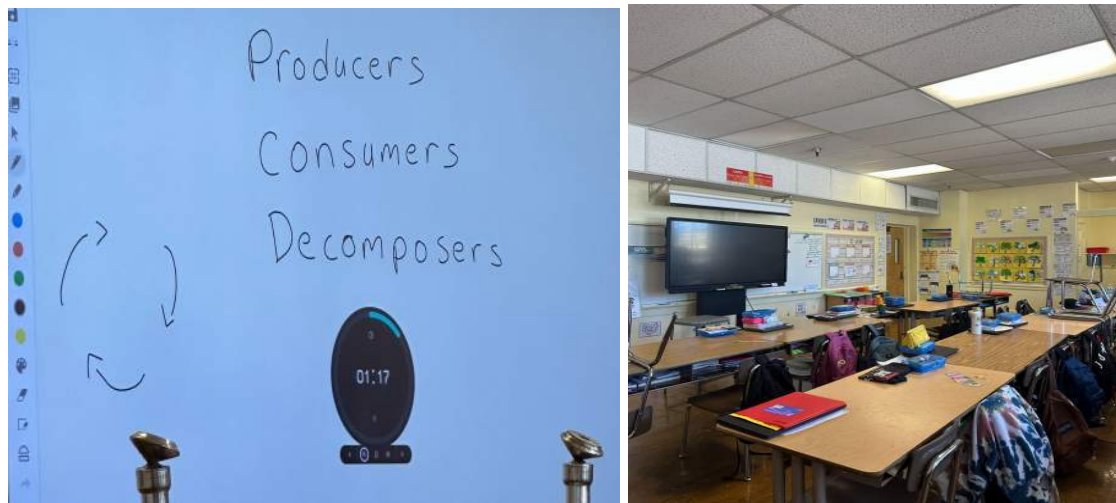
were giving me so much content that I sometimes forgot to look down at my list of questions, and when I did happen to look, I realized most of these questions had already been answered. Comparing the zoom interview I had with my two teacher friends, this group interview felt a lot more different. It felt as if we were all a family just having a conversation. I appreciated this meeting a lot because I was not only creating the type of dialogue I wanted among teachers but also because I had the chance to bring my mother into the dialogue.



Pictures of a day care center in a home

I finally ended my research activities by asking one of my teacher friends if I could observe her classroom. The reasoning behind this was because I wanted to see how young children retained information, what made them excited and what kept their attention. She had given me a schedule of what time they went to break and lunch. I arrived at the school right before lunch ended and entered the office to sign in my name. My friend met me in the office and took me to her classroom. On the way there she wanted to stop at the copy room so she could print out the handouts for her next subject to teach (Science). While she was copying her papers, she was telling me all the ways the school does to reduce paper. I appreciated her enthusiasm to give me as much information as she can to help me with my paper. We later entered the classroom and she told me I could sit on a U shaped desk that was against the left side of the classroom. This gave me a full view of the classroom, students and what she was about to teach. The subject was on Producers, Consumer and Decomposers. The students had just come back from lunch and finished their 1 week of spring break, so their energy levels were not the greatest. But they were still very much interested in what was being taught and also answering any questions the teacher had. After the session ended, I let my friend know I would be heading out and that I was so lucky

I came during this type of lesson. I left excited because now I had various things to include in my paper.

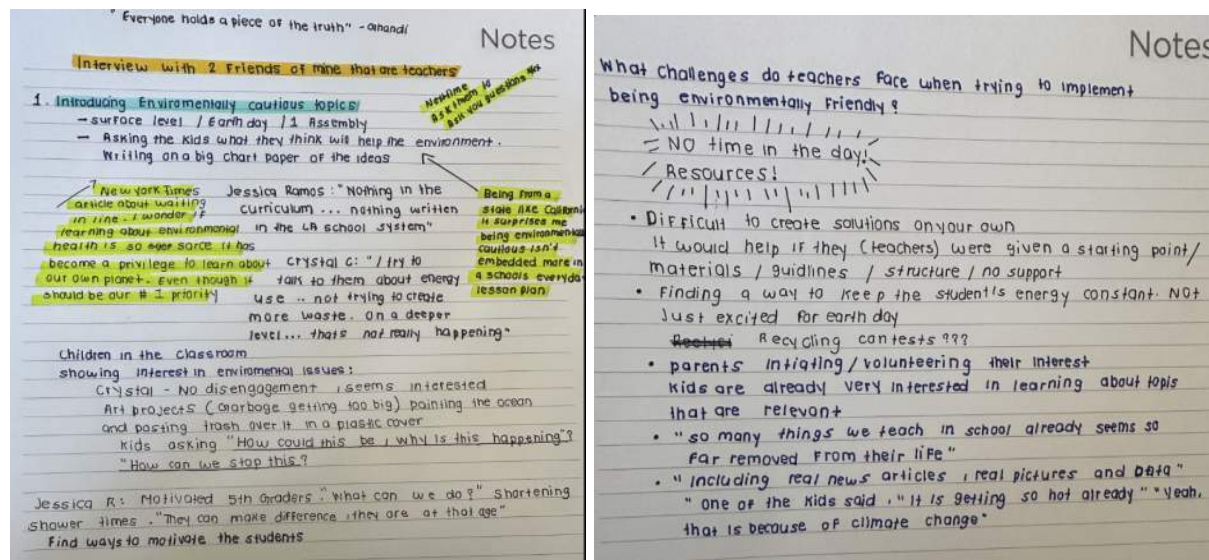


Pictures from a 5th grade classroom + lesson plan for the topic of science

Results and Discussion :

My goal in collecting these types of material was to create an open dialogue with teachers about implementing the practices of environmental consciousness to inspire kids in a classroom setting. My research question does not directly force an implementation of action towards change but creates a space where a conversation can be directed with the teachers itself. This highlights the impact of their influence over important issues. Whether it is implemented in a lesson plan for the day or extra credit activity at home, how children will respond will be known by their educators. If we can find a way to help students who will be adults not too far from now, I think that we can make a big difference. A friend of mine who happened to be a teacher, recently asked what I was studying for my masters. After I told what my capstone project was about, she proceeded to ask me what she can do as a teacher to enforce being environmentally aware in her classroom. I was not expecting this question so it did take me a while to answer, I later proceeded to ask her if her school had a community garden, and how it would be a good idea for each student to plant something easy and fun where they can see it grow throughout the school year. And what better way to do this than to have young kids take care of something they will tend to and watch it grow. This can open up many opportunities for them to learn about organic products, composting, creativity, hobbies, and the concept of not wasting food. While I was explaining this to her, I caught myself realizing that if we want a group of young individuals to be Eco - literate, we have to as educators and researchers find ways where we can also take part in it. I do realize after she asked me that question, I should have not given her solutions right away but as a researcher I needed to form a discussion where I asked what more as an educator she thinks are some other ideas to implement in the classroom.

I met two of my teacher friends over zoom and had a dialogue about the ways their students engaged in environmental activities, what their emotions were and what they were already doing to help the students be environmentally conscious. The topic of taking care of our planet should be an effortless conversation, but it is not something being prioritized in schools, “Many schools do not have the financial resources and other supports to develop enduring environmentally focused programs, or to consistently provide learning experiences outside of the classroom” ([California Department of Education, 2015](#)). This comment can be related back to the zoom I conducted with the two teachers (Jessica & Christine). Chrstine (2nd grade teacher) comments on how her students have reacted to the topic of environmental health. She continues to explain from her experience the education school system is just not implementing the importance of environmental health as a vital school learning requirement all throughout the year. She then went on to comment on her students, “ It's not that they are not interested, it is just there is no time or space in the lesson plan to implement it deeply enough”. From the beginning these educators we rely on are not given the right materials and solutions, and this does not include strenuously participating in earth week. In a NPR article, *Most Teachers Don't Teach Climate Change; 4 In 5 Parents Wish They Did*, the author Anya Kamenetz goes into saying the percentage of parents that want their children to learn about climate change is greater than 80% and even a bigger percentage of teachers (86%) that agree (Kamenetz, 2019).



Notes I took down during my Zoom meeting with two teachers, Christine a 2nd grade teacher & Jessica a 5th grade teacher

When I interviewed the three day care teachers, one of them being my mother. I noticed from our 1 hour long interview discussion that within their teaching styles, which happened to be the Montessori method, environmental knowledge was already embedded in the curriculum, “ The Montessori philosophy inherently supports eco-friendliness and sustainability in early childhood through various principles and practices” ([Cummins, 2024](#)). When I asked the teachers how they are teaching kids to be environmentally aware, they were able to give me a list of activities they

have done throughout the school year, engaging in teaching kids to be Eco-literate. One example the teachers were able to give me was that when the children were outside, it was really important to have love for all living beings, to be careful and not step on any insects they see. This lesson was something a child from the teacher's classroom took home and made sure to let his parents know that he is not someone who kills living beings. Another teacher (shown in the picture below), proceeded to tell me how she organized a lesson plan to teach her children about the transformation of a butterfly. She made it clear to me that she finds it important that her children know the importance of nature and how to take care of it.



Earth day assignment in day care classroom



Day care classroom teacher presenting the butterfly life cycle

While there are certain curricula that everyone might not be exposed to, there was one thing that reminded me of something that my mother mentioned when I interviewed her. When my mother was in school, even though the concept of climate change was not a popular subject, demonstrating the will to take care of the environment was. Just like the Montessori method has environmental practices, so does the environment where she grew up in. Growing up on an island can mean each house had a lot of space around them, whether it was to grow crops, dig a big composting hole or even create a drinking well. Sometimes in certain countries, even though there is not much dialogue happening in the classrooms, growing up on an island, and even surviving off very little can motivate individuals to take care of what's around them ([Darapati, 2020](#)). This really does make me believe that the concept of sustainability truly comes from what you are exposed to from an early age.

My mother: “Because in the villages, since the population is spread, there is more space. The village life – they already have recycling as in their lifestyle. When we were growing up there was a big pit in the garden, where food waste and leaves go and coconut husks”.

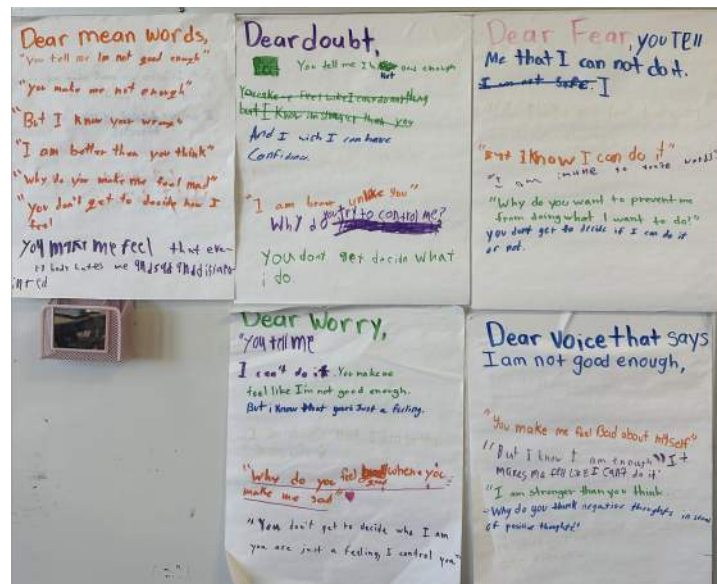
Me: “What about plastic trash?”

My mother: “When I was growing up plastic bottles were not very popular, also we always recycled plastic bottles – used them as spice containers”

Growing up surrounded by nature can give anyone a special connection to the environment. And having that special connection can create an influence to tend to nature. Something new I have discovered was the concept of social media and technology being a barrier in children wanting to spend more time outside in nature. With summer being the time kids are almost always home, many parents are having to deal with trying to avoid their kids not being stuck to their ipads ([Evolve Training Center, 2023](#)). When I came to the U.S, my love for nature continued with my hobbies including exploring National Parks. In the article, *Why Environmental Education is Important for Kids*, the author talks about how there is a very special connection with spending your time outdoors and your love for nature evolving at the same time, “Spending time outside will make you care more about the environment. Caring more about the environment will make you want to spend more time outside”. ([Kinneer, 2023](#)). Even though I was not taught about environmental education in schools, the island I am from and having the opportunity to travel and explore nature has heightened my interest in Sustainability throughout the years. If children never gain the interest to be outside, I have a fear they may never form the connection that is needed to protect it.

As mentioned before I wanted to participate in one more research activity - observing my teacher friend’s 5th grade classroom. While I was waiting for the children to enter the classroom, I saw 5 posters they had worked on about what they wanted to say to negative emotions. These posters reminded me when the two teachers I had interviewed explained how excited their children were about learning more about environmental health, feeling concerned and helpless overall because they didn’t understand why this was happening in the first place. In the article “How ‘Climate Anxiety’ Affects Students - and What We Can Do About it”, the author Nadia Tamez-Robledo explains how the 24 year old, feels helpless when she realizes who climate change is really affecting, “As you come to the realization of how big an issue climate change is and how small it makes you feel, it really brings around this impending sense of doom. It makes you feel super helpless, especially when you start acknowledging who gets affected.” (Tamez-Robledo, 2023). When I was reading what they had put down, it reminded me of why I wanted to focus my attention in my capstone paper towards children being Eco-literate. The posters in the classroom forced me to think how important these types of dialogues were in the classroom. The concern the children were having in the teacher’s classroom made me realize the kids already have one of the most important qualities to spark the conversation of environmental health - concern. It reminded me of the amount of passion and resilience children have, and why out of all ages I

believe children should be exposed to environmental health from an early age all throughout school.



Posters hung in a 5th grade classroom

When looking at my literature review and what my findings have exposed, I saw a big connection between the results with Montessori methods having the biggest environmental influence in children and teachers wanting to teach their children to be Eco-literate but not having the enough resources. Creating an open dialogue between teachers has opened my eyes to realizing that teachers have a tremendous amount of impact for children, especially the ages of adolescence. By promoting action and social connection within the environment. Talking about climate change can be a scary topic to introduce to kids when it is not done in the right way ([Léger-Goodes et al. 2022](#)). When teachers introduce this topic, this can be a positive introduction since children already see their educators as individuals who are there to teach them. The important finding I found out through enforcing research methods, is the idea behind teachers wanting to teach their classes about environment health and knowing how important this topic is. When I asked the group of day care teachers and my mother if they thought the education of Environmental health is important, every one of them responded, “Of course! It is very important”.

Summary:

After conducting the types of interviews and observations throughout this paper, I opened a type of dialogue with and among teachers that ignited the type of environmental conversations that could have a positive influence on children. I discovered that prioritizing these types of conversations in the classroom might not be as easy as it looks but teachers and students are still very excited about being part of the solutions that come with learning about Sustainability. I noticed with a child’s continuous curious mind to invariably wanting to learn and explore - the connection between kids and the environment is something that can be long lasting ([Jennifer-](#)

[The Zoo Family, 2026](#)). While I research this topic in depth, I begin to think about the unique contribution I will be making in the research world. And while there are examples about children making extraordinary accomplishments in being more environmentally aware ([Heriyati et al, 2025](#)) & ([13 Inspiring Examples of Young Environmentalists Making a Difference](#)), environmental consciousness is often not built into school curriculum. I wanted to begin a dialogue among teachers about opening up the space for this type of conversations, and what we can do to start these kinds of conversations more regularly in schools if none have begun. With the amount of research and time I spent on this project, I hope to continue this conversation in the schools of my home (Sri Lanka). With the immense amount of waste continuing to exceed its limits throughout the world, I truly believe it is important to keep having these kinds of conversations, especially in classrooms. This might seem like a small step to start from, but every great success story has a strong foundation, and the start to a strong foundation stems from dialogue.

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Rewilding the City: Small Spaces, Big Impact in Urban Biodiversity



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Abstract

This project explores how urban rewilding strategies, including native plant restoration and wildlife corridors, can enhance biodiversity in San Francisco while addressing the social, spatial, and institutional barriers that limit their implementation. Using an interdisciplinary qualitative approach, this research synthesizes academic literature, urban planning documents, and case studies to examine how rewilding operates within a dense urban environment. Rather than simply confirming existing literature, this project finds that the primary barrier to urban rewilding is not just spatial limitation, but a conceptual bias toward large-scale restoration models that overlook the ecological potential of small and distributed interventions. By reframing rewilding as a networked, multi-scalar process embedded within everyday urban spaces, this project identifies connectivity and community participation as the defining factors of ecological success. Findings suggest that while large scale ecological restoration is often emphasized in existing literature, it is frequently impractical in highly developed cities. Instead, small scale, distributed interventions such as sidewalk plantings, green corridors, and neighborhood based restoration emerge as more feasible and impactful when connected across the urban landscape. However, governance challenges, maintenance responsibilities, and social inequities significantly influence the success of these efforts. This project argues that effective urban rewilding must integrate ecological design with inclusive community engagement and equitable planning processes. Ultimately, rewilding is reframed not as a purely environmental intervention, but as a socio environmental strategy essential to climate resilience, public health, and urban livability.

As cities continue to expand, the relationship between urban development and ecological health has become increasingly strained. In places like San Francisco, reimagining how cities coexist with nature is both an environmental and social imperative. This project explores urban rewilding as a framework for restoring biodiversity while strengthening community well-being, positioning ecological restoration not as an abstract ideal but as a necessary and achievable component of a resilient urban future.

My topic will focus on rewilding strategies aimed at reintegrating native wildlife and plant species into San Francisco's urban landscape. Growing up near San Francisco, I've developed a deep appreciation for the city's distinctive culture and character. The city's unique environment supports many endemic species; however, as infrastructure continues to expand, these plants and animals are often overlooked. Engaging communities across the city in rewilding efforts is essential, as I believe collective participation can enhance ecological resilience while improving the overall well-being of both the city and its residents.

The personal connection not only motivates my interest in rewilding, but also shapes how I understand the central gap in existing research. While cities like San Francisco are widely recognized as sites of ecological importance, the lived realities of the residents and the constraints of urban life are often insufficiently integrated into how rewilding strategies are designed and evaluated. This project emerges from that tension, linking personal experiences with a broader analytical focus on how rewilding can be made both ecologically effective and socially meaningful within a dense urban context.

This project asks: How can rewilding strategies such as native plant restoration and wildlife corridors increase urban biodiversity in San Francisco, and what barriers exist to implementing these strategies at the city scale? Rather than proposing a single or universal solution, the project seeks to clarify how rewilding interventions can be realistically applied within a dense urban environment. By examining ecological outcomes alongside social, spatial, and institutional constraints, this research aims to guide understanding of accessible, community-centered rewilding practices that can be integrated into San Francisco's existing urban fabric.

This project serves as a bridge between ecology, public health, and urban planning, highlighting the interconnected nature of environmental and human well-being in urban contexts. It also challenges simplified or purely technocratic sustainability narratives by emphasizing the social, cultural, and ecological dimensions of rewilding. Rather than framing rewilding as an optional enhancement or aesthetic amenity, this project reframes it as a human and ecological necessity that is essential to climate resilience, public health, and urban livability.

To develop this project and deepen my understanding, I reviewed academic literature on urban rewilding and biodiversity, alongside urban planning and sustainability policy documents, and relevant case studies from San Francisco and comparable cities. I will be reviewing with an analytical approach focused on identifying recurring patterns, documented benefits, limitations, and emerging best practices across interdisciplinary research. In addition, I will evaluate how rewilding strategies operate across both ecological and social systems, paying particular attention to how environmental outcomes intersect with governance structures, community participation, and equity considerations. Through this integrative review, the project uses rewilding not only as an ecological intervention, but as a socio-environmental process shaped by urban contexts.

These methods are the most appropriate for the project because urban rewilding exists at the intersection of ecology, planning, and social systems, making it impossible to evaluate through a single disciplinary lens. By synthesizing scientific research with policy analysis and real-world case studies, this approach allows for a more comprehensive understanding of how rewilding functions in practice rather than in theory alone. It also enables the identification of strategies that are both ecologically effective and socially viable within dense urban environments. Ultimately, this method supports a nuanced assessment of rewilding as a scalable, inclusive, and context-sensitive approach to improving urban biodiversity and community well-being.

My positionality may inform my approach because of my firsthand experience with the city and its surrounding region. Growing up about 45 minutes from San Francisco has allowed me to develop a strong connection to the city, but it has also shaped the lens through which I view it. While I have spent significant time in San Francisco, I recognize that I have not fully lived the day-to-day experiences of its residents. As a result, there may be social, cultural, or environmental dynamics that I unintentionally overlook due to this partial distance. This awareness informs both why I care about this topic and how I plan to approach it. My appreciation for the city's environment and character motivates my interest in rewilding as a way to preserve and enhance what makes San Francisco unique. At the same time, I acknowledge that my values may shape the questions I ask and the solutions I find compelling. To address these potential biases, it will be important for me to actively seek out and incorporate testimonies from San Francisco residents, both long-term natives and newer community members. Centering diverse lived experiences will help ensure a more representative and equitable understanding of the city, strengthening the project's ability to reflect San Francisco as it is experienced by those who call it home.

Addressing Gaps in Current Rewilding Research

Urban rewilding has emerged as a prominent framework for rethinking how cities can host vibrant non-human life while responding to climate change and enhancing human well-being. In contrast to older models that treated urbanization as fundamentally incompatible with robust ecological function, recent scholarship and practice define urban rewilding as a suite of strategies that restore ecological processes (Finnerty et al., 2025) and habitats within highly modified city landscapes. These strategies typically include native plant restoration, the creation of habitat patches and corridors, and the integration of green infrastructure. This includes bioswales, green roofs, and vegetated streetscapes into the built environment. Rather than aiming to recreate an imagined, pristine "pre-urban" nature, rewilding emphasizes dynamic, self-organizing ecosystems that can coexist with dense development, transportation networks, and everyday urban activity. Across case studies and review articles, researchers argue that even relatively small interventions, like curbside pollinator gardens, pocket wetlands, and native plantings in vacant lots, can meaningfully increase local species richness, support pollinators and other wildlife, and improve connectivity between otherwise isolated habitat fragments. At the same time, literature positions urban rewilding as a nature-based climate adaptation strategy: vegetated surfaces, restored soils, and structurally complex plant communities help to cool urban microclimates, intercept and infiltrate stormwater, buffer flooding, and improve local air quality, thereby reducing cities' vulnerability to climate stressors.

Parallel work on urban green space and public health reinforces this multi-benefit framing by documenting the mental, social, and physiological benefits of contact with biodiverse nature in cities. Studies consistently associate access to green spaces with reduced stress, improved mood, and lower levels of anxiety and depression, and they note that nearby nature can support physical activity, social interaction, and a sense of place attachment (Aziz & Rasidi, 2014), particularly in communities that have historically lacked high-quality public space. Some researchers distinguish between generic “green” environments and ecologically rich ones, suggesting that structurally diverse vegetation, native species, and opportunities to observe birds, insects, and seasonal change can deepen psychological benefits and strengthen human–nature relationships beyond what manicured lawns or uniform ornamental plantings typically provide (Aziz & Rasidi, 2014). This distinction aligns closely with the focus of biodiversity hotspots rather than simply more greenery. The aim is to re-embed functioning ecosystems into the city in ways that support both non-human and human life, rather than treating vegetation as an aesthetic overlay.

San Francisco represents a particularly prominent setting for this kind of work because it concentrates intense urbanization and remarkable biodiversity within a relatively small geographic footprint. Conservation organizations and local environmental agencies repeatedly describe the San Francisco Bay Area as one of the nation’s most important biodiversity hotspots and highlight that the city itself sits within the California Floristic Province (Finnerty et al., 2025), a global hotspot characterized by high endemism and acute development pressures. San Francisco’s complex topography, range of microclimates, and mosaic of habitats, including coastal scrub, sand dunes, wetlands, riparian corridors, grasslands, and nearshore marine environments, support an unusually high diversity of plants and animals. This includes several species that are rare, threatened, or endemic to the region. At the same time, urban sprawl, infrastructure expansion, and population growth have fragmented or erased many of these ecosystems, leading to habitat loss, disrupted wildlife movement, and increased exposure of species to pollution and human disturbance. The Center for Biological Diversity and other organizations note that hundreds of thousands of acres of natural landscape in the broader Bay Area remain at risk of development, while remaining habitats within the city are often isolated within a matrix of housing, roads, and commercial uses (*Bay Area Wild*, n.d.). The tension between ecological richness and fragmentation provides crucial context for my project’s emphasis on creating biodiversity hotspots and wildlife corridors within San Francisco’s existing urban fabric.

Municipal policy in San Francisco has increasingly recognized these ecological realities and attempted to position biodiversity and urban nature restoration as core city priorities. The City and County of San Francisco has formally identified itself as part of a global biodiversity hotspot and acknowledged that its parks, natural areas, and open spaces still harbor hundreds of indigenous plant and animal species, including multiple federally listed endangered species and locally unique taxa. A 2017 resolution adopting citywide biodiversity goals articulates a vision in which “all San Franciscans connect to nature daily” and biodiversity is integrated throughout both natural and built environments (*Resolution Adopting Citywide Biodiversity Goals | San Francisco Environment Department (SFE)*, n.d.). The resolution emphasizes three interrelated goals: community and ecological stewardship (empowering residents and partnerships to restore and enjoy nature in every neighborhood), ecological planning and design (incorporating

biodiverse, purposeful greening into all building and open space development), and resilience in a “living city” (leveraging ecosystems to sequester carbon, prevent flooding, manage pests, conserve water, and improve air quality). It also commits the city to actions such as inventorying biodiversity, developing indicators of ecosystem health, promoting wildlife-friendly landscaping and biophilic design in major development projects, supporting an expanded and biodiverse urban forest, and participating in local-to-international knowledge networks.

Alongside this policy framework, agencies such as the San Francisco Department of the Environment describe an urban biodiversity program that seeks to restore native habitats, support pollinators, and bring nature into the built environment through collaboration among city departments, nonprofits, and community groups (*Resolution Adopting Citywide Biodiversity Goals* | *San Francisco Environment Department (SFE)*, n.d.). Media and educational pieces reinforce the idea of San Francisco as a biodiversity hotspot, stressing that the city’s microclimates, soil types, and habitats support rare species and that habitat restoration efforts play a vital role in sustaining threatened species and ecosystems. Local advocacy organizations similarly frame San Francisco and the Bay Area as part of a globally significant biosphere reserve and argue for integrating green infrastructure, habitat corridors, and expanded open space into city planning to benefit both people and nature. Together, these sources show that San Francisco is not starting from zero: biodiversity is already articulated as a priority, and there is an existing network of policies, programs, and advocacy efforts that your project can both draw upon and critically assess.

However, the dominant narratives within this policy and advocacy landscape tend to emphasize large, high-profile projects and citywide targets, mirroring broader international trends in how urban nature and rewilding are framed. Commentaries on nature-based solutions and urban biodiversity often present restoration as a “strategic imperative” for cities, highlighting multi-benefit returns on investment for climate resilience, public health, and quality of life and encouraging cities to commit to quantifiable targets such as acres restored, trees planted, or kilometers of green corridors installed. In San Francisco, for instance, discussions of biodiversity policy and open-space planning frequently highlight the city’s extensive park system, shoreline restoration efforts, and large natural areas in places like the Presidio or Lake Merced (Bartley, 2020), along with broad goals to expand the urban forest and create more connected green networks. These initiatives are important and often ecologically significant, but they also reflect an institutional preference for interventions that fit into existing capital planning frameworks. These are often projects that are spatially large, technically complex, and well suited to being measured and showcased.

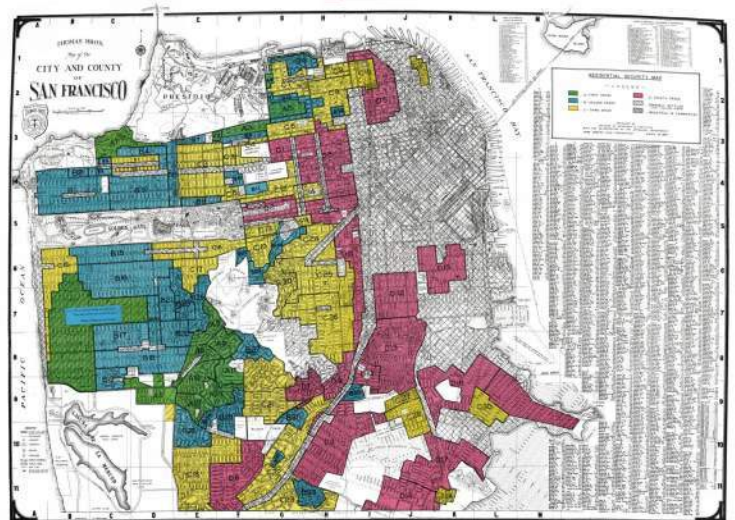
This preference reveals one of the dominant assumptions in the broader literature on urban rewilding and biodiversity. That one thing is the meaningful ecological gains primarily come from large, contiguous, and often capital-intensive projects. Many academic and policy case studies focus on major parks, waterfront redevelopments, or large brownfield restorations as emblematic examples of urban nature restoration. These projects lend themselves to before-and-after narratives and quantifiable outcomes but can inadvertently marginalize the potential of smaller, dispersed interventions that operate through micro-sites (Apfelbeck et al., 2020). While practitioner materials and advocacy campaigns increasingly reference “micro-rewilding” and neighborhood-scale initiatives, rigorous, peer-reviewed analysis of the cumulative ecological, social, and governance implications of such distributed approaches

remains limited compared with the attention given to flagship projects. This scale bias is precisely what my project challenges by centering biodiversity hotspots and wildlife corridors within the everyday spaces of San Francisco's urban fabric.

A second dominant assumption is technocratic. This means that rewilding and nature-based solutions are often treated as primarily technical problems that can be solved through expert-driven planning, design standards, and performance metrics. Reports aimed at city governments and planners emphasize best-practice guidelines for habitat design, species selection, and monitoring. They propose standardized interventions, such as biodiverse streetscapes or modular green infrastructure, that can be replicated across multiple sites (Garrett, n.d.). In San Francisco, biodiversity and open-space policies similarly incorporate ecological goals into planning and design, encouraging wildlife-friendly landscaping, biophilic architecture, and integrated green infrastructure in new development. This approach has important strengths, including ensuring that biodiversity is not left to improvised decisions and that ecological considerations are embedded in codes, standards, and project review processes. Yet, by emphasizing technical optimization, it can underplay the deeply social and political nature of urban land, obscuring questions about who gets to decide where rewilding occurs, what forms of urban nature are considered acceptable, and how conflicts over aesthetics, maintenance, and public safety are negotiated.

These tensions are especially visible when considering resident-led or community-centered rewilding efforts, which are central to my project. In practice, residents' ability to initiate and sustain rewilding in small urban spaces is shaped by tenancy status, property relations, neighborhood histories, and regulatory regimes. For example, sidewalk gardens and curbside plantings might require permits, adherence to visibility and access rules, and ongoing maintenance that can become burdensome for individuals or small groups. Aesthetic norms and enforcement practices can also penalize ecologically beneficial "messiness." Oftentimes native plantings that support insects and birds may be perceived as unkempt or unsafe, particularly in neighborhoods historically subject to over-policing or stigmatization. Meanwhile, property owners may worry that wildlife-supporting vegetation could attract pests, interfere with infrastructure, or create liability risks. Despite these realities, the academic and policy literature often treats community involvement in rewilding in broad strokes. Usually framing it positively but without detailed analysis of how social inequities, regulatory frameworks, or historical injustices shape who can actually participate and benefit.

Recent work on environmental justice and urban biodiversity begins to address these gaps by linking ecological patterns to histories of racialized disinvestment. For instance, studies using citizen-science biodiversity data and historical redlining maps in California cities, including San Francisco, have found that historically redlined neighborhoods exhibit significantly lower levels of observed wildlife



San Francisco Residential Redlined Map (Photo from University of Richmond)

biodiversity than greenlined areas, sometimes with five to ten times fewer species recorded (Estien et al., 2024). These findings underscore that urban biodiversity is not evenly distributed. It is patterned by legacies of housing discrimination, infrastructure siting, and uneven investment in urban trees and vegetation. Qualitative accounts echo this picture, noting that older, wealthier neighborhoods often have mature street trees, gardens, and access to large parks, while lower-income areas may have sparse vegetation (Estien et al., 2024), more impervious surface, and fewer opportunities for everyday encounters with nature. For my project, this literature is crucial because it suggests that rewilding strategies could deepen ecological inequalities rather than amend them. Yet the same studies also indicate that historically marginalized neighborhoods may offer important opportunities for targeted rewilding that combines biodiversity gains with climate adaptation and public health benefits, provided that initiatives are designed with and for local communities.

Taken together, the existing literature demonstrates that urban rewilding can deliver substantial ecological and human benefits and that San Francisco possesses both the ecological potential and policy frameworks to support such efforts. However, it also reveals significant gaps. First, there is limited guidance on how rewilding strategies such as native plant restoration and wildlife corridors can be implemented through small, spatially distributed interventions at city scale in a dense, already built-out environment like San Francisco. Most work stops at the level of general recommendations or isolated case examples without systematically examining how many such interventions might be needed, how they could be spatially configured to maximize connectivity, or how they interact with existing land uses and regulations. Second, the literature offers relatively little empirical insight into the institutional and governance barriers that occur when residents, community organizations, or smaller institutions attempt to initiate rewilding: issues such as fragmented jurisdiction, complex permitting, unclear maintenance responsibilities, and conflicting departmental priorities are acknowledged but rarely mapped or analyzed in depth. Third, while policy documents and advocacy materials frequently invoke community participation and equity, they rarely specify which forms of participation are realistic or empowering for renters, low-income residents, or communities facing housing instability, nor do they fully understand the risks of green gentrification or eco-austerity.

My capstone project directly responds to these gaps by centering the question: “How can rewilding strategies such as native plant restoration and wildlife corridors increase urban biodiversity in San Francisco, and what barriers exist to implementing these strategies at the city scale?” By focusing on biodiversity hotspots and corridors in the interstices of the urban fabric, you challenge the scale bias of existing work and explore how networks of small sites can cumulatively contribute to ecological connectivity and species support. By situating these interventions within San Francisco’s specific planning history, zoning context, and biodiversity policy landscape, you move beyond abstract advocacy to examine how rewilding must navigate concrete institutional realities documented in planning histories and municipal resolutions. And by foregrounding community participation, public health, and feelings of agency as central outcomes rather than secondary benefits, you offer an alternative to technocratic narratives that present rewilding as something done to or for residents rather than with them.

Finally, the literature I have leans heavily on ecological science, municipal policy, and planning-oriented sources, which provides a strong foundation but also points to important directions for further reading. Importantly, this pattern is itself a finding. The relative absence of

Indigenous and decolonial perspectives in dominant urban rewilding literature reflects a broader tendency to frame restoration as a technical or ecological project, rather than one deeply embedded in histories of land dispossession and ongoing Indigenous relationships to place. In the context of San Francisco, which sits on unceded Ohlone territory, this absence is particularly significant. Indigenous scholarship on urban ecology challenges conventional notions of “rewilding” by emphasizing that land is not empty or in need of return to a pre-human state, but is part of ongoing systems of stewardship, knowledge, and cultural meaning. Integrating these perspectives complicates the idea of restoration by raising critical questions about who defines ecological value, what histories are acknowledged, and how restoration efforts might support or erase Indigenous presence. Even when not extensively represented in planning documents, these perspectives are essential for developing a more just and historically grounded approach to urban rewilding. Environmental justice and green-gentrification scholarship can help assess how rewilding initiatives interact with housing markets, policing, and the politics of visibility, ensuring that your recommendations do not unintentionally reinforce displacement or deepen inequalities. Comparative case studies from other dense cities experimenting with micro-rewilding, ecological corridors, and participatory nature-based interventions can offer transferable governance and design lessons, as well as cautionary tales. Finally, becoming more attentive to who funds and authors the reports and articles that are cited will allow you to critically evaluate how institutional agendas shape what counts as successful rewilding, which metrics are prioritized, and which conflicts or trade-offs are downplayed.

The literature suggests that rewilding in cities like San Francisco is both ecologically necessary and socially consequential. It documents strong evidence that urban nature can support biodiversity, climate resilience, and public health, and it shows that San Francisco has already begun to articulate ambitious biodiversity goals. Yet it also leaves open crucial questions about how small-scale, community-centered interventions can be realistically implemented and scaled within dense urban fabrics, how they intersect with histories of inequality and disinvestment, and how planning and governance structures can either support or constrain them. The project makes a distinctive contribution by directly engaging these questions, bridging ecology, planning, and public health, and framing rewilding not as an optional aesthetic amenity but as a socio-environmental necessity that must be co-produced with communities if it is to be both effective and just.

Methodology: An Interdisciplinary Approach to Urban Rewilding

This project explores the question: How can rewilding strategies such as native plant restoration and wildlife corridors enhance urban biodiversity in San Francisco, and what barriers exist to implementing these strategies at the city scale? To address this question, I used a qualitative and interdisciplinary research approach that combines literature review, case study analysis, and contextual examination of urban planning and social factors in San Francisco. Rather than conducting laboratory experiments or collecting quantitative ecological data, this project focuses on synthesizing existing knowledge from multiple fields in order to understand how rewilding operates within a dense urban environment. This approach allows the project to examine ecological processes alongside social, political, and spatial constraints that shape the feasibility of urban rewilding.

The first stage of the methodology involved conducting a literature review on urban rewilding and related environmental topics. I reviewed peer-reviewed academic articles, environmental studies research, and sustainability literature that discuss urban biodiversity, habitat restoration, green infrastructure, and climate resilience. These sources provided the scientific foundation for understanding the ecological benefits of rewilding strategies such as native plant restoration and wildlife corridors. In particular, the literature helped identify how restoring native species can support pollinators, birds, and other urban wildlife, while also improving ecosystem services like air quality, stormwater management, and urban cooling. Examining these ecological studies allowed me to establish the environmental importance of rewilding and understand the mechanisms through which biodiversity can increase within cities. While ecological literature provided important insights, it quickly became clear that rewilding cannot be understood through environmental science alone. Cities are complex social systems, and environmental interventions must operate within political, economic, and spatial constraints. Because of this, the second stage of the research focused on urban planning and policy contexts, particularly those related to San Francisco. I examined planning histories, urban design frameworks, and policy discussions that shape how land is used within the city. Sources such as planning reports, sustainability documents, and urban policy analyses helped explain why implementing large-scale ecological projects can be difficult in dense cities. High land values, development pressures, and long-standing planning priorities often limit the amount of space available for new green areas. By examining these constraints, the research moves beyond simply identifying ecological solutions and instead explores the institutional and structural barriers that influence whether those solutions can realistically be implemented.

Another important component of the methodology was the analysis of case studies related to urban rewilding and biodiversity initiatives. Case studies provide real-world examples of how environmental ideas are applied in practice. For this project, I examined examples of urban ecological restoration, biodiversity corridors, and native plant initiatives both within San Francisco and in comparable cities. Studying these cases helped illustrate how rewilding strategies are implemented on the ground, what kinds of partnerships are required, and what challenges typically arise during implementation. In many cases, these examples revealed that successful projects rely on collaboration between city governments, environmental organizations, and community members. They also highlighted the importance of smaller-scale interventions, such as pollinator gardens, sidewalk plantings, or neighborhood restoration projects, which can collectively contribute to broader ecological connectivity even in dense urban landscapes.

In addition to ecological and planning perspectives, this project also considered social and community dimensions of rewilding. Environmental initiatives can have uneven impacts across communities, and access to green space is often shaped by broader patterns of inequality. For this reason, part of the research involved examining literature and reports that discuss environmental justice, social barriers, and community participation in urban environmental projects. These sources helped identify the ways in which rewilding efforts can either support or overlook local communities. For example, some projects emphasize community stewardship and education, while others are implemented primarily through top-down planning processes. Understanding these dynamics was important because long-term success of urban rewilding often depends on local engagement and maintenance.

The data generated through these methods consisted primarily of qualitative insights and thematic patterns rather than numerical measurements. After collecting sources and case study information, I analyzed the material by identifying recurring themes across the literature. This thematic analysis is guided by two primary theoretical frameworks: environmental justice and political ecology. Environmental justice provides a lens for examining how access to biodiversity, green space, and environmental benefits is unevenly distributed across communities, and how rewilding efforts may either mitigate or reinforce these inequalities. Political ecology further informs the analysis by emphasizing the role of power, governance, and institutional structures in shaping human-environment relationships. This framework is particularly relevant for understanding how land use decisions, regulatory systems, and resource allocation influence which forms of rewilding are possible, who participates in them, and who ultimately benefits. Together, these frameworks ensure that the analysis moves beyond description to critically interpret the social and political dimensions of urban ecological restoration.

Another aspect of the methodology involved reflective analysis throughout the research process. Because this project is interdisciplinary and interpretive, it requires acknowledging how perspectives and assumptions influence the interpretation of information. Reflecting on my own academic background in environmental studies helped me recognize that I initially approached the topic primarily from an ecological standpoint. As the research progressed, I became more aware of the importance of planning processes, governance structures, and community perspectives. This reflection helped broaden the scope of the project and ensured that the analysis considered multiple dimensions of urban rewilding rather than focusing exclusively on ecological outcomes.

The reason for using this combined methodology is that urban rewilding operates at the intersection of ecology, planning, and society. A purely ecological method would overlook the policy and social constraints that shape environmental decision-making, while a purely planning-focused approach might miss the biological processes that make biodiversity restoration possible. By integrating literature review, case studies, and contextual analysis, this project aims to develop a more comprehensive understanding of how rewilding can realistically function within San Francisco's urban landscape.

Ultimately, the methodology is designed to answer the central research question by connecting theory with practice. Reviewing ecological literature explains why rewilding is important, examining urban planning contexts reveals why it can be difficult to implement, and analyzing case studies demonstrates how these challenges can sometimes be addressed through creative or community-centered approaches. Together, these methods provide a framework for evaluating the feasibility of rewilding strategies in San Francisco and for identifying opportunities where biodiversity restoration and urban development can coexist.

Reframing Urban Rewilding: From Idealized Landscapes to Urban Realities

One of the most significant findings of this project is a shift in how rewilding must be conceptualized within dense urban environments like San Francisco. Early in the research process, rewilding was understood primarily through examples in the literature that emphasize large-scale ecological restoration. This included spaces such as expansive wildlife corridors, restored wetlands, and protected natural areas. These models present clear ecological benefits and are often treated as the ideal standard for biodiversity restoration.

However, when these models are examined within the spatial and political context of San Francisco, their limitations become apparent. The city's high population density, constrained land availability, and competing development priorities make large, uninterrupted ecological restoration projects difficult to implement. This finding aligns with existing urban planning literature, which emphasizes how land-use constraints and economic pressures shape environmental possibilities in cities (Garrett, n.d.). In this sense, my findings confirm prior research that highlights the structural barriers to large-scale urban ecological interventions.

At the same time, this project expands on existing literature by demonstrating that the challenge is not only spatial, but also conceptual. The dominant framing of rewilding as something that requires large, pristine, and separate spaces contributes to the perception that dense cities are inherently incompatible with ecological restoration. This suggests that rewilding is often limited not just by physical constraints, but by the way it is imagined and defined.

The Emergence of Small-Scale, Distributed Rewilding

In response to these constraints, a key pattern that emerged across the research is the importance of small-scale, distributed ecological interventions. While individually modest, spaces such as sidewalk plantings, tree wells, street medians, and neighborhood gardens collectively form a network of potential habitat within the urban fabric.

This finding reflects a shift from thinking about rewilding as isolated sites to understanding it as a connected system. Rather than relying on a few large green spaces, biodiversity in cities may be supported through a series of smaller “stepping-stone” habitats that enable species movement and ecological processes. This idea is strongly supported by the case study of the Green Hairstreak Corridor, which demonstrates how linking multiple small habitat patches can prevent local species extinction even in a highly urbanized environment (*Green Hairstreak Corridor*, n.d.). By connecting more than ten small sites, the corridor enables movement and reproduction of the green hairstreak butterfly, illustrating the ecological value of connectivity over scale alone.

Similarly, the Sunset Boulevard Biodiversity Corridor provides evidence that distributed and linear forms of restoration can support broader ecosystem functions. By integrating native plantings along an existing urban corridor, the project enhances habitat, improves air quality, and contributes to climate resilience without requiring the creation of new large green spaces (*Sunset Boulevard Reforestation – ClimateActionNow*, n.d.). These findings support and extend existing ecological literature, which emphasizes connectivity and habitat networks as key drivers of biodiversity.

Together, these case studies suggest that rewilding in San Francisco is most feasible when it is integrated into existing infrastructure rather than imposed as a separate system. This represents a central insight of the project: rewilding does not require entirely new spaces, but can emerge through the transformation of spaces that already exist.



Sunset Boulevard Reforestation Project (Engardio, 2025)

Barriers to Implementation: Governance, Maintenance, and Responsibility

While small-scale rewilding offers a more feasible pathway, the research also reveals that these strategies are not without significant barriers. One of the most consistent challenges identified across the literature and case studies is the issue of governance and maintenance (Zellmer & Goto, 2022).

Unlike large parks, which are typically managed by centralized institutions, distributed rewilding initiatives often require coordination across multiple actors, including city agencies, nonprofit organizations, and local residents. This raises critical questions: Who is responsible for maintaining these spaces? How are resources allocated? And how can long-term stewardship be sustained?

The Green Hairstreak Corridor highlights both the strengths and limitations of this model. Its reliance on volunteer site stewards demonstrates the power of community involvement (*Green Hairstreak Corridor*, n.d.), but also reveals a potential vulnerability: the success of the project depends on sustained volunteer labor. This raises concerns about scalability and equity, particularly in neighborhoods where residents may have less time or resources to participate.

To address these limitations, the literature suggests the need for hybrid governance models that combine community stewardship with institutional support. Rather than relying solely on volunteer labor, more sustainable approaches may include city-funded maintenance programs, partnerships with local nonprofits, and the integration of rewilding responsibilities into existing municipal services such as public works or urban forestry departments. Additionally, participatory governance structures, such as community advisory boards or compensated stewardship programs, can help redistribute responsibility while ensuring that local knowledge and priorities shape implementation. These models shift rewilding from an informal, volunteer-driven activity to a more stable and equitable system of shared responsibility.

These findings align with planning and sustainability literature that identifies governance complexity as a major barrier to urban environmental initiatives. However, this project adds nuance by showing how governance challenges become even more pronounced when rewilding is distributed across many small sites rather than concentrated in a single location.

Social Barriers and Environmental Inequality

Beyond logistical and institutional challenges, this project identifies social barriers as central to the success or failure of urban rewilding. Research on environmental justice reveals that access to green space is not evenly distributed, and that social factors such as race, income, language, and cultural perception influence who benefits from environmental initiatives.

The study *When Green Is White* highlights how parks and green spaces can be perceived as exclusionary, particularly by marginalized communities (Byrne, 2012). Barriers such as language differences, lack of representation, and limited accessibility can discourage engagement, even when spaces are physically available. Similarly, research on environmental gentrification demonstrates how sustainability initiatives can inadvertently contribute to displacement and inequality if they are not implemented with community input.

These findings are directly relevant to this project, as they suggest that rewilding strategies cannot succeed at the city scale without addressing who they are for. While ecological restoration may increase biodiversity, it does not automatically produce equitable

outcomes. This has direct implications for how models like the Green Hairstreak Corridor should be replicated. In lower-income or historically marginalized neighborhoods, simply introducing small-scale habitat patches without addressing underlying social conditions may reproduce patterns of uneven access and benefit. Instead, rewilding strategies in these contexts must be co-designed with communities, incorporate local priorities, and be paired with protections against displacement, such as anti-gentrification policies or community land stewardship models. This reinforces that ecological connectivity cannot be separated from social context; the success of rewilding depends not only on where interventions are placed, but on how they are governed and who they are designed to serve.

This project therefore confirms existing environmental justice literature, while also applying it specifically to the context of urban rewilding. There is a need to integrate social considerations into ecological design, ensuring that rewilding efforts are inclusive, accessible, and responsive to community needs.

Rethinking Success: From Outcomes to Processes

Another important insight that emerged from this project is a shift in how success is defined. Initially, success was understood in terms of measurable ecological outcomes, such as increased biodiversity or restored habitat. However, through the research process, it became clear that in urban contexts, success must also include process-oriented factors, such as community engagement, governance structures, and long-term sustainability.

This reflects a broader shift in the project from seeking definitive answers to embracing complexity and uncertainty. In practice, a process-oriented definition of success means evaluating not only ecological outcomes, but also the quality of participation, inclusivity of decision-making, and long-term sustainability of stewardship. Success may look like increased community involvement in maintaining green spaces, the development of local ecological knowledge, or the creation of governance structures that enable continued care beyond initial implementation. It also raises important questions about measurement: rather than relying solely on metrics such as species counts or acreage restored, process-based success may be assessed through indicators such as community engagement, accessibility, and the durability of partnerships over time. This reframing shifts authority over defining success away from purely technical experts and toward a more collaborative and context-specific understanding of what effective rewilding looks like. Rather than asking whether rewilding “works,” the research now asks how it can be practiced in ways that are adaptive, inclusive, and context-specific. This perspective aligns with interdisciplinary approaches in sustainability science, which emphasize systems thinking and the integration of social and ecological dimensions.

Answering the Research Question

Overall, this project finds that rewilding strategies can enhance urban biodiversity in San Francisco, but their effectiveness depends heavily on how they are designed and implemented. Native plant restoration and wildlife corridors are most successful when they are adapted to the constraints of dense urban environments through small-scale, distributed, and connected interventions.

However, the primary barriers to implementation are not purely ecological. Instead, they are social, political, and institutional, including governance complexity, maintenance

responsibilities, and unequal access to resources and participation. These barriers must be addressed in order for rewilding to function at the city scale.

Why It Matters

The findings of this project are significant because they challenge dominant narratives of urban sustainability that prioritize large-scale solutions while overlooking smaller, more incremental approaches. By demonstrating the potential of distributed rewilding, this research offers a more realistic and adaptable framework for integrating biodiversity into dense cities.

At the same time, the project emphasizes that ecological solutions cannot be separated from social context. Rewilding is not just about restoring nature, but about reshaping relationships between people, place, and environment. As cities continue to face climate change and biodiversity loss, these insights highlight the importance of approaches that are not only ecologically effective, but also socially just and practically feasible.

Ultimately, this project shows that rewilding in San Francisco will not emerge through a single large transformation, but through the accumulation of many small, connected interventions, each contributing to a broader and more equitable network of urban ecological resilience.

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**Rethinking a Restored Los Angeles River through Traditional Ecological Knowledge and
Environmental Stewardship**

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Abstract

This study examines the role of Traditional Ecological Knowledge (TEK) and environmental stewardship in the restoration efforts of the Los Angeles River as described in the LA River Master Plan. Traditional Ecological Knowledge (TEK) is the place-based understanding of an ecosystem, often connected to the interconnected ecological systems between plants, humans, and animals (NPS, 2026). TEK is typically developed by indigenous or local communities, often connecting to these communities' beliefs, cultural practices, and historical connections to the natural environment. Environmental stewardship is the responsible use, management, and protection of the natural environment through conservation and sustainable practices (NOAA, 2024). Environmental stewardship can be performed through an individual's or organization's actions to care for the environment through restoration efforts, clean up events, community outreach and more. The idea behind environmental stewardship is to protect an ecosystem to provide a healthy environment for current and future generations.

In the context of the Los Angeles County's LA River Master Plan, these perspectives remain underrepresented despite the County's emphasis on community engagement during the development of the plan. Through this research, I analyze how Los Angeles residents experience and relate to the Los Angeles River and evaluate how integrating TEK and environmental stewardship into the plan can strengthen community involvement and long-term maintenance of a restored river. My findings indicate that the river's current design and channelized structure disrupt both the physical and emotional connection between residents of the river, contributing to its neglect as an ecological and social resource. This study also finds that combining TEK with Western Ecological Knowledge (WEK) can foster a more resilient ecosystem by reintroducing long standing ecological relationships that are often overlooked in WEK restoration approaches. Additionally, incorporating environmental stewardship into the LA River Master Plan can empower local communities to take an active role in caring for the watershed, ultimately supporting a more sustainable and resilient ecosystem for future generations.

Introduction

The Los Angeles River is a 51-mile river that flows from the San Fernando Valley, through Los Angeles before reaching the Pacific Ocean near Long Beach. In the 1930s, the U.S. Army Corps of Engineers channelized the river to mitigate flooding, turning it into a concrete lined channel designed to move stormwater runoff out into the ocean. While this engineering feat reduced flood risk for the County of Los Angeles, it also altered the river's natural ecological functions and severed the human connections to the river. It created a watershed with a system that prioritizes stormwater drainage over environmental health and community connection to the ecosystem.

In 1996, Los Angeles County directed the Departments of Public Works, Parks and Recreation, and Regional Planning to coordinate all parties interested in the planning, financing, and implementation of a master plan for the LA River (LARMP, 2026). This plan outlined eight goals that would focus on aesthetics of the river, economic development, environmental quality, flood management and conservation, jurisdiction implementations, and recreational features. Overall, emphasizing the focus on flood control, stormwater, and safety along the river.

By 2022, Los Angeles County wanted to update the LA River Master Plan by shifting the focus of the plan to take a more holistic approach to this project and include sustainability, social equity, and habitat restoration. In the 2022 version, the plan outlines nine planning phases and emphasizes expanded goals to include features such as river access, arts and culture, and housing affordability.

The LA River Master Plan does a thorough job at breaking down the watershed into nine planning phases, with the idea of implementing short-term projects to deliver the long-term goals of the master plan. Some of the main goals include improving the aesthetics of the river; promoting economic development for the surrounding communities; preserving, enhancing the environmental resources; ensuring proper flood and management control; ensuring jurisdiction and public involvement of the plan; and providing a safe recreational space along the river.

One element of this plan that stood out to me was the land acknowledgment that was intentionally placed at the beginning of the document and the community partner's portion. The County of Los Angeles acknowledged that the LA River and the watershed is on the traditional lands of the Fernandeño Tataviam, Gabrieleño Tongva, and Ventureño Chumash Nations. This acknowledgement and the varying goals of the plan made me think about Traditional Ecological Knowledge (TEK) and environmental stewardship within the systems of the LA River restoration project.

Traditional Ecological Knowledge (TEK) is the place-based understanding of an ecosystem, often connected to the interconnected ecological systems between plants, humans, and animals (NPS, 2026). TEK is typically developed by indigenous or local communities, often connecting to these communities' beliefs, cultural practices, and historical connections to the natural environment. This differs from Environmental Stewardship, which is less rooted in a historical context, but often involves community engagement to protect the environment. Environmental stewardship is the responsible use, management, and protection of the natural environment through conservation and sustainable practices (NOAA, 2024). Environmental stewardship can be conducted through an individual's or organization's actions to care for the environment through restoration efforts, clean up events, community outreach, and more. The idea behind environmental stewardship is to protect an ecosystem to provide a healthy environment for current and future generations

Considering the historical perspectives of TEK and community involvement of Environmental Stewardship, this raised several intriguing questions for me: *How do Los Angeles residents currently experience and relate to the LA River; How might the integration of Tradition Ecological Knowledge (TEK) and environmental stewardship into the LA River Master Plan impact these relationships with Los Angeles River?*

Why this perspective matters

The purpose of these questions is to explore alternative approaches to river management that not only support the goals of the restoration efforts along the LA River but also ensure the long-term health and resilience of the river after implementation of the LA River Master Plan. The Los Angeles River Master Plan outlines 78 major project sites organized into nine project target areas, each defined by its unique geographic conditions and ecological characteristics. Given the scale of the river, the financial requirements of this plan are substantial, with implementation costs estimated between \$19 billion and

\$24 billion (in 2020 dollars) (LACDPW, 2022). In addition, ongoing maintenance is projected to cost approximately \$1.5–\$3 million per mile annually (in 2019 dollars) (LACDPW, 2022). These significant costs raise an important question for stakeholders: is a project of this magnitude both feasible and justified?

The Los Angeles River watershed, primarily managed by the U.S. Army Corps of Engineers and the Los Angeles County Flood Control District, spans 13 cities, meaning that restoration efforts will have widespread impacts on surrounding communities. While a project of this scale has the potential to generate substantial environmental and social benefits across the metropolitan region, its feasibility may depend on incorporating alternative, cost-effective strategies for maintaining and protecting the river for future generations. This is where TEK and environmental stewardship can help elevate the project in terms of creating a more resilient ecosystem because of the historical and on-the-ground knowledge and perspective of the river, while also involving the community so that the river can be protected for future generations.

Literature Review

Literature Review Introduction

For generations humans have altered rivers for agricultural purposes, residential and industrial developments, and flood mitigation. These types of alternations have led to issues like decreased water quality, disruption of natural ecological systems, and a depletion in our natural resources. While there is acknowledgement of how river alterations are impacting on the physical and ecological conditions of a river, we are now starting to acknowledge how these river alterations impact communities and societal systems.

In the 1930s, the U.S. Army Corps of Engineers channelized the Los Angeles River to mitigate flooding. This effort turned the river into a concrete lined channel designed to move stormwater runoff from the streets of Los Angeles out into the Pacific Ocean. This infrastructure project successfully altered the river to carry the volumes of water that would runoff from the mountain basins into the valleys of the Los Angeles area. While this engineering project reduced flood risk for the County of Los Angeles, it also altered the river's ecological functions, decreasing the water quality and reduced natural green spaces for communities.

In 2022 the County of Los Angeles wanted to reimagine the iconic concrete lined Los Angeles River to create more intentional green spaces for the communities throughout LA County, while improving the health of the watershed and improving the water management. With these goals in mind the County of Los Angeles published the 2022 LA River Master Plan. This plan breaks down the technical steps for restoring the Los Angeles River and considers things like project timeline, impacts on water quality and supply, groundwater recharge, and green spaces.

For this literature review, I have analyzed scholarly journals that address environmental justice disparities in restoration projects and explore how the integration of indigenous knowledge within a restoration project can influence environmental justice outcomes for impacted communities. This literature review

addressed themes such as the relationships between restoration efforts and communities; Traditional Ecological Knowledge (TEK) compared to Western Ecological Knowledge (WEK), and the impacts of Indigenous Knowledge on restoration practices and policy change.

Through this synthesis, several patterns emerged. First being that historically, restoration project locations were prioritized in white-dominated, wealthier cities. The lack of investment in communities without resources is what inadvertently creates environmental inequalities (Dernoga, 2014). In Los Angeles, these communities have also faced historical injustices such as redlining. Redlining reduced the economic opportunities for people of color in Los Angeles in the 1930s, restricting people of color from investing in homes within specific parts of LA. This policy fueled segregation through the Los Angeles metropolitan area.

Second, the literature discusses how environmental restoration projects that were led by Indigenous communities, created the political space to decolonize river governance (Fox, 2017). This change in political stance brings in environmental equality for communities who otherwise would not get these chances.

Third, while Western Ecological Knowledge offers strong technical guidance for restoration projects, Traditional Ecological Knowledge allows for the rebuilding of ecological resilience and the restoration of culturally significant connections (Zedler, 2018), while also encouraging a collaborative approach to ecosystem science. Integrating these knowledge systems enables a more holistic approach to restoration, strengthening capacity of decision-makers and policymakers to address complex environmental issues such as climate change adaptation (Whyte, 2013). By bringing these approaches together we can build a more resilient and cohesive ecosystem.

Literature Review & Discussion

Environmental disparities do not occur overnight, rather it is the implementation of systematic inequalities that accumulate over generations. While this issue is rooted in historical processes, environmental injustice is still a contemporary issue. As environmental restoration efforts become more widespread, systematic barriers continue to limit the ability of low-income communities and communities of color to access and implement beneficial projects that can improve ecosystems and bring green spaces into communities. We see this in the case of Maryland's Water Restoration programs. From the research article, *Environmental Justice Disparities in Maryland's Watershed Restoration Programs*, there was an examination of two state-level initiatives aimed at restoring impaired waterways. This study found significant geographic, racial, and socioeconomic disparities in both the placement of state-funded wetland restoration projects and the allocation of Clean Water Act Section 319(h) funds. These findings indicate that predominantly white and wealthier communities received disproportionately greater environmental opportunities, while communities of color and low-income communities had less access to restoration opportunities. These disparities may stem from unequal access to financial, technical, and administrative resources needed to secure funding and implement restoration projects. With the acknowledgement of these disparities, we can remove the systematic barriers preventing underserved communities from implementing restoration projects and green spaces in their communities.

This similar issue is what we are starting to see in the Los Angeles River Restoration project. Wealthier neighborhoods and cities have the financial resources and opportunities to begin the restoration efforts compared to lower income cities in central Los Angeles. One of the first locations to implement the Los Angeles River Master Plan and restore the river was the city of Glendale. The city of Glendale is known as an upper-middle class city in Los Angeles with a predominately white population and had the resources to implement the restoration plan before other south-central cities (City of Glendale, 2026). These types of priorities are not uncommon in Los Angeles and have an impactful effect on communities. According to the article *Environmental Justice in Greater Los Angeles: Impacts of Spatial and Ethnic Factors on Residents' Socioeconomic and Health Status*, it was found that white populations tend to be segregated in the Los Angeles area. These populations were found to be located in more green spaces, in communities with higher housing and financial stability, and more educational opportunities. This was compared to the populations of people of color, where these communities are located in spaces that have to deal with higher pollution levels contributing to environmental justice concerns. Additionally, it was found that the accessibility of green spaces creates a more inclusive society, reducing societal segregation for individuals.

These inequity issues then bleed into the aftermath of restoring the Los Angeles River. From the dissertation titled, *Restoring a River to Reclaim a City?: The Politics of Urban Sustainability and Environmental Justice in the Los Angeles River Watershed*, Ester Kim discusses how the movement to restore the Los Angeles River is a sustainable approach to rethinking the watershed but in reality, the plans rely on dominant political-economic processes. Kim describes how the neighborhoods who need the implementation of green spaces and are historically divested neighborhoods are often left unprotected from real estate speculation and housing markets that threaten to displace lower income residents (City of Glendale, 2026). So, while there the intent to bring environmental equity into these neighborhoods has value, this Los Angeles River Restoration Project can lead to things like increased housing prices or living prices that can push out the low-income community members if these potential outcomes are not considered.

So how could Los Angeles' history help with present-day environmental inequities? Indigenous communities are increasingly taking the lead in ecological restorations. These types of projects are being used as a method to bring a healthier ecosystem into communities but also allow these communities to reveal the sociocultural and political dimensions of restoration. According to the research article "*The river is us; the river is in our veins*": re-defining river restoration in three Indigenous communities, due to Indigenous' communities cultural, spiritual foundation, river restorations created potential to repair community relationships with the environment and empowered communities. To open these opportunities, the indigenous members had to create a space to decolonize river governance bringing equity to the table. This may be a mighty feat for a project like the LA river restoration project, but due to the nature of intertwined governance of the Los Angeles River, it might be a necessary step to achieving an equitable river restoration.

From an ecological and cultural standpoint, implementing Traditional Ecological Knowledge (TEK) is a way to enhance and protect cultures while managing the natural resources that are more resilient. This type of work can be seen in The Delta Plan in Northern California. As seen in the article, *Western and Traditional Ecological Knowledge in Ecocultural Restoration*, it discusses how Western Ecological Knowledge (WEK) offers a strong technical guidance for restoration projects while Traditional Ecological

Knowledge (TEK) allows for a rebuild of ecological resilience and culturally significant connections to the ecosystem. This brings in significant cultural plants that are native to the area into restoration projects, creating a more sustainable ecosystem that is more resilient. The article states that TEK compliments WEK and is “potentially synergistic in achieving data-based decision-making” creating a more holistic approach to restoration efforts.

Traditional Ecological Knowledge not only brings historical perspectives to the table, but also creates a collaborative space for communities. In the article *On the role of traditional ecological knowledge as a collaborative concept: a philosophical study*, it describes how TEK has many definitions due to the nature of cultural differences across indigenous communities. While TEK can be described as having many definitions, Whyte likes to think about TEK as a collaborative concept. It allows a diverse population to continually learn from one another, allowing for a blend of knowledge from many different perspectives. This blend allows people to be better stewards for the environment as it can make space for multiple approaches to one problem. For the Los Angeles River restoration project, a collaborative knowledge approach would allow input from many communities along the river, bringing out diverse knowledge that can best suit the ecosystem’s needs throughout the watershed. This type of collaborative approach could then transition into environmental stewardship efforts along the watershed.

Environmental Stewardship is described in *Environmental Stewardship: A Conceptual Review and Analytical Framework*, as the “actions taken by individuals, groups or networks of actors, with various motivations and levels of capacity, to protect, care for or responsibly use the environment in pursuit of environmental and/or social outcomes in diverse social–ecological contexts” (Bennett. et. al., 2017). The article discusses how local environmental stewardship is a good way to promote sustainability while also promoting more meaningful and effective environmental policies and programs that can improve the ecological and social outcomes in communities and ecosystems. While this article describes how environmental stewardship has not received adequate attention yet, they describe how it can bring a valuable and holistic approach to guiding productive and sustained relationships with the environment. For the Los Angeles River, the watershed travels through seventeen cities before entering the Pacific Ocean. By creating a collaborative foundation in the LA River Master Plan, Los Angeles County can develop a more sustainable restoration project.

Literature Review Reflection

One notable gap in the literature is the limited assessment of Indigenous Knowledge (IK) and Traditional Ecological Knowledge (TEK) as applied to restoration efforts in Los Angeles. The LA metropolitan area has a long and complex history shaped by colonization and urban development. This often overshadows the deep cultural and ecological knowledge embedded in the landscape. While Los Angeles is widely associated with economic growth and global influence, it is also a place rich in Indigenous history and cultural diversity. As the city increasingly embraces green infrastructure and sustainable urban development to reintroduce natural spaces in dense urban neighborhoods, there is a critical opportunity to meaningfully integrate TEK and environmental stewardship into planning and restoration practices. Doing this can strengthen ecological resilience, foster culturally rooted connections to the watershed, and challenge conventional policy frameworks that have historically contributed to environmental inequities.

This capstone project aims to acknowledge these missing pieces in the LA River Master Plan. By bringing this perspective to the table, the LA River restoration project can create the space needed to uplift the communities who will be economically, environmentally, and systematically impacted by the river restoration project. Integrating Traditional Ecological Knowledge and environmental stewardship into the LA River Master plan is necessary to advance environmental equity and sustainability throughout the Los Angeles watershed. Through this project I am to promote equitable decision-making processes for urban development and support a healthier environment that reflects Angelenos' cultural values, creating a healthier and more sustainable city for all residents.

Methodology

For this capstone project, I ask two questions: *How do Los Angeles residents currently experience and relate to the LA River* and *How might the integration of Tradition Ecological Knowledge (TEK) and environmental stewardship into the LA River Master Plan impact this relationship with the Los Angeles River?* To address these questions, I used multiple methods of data collection to gather information targeting each question. These methods of data collection focus on capturing people's experiences with their watersheds, my own experience with the LA River, and Traditional Ecological Knowledge and environmental stewardship in practice.

To answer the first question, I wanted to focus on capturing people's experiences with their land or the LA River. To do this, I used a combination of on-the-ground observational research and case study research which allowed me to get a better understanding of how and why people interact with their environments. To address the second question, I combined case study research and interview research to examine how TEK and environmental stewardship can influence restoration efforts. Together these methods allowed me to get a more hands-on and comprehensive perspective on how TEK and Environmental stewardship can be applied in practice.

Observational Research

One of the primary research methods used during this capstone study was observational research. As part of this approach, I visited multiple locations along the Los Angeles River to better understand its conditions across different sections of the watershed. These site visits allowed me to engage directly with the Los Angeles River trail and observe how the river functions in a real-world context. The three sites selected for this study included the Wrigley Greenbelt in Long Beach, the Urban Orchard Park in South Gate, and the Glendale Narrows Riverwalk in Glendale, California. These locations were chosen because they all featured dedicated green spaces and were located along the Los Angeles River with nearby access points adjacent to the bike trail.

During the site visits, I documented the conditions of the trail, river, and green spaces with photographs and field notes. I also observed how individuals interacted with these environments. This method of research allowed me to gather real-time, place-based data on the river in its current conditions. My observations included the types of wildlife that interacted with the river, the visible forms of pollution, and the overall accessibility of the river to the public.

Case Study Research - Klamath River Restoration Project

The second research method used in this capstone project was a case study analysis. Specifically, I examined the Klamath River Restoration Project, which successfully transformed a once dammed river by removing multiple hydroelectric dams along the watershed, improving river health and supporting the recovery of fish populations in the Klamath Basin.

I selected this project as a case study because it highlights the Traditional Ecological Knowledge and Environmental Stewardship that derived from the Tribal Nation along the Klamath River Basin. The effort to remove the dams stemmed from the strong advocacy that came from the Klamath Tribal Nations. Through a combination of Traditional Ecological Knowledge, such as the historical understanding of the watershed, and western science, such as monitoring the water quality and conducting fish tissue sampling, they were able to identify the major concerns with the waterbody. This led to support from state and local governments after many years of fighting for the right to a healthy watershed and ecosystem for the people of the Klamath River Tribal Nations and the wildlife populations.

Another factor that I considered when selecting this project was its strong emphasis on inclusive and collaborative partnership between the State, Federal, and Tribal agencies. Key partners in this project involved the State of California, the State of Oregon, local conservation groups, and multiple Tribal Nations including the Yurok Tribe, Karuk Tribe, Klamath Tribes, Hoopa Valley Tribe, and Shasta Indian Nation. Through meaningful collaboration and heavy advocacy from the Nations, the agencies were able successfully conduct the largest dam removal and river restoration effort in U.S. History (The Conservation Alliance, 2023).

Another reason for selecting this case study is the project's extensive timeline. Advocacy efforts began in 2002, when Tribal communities-initiated calls for dam removal. It took more than two decades of organizing, negotiation, and partnership-building to bring the project to completion. Because the restoration is both recent and well-documented from inception to implementation, it provides valuable insight into the long-term realities of environmental stewardship, as well as the role of Traditional Ecological Knowledge in large-scale restoration efforts.

Interview Research

To gain a deeper understanding of how Traditional Ecological Knowledge (TEK) and environmental stewardship is applied in practice, I conducted an interview with the Yuhaaviatam of San Manuel Nation's Environmental Department. The San Manuel Environmental Department (SMED) is dedicated to protecting Tribal lands through the stewardship of natural resources and community outreach efforts (YSMN, 2026). For this interview, I spoke with the Environmental Manager to gain insight into how the department upholds Tribal sovereignty through environmental stewardship and partnerships with federal agencies.

The Yuhaaviatam of San Manuel Nation is located in San Bernardino County, California, just outside of Los Angeles, and governs a reservation spanning over 1,100 acres (YSMN, 2026). The Nation works to uphold its sovereignty through environmental stewardship, legal partnerships with the United States, and

the development of its own internal ordinances, practices, and policies. These frameworks help ensure the protection and sustainable management of natural resources and the environment on the reservation (YSMN, 2026).

Results and Discussion

Research Question: *How do Los Angeles residents currently experience and relate to the LA River; How might the integration of Tradition Ecological Knowledge (TEK) and environmental stewardship into the LA River Master Plan impact these relationships with the Los Angeles River?*

Experiencing the Los Angeles River

One of the first data points that I wanted to collect was from my own experience with the Los Angeles River and to gauge how the public was interacting with the river. To do this, I visited three different sites along the river to note the condition of the river and the bike path and to determine how accessible the river was for the public. The three sites that I chose to visit included the Wrigley Greenbelt in Long Beach, the Urban Orchard Park in South Gate, and the Glendale Narrows Riverwalk in Glendale, California. Below are my observations from each location.

Wrigley Greenbelt - Long Beach, CA

The first site that I explored was the Wrigley Greenbelt in Long Beach, CA. This location has a dedicated green space with a walking trail, picnic tables, and a horse path. The greenbelt is located next to the Los Angeles River Bike trail, where residents can access the bike trail directly from the greenbelt.



Gutierrez, M., 2026. Photographs of Wrigley Greenbelt near Long Beach, CA

The greenbelt itself was well maintained, with native plants growing along an accessible walking path. Right next to the Greenbelt was a path to access the Los Angeles River Bike trail. This path was large enough that a vehicle could drive up the side of the levee, yet the conditions of the walking trail and the bike trail differed quite a bit. While the greenbelt was well maintained with lush vegetation, the bike path was surrounded by weeds and trash pollution.



Gutierrez, M., 2026. Photographs of the path next to Wrigley Greenbelt to access the LA River Bike Trail near Long Beach, CA

Along the LA River bike path, I noticed a large population of seagulls in the water. The water was moving quickly, but there were spots of low water volumes. In these spots, I saw trash pollution piled up in the water, caught on other debris such as tree branches, construction materials, or just in the shallow spaces of the waterway. There were no visible signs of fish or aquatic vegetation in the water.



Gutierrez. M., 2026. Photograph of the LA River near Long Beach, CA

The bike trail itself had several bikers on it, but it was noted that there was no public infrastructure such as trash bins, water stations, or benches. Shade was also non-existent along the trail, which made me wonder how much the trail is used during the summer season.

Urban Orchard Park - South Gate, CA

The Urban Orchard Park in South Gate, CA, was the second place I visited. This site is dedicated park space that contains features such as a playground, picnic tables, a restored wetland and pond waterbody, fitness machines, and more. In the design of the park, they also included a citrus orchard, avocado orchard, and a community garden.



Gutierrez. M., 2026. Photographs of Urban Orchard Park in South Gate, CA

One very notable part of the park was it was designed to reflect elements of the Tongva Nation's culture. The playground had play structures such as Kiches, a canoe, and a fish. There were words such as "friendship" and "welcome" in the Tongva, Spanish, and English languages along the ground, and there were murals of the Los Angeles River on structures in the park.



Gutierrez. M., 2026. Photographs of the playground structures at Urban Orchard Park in South Gate, CA

While I found this park to be an incredible addition to the city of South Gate, I noticed it was quite tucked away from the public and located right next to 710 freeway. To access this park, it did require you to drive to it because the only access point to the park has you driving under the freeway through a very industrial area.

Another point that I noted while exploring this park is that there was no way to access the Los Angeles River from the park, when the park was adjacent to the river. From the maps of the area, it seemed as though there were little to no access points directly to the LA River bike path. This means that the river is almost completely disconnected from communities in the area. This disconnection fuels the image of the river being a drainage channel rather than a natural river that plays a big part in the Los Angeles ecosystem.

Glendale Narrows Riverwalk - Glendale, CA

The last site that I visited was the Glendale Narrows Riverwalk in Glendale, CA. This location is known for being the only restored portion of the Los Angeles River. In the center of the channel, large rocks and boulders were placed in the river to catch soil and hold vegetation. Trees and grasses were planted in the center of the channel, creating shelter for a variety of waterfowl such as ducks and Canadian geese and wading birds such as Herons and Black Necked Stilts.



Gutierrez, M., 2026. Photographs of the Glendale Narrows Riverwalk in Glendale, CA

The main things that I noticed while exploring the Glendale Narrows were the high volume of pedestrians on the trail and the larger number of access points to the trail. This was especially compared to the previous locations where there were little to no access points. These points contained several public infrastructure elements such as trash bins and picnic tables, creating a more inviting space for the public. As I was out there, a pedestrian stopped to talk with me as I was taking photos, he was explaining how the “the view will get even better just around the corner!”. This person was referencing the beauty that he found in the river, where the restoration was occurring. Through this small interaction, you could see his

excitement for the river, which made me think about the local stewardship efforts that occur along this walking path.

Another point that I noticed about the restored area inside of the channel was the large volume of trash pollution. Just like how we saw trash pollution in the LA river near Wrigley Greenbelt, we saw trash pollution in the vegetation of the channel. My thought is that as the water level rises, more pollution is carried into the river through the storm drains and catching on vegetation. Understandably, this may be a difficult place to maintain if there is a higher volume of trash pollution during or after rain events. Even though this location had trash pollution in the water just like the other sites, there were far more people on this trail compared to the previous locations.



Gutierrez, M., 2026. Photographs of the trash in the river at the Glendale Narrows Riverwalk.

Analysis of the in-person Site visits

Visiting the three sites provided valuable insight into how the Los Angeles River is currently experienced across different communities. Overall, I found a clear effort to reconnect the residents to the river or nature through the development of green spaces. While these spaces may not be directly on the river, they are often adjacent to it, which offers indirect access and opportunities for recreational spaces such as bike riding.

With this, I did find that access to the river was not evenly distributed in every city. I noticed fewer access points in cities along the southern half of the river, suggesting disparities in how different communities can engage with this natural resource. It got me questioning if environmental stewardship would naturally occur along the Los Angeles River as people begin to have access to this natural resource.



Gutierrez. M., 2026. Photograph of the LA River and LA River Bike Path near Long Beach, CA

Another issue that was consistent across the three sites was the visible trash pollution that was seen in the water. At each location, trash debris was evident either in the waterway or along the levee. The prevalence of trash contributes to a broader perception of the river as polluted and neglected. This reinforces a common view among some Los Angeles residents that the river functions primarily as a drainage or sewage system, especially during storm events when runoff carries waste downstream.

Additionally, I found that the development of these green spaces depends on two key factors: financial investments and available land. Both present significant challenges in a dense metropolitan area such as Los Angeles. High costs that are associated with the design, engineering, and maintenance of these spaces, plus the combination of limited open space, creates barriers for cities attempting to expand green infrastructure along the river. This is why I believe the Los Angeles River is a resource with so much potential to create those much needed green spaces for the residents of Los Angeles.

Klamath River Restoration Project

Environmental Stewardship can come from many groups of people or individuals, but what happens when your values, cultures, and livelihoods are connected to the environment and impacted when environmental degradation occurs? For Tribal Nations of the Klamath River watershed, the Klamath river is their lifeblood (American Rivers, 2023). So, when their river had shown evidence of environmental degradation due to hydroelectric dams built throughout the Klamath River Basin, these Nations and communities took matters into their own hands to advocate for the health of the river, the wildlife populations, and their food sovereignty for their people.

For years, the Yurok Tribe had been monitoring the water quality of the Klamath River and fish populations in the watershed. Over time, they found that the water quality was getting worse, leading to human health advisories for the communities to stay out of the water and to avoid consuming the fish from the watershed. This was a major hardship for the people of the Klamath River basin, as they rely on

the salmon populations for food. In 2002, due to ongoing droughts and the diversion of water for agriculture, deadly algal and bacterial growth in the river left an estimated 70,000 adult salmon dead (The Conservation Alliance, 2023). This environmental tragedy sparked community wide protests throughout the Klamath Basin. Through protests and vocalizing their concerns, the Yurok Tribe was able to gain support from the State of California, State of Oregon, and local governments to work with the Tribal Nations along the Klamath basin to improve the water quality throughout the Basin.

These stewardship efforts lead to the removal of four Klamath hydroelectric dams that had altered the river's natural flow and ultimately disrupted the natural systems in this watershed. This lack of flow increased stagnate water throughout the basin, causing water temperatures to rise. As the water temperatures increased, salmon, steelhead, and lamprey fish populations were unable to spawn throughout the basin in their historic spawning grounds and bacteria and algae levels increased leading to poor habitat conditions for aquatic life (KRRC, 2026). This change in the ecosystem not only degraded the water quality of the river, but also altered the local communities' way of life as the dams had removed the natural habitat for key fish species that supported the local communities and ecosystem.



Photographs show the before (left) and after (right) of the dam removal at the Klamath River. Photos sourced from [Los Coast Outpost](#).

In 2022, the Federal Energy Regulatory Commission (FERC) approved the removal of the dams. As the dams began to be removed the Tribal Nations of the Klamath River immediately noticed an improvement in the water quality. The now free flowing river reduced the temperatures of the water, allowing fish populations to return to the ecosystem. By having a community who was willing to advocate and fight for the health of the river and ecosystem, this historic river restoration successfully brought the river back to life, reducing water pollutants and protecting this resource for future generations.

Interviewing Yuhaaviatam of San Manuel Nation

To get some first hand perspective on Traditional Ecological Knowledge and water management, I interviewed Clifford Batten, the Environmental Manager of the San Manuel Environmental Department (SMED) of the Yuhaaviatam of San Manuel Nation. Clifford has been working with SMED for over 25 years, targeting water quality, conservation, and human health impacts on the nation.

One of the key topics that we discussed during this interview was the deep cultural connections that Indigenous communities have to their lands. This connection is a key part of many Tribal Nations' decision-making processes when it comes to environmental and human health. As a result, when environmental degradation begins to occur Tribal Nations are some of the first people to recognize these changes. Since their cultural practices are often closely tied to both ancestral lands and present-day reservation boundaries, there is often continuous observation and interaction with the environment. While Traditional Ecological Knowledge (TEK) is a relatively newer term, the practice of TEK has been used in indigenous communities for generations. This is why rather than only relying on Western Ecological Knowledge (WEK) in our restoration designs, we should be integrating TEK with WEK to create more resilient ecosystems with a holistic approach.

One environmental concern identified by the San Manuel Environmental Department is increasing levels of trash pollution that is found on the reservation. Clifford described littering and illegal dumping as being a growing concern in the area that they are actively using resources on to maintain. To address this concern, SMED has been focusing on education, outreach and community involvement to bring more awareness to the issue. Clifford mentioned "if a place looks like trash, then people will treat it like a trash can". Therefore, it is important to bring awareness to environmental issues and get the community involved in conserving the lands that they want to protect. By raising awareness and engaging with community members, especially the younger generations, these efforts promote environmental stewardship and emphasize how ecosystem health directly impacts daily life.

Trash pollution is not only an issue with San Manuel Nation, it also is a persistent issue for the county of Los Angeles. In the Los Angeles River, trash pollution is one of the major water quality issues that was visible at all the site visits. During the visits, trash was found caught on larger debris and in the shallow areas of the river near Wrigley Greenbelt and caught on the vegetation that was planted in the restored portion of the river at Glendale Narrows Nature walk. One challenging part of controlling trash pollution is a human generated issue produced by everyone and when mismanaged it can enter waterways via the wind or storm runoff making it difficult to control. So, in a county like Los Angeles, where there are roughly 9.8 million residents, this becomes an area of concern when maintaining the LA River. Having local support through environmental stewards could relieve some of that resource burden that the county of Los Angeles would experience if trying to maintain a restored river by themselves. Instead, it could foster the engagement of the people and create opportunities for local residents to give back to the ecosystem.

Connecting it all back to the LA River Master Plan

Throughout this capstone project, I explored the potential integrations of Traditional Ecological Knowledge and environmental stewardship in the settings of a restored Los Angeles River, while also working towards understanding how the Los Angeles River is experienced. From my data and observations, I have come to the conclusion that the Los Angeles River is still viewed as a disregarded natural ecosystem but has the potential to be a thriving resource for the residents of Los Angeles. By incorporating TEK and environmental stewardship into the LA River Master Plan, the county of Los Angeles has the potential to create a space that goes beyond aesthetics and stormwater.

By incorporating Traditional Ecological Knowledge (TEK) into the LA River Master Plan, we can strengthen ecological resilience of a restored LA River while reintroducing historical ecological relationships that often go unnoticed in the Western Ecological Knowledge (WEK) based approaches to restoration. TEK offers a place-based knowledge that is developed from a collaborative effort of people over generations, emphasizing the interconnectedness among species, natural environmental systems, and the responsible use of natural resources. This is compared to, Western Ecological Knowledge that often prioritizes technical and engineering-based solutions that may overlook deeper ecological relations. By integrating TEK into WEK, restoration approaches can flourish beyond the technical approaches to a river restoration to include practices that support biodiversity, habitat, and long-term ecosystem health. This combined approach will not only enhance ecological outcomes along the LA river but also acknowledge and restore cultural relationships with the river that have diminished since the river was channelized.

Thinking about environmental stewardship, incorporating environmental stewardship into the LA River Master Plan can empower local communities to take an active role in caring for the watershed. This can foster a sense of ownership, responsibility, and connection to the river. Stewardship initiatives, like community-led clean up events, vegetation restoration, outreach and educational programs, and citizen ecosystem monitoring, can create opportunities for residents to directly engage with their environment. This engagement not only improved the health of the river but also strengthened community ties and environmental awareness. By incorporating stewardship into the planning process, the LA River Master Plan can shift from a top-down approach to a more collaborative approach that values local knowledge and participation. By doing this, we can build long-term support for the restoration of the LA River and help ensure that the river is maintained as a shared resource rather than only infrastructure.



Gutierrez, M., 2026. Photograph of the LA River and LA River Bike Path near Long Beach, CA

Summary

From this capstone project, I found that many residences of Los Angeles remain disconnected from the Los Angeles River due to its channelized state, despite the ongoing efforts to try and restore that connection. Strengthening this connection presents an opportunity to foster greater environmental stewardship among local communities. While Traditional Ecological Knowledge and environmental stewardship are not a singular solution to the challenges of restoring and maintaining the Los Angeles River, lessons from past restoration efforts demonstrate how relationships between people and waterways can inform more holistic and sustainable approaches to river restoration projects. By rebuilding connections between communities and the river there is potential to cultivate a stronger sense of stewardship that can be sustained across future generations.

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THE GREEN ILLUSION

Who Gets Shade, Who Gets Heat, and Who Is Told to Wait?

Joshua Garcia

Abstract

Urban green space initiatives are widely promoted as “win-win” solutions for addressing climate change, public health, and urban livability. However, growing evidence suggests that the benefits of green infrastructure are unevenly distributed and shaped by historical patterns of racial segregation, economic inequality, and uneven urban development. Communities with greater wealth and political influence tend to receive higher levels of investment, maintenance, and mature green infrastructure, while historically marginalized communities often experience underinvestment and reduced access to environmental benefits such as cooling and improved air quality.

Despite increasing attention to urban greening, the extent to which these initiatives address or reproduce environmental inequalities remains insufficiently examined. This study investigates how unequal access to green spaces contributes to disparities in environmental conditions and lived experiences across communities. Guided by environmental justice theory, this research integrates spatial analysis, policy review, and community-centered perspectives to evaluate the distribution and impact of green infrastructure.

Findings suggest that without explicit equity-centered planning and structural policy intervention, green space initiatives often function as symbolic rather than transformative solutions, improving visual landscapes while leaving underlying disparities largely unchanged. These results highlight the need to evaluate sustainability not solely through the quantity of green spaces, but through its capacity to redistribute environmental benefits and reduce systemic inequalities.

Introduction

Who gets shade? And who does not? This seemingly simple question reveals a deeper reality about how environmental benefits are distributed across cities. Shade is not just a comfort, it is a form of protection against heat, a determinant of public health, and a reflection of investment. By asking who has access to shade, this study makes environmental inequality visible, showing that sustainability is not experienced equally, but unevenly across neighborhoods.

The Green Illusion is a conceptual framework that examines how urban sustainability efforts, particularly green space initiatives, are presented as universal solutions while obscuring the structural inequalities that shape their distribution and impact. Many urban neighborhoods in the United States reflect long-standing patterns of racial segregation, economic inequality, and uneven infrastructure development shaped by policies such as redlining, zoning practices, and municipal investment decisions. These patterns are visible in cities across the United States.

For example, this study focuses on areas such as East Los Angeles and South Los Angeles, which are characterized by lower canopy coverage and higher environmental exposure, compared to areas such as Beverly Hills and West Hollywood, which exhibit higher canopy density and lower vulnerability. In Chicago, comparisons are drawn between North Side neighborhoods with higher levels of investment and South Side neighborhoods that have experienced historical disinvestment ([Nesbitt et al., 2019](#); [Schwaab et al., 2021](#)). In contrast, neighborhoods that have benefited from continuous public investment and zoning protections tend to have a mature tree canopy, well-maintained parks, and greater access to environmental amenities. These differences are not just demographic, as they reflect long-standing relationships between communities, land use decisions, and public investment that continue to shape environmental conditions today. These processes have contributed to the uneven distribution of environmental benefits, including tree canopy coverage, park access, and cooling infrastructure, while concentrating environmental burdens such as pollution and heat exposure in historically marginalized communities ([Gochfeld & Burger, 2011](#); [Anguelovski et al., 2020](#)).

This illusion is not merely a matter of perception but is embedded within the structures and incentives that shape urban planning and development. By prioritizing visibility and short-term outcomes, these systems can produce interventions that look effective while failing to deliver meaningful change. This also raises a broader question that is often left unexamined in sustainability discourse: sustainable for whom? While green space initiatives are widely promoted as universal solutions, their benefits are not distributed equally, and their impacts depend on who receives investment and who is left out.

In this analysis, neighborhoods are not treated solely as demographic units but as historically shaped environments with distinct relationships to land use, public investment, and environmental infrastructure. Some neighborhoods have benefited from sustained investment in parks, mature tree canopy, and environmental amenities, while others have experienced disinvestment, industrial proximity, and limited access to cooling resources.

This comparative framing allows the study to move beyond generalized assumptions about sustainability by examining how environmental inequality operates across different spatial and social contexts. These differences are not incidental but are rooted in long-standing policy decisions that continue to shape environmental conditions today. Using *The Green Illusion* as a central analytical framework, this study argues that urban greening is often presented as universally beneficial, but in practice, it can reproduce environmental inequality depending on how it is distributed and experienced. By examining who gets access to green space, and what kinds of green space, this study challenges the assumption that sustainability is inherently equitable and instead demonstrates that its benefits are shaped by systems of power, policy, and historical investment.

Literature Review

Urban green spaces have long been positioned as a cornerstone of sustainable urban development ([Wolch et al., 2014](#); [Pataki et al., 2021](#)), supported by extensive research demonstrating its ability to reduce urban heat, improve air quality, support biodiversity, and enhance both physical and mental health outcomes. These findings have contributed to widespread policy adoption, with cities across the world investing in tree planting initiatives,

park expansion, and green infrastructure as visible and politically appealing responses to climate change. However, while the environmental benefits of green spaces are well-documented, more recent scholarship has shifted the focus from whether green space works to how it works, for whom it works, and under what conditions those benefits are realized.

A key concept that helps explain these dynamics is greenwashing in urban planning and sustainability policy. Greenwashing has been characterized as the practice of promoting environmentally friendly claims or interventions that exaggerate or misrepresent actual environmental benefits, often prioritizing perception over measurable impact (Delmas & Burbano, 2011; Lyon & Maxwell, 2011). While often associated with corporate environmental claims, greenwashing in urban planning reflects a broader pattern in which sustainability is framed in ways that prioritize visibility and perception over measurable impact. [Galecka-Drozda et al., \(2021\)](#) show that green infrastructure is frequently incorporated into development projects in ways that exaggerate its environmental benefits, particularly when these features serve as marketing tools or regulatory checkboxes. In these cases, green spaces may exist in form but not in function, creating a disconnect between what is promised and what is delivered. This disconnect is not incidental but reflects structural incentives within planning and development systems that reward visible, short-term interventions over long-term, equity-focused solutions. This illustrates how *The Green Illusion* operates in practice: sustainability is made visible through green interventions, but not necessarily effective or equitable in its outcomes. This pattern extends beyond greenwashing alone and becomes even more visible when examining how green space investments reshape urban communities over time. This demonstrates how *The Green Illusion* operates by prioritizing visible environmental action over measurable and equitable outcomes.

This distinction is critical to understanding how green infrastructure can be used to signal environmental progress while failing to address underlying inequalities, reinforcing the central argument of *The Green Illusion*. It also raises important questions about how sustainability is defined and measured. When success is evaluated primarily through visible outputs, such as the number of trees planted, the size of the parks created, or the presence of green amenities, rather than through outcomes, such as reductions in heat exposure, improved air quality, or enhanced community well-being, sustainability efforts may prioritize perception over impact ([Galecka-Drozda et al., 2021](#)).

Furthermore, this emphasis on visibility can create institutional incentives to prioritize projects that are easily quantifiable and publicly recognizable, rather than those that address more complex or less visible forms of environmental inequality. As a result, the greenwashing becomes embedded not only in individual projects, but in the broader systems of governance, funding, and evaluation that shape urban sustainability. This reinforces the need to critically assess not only the presence of green infrastructure, but its effectiveness, distribution, and long-term impact. However, even when green infrastructure produces measurable environmental improvements, its social impacts are not evenly distributed.

This dynamic becomes even more complex when considering green gentrification, which represents another way *The Green Illusion* operates in practice. [Rigolon & Németh, 2020](#) demonstrate that investments in green infrastructure are often associated with rising property values and demographic shifts, particularly in urban areas undergoing redevelopment. While

these investments may improve environmental conditions, they can also contribute to displacement, ultimately excluding the very communities they were intended to benefit. This creates a paradox in which environmental improvements produce social harm, highlighting the need to consider not only the environmental effectiveness of green spaces but also its social and economic consequences. At the same time, understanding these consequences also requires examining the actual environmental performance of green infrastructure itself. In this context, *The Green Illusion* extends beyond environmental performance, as green spaces appear beneficial while redistributing its advantages to more privileged populations. This further illustrates *The Green Illusion*, where environmental improvements appear beneficial but redistribute advantages toward more privileged populations.

While technical research highlights the limitations of green infrastructure, environmental justice research explains why these limitations are unevenly experienced. Diane Pataki and colleagues (2021) examined the environmental performance of urban trees and found that while they contribute to pollution removal, they cannot offset the total volume of emissions in urban environments. This is important because it shows that green infrastructure alone cannot address systemic environmental challenges. Similarly, [Schwaab et al., 2021](#) demonstrate that the cooling benefits of green spaces depend heavily on design, density, and spatial configuration, meaning that poorly planned interventions may provide minimal benefit. [Nesbitt et al., 2019](#) conducted a study examining urban tree canopy distribution across U.S. cities and found that canopy coverage is disproportionately concentrated in wealthier neighborhoods. This is important because it shows that environmental benefits are not evenly distributed, but instead reflect broader patterns of inequality. These findings reinforce *The Green Illusion* by showing that the presence of green infrastructure does not guarantee meaningful environmental or social outcomes.

These patterns are consistent with broader findings on urban environmental inequality, which demonstrate that race and income remain strong predictors of environmental exposure ([Anguelovski et al., 2020](#)). Rather than viewing environmental conditions as isolated variables, environmental justice emphasizes the ways in which environmental benefits and burdens are distributed across different populations. Michael Gochfeld and Joanna Burger (2011) examined patterns of environmental exposure and found that marginalized communities experience significantly higher levels of environmental risk due to historical disinvestment and limited access to green infrastructure. This is important because it shows that environmental inequality is structurally produced, not random.

These patterns are rooted in long-standing structural processes, including redlining, zoning practices, and uneven public investment, which continue to shape urban environments today. Environmental justice perspectives make clear that *The Green Illusion* is not accidental, but produced through structural inequalities in policy, planning, and investment.

At the same time, a growing body of research emphasizes the importance of lived experience in understanding environmental inequality. [Roberts, 2022](#) highlights that green spaces is not only an environmental resource but also a site of cultural meaning, healing, and identity within Black communities. [Wolch et al., 2014](#) similarly argue that equitable access to green spaces requires attention to both physical distribution and social inclusion, emphasizing that environmental benefits must be understood in relation to how they are experienced in everyday

life. These perspectives challenge dominant approaches that rely solely on quantitative metrics, suggesting instead that a comprehensive understanding of environmental inequality must include both measurable conditions and lived realities. This distinction between measurable outcomes and lived experience further reinforces the divide between symbolic and substantive sustainability.

This distinction between symbolic and substantive sustainability has also been expanded in recent research on nature-based solutions, which differentiates between projects that merely appear environmentally beneficial and those that produce measurable ecological and social outcomes ([Gałęcka-Drozda et al., 2021](#)). Symbolic greening efforts often prioritize visibility, speed, and alignment with sustainability branding, making them politically attractive and easier to implement within existing institutional frameworks. These projects may include highly visible tree planting campaigns, decorative green corridors, or limited-scale interventions that are designed to demonstrate progress without requiring significant structural change.

In contrast, substantive sustainability requires long-term investment, intentional design, and ongoing maintenance. It involves not only the installation of green infrastructure, but also the integration of that infrastructure into broader systems such as housing, transportation, and public health. Substantive interventions require consideration of how green spaces function over time, how it is distributed across different populations, and whether it produces meaningful improvements in environmental and social outcomes. These interventions are often less immediately visible but are more likely to produce lasting and equitable benefits ([Wolch et al., 2014](#)). Achieving these outcomes, however, depends heavily on how policies are designed, implemented, and enforced.

Policy research underscores the central role of governance in shaping environmental outcomes. [Rigolon & Christensen, 2025](#) show that even equity-focused policies face significant barriers in implementation, including funding limitations, institutional fragmentation, and a lack of coordination. The results of this study reveal clear and measurable patterns of environmental inequality across neighborhoods. Quantitative data shows disparities in tree canopy coverage, surface temperature, and pollution exposure, while qualitative findings illustrate how these differences are experienced in everyday life. Taken together, this literature demonstrates that green spaces are not inherently equitable but are shaped by systems of power, policy, and lived experience. These governance dynamics also extend beyond green spaces to broader urban systems, including how cities manage resources, waste, and infrastructure.

It is important to acknowledge that a substantial body of research continues to demonstrate the benefits of green spaces, including reduced urban heat, improved air quality, and enhanced mental and physical health outcomes ([Pataki et al., 2021](#)). In many contexts, these findings are supported by robust empirical evidence and have informed urban sustainability policies worldwide. However, while these benefits are well established, they are often presented in aggregate terms that obscure variation across different populations and locations. When examined more closely, the effectiveness of green spaces are highly dependent on factors such as distribution, accessibility, design, and long-term maintenance ([Schwaab et al., 2021](#)). As such, the existence of strong evidence supporting green infrastructure does not invalidate critiques of inequality, but rather highlights the importance of understanding the conditions under which these benefits are realized.

Taken together, these perspectives demonstrate that green infrastructure is not inherently equitable, but instead shaped by systems of power, governance, and lived experience. *The Green Illusion* provides a unifying framework for understanding how these dynamics operate together, revealing how sustainability efforts can appear effective while reproducing environmental inequality.

Methodology

Study Design

This study adopts a mixed-methods approach designed to move beyond purely technical analyses of green spaces and instead capture the complex relationship between environmental conditions, lived experience, and structural inequality. This approach is specifically designed to reveal *The Green Illusion* by comparing visible green space interventions with their actual environmental and social outcomes. Rather than privileging one form of knowledge, this approach integrates peer-reviewed literature, spatial comparison, ethnographic insights, and an environmental justice framework to provide a more comprehensive understanding of how green space functions across different communities. This study adopts a purposive comparative approach, selecting neighborhoods that reflect variation in tree canopy coverage, environmental exposure, and socioeconomic conditions in order to illustrate both disparities and patterns of inequality. This methodological design reflects a key premise of this research: that environmental inequality cannot be fully understood through quantitative data alone, but must be interpreted through the perspectives of those who experience it, consistent with mixed-methods research approaches that integrate qualitative and quantitative forms of data ([Fetters et al., 2013](#)).

Case Selection

This study focuses on a comparative analysis of neighborhoods in cities such as Los Angeles and Chicago, selected to reflect variation in tree canopy coverage, environmental exposure, and socioeconomic conditions. These cases were chosen due to their well-documented histories of redlining, industrial zoning, and uneven investment, which make patterns of environmental inequality particularly visible.

A central component of this approach is the decision to define green space as a heterogeneous category rather than a single uniform concept. In many policy and research contexts, green space is treated as a broad, interchangeable term, which obscures important differences in how various types of green infrastructure function. To address this limitation, this study categorizes green space into four primary types: street trees, parks, community gardens, and informal green areas. Each of these categories provides different levels of environmental benefit, accessibility, and social meaning. For example, mature tree canopy can significantly reduce surface temperatures and provide consistent shade ([Schwaab et al., 2021](#)), while newly planted trees may take years or decades to deliver similar benefits ([Pataki et al., 2021](#)). Parks may offer recreational opportunities and social gathering spaces, but their accessibility is influenced by factors such as location, safety, and maintenance. Community gardens, while often smaller in scale, can serve as important sites of cultural expression and collective resilience. By differentiating between these types, this study avoids treating green space as a monolith and instead allows for a more nuanced analysis of how benefits are distributed.

Environmental Justice Framework

The analytical framework for this study is grounded in environmental justice, specifically through four key dimensions: exposure, sensitivity, adaptive capacity, and procedural equity ([Schlosberg, 2013](#)). Exposure refers to the extent to which communities experience environmental risks, including heat, air pollution, and lack of shade. Sensitivity captures the degree to which populations are vulnerable to these risks, which may be influenced by factors such as age, health conditions, and socioeconomic status. Adaptive capacity refers to the ability of communities to respond to environmental challenges, including access to resources, infrastructure, and social support systems. Procedural equity focuses on the extent to which communities are included in decision-making processes that shape their environments. Together, these dimensions provide a structured framework for understanding not only where environmental inequality exists, but how it is produced and maintained.

Quantitative Data

In this study, environmental inequality is operationalized through a combination of measurable indicators, including tree canopy coverage, surface temperature variation, air pollution exposure, and access to green space per capita ([Nesbitt et al., 2019](#); [Schwaab et al., 2021](#)). These environmental indicators are analyzed alongside social variables such as income, race, and historical patterns of disinvestment. By combining environmental and social data, this study develops a multidimensional understanding of inequality that reflects both physical conditions and structural determinants.

Qualitative Data

To integrate qualitative and quantitative data, this study employs a thematic coding approach to analyze qualitative data and integrates these findings with quantitative indicators, consistent with mixed-methods research practices ([Fetters et al., 2013](#)), which allows for the systematic analysis of community experiences alongside measurable environmental indicators. Qualitative data, including ethnographic accounts and documented community narratives, are coded into themes such as access, safety, comfort, and belonging. These themes are then aligned with quantitative indicators such as tree canopy coverage, surface temperature, and pollution levels. This approach allows for a more comprehensive analysis that connects measurable environmental conditions with lived experience, ensuring that qualitative insights are not treated as secondary or anecdotal, but as essential forms of knowledge.

To incorporate lived experience, this study draws on existing ethnographic research and documented community narratives rather than primary data collection. This approach allows the analysis to include perspectives grounded in real experiences while maintaining methodological and ethical rigor. Prior research using participatory methods such as photovoice demonstrates the importance of incorporating community knowledge in identifying environmental needs, particularly in highlighting where shade, cooling, and accessibility are most lacking. By engaging with these existing sources, this study ensures that lived experience is treated as a critical form of knowledge rather than a supplementary perspective.

For example, community-based projects such as the South Los Angeles Tree Coalition have demonstrated how resident-generated observations can reshape urban greening strategies. These efforts often involve local residents participating directly in activities like identifying areas with little shade, mapping heat exposure, and organizing tree-planting events in neighborhoods that need them most. Instead of relying only on city planners or technical data, these projects use lived experience, where people actually feel the heat, walk, and spend time, to guide where trees and green infrastructure should be placed. Similarly, participatory planning efforts such as the My Mabopane project show how tools like photography, storytelling, and community workshops allow residents to document their environments and highlight gaps in green space access. These visual and narrative approaches help decision-makers better understand everyday realities that are often missed in traditional planning processes. Together, these examples reinforce the importance of treating community members as co-producers of knowledge ([Schlosberg, 2013](#); [Roberts, 2022](#)), rather than passive subjects of study.

An important methodological consideration in this study is the inclusion of ethnographic and community-based perspectives without relying on primary data collection that would require Institutional Review Board (IRB) approval. Instead, this study draws on existing ethnographic research and documented community accounts to incorporate lived experience into the analysis. This approach addresses a common limitation in environmental research, where community experiences are often filtered through technical or institutional lenses. By integrating these perspectives directly, this study aligns with principles of environmental justice that emphasize recognition, participation, and the legitimacy of multiple forms of knowledge ([Schlosberg, 2013](#)).

By using secondary qualitative sources, this research prioritizes interpretations that are grounded in documented experiences rather than assumed or generalized perspectives. This ensures that the analysis remains both ethically responsible and methodologically rigorous, while still capturing the social and cultural dimensions of environmental inequality ([Roberts, 2022](#)).

This approach also reflects a recognition that lived experience should be represented through sources that are explicitly produced by or in collaboration with affected communities. Rather than attempting to recreate or simulate these perspectives, this study engages with existing scholarship that has already documented these experiences through participatory or ethnographic methods. In doing so, it maintains the integrity of those voices while situating them within a broader analytical framework ([Schlosberg, 2013](#)).

This approach also reflects an intersectional understanding of environmental justice, recognizing that environmental experiences are shaped by overlapping social identities and structural conditions. By incorporating these perspectives, the methodology strengthens its ability to capture not only where environmental inequality exists, but how it is experienced differently across populations ([Schlosberg, 2013](#)).

While this study engages with policy-related factors such as funding distribution and planning priorities, it does not attempt to fully model or redesign broader systems such as transportation infrastructure, zoning reform, or industrial regulation. These systems are acknowledged as critical drivers of environmental inequality but are beyond the scope of this analysis. Instead, this study focuses on how green spaces function within these existing

structures to better understand its role in reproducing or mitigating inequality ([Anguelovski et al., 2020](#)).

Results

The results of this study reveal clear and measurable patterns of environmental inequality across neighborhoods. Quantitative data shows disparities in tree canopy coverage, surface temperature, and pollution exposure, while qualitative findings illustrate how these differences are experienced in everyday life.

One of the most significant findings is the extent to which environmental inequality is reflected in physical infrastructure. Differences in tree canopy coverage are not randomly distributed but are closely aligned with patterns of wealth and race ([Nesbitt et al., 2019](#); [Schwaab et al., 2021](#)). Neighborhoods with higher incomes and historically privileged populations tend to have more mature and dense canopy, while marginalized communities often have significantly lower coverage. One study conducted in Phoenix found that neighborhoods with higher income had up to 25–30% greater tree canopy coverage than lower-income neighborhoods, resulting in surface temperature differences of 4–7°C across short distances ([Schwaab et al., 2021](#)). Similarly, in Los Angeles, research has shown that historically marginalized communities experience significantly lower canopy coverage and higher exposure to extreme heat compared to wealthier areas ([Nesbitt et al., 2019](#)). These findings show that tree canopy coverage is unevenly distributed across neighborhoods, with higher concentrations in wealthier areas.

These environmental disparities often intersect with patterns of waste infrastructure and environmental burden. Communities with lower tree canopy coverage and higher heat exposure are also more likely to be located near industrial facilities, waste processing sites, or areas with higher pollution exposure ([Gochfeld & Burger, 2011](#)). This overlap suggests that environmental inequality is not limited to the absence of green spaces but is compounded by the presence of environmental hazards ([Gochfeld & Burger, 2011](#); [Anguelovski et al., 2020](#)). In cities such as Chicago and Los Angeles, historically redlined neighborhoods were more likely to be zoned for industrial use, waste processing facilities, and major transportation corridors. For example, South Los Angeles has long been a site for industrial activity and freight movement due to zoning decisions that prioritized economic development over community health. These same neighborhoods also receive lower levels of investment in green infrastructure, resulting in a dual burden of increased environmental hazards and reduced environmental benefits ([Gochfeld & Burger, 2011](#); [Anguelovski et al., 2020](#)). This pattern exists because land in marginalized communities has historically been treated as more “available” for undesirable land uses due to political exclusion, lower property values, and reduced community influence in planning processes. This demonstrates how *The Green Illusion* operates across multiple systems, where visible environmental improvements coexist with concentrated environmental burdens.

Discussion

This raises a critical tension within sustainability discourse: sustainability is often treated as a neutral and universally beneficial concept, but in practice, its outcomes are uneven. This study reinforces the need to ask a more critical question, sustainable for whom? While circular city models and green infrastructure are presented as comprehensive solutions, their

implementation often reflects existing power structures, meaning that benefits remain concentrated in already advantaged communities.

Taken together, these findings reinforce the central argument of this study: that sustainability efforts can appear effective while reproducing environmental inequality, a dynamic captured by *The Green Illusion*. *The Green Illusion* provides a framework for understanding how sustainability can be simultaneously visible and ineffective, masking disparities rather than resolving them.

The implications of this analysis extend beyond urban green spaces to broader questions about how sustainability is defined, measured, and implemented in contemporary cities. As climate change intensifies and urban populations continue to grow, the pressure to adopt visible and scalable solutions will likely increase. However, without a critical examination of how these solutions are distributed and experienced, there is a risk that sustainability efforts will continue to reproduce existing inequalities under the guise of progress ([Anguelovski et al., 2020](#)).

This study highlights the need for a shift in both perspective and practice. Rather than treating sustainability as a technical problem that can be solved through the implementation of discrete interventions, it must be understood as a social and political process that requires ongoing negotiation, accountability, and redistribution ([Schlosberg, 2013](#)). This includes recognizing the limitations of current approaches, valuing diverse forms of knowledge, and prioritizing the needs of those most affected by environmental harm.

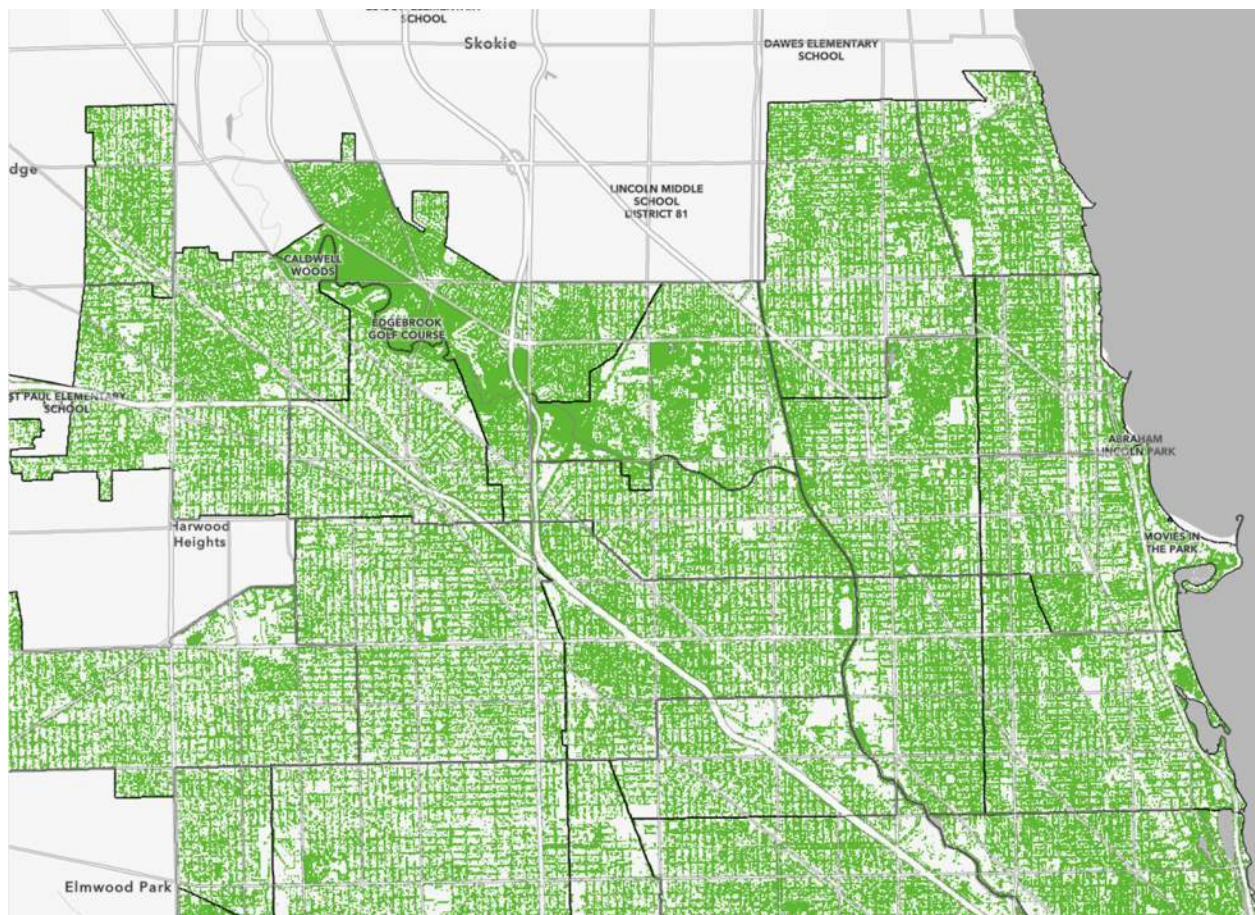
In this sense, *The Green Illusion* is not only a critique but also a call to action. It challenges policymakers, planners, and researchers to move beyond surface-level solutions and engage with the deeper structural changes required to achieve environmental justice. Recognizing *The Green Illusion* is the first step toward designing sustainability strategies that are not only visible, but truly equitable and transformative. By doing so, it opens the possibility for a more inclusive and equitable vision of sustainability, one that is grounded not in appearances, but in outcomes ([Schlosberg, 2013](#); [Anguelovski et al., 2020](#)).

Figure 1. Tree Canopy Distribution by Neighborhood (Chicago, IL)

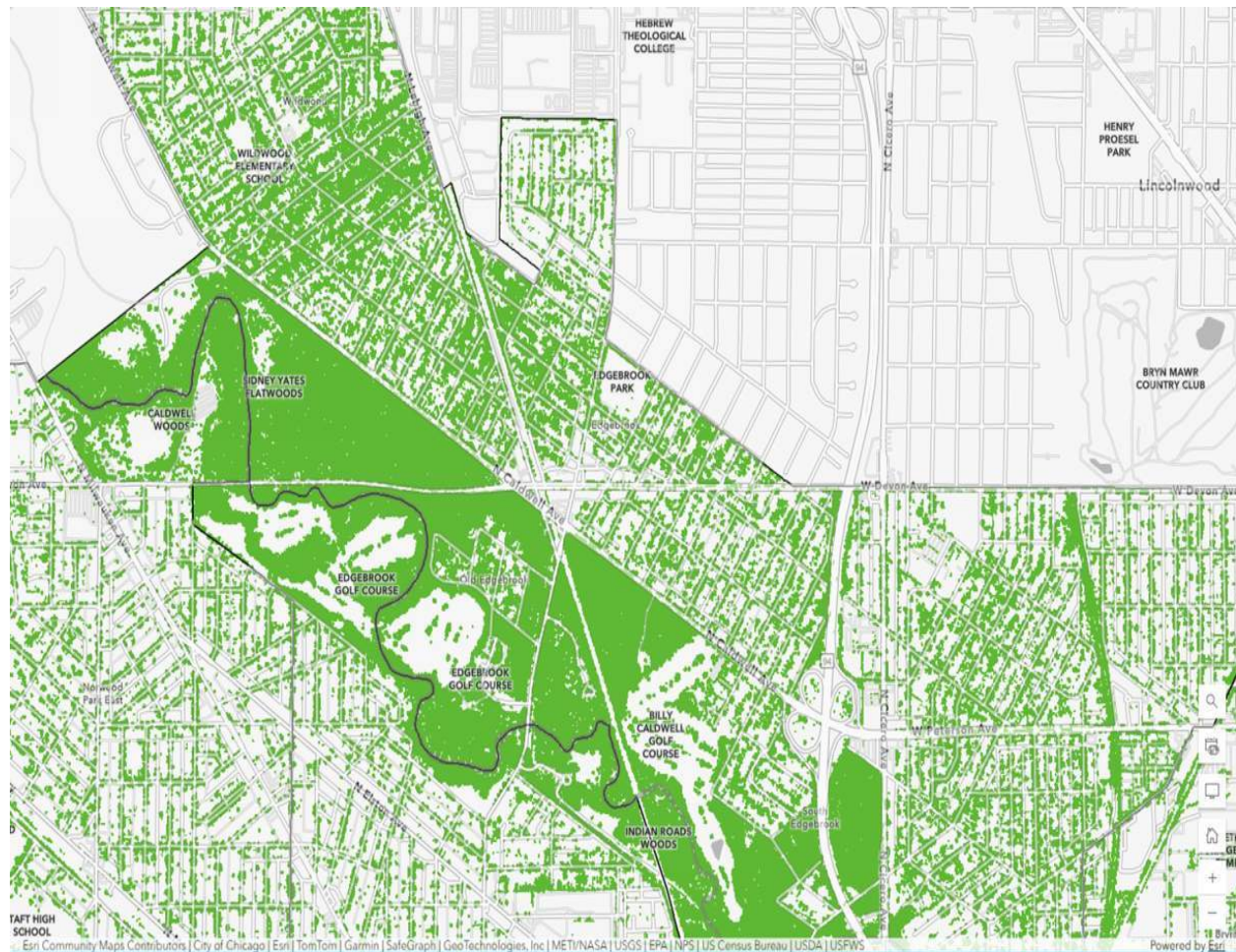
Tree canopy coverage varies significantly across neighborhoods in Chicago, reflecting patterns of environmental inequality and historical disinvestment. Areas with higher canopy coverage tend to align with greater investment and infrastructure, while lower canopy areas reflect reduced access to environmental benefits such as shade and cooling. This visual demonstrates *The Green Illusion*: while the city appears green overall, environmental benefits remain concentrated in already advantaged areas.

[Chicago Tree Canopy Map v4](#)

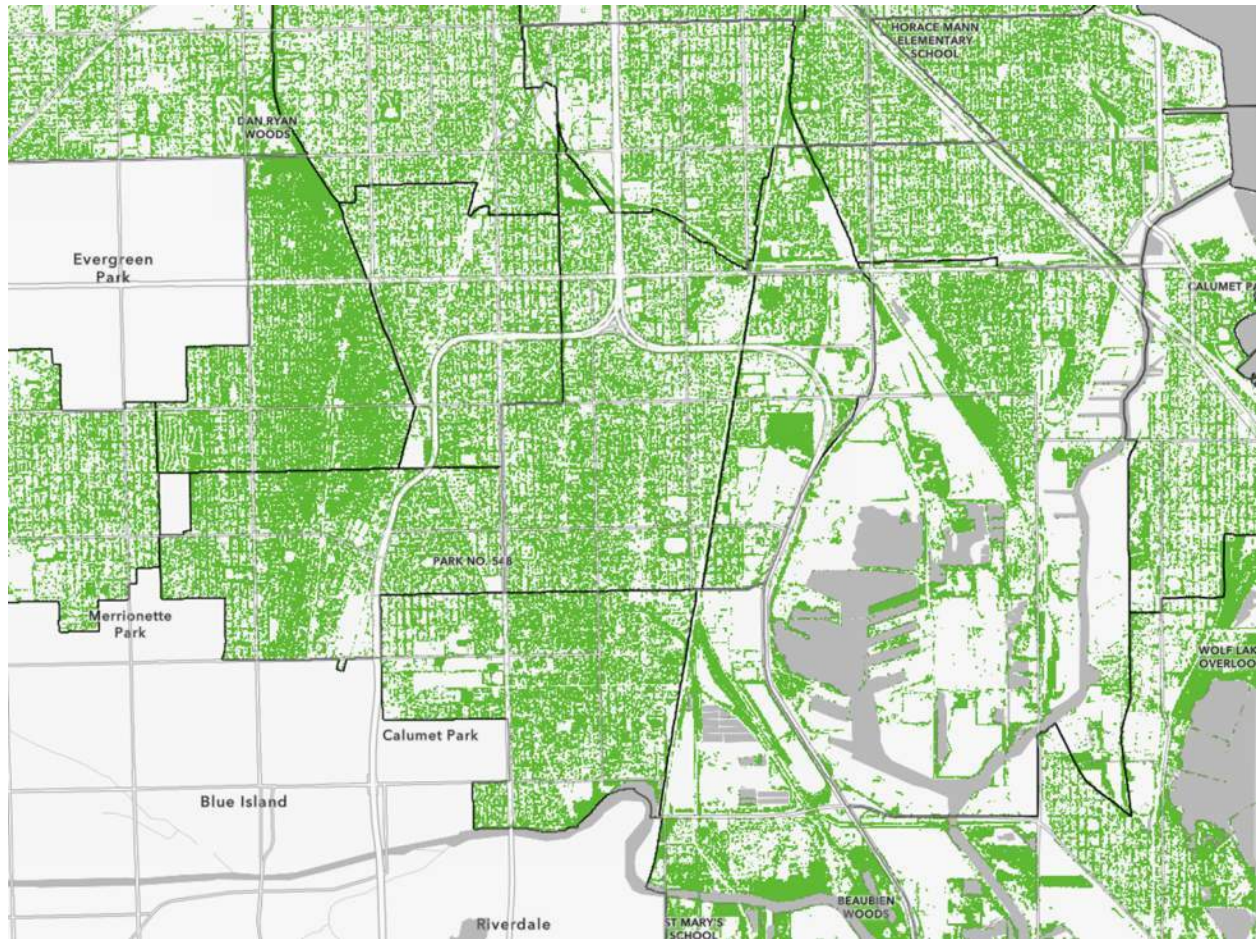
Northside of Chicago - Higher canopy/investment:



Northside of Chicago - Higher canopy/investment:



Southside of Chicago - Lower canopy/disinvestment:



Southside of Chicago - Lower canopy/disinvestment:



Importantly, these patterns are not abstract. They are visible in everyday life. Walking through different neighborhoods reveals clear differences in shade, comfort, and environmental quality. This reinforces that environmental justice is not an invisible process, but something that can be directly experienced.

As shown in Figure 1, tree canopy coverage is unevenly distributed across Chicago neighborhoods, with higher concentrations in more affluent areas and lower coverage in historically underserved communities. These disparities highlight the role of green space as a form of environmental infrastructure that shapes lived conditions. Just as roads, utilities, and housing influence quality of life, so too does access to shade, cooling, and environmental amenities. In this sense, environmental inequality is not merely a difference in environmental quality, but a difference in infrastructure that affects health, comfort, and overall well-being ([Schlosberg, 2013](#)).

At the same time, the findings challenge the assumption that green spaces are inherently beneficial. While green infrastructure does provide measurable benefits, including cooling and pollution reduction, these benefits are highly conditional. They depend on factors such as the type of green spaces, its maturity, its design, and its maintenance. Newly planted trees, for example, may represent future benefits but do not provide immediate cooling or shade. Similarly, poorly designed green spaces may fail to deliver intended environmental outcomes, particularly

if they do not account for local climate conditions or patterns of use ([Pataki et al., 2021](#); [Schwaab et al., 2021](#)).

This visual evidence strengthens the central argument of *The Green Illusion* by revealing that urban greening is not distributed evenly, despite citywide claims of sustainability progress. While the city appears green at a macro level, the concentration of canopy in wealthier neighborhoods shows that environmental benefits are selectively allocated.

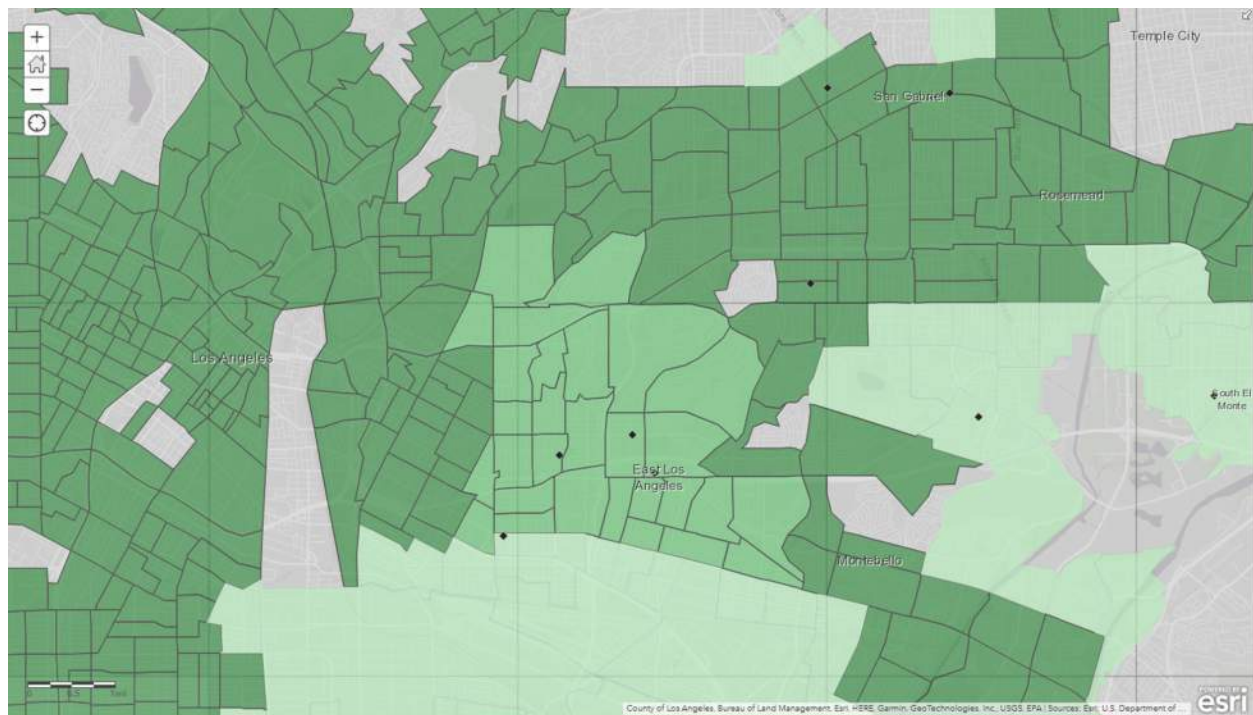
Figure 2. Heat Map Comparison

Temperature disparities across neighborhoods highlight unequal exposure to urban heat. Areas with lower tree canopy and higher development density experience significantly higher surface temperatures, demonstrating the uneven distribution of environmental benefits.

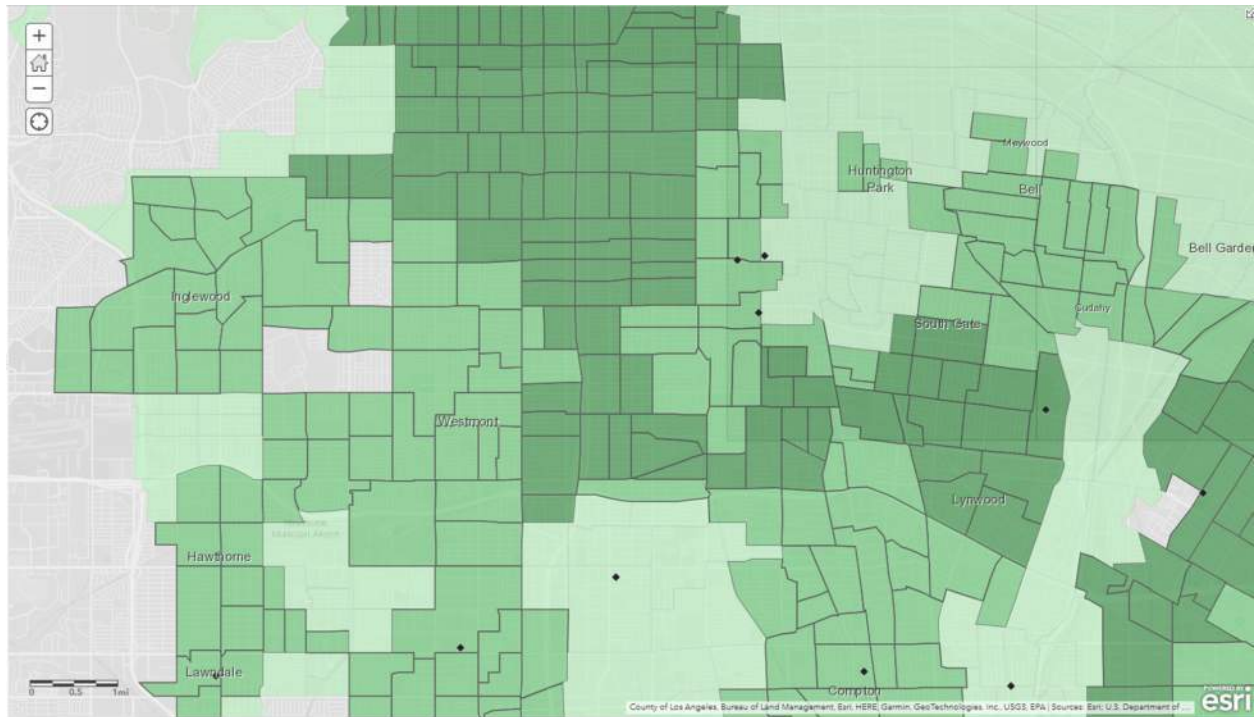
This heat map provides further evidence of *The Green Illusion* by demonstrating that environmental outcomes are uneven, even within the same metropolitan area. While green infrastructure is often promoted as a universal solution to heat, this visual shows that its benefits are spatially concentrated. The persistence of high temperatures in lower-income areas indicates that sustainability efforts have not been implemented in ways that address underlying inequality.

[Urban Heat Island Analysis and Adaptation in Los Angeles County](#)

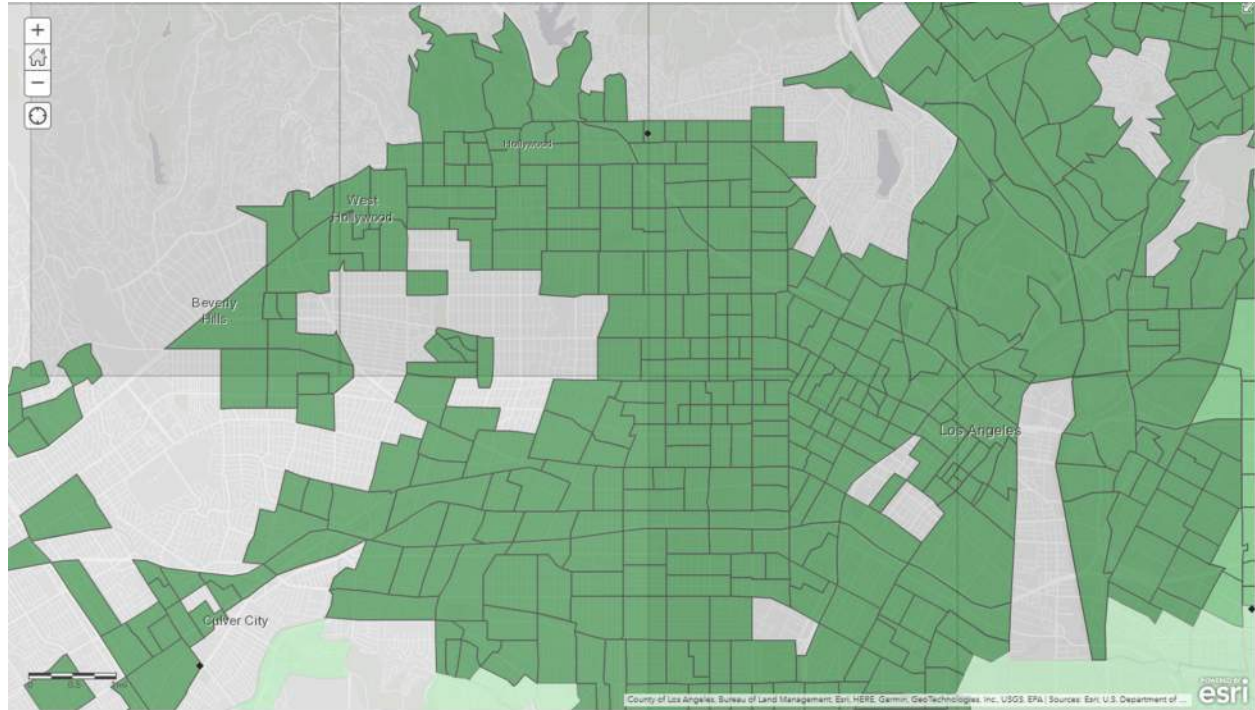
East LA - Highly Vulnerable Area - Low Income Area



Inglewood, Hawthorne, Lawndale, Compton - Highly Vulnerable Areas - Low Income Areas



Hollywood, West Hollywood, Beverly Hills, Culver City - Low Vulnerability Areas - High Income Areas



The existence of green infrastructure alone does not ensure meaningful environmental outcomes. Instead, its impact depends on how it is implemented and maintained over time. This challenges the assumption that green infrastructure functions as a universally effective solution ([Schwaab et al., 2021](#)).

As shown in Figure 2, temperature variation across Los Angeles neighborhoods reflects uneven exposure to urban heat, with hotter conditions concentrated in areas with lower tree canopy and higher levels of development. This relationship between green spaces and waste exposure reflects broader patterns of environmental injustice that extend beyond individual environmental factors. Environmental justice research has consistently shown that marginalized communities are disproportionately burdened by multiple forms of environmental risk simultaneously, including air pollution, heat exposure, and proximity to waste infrastructure ([Gochfeld & Burger, 2011](#)). These overlapping exposures are not coincidental but are the result of historical and institutional processes that have shaped land use patterns, zoning decisions, and infrastructure placement over time. These temperature disparities reveal that green infrastructure does not function as a universal solution, but instead reflects existing patterns of inequality central to *The Green Illusion*. This pattern further reflects *The Green Illusion*, where environmental solutions are presented as universal but experienced unevenly.

In many urban contexts, neighborhoods that lack green spaces are also those that have been designated for industrial use, waste processing, or other environmentally hazardous activities. This dual burden creates compounding effects, where the absence of environmental benefits is paired with the presence of environmental harms. As a result, residents in these areas experience higher cumulative risk, which can manifest in increased rates of respiratory illness, heat-related health impacts, and reduced overall quality of life ([Gochfeld & Burger, 2011](#)).

Understanding environmental inequality in this way requires moving beyond single-variable analyses and toward a more integrated framework that accounts for multiple, intersecting forms of exposure. This reinforces the importance of examining green spaces not in isolation, but as part of a broader environmental system in which benefits and burdens are unevenly distributed. By situating green spaces within this larger context, the concept of *The Green Illusion* becomes even more apparent, revealing how selective investment in visible environmental improvements can obscure deeper patterns of environmental harm ([Schlosberg, 2013](#); [Anguelovski et al., 2020](#)).

This framing also highlights the importance of cumulative exposure as a defining feature of environmental inequality. Rather than experiencing a single environmental burden, many communities face layered and reinforcing risks, including heat stress, air pollution, and proximity to waste infrastructure. These combined exposures interact in ways that amplify vulnerability, particularly for populations already facing socioeconomic disadvantage. As a result, the absence of green spaces cannot be understood in isolation but must be analyzed alongside the presence of environmental hazards and the broader conditions that shape everyday life. This cumulative perspective further demonstrates that addressing environmental inequality requires comprehensive and integrated approaches, rather than isolated interventions ([Gochfeld & Burger, 2011](#); [Schlosberg, 2013](#)).

Another key finding of this study is the role of green spaces in processes of urban change, particularly in relation to green gentrification. While investments in green infrastructure are often intended to improve environmental conditions, they can also contribute to rising property values and demographic shifts ([Rigolon & Németh, 2020](#); [Gould & Lewis, 2017](#)). New parks and green amenities are frequently associated with increased housing costs, which can lead to the displacement of long-term residents. This creates a paradox in which environmental improvements benefit incoming populations rather than existing communities, effectively redistributing environmental benefits along socioeconomic lines.

This dynamic reveals an important limitation of sustainability planning that focuses solely on environmental outcomes without considering social impacts. When green spaces are implemented without safeguards against displacement, it can reinforce inequality rather than reduce it. In this context, green infrastructure becomes part of a broader system of urban development that prioritizes economic growth over social equity ([Schlosberg, 2013](#); [Anguelovski et al., 2020](#)).

Qualitative findings further illustrate how these dynamics are experienced at the community level. Residents in low-canopy neighborhoods often describe environments that are not only hotter but also less comfortable, less walkable, and less conducive to social interaction. Lack of shade can make outdoor spaces difficult to use, particularly during periods of extreme

heat, while poorly maintained or unsafe parks may discourage use altogether. These experiences highlight the importance of considering not only the presence of green spaces, but its usability and accessibility ([Wolch et al., 2014](#)).

At the same time, community narratives reveal that green spaces can serve as a site of resilience, healing, and cultural connection. [Roberts, 2022](#) emphasizes that green spaces within Black communities often function as more than environmental amenities, they are spaces of gathering, cultural expression, and emotional well-being. This perspective challenges deficit-oriented narratives that focus solely on lack or absence, instead highlighting the ways in which communities actively engage with and shape their environments.

For example, studies of community gardens and neighborhood green spaces in urban areas have documented how residents describe these spaces as sources of cultural connection, food security, and emotional well-being, even in the absence of formal investment. In South Los Angeles, community-led greening initiatives have demonstrated how residents actively reshape their environments to meet local needs, often prioritizing shade, safety, and accessibility over aesthetic improvements ([Roberts, 2022](#); [Anguelovski et al., 2020](#)). These examples highlight that while access to green spaces may be limited, communities continue to create and sustain meaningful environmental resources through collective action.

The concept of adaptive capacity provides a useful framework for understanding these dynamics. Adaptive capacity includes not only physical infrastructure, such as tree canopy and parks, but also social resources, such as community networks and local knowledge ([Schlosberg, 2013](#)). This includes community-led initiatives such as neighborhood tree planting, community gardens, and grassroots climate adaptation efforts, which play a critical role in building resilience in under-resourced areas. Communities with higher adaptive capacity are better able to respond to environmental challenges, while those with limited resources may be more vulnerable. This finding expands the scope of environmental justice by emphasizing the importance of both physical and social factors in shaping environmental outcomes ([Schlosberg, 2013](#); [Wolch et al., 2014](#)).

In many cases, adaptive capacity is actively built through community-led initiatives rather than formal policy interventions. Neighborhood tree-planting programs, community garden maintenance efforts, and grassroots environmental organizations play a critical role in enhancing local resilience. These initiatives often address immediate needs, such as access to shade, food, and safe public space, while also strengthening social networks and collective capacity to respond to environmental stressors. Recognizing these efforts shifts the narrative from vulnerability to agency and highlights the importance of supporting community-driven solutions within broader sustainability planning ([Roberts, 2022](#); [Schlosberg, 2013](#)).

Another important theme that emerges from this analysis is the role of greenwashing in shaping perceptions of sustainability. Green infrastructure can function as a visible signal of progress, even when its actual impact is limited. This creates a disconnect between appearance and reality, in which cities may appear more sustainable without addressing underlying inequalities. This phenomenon reinforces the concept of *The Green Illusion*, where environmental improvements appear effective without producing equitable outcomes ([Gałęcka-Drozda et al., 2021](#)).

This distinction between symbolic and substantive sustainability has also been expanded in recent research on nature-based solutions, which differentiates between projects that merely appear environmentally beneficial and those that produce measurable ecological and social outcomes. This distinction is critical to understanding how green infrastructure can be used to signal environmental progress while failing to address underlying inequalities, reinforcing the central argument of *The Green Illusion* ([Gałęcka-Drozda et al., 2021](#)).

Ultimately, these findings point to governance as the central mechanism through which environmental inequality is produced and maintained. Decisions about where to invest, how to design green spaces, and how to allocate resources are shaped by political and institutional processes that often prioritize efficiency, visibility, and economic return over equity ([Rigolon & Christensen, 2025](#)). As a result, environmental outcomes reflect broader systems of power rather than neutral or purely technical considerations.

These patterns are not incidental but are closely tied to policy mechanisms such as municipal budgeting priorities, zoning regulations, and infrastructure investment decisions. Neighborhoods that receive sustained funding for park maintenance and canopy expansion often reflect broader patterns of political prioritization, while under-resourced areas experience delayed or minimal investment. This reinforces the argument that environmental inequality is produced not only through physical conditions but through governance structures that determine how resources are distributed ([Anguelovski et al., 2020](#)).

These findings support the central argument of this article: when green spaces are unevenly distributed and implemented without structural consideration, they reinforce rather than resolve environmental inequality. Green infrastructure produces uneven outcomes across neighborhoods, shaped by patterns of investment, governance, and access ([Schlosberg, 2013](#); [Anguelovski et al., 2020](#)). While the analysis reveals clear patterns of environmental inequality, it is important to note that these findings are based on secondary data, spatial comparisons, and documented community narratives rather than primary field data.

Limitations

One limitation of this approach is that it relies on existing datasets and literature which may not fully capture localized variations in environmental conditions or lived experience. While this study integrates ethnographic and community-based research, it does not include direct participant engagement, which may limit the specificity of certain claims. Future research could build on this work by incorporating participatory methods, such as interviews or community-led data collection, to further ground the analysis in lived experience.

Additionally, while this study acknowledges broader structural systems such as zoning, transportation, and industrial regulation, it does not attempt to fully model or redesign these systems. Instead, it focuses on how green spaces function within these existing conditions. This represents a deliberate scope limitation but also highlights an important area for future research. These findings reinforce that the presence of green infrastructure does not guarantee equitable outcomes, a key aspect of *The Green Illusion*.

Implications for Policy & Practice

Despite these limitations, the findings have important implications for both research and policy. They suggest that sustainability initiatives must move beyond technical implementation and engage more directly with questions of equity, governance, and community participation. By demonstrating that green space outcomes are conditional and shaped by broader systems, this study contributes to a growing body of work that calls for more integrated and justice-oriented approaches to urban sustainability ([Schlosberg, 2013](#); [Anguelovski et al., 2020](#)).

Ultimately, this discussion reinforces the central argument of *The Green Illusion*: that environmental improvements cannot be evaluated solely based on their presence, but must be assessed in terms of their distribution, accessibility, and impact across different communities ([Schlosberg, 2013](#)).

The findings of this study make it clear that addressing environmental inequality requires more than simply increasing the amount of green spaces in urban environments. While tree planting campaigns, park expansions, and green infrastructure projects are often presented as progressive solutions, their effectiveness depends on whether they are designed and implemented through equity-centered planning and long-term investment. Without structural changes, these initiatives risk reinforcing the very inequalities they are intended to address. As such, the policy implications of this research point toward the need for a fundamental shift in how cities approach sustainability, moving from a focus on quantity and visibility to a focus on equity and long-term impact ([Rigolon & Christensen, 2025](#); [Anguelovski et al., 2020](#)).

One of the most critical steps in this transition is the adoption of equity-based funding models. Rather than allocating resources evenly across a city or prioritizing areas with the greatest economic return, funding should be directed toward communities with the greatest environmental need. These disparities are often reinforced through municipal budgeting processes, where investment in green infrastructure reflects political priorities rather than environmental need ([Anguelovski et al., 2020](#)).

This requires the use of data-driven approaches that incorporate environmental indicators, such as canopy coverage, surface temperature, and pollution levels, alongside social indicators such as income, race, and health outcomes ([Nesbitt et al., 2019](#); [Schwaab et al., 2021](#)). By aligning funding decisions with environmental justice metrics, cities can begin to address the uneven distribution of environmental benefits and burdens.

Equally important is the need to shift from short-term implementation to long-term maintenance. Many green infrastructure projects focus on installation, planting trees, building parks, or creating green corridors, without ensuring that these investments are sustained over time. However, the benefits of green spaces depend not only on its presence but on its condition. Trees require watering, pruning, and protection, while parks require maintenance, safety measures, and community engagement. Without these ongoing investments, green spaces may deteriorate or fail to deliver its intended benefits. This highlights the importance of viewing green infrastructure not as a one-time project, but as an ongoing commitment that requires sustained funding and attention ([Pataki et al., 2021](#)).

Another key policy consideration is the prevention of displacement associated with green gentrification. As this study has shown, investments in green spaces can increase property values and contribute to demographic shifts, potentially displacing long-term residents. To address this issue, green space planning must be integrated with housing policy. This may include measures such as rent stabilization, affordable housing requirements, and community land trusts that help ensure that existing residents can remain in place and benefit from environmental improvements. Without these protections, green infrastructure risks becoming a tool of exclusion rather than inclusion ([Rigolon & Németh, 2020](#); [Gould & Lewis, 2017](#)).

Supporting community-led initiatives is also essential to building equitable and effective green space systems ([Rigolon & Christensen, 2025](#); [Roberts, 2022](#); [Schlosberg, 2013](#)). Community gardens, neighborhood tree planting programs, and grassroots environmental organizations often play a critical role in creating and maintaining green spaces, particularly in areas that have been historically underserved. These initiatives not only provide environmental benefits but also strengthen social networks, build local capacity, and foster a sense of ownership and belonging. By providing funding, technical support, and institutional recognition to these efforts, cities can enhance adaptive capacity and ensure that green spaces reflect the needs and priorities of the communities it serves.

In addition to these strategies, it is necessary to integrate green space planning with broader policy systems, including transportation, housing, and pollution regulation. Environmental inequality is not produced by a single factor but by the interaction of multiple systems. For example, proximity to industrial facilities, access to public transit, and patterns of land use all influence environmental conditions. Addressing these interconnected factors requires a coordinated approach that goes beyond isolated interventions. Green spaces must be understood as one component of a larger system of urban infrastructure and governance ([Anguelovski et al., 2020](#)).

Finally, cities must reconsider how success is measured in sustainability initiatives. Traditional metrics, such as total canopy coverage or number of trees planted, provide a limited view of environmental progress. While these indicators are useful, they do not capture the distribution of benefits or the lived experiences of communities. Instead, success should be evaluated based on reductions in environmental inequality, improvements in health outcomes, and increased access to environmental resources. This shift in evaluation criteria is essential to ensuring that sustainability efforts move beyond symbolic gestures and produce meaningful change ([Schlosberg, 2013](#); [Anguelovski et al., 2020](#)).

The evidence presented in this article shows that environmental inequality is both measurable and experienced. Disparities in tree canopy coverage, temperature, and pollution exposure reflect broader patterns of investment and governance, while qualitative insights reveal how these disparities affect everyday life. Together, these findings challenge the assumption that green spaces can serve as a universal solution and instead highlight the need to consider the conditions under which it is implemented.

Green space is not only an environmental resource but also a social and cultural one, capable of supporting well-being and community connection. However, these benefits are not guaranteed and depend on how green infrastructure is distributed and governed. The question is

not whether green space works, but for whom it works and under what conditions. Addressing this requires recognizing that sustainability is not a neutral or technical issue, but a political one shaped by decisions about investment, access, and inclusion.

The path forward lies in reimagining sustainability as a process of redistribution rather than accumulation. By reframing green space through an environmental justice lens, this study contributes to a broader shift in how sustainability is understood and practiced. It challenges policymakers, planners, and researchers to move beyond surface-level interventions and toward approaches that prioritize equity, accountability, and long-term community outcomes. In doing so, this work not only critiques existing systems but also provides a foundation for more just and effective urban sustainability strategies. Rather than focusing on how much green space exists, cities must focus on who has access to it, who benefits from it, and how it contributes to reducing inequality. This shift in perspective is essential to moving beyond symbolic solutions and toward truly transformative change.

Green space is not inherently equitable. Its impact depends on how it is designed, distributed, and governed. The question is not whether green infrastructure works, but for whom it works and under what conditions. Addressing this requires moving beyond simplified sustainability narratives and recognizing that environmental outcomes are shaped by power, policy, and historical inequality. Without this shift, sustainability efforts risk continuing to reproduce the very disparities they aim to solve.

Summary

Ultimately, this study challenges the idea that sustainability can be measured by appearance alone. A city may look green, but that does not mean it is equitable. The question is not whether green spaces exist, but who benefits from them. By asking who gets shade, this research makes environmental inequality visible and calls for a shift in how sustainability is understood and implemented. If sustainability is to be meaningful, it must move beyond visibility and toward justice.

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Wildfire Management in Alaska



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Abstract

This article analyzes how wildfire mitigation strategies in Alaska can better incorporate Indigenous fire stewardship and Traditional Ecological Knowledge (TEK) to support more culturally responsive, equitable, and ecologically effective approaches to fire management. Using a qualitative, interdisciplinary methodology, this project integrates literature review, place-based observation in rural Colorado, community mapping, and reflective analysis to examine wildfire as a socio-ecological system formed by environmental conditions, governance structures, and cultural perspectives. The findings show that dominant wildfire management strategies are still heavily rooted in suppression-based frameworks, which often contribute to fuel accumulation and increased fire severity over time. In contrast, Indigenous fire stewardship emphasizes the intentional use of fire to maintain ecosystem balance, reduce fuel loads, and sustain biodiversity. This study shows a significant gap between the expanding recognition of these practices and their limited integration into policy and governance. By bringing together ecological, cultural, and governance perspectives, this research shows the need for more integrated and inclusive wildfire mitigation strategies. Ultimately, it argues that building long-term fire resilience requires technical solutions, as well as a shift toward valuing Indigenous knowledge systems and supporting more collaborative approaches to land stewardship.

Wildfire Management in Alaska

As of April 8, 2026 there are currently [24 active wildfires](#) across the United States.

About four years ago, while living in the mountains outside Littleton, Colorado, my relationship with wildfire shifted from something abstract to something deeply personal. One afternoon, while I was at work, I noticed smoke rising in the distance toward my home. At first, it seemed far away, just a thin plume against the sky. But as the day went on and I began driving home, the smoke grew darker and more defined. By the time I approached the mountain where I lived, the situation had become impossible to ignore. Flames were actively burning along the



mountainside, and the road leading up to my home was blocked by firefighters, homeowners, and spectators watching the fire unfold.

Standing at the roadblock, I was overwhelmed with concern about the animals waiting at home and unsure how far the fire had spread. After speaking briefly with those nearby, I learned that the fire might not yet have reached my property. I decided to take an alternate route around the mountain, hoping I would still be able to get home in time. When I arrived, I

found my home safe and was able to gather my animals and prepare in case evacuation became necessary.

Although the fire ultimately did not destroy my home, the experience stayed with me. Experiencing directly how quickly wildfire can shift from a distant concern to an immediate threat motivated me to think more deeply about how rural and forested communities adapt to fire risk. That experience now informs my interest in wildfire management and in understanding what it means to live in fire-prone landscapes, where the beauty of the environment is inseparable from the risks it carries.

In the years since, I have become increasingly interested in how communities prepare for and respond to wildfires. My research now focuses on the strategies communities use to reduce wildfire risk and accommodate changing fire regimes. Much of wildfire management in the United States has historically been guided by policies centered on [suppression, treating fire mainly as a destructive force to be controlled or eliminated](#). However, as wildfire seasons grow longer and fires become more intense across North America, it has become increasingly clear that suppression alone may not be enough to deal with the complex ecological and social challenges wildfires create.

At the same time, Indigenous communities across North America have long maintained different relationships with fire. Using practices commonly referred to as Traditional Ecological Knowledge (TEK), many Indigenous groups have intentionally used fire to manage landscapes, support biodiversity, and maintain ecological balance. These approaches to fire stewardship reflect generations of observation, cultural knowledge, and relationships with the land. In recent years, researchers and land managers have begun to recognize that these [knowledge systems](#) may offer meaningful insights into dealing with modern wildfire challenges.

This realization forms the foundation of my capstone research. Building on my interest in wildfire management, this project asks: **How can wildfire mitigation strategies in Alaska better incorporate Indigenous fire knowledge, particularly TEK, to support culturally responsive, equitable, and ecologically effective fire resilience?** By examining wildfire trends, public health risks, cultural perspectives on fire, and Indigenous land stewardship practices, this research intends to demonstrate how integrating multiple knowledge systems can help communities build more resilient relationships with fire amid accelerating environmental change.

In this context, *culturally responsive* wildfire management refers to approaches that recognize, respect and incorporate the values, knowledge systems, and lived experiences of the communities most affected by fire, particularly Indigenous communities whose relationships with fire are strongly ingrained in place-based traditions. *Equitable* fire management stresses fairness in both process and outcomes, making certain that marginalized communities, especially those historically excluded from decision-making, have meaningful authority, access to resources, and the ability to shape policies that directly impact their land's livelihoods. Finally, *ecologically effective* strategies are those that work with, rather than against, natural fire regimes by supporting biodiversity, reducing fuel accumulation, and maintaining long-term ecosystem health. Together, these concepts move beyond narrow, suppression-focused definitions of success and instead frame wildfire resilience as a balance between social justice, cultural integrity and ecological sustainability.

Understanding how wildfire management strategies have developed and why they often differ from Indigenous approaches to fire stewardship requires examining existing research on wildfire ecology, public health, land management, and Indigenous knowledge systems. Over the past several decades, scholars have increasingly recognized that wildfire is a social and political phenomenon affected by climate change, policy, and cultural relationships with the land.

Research on wildfire trends in Alaska and across North America shows how rising temperatures, changing moisture patterns, and decades of fire suppression have contributed to larger and more frequent wildfires. At the same time, studies on the public health impacts of wildfire smoke show that these events affect ecosystems as well as human well-being, [especially in rural and Indigenous communities with scarce access to healthcare resources](#). Together, these findings

stress that wildfire mitigation must be understood as a social and public health concern as much as an environmental challenge.

Alongside this scientific research, a growing body of literature has begun to explore the role of TEK and Indigenous fire stewardship in developing more sustainable land management approaches. Indigenous communities have long used cultural burning and other stewardship practices to maintain ecosystems and reduce fuel buildup. However, colonial policies and modern fire suppression strategies disrupted many of these practices, creating enduring tensions between Western wildfire management systems and Indigenous fire traditions.

Taken together, these bodies of literature reveal important gaps in current wildfire policy and management frameworks. While research increasingly acknowledges the ecological benefits of cultural burning and Indigenous land stewardship, Indigenous perspectives and governance structures remain underrepresented in wildfire mitigation planning. The following literature review therefore analyzes existing research on wildfire trends, public health impacts, fuel mitigation approaches, and Indigenous fire stewardship to better understand how wildfire mitigation strategies, particularly in Alaska, might more adequately incorporate Indigenous knowledge systems and support more resilient, fire-adapted landscapes.

Approach and Positionality

This research is informed by my personal and professional experiences, shaping both how I approach wildfire management and how I interpret the findings. I recognize that I bring a critical perspective toward dominant Western approaches to fire management, particularly suppression-based strategies, which I view as incomplete and, in some cases, counterproductive to long-term ecological health. This perspective is informed by both my lived experience in wildfire-prone environments and my engagement with literature that emphasizes the limitations of these approaches. At the same time, I acknowledge that this stance carries a degree of bias, as I am inclined to favor alternative structures, especially those grounded in Indigenous knowledge and TEK. Additionally, this study is limited by my inability to directly include Indigenous voices through interviews or community-based engagement due to personal and logistical constraints. As a result, Indigenous perspectives are represented mainly through existing literature, recorded media, and secondary sources, which cannot fully capture the depth, nuance, or diversity of lived experience. I recognize that this limitation affects the scope of this research and underscores the importance of approaching this work with humility, reflexivity, and a commitment to not speaking for, but rather learning from, Indigenous communities.

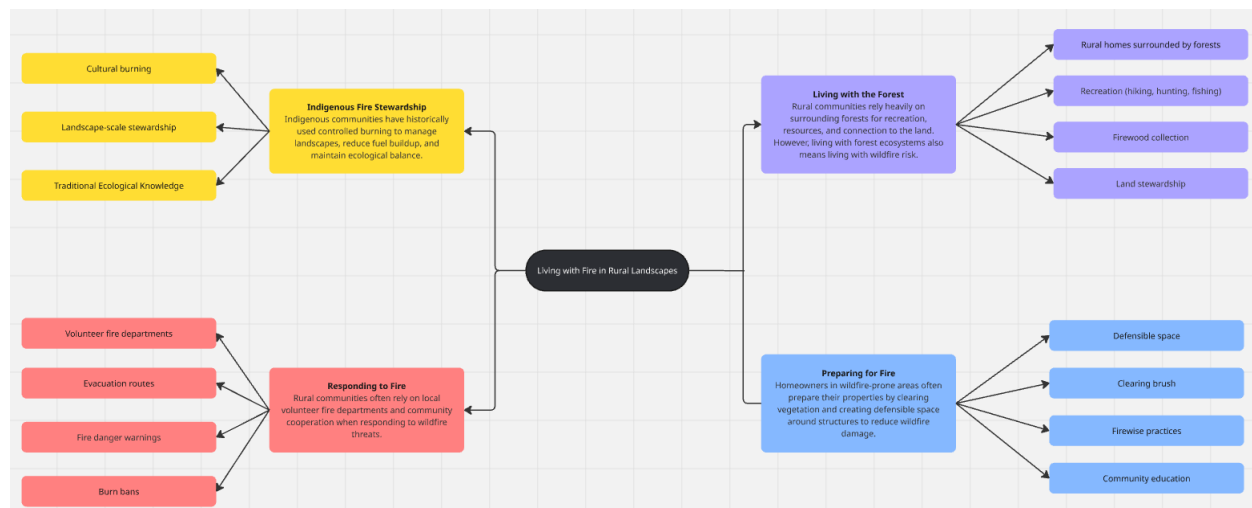
This study uses a qualitative, interdisciplinary approach to explore how wildfire mitigation strategies in Alaska might better incorporate Indigenous fire knowledge, particularly TEK. Rather than relying on a single method, this project draws on multiple forms of data collection and analysis, including literature review, place-based observation, visual analysis, and community mapping. This approach was intentionally chosen to support a polyvocal

understanding of wildfire, recognizing that fire is not only an ecological phenomenon but also a cultural, social, and political one.

The research began with an extensive literature review focused on wildfire trends in Alaska, climate change impacts, public health risks, and Indigenous fire stewardship. Academic articles, government reports, and Indigenous-led organizational materials were examined to identify key themes and gaps within existing research. This phase helped establish a framework for understanding how wildfire has historically been managed and how Indigenous knowledge systems have been marginalized within dominant policy models.

To complement this literature-based approach, I conducted place-based observations in Florissant, Colorado, a rural, fire-prone landscape with ecosystem and social characteristics similar to those of parts of rural Alaska. While geographically distinct, both regions share characteristics such as forested ecosystems, limited infrastructure, and increasing wildfire risk. Observations were documented through field notes and photography, focusing on forest density, defensible space practices, community fire awareness, and rural infrastructure. These observations were not intended to generalize across all contexts; rather, they offer a grounded, experiential perspective on how wildfire risk is lived and managed at the community level.

In addition to research data, I created a community map as a form of multimedia storytelling.



This map did not represent geographic features alone but instead visualized relationships between wildfire risk, community practices, and knowledge systems. By mapping elements such as preparedness behaviors, fire governance, and Indigenous stewardship, the project aimed to highlight how wildfire is affected by interconnected social and ecological systems. This method is consistent with qualitative research approaches that emphasize relational understanding over purely spatial representation.

Data analysis used a thematic analysis approach, identifying recurring patterns across the literature, observations, and reflections. Key themes included: (1) fire as a cultural versus

technical phenomenon, (2) the limitations of suppression-based wildfire management, (3) the ecological and social benefits of Indigenous fire stewardship, and (4) the role of power and governance in directing wildfire policy. These themes were not treated as isolated categories but as connected dimensions of a larger system. This methodology was picked not only to answer the research question but also to challenge traditional research approaches that privilege Western scientific knowledge over other ways of knowing. By using visual, experiential, and reflective methods along with academic literature, this project aims to develop a more holistic and integrated understanding of wildfire resilience.

Situating the Research: Fire, Knowledge and Governance

The literature relevant to this project sits at the intersection of wildfire ecology, climate change, public health, Indigenous fire stewardship, and rural governance. Taken together, these bodies of work show that wildfire in Alaska is not only a biophysical hazard but also a cultural, political, and public health issue. Existing research provides strong evidence that [wildfire activity in Alaska is intensifying](#), that dominant management strategies are still heavily controlled by Western suppression paradigms, and that Indigenous knowledge systems are increasingly recognized but still insufficiently centered in policy and practice. This project builds on those insights by examining how wildfire mitigation strategies in Alaska might better incorporate TEK in ways that are culturally responsive, equitable, and ecologically effective.



One major strand of the literature focuses on wildfire trends, boreal ecology, and climate feedbacks in Alaska. Early ecological research showed that fire has long been a central process in Alaska's boreal landscapes. [Johnstone et al.](#) describe fire as an important ecological force in

Alaska, helping shape vegetation patterns, succession, and habitat change. More recent scholarship shows that these long-standing fire regimes are being altered by climate change. [Elder et al.](#) argue that warmer temperatures and changing fire conditions are increasing the frequency and severity of wildfires in Alaska, with major implications for carbon emissions through 2100. Their economic modeling shows that the benefits of increased fire management investment outweigh the costs when the social cost of carbon is factored in. Similarly, [Vynne et al.](#) emphasize Alaska's outsized global significance for climate stabilization because of its extensive intact ecosystems and enormous carbon stores. [Sundquist et al.](#) reinforce this point by showing how terrestrial carbon sequestration is vulnerable to disturbance, particularly fire. Together, these studies establish that wildfire in Alaska is a local hazard and represents part of a broader climate-fire-carbon feedback loop with global consequences.

A second body of literature examines wildfire governance and adaptation in Alaska, mainly under conditions of climate change. [Trainor et al.](#) are especially important here because they show that climate-related fire impacts are experienced unevenly across rural and urban Interior Alaska. Their work shows that Indigenous and rural communities routinely face greater vulnerability because of geographic isolation, limited emergency infrastructure, and dependence on subsistence resources. [Rutherford and Schultz](#) extend this argument by examining how wildland fire governance in Alaska has to adapt to climate change. They show that Alaska's fire governance system is already under strain and that current institutional arrangements do not easily accommodate the complexity of changing fire regimes, Native lands, and community priorities. State and agency documents, such as the [Alaska Division of Forestry and Fire Protection's overview of fuel mitigation and prescribed fire](#), further demonstrate that dominant management strategies still emphasize fuel reduction, prescribed burning, and Community Wildfire Protection Plans (CWPPs) in ways that are largely technocratic and state-centered. Although these measures can reduce structural risk, they do not necessarily address the more extensive cultural and governance questions raised by Indigenous communities.

A third cluster of literature centers on public health, vulnerability, and wildfire smoke. [Finlay et al.](#) provide a broad overview of wildfire's health consequences, showing that smoke exposure is associated with respiratory, cardiovascular, and psychological harms, particularly among children, older adults, and people with preexisting conditions. [The U.S. Environmental Protection Agency](#) similarly frames wildfire as an environmental health issue, focusing on air quality, debris, toxic exposure, and emergency guidance. These sources are useful for establishing that wildfire is not only an ecological event but also a public health crisis. However, they are more general than place-specific, and neither fully addresses how wildfire smoke and displacement intersect with rural isolation, subsistence dependence, and colonial health inequities in Alaska Native communities. That gap is especially important given [USDA Climate Hubs'](#) discussion of food insecurity in Alaska, which shows how climate extremes, wildfire smoke, and disrupted access to subsistence resources can directly affect food systems, transportation, and community vitality. In combination, these studies suggest that wildfire mitigation in Alaska must be understood through a broader model of environmental health equity.

The most important literature for this project concerns Indigenous fire stewardship and Traditional Ecological Knowledge. [Lake and Christianson](#) provide a basic framework, defining Indigenous fire stewardship as a holistic practice encompassing ecological management, cultural continuity, and intergenerational knowledge transmission. Their work makes clear that fire has long been



used by Indigenous peoples to shape habitats, protect valued resources, and sustain livelihoods, and that colonial fire suppression disrupted these practices. Other scholars similarly argue for [place-based fire management strategies informed by TEK](#), noting that [fire managers have much to learn from Indigenous knowledge holders](#). [Finn et al.](#) further demonstrate the relevance of TEK to environmental health sciences, highlighting its value beyond ecological management alone. More recent scholarship continues to expand this conversation, emphasizing Indigenous fire stewardship as a [critical pathway for climate resilience and sustainable land management](#). Collectively, these works challenge the assumption that wildfire expertise resides solely within state agencies or scientific institutions.

The global literature on Indigenous fire stewardship reinforces these arguments. [The Firesticks Alliance Indigenous Corporation](#) presents Aboriginal cultural burning as both ecological restoration and community healing. [Syrou et al.](#), while not Alaska-specific, situate fire protection within broader biodiversity and circular-economy frameworks and highlight the value of integrating Indigenous stewardship into sustainability planning. These examples are useful because they show that Indigenous fire stewardship is not a remnant of the past but an active, contemporary framework for resilience. At the same time, they highlight a key gap in the Alaska-focused literature: while Indigenous fire stewardship is well documented in places such as Australia, British Columbia, and California, there is still relatively limited documentation of Native fire practices, oral histories, and contemporary efforts to revitalize cultural fire in Alaska.

This leads to the central gap that this project addresses. Across the literature, several patterns emerge. First, there is substantial research on wildfire trends, carbon impacts, and fire governance in Alaska. Second, there is a growing body of work demonstrating the ecological and cultural value of Indigenous fire stewardship. Third, there is increasing recognition that wildfire is also a public health and food security issue in rural and Indigenous communities. What remains underdeveloped is research that brings these strands together in an Alaska-specific way. In particular, there is a need for research examining how wildfire mitigation policy in Alaska might move beyond one-size-fits-all suppression models and instead incorporate TEK, Indigenous governance, and community-defined resilience.

This project contributes to the literature in several ways. First, it addresses a regional gap by centering Alaska within conversations about Indigenous fire stewardship, a field that is regularly dominated by examples from California, Australia, or Canada. Second, it addresses a methodological gap by adopting a more polyvocal approach, bringing together academic literature, policy analysis, community mapping, visual storytelling, and place-based observation, to think about wildfire as lived experience rather than solely as technical risk. Third, it challenges a dominant assumption in Western wildfire policy: that fire is primarily a destructive force to be controlled. By foregrounding Indigenous understandings of fire as relational, regenerative, and necessary, this project questions whether suppression-centered paradigms are adequate for fire-prone rural landscapes. Finally, it contributes to broader discussions of justice

and governance by showing that utilizing TEK requires confronting questions of sovereignty, authority, and whose knowledge counts in wildfire planning.

Rethinking Fire: Findings, Knowledge, and Power

Indigenous Knowledge and Fire Management Practices

A major finding of this study is the key role of Indigenous knowledge systems, particularly TEK, in creating more holistic and sustainable approaches to wildfire management. Across the literature, Indigenous fire stewardship is consistently described not simply as a set of techniques, but as a relational practice grounded in long-term observational, cultural values, and reciprocal relationships with the land. This stands in contrast to dominant Western frameworks that often isolate fire as a technical problem to be controlled.

[Christianson et al.](#) emphasize that Indigenous fire stewardship in boreal regions of North America is deeply embedded in cultural practices that support biodiversity, landscape heterogeneity, and ecosystem resilience. Their research shows that Indigenous communities have historically used fire intentionally to manage vegetation, enhance wildlife habitat, and maintain important subsistence resources. These practices were not random or purely utilitarian; rather, they were guided by detailed, place-based knowledge accumulated over generations. Importantly, the authors argue that the exclusion of Indigenous fire practices through colonial policies has disrupted these systems, adding to the increased severity and frequency of wildfires observed today.

Similarly, [Cochran et al.](#) demonstrate that Alaska Native knowledge systems, including those of Yup'ik and Iñupiaq communities, are grounded in continuous environmental observation and adaptive response. While fire is not always the central focus of these systems in Arctic and sub-Arctic regions, the underlying principles of TEK, such as attentiveness to seasonal change, respect for environmental balance, and intergenerational knowledge transmission, are directly relevant to fire management. Indigenous frameworks highlight the interconnectedness of environmental processes, suggesting that wildfire cannot be adequately addressed without considering broader ecological and cultural systems. This perspective challenges reductionist approaches to wildfire mitigation and supports the building of more place-based, context-specific strategies.

Further reinforcing this point, [Lipka](#) illustrates how Indigenous knowledge operates within multifaceted social, cultural, and ecological systems, where environmental stewardship is inseparable from cultural identity, governance, and collective well-being. Through case studies in Alaska, Lipka highlights how Indigenous communities draw on TEK to navigate environmental change, underscoring collaboration, cultural survival, and adaptive resilience. This systems-based approach closely aligns with Indigenous fire stewardship practices, which are not exclusively about reducing fire risk but about maintaining relationships among people, land and ecological processes.

Together, these sources reveal that Indigenous fire management practices are fundamentally relational, adaptive, and place-based. Fire is understood not as an external threat, but as a natural and necessary process that can be guided to support ecological health. This perspective affords a meaningful departure from suppression-based models, suggesting that effective wildfire mitigation requires technical solutions as much as it requires cultural and epistemological shifts.

However, a substantial gap remains between the recognition of Indigenous knowledge and its meaningful inclusion in wildfire governance. Although TEK is increasingly acknowledged in academic and policy conversations, it is often incorporated superficially or treated as supplementary to Western scientific frameworks instead of as an equally valid and essential knowledge system. Christianson et al. note that Indigenous voices are still frequently marginalized in decision-making processes, limiting the potential for truly collaborative fire management strategies. This finding directly supports the core argument of this article: that wildfire mitigation strategies in Alaska, and more broadly, must move beyond singular, technocratic approaches and toward more encompassing, polyvocal frameworks. Integrating Indigenous fire stewardship is not simply a matter of adding new techniques; it requires rethinking how knowledge, authority, and relationships to land are understood. By centering TEK and Indigenous perspectives, wildfire management can become more culturally responsive, ecologically effective and socially just.

Colonization, Power, and Fire Governance

A critical finding emerging from this study is that contemporary wildfire management systems cannot be fully understood without examining the role of colonization in developing both land governance and knowledge systems. The dominant framework of fire suppression is historically rooted in colonial policies that displaced Indigenous land stewardship practices and redefined relationships between people, fire, and the environment. In this context, wildfire management reflects not only ecological decisions but also political and cultural power structures that determine whose knowledge is recognized and whose is marginalized.

Prior to colonization, many Indigenous communities across North America, including those in Alaska, actively used fire to manage landscapes, support food systems, and maintain ecological balance. These practices were embedded within broader systems of TEK, which emphasized long-term relationships, seasonal awareness, and reciprocal responsibility to the land. However, with the expansion of settler colonial governance, Indigenous burning practices were often criminalized or actively suppressed. Fire was reframed within Western systems as a hazard rather than a resource, and management authority was centralized within state and federal agencies.

This shift radically changed both ecosystems and governance structures. As [Trainor et al.](#) demonstrate, rural and Indigenous communities in Alaska continue to experience disproportionate vulnerability to wildfire as a result of a combination of geographic isolation, limited infrastructure, and reduced influence in decision-making processes. These vulnerabilities

are not incidental; they are tied to longstanding patterns of exclusion that have limited Indigenous participation in land management governance. Similarly, [Rutherford and Schultz](#) argue that wildfire governance systems in Alaska are under increasing pressure to adapt to climate change but remain constrained by institutional structures that do not easily accommodate Indigenous knowledge systems or community-based approaches.

This brings up critical questions about power and authority in wildfire management. Current governance systems generally operate within a top-down framework in which decisions are made by government agencies and technical experts, with limited input from local or Indigenous communities. While there have been efforts to incorporate Indigenous perspectives into wildfire planning, these are often consultative rather than collaborative, meaning that Indigenous knowledge is acknowledged but not given equal authority in forming outcomes. This pattern reflects a form of epistemic inequality, in which certain ways of knowing, particularly Western scientific approaches, are preferred over others.

The consequences of this disproportion are both ecological and social. Ecologically, the exclusion of Indigenous fire stewardship has disrupted natural fire regimes and led to the accumulation of hazardous fuels. Socially, it has reinforced systems in which Indigenous communities are disproportionately affected by wildfire risks while having limited control over how those risks are managed. This disconnect illustrates the shortcomings of current wildfire governance models, which frequently fail to account for the complicated links among land, culture, and community.

Handling these challenges requires more than simply integrating Indigenous practices into existing systems. It calls for a shift toward co-governance and Indigenous leadership, where decision-making authority is shared, and Indigenous communities are recognized as equal partners in land stewardship. This involves not only incorporating TEK into management strategies but also respecting the cultural, legal, and political sovereignty of Indigenous nations. Without this shift, efforts to include Indigenous fire stewardship risk becoming tokenistic, reinforcing existing power imbalances rather than transforming them.

In this context, the idea that “we have colonized fire” offers a useful lens for understanding the broader implications of wildfire management. It suggests that fire itself has been removed from its relational and ecological context and placed within a system of control that centers on human dominance over environmental processes. Reimagining wildfire governance, therefore, requires not simply technical innovation but also a process of decolonization, one that re-centers Indigenous knowledge, restores relationships with the land, and challenges dominant assumptions about how fire should be understood and managed.

Indigenous Fire Stewardship as an Alternative Framework

In contrast to suppression-based approaches, the literature and visual analysis point out the importance of Indigenous fire stewardship as a relational, place-based, and ecological practice. [Indigenous fire stewardship](#) involves the intentional and knowledgeable use of fire to maintain ecosystem balance, sustain biodiversity, and sustain cultural practices. Rather than viewing fire as an external threat, this approach sees it as part of an ongoing relationship among people, land, and ecological systems. It is grounded in TEK, which reflects generations of observation, adaptation, and interaction with specific landscapes. TEK is not static; it is dynamic and responsive, formed by seasonal patterns, species behavior, and long-term environmental change.

The [prescribed burn practices](#) examined in this study illustrate how low-intensity, controlled fire can reduce fuel loads, promote the growth of native vegetation, and support wildlife habitats. Unlike large, high-intensity wildfires, these burns are carefully timed and executed under certain environmental conditions to achieve desired ecological outcomes. For example, burning at the right time of year can stimulate the regeneration of certain plant species, improve forage for animals, and prevent the accumulation of hazardous fuels. These practices reflect a fundamentally different understanding of fire, not as an element to be suppressed, but as a means for ecological care, renewal, and continuity.



Importantly, Indigenous fire stewardship is about ecological management and is also deeply tied to cultural identity, knowledge transmission, and community well-being. Fire is used to maintain food systems, support traditional harvesting practices, and reinforce relationships with the land. This holistic perspective contrasts noticeably with Western management approaches that often separate ecological processes from cultural and social contexts. In Indigenous frameworks, fire is

embedded within systems of responsibility and reciprocity, where land stewardship is understood as an ongoing obligation rather than a reactive intervention.

Global examples serve to reinforce the importance and efficacy of these practices. [The Firesticks Alliance Indigenous Corporation](#) demonstrates how Indigenous-led fire management programs in Australia are successfully restoring ecosystems while also revitalizing cultural knowledge and bolstering community resilience. These programs highlight the importance of intergenerational knowledge sharing, particularly between Elders and youth, and emphasize fire stewardship as both an ecological and cultural practice. Similarly, [Syrou et al.](#) situate fire stewardship within broader sustainability frameworks, showing how combining ecological knowledge with cultural practices can bolster biodiversity conservation and more resilient land management systems.

Despite heightened recognition of Indigenous fire stewardship in scholarly literature and policy discussions, a significant gap persists between acknowledgment and implementation. Indigenous practices are often referenced as valuable or innovative, yet they are rarely centered within formal governance structures or decision-making processes. In many cases, Indigenous knowledge is incorporated in a limited or symbolic way, without granting Indigenous communities meaningful authority over land management. This indicates broader patterns of marginalization, where Indigenous knowledge systems are recognized but not fully respected or operationalized.

This gap highlights a major challenge for wildfire mitigation efforts: integrating Indigenous fire stewardship requires more than adopting specific techniques. It requires a shift in power, governance, and epistemology. It involves recognizing Indigenous communities not just as stakeholders, but as leaders and knowledge holders with the authority to guide land management practices. Without this shift, efforts to incorporate TEK run the risk of reproducing the same extractive dynamics that have historically excluded Indigenous voices.

Public Health, Vulnerability, and Rural Contexts



An additional critical finding emerging from this study is the intersection of wildfire with public health, community vulnerability, and environmental justice, particularly in rural and Indigenous contexts. While wildfire is frequently framed primarily as an ecological or infrastructural issue, the literature and observations demonstrate that its impacts extend deeply into human health and

well-being. These effects are not evenly distributed; rather, they disproportionately affect

communities bearing limited resources, restricted access to healthcare, and strong dependencies on local ecosystems.

Wildfire smoke is among the most immediate and widespread public health risks associated with fire events. [Finlay et al.](#) document the significant health impacts of wildfire smoke exposure, including pulmonary and cardiovascular complications, as well as longer-term effects that remain poorly understood. High-risk populations, such as children, elders, and individuals with pre-existing health conditions, are particularly at risk. In addition to physical health impacts, wildfire events can also add to psychological stress, anxiety, and displacement, further compounding their effects on community well-being.

[The U.S. Environmental Protection Agency](#) similarly notes the dangers associated with wildfire smoke, including exposure to fine particulate matter ([PM_{2.5}](#)), toxic chemicals from burned materials, and hazardous conditions during and after fire events. These risks persist beyond the fire itself, as lingering air pollution and environmental contamination can continue to affect communities long after flames are extinguished. This reinforces the idea that wildfire is not a short-term crisis but a prolonged public health challenge.

Observations in Florissant, Colorado, help illustrate how these risks are experienced at the community level. The rural landscape, characterized by dispersed housing, limited road access, and reliance on local infrastructure, creates additional challenges for evacuation and emergency response. Residents must regularly rely on personal preparedness and community networks rather than immediate access to centralized services. While these dynamics can promote resilience and self-reliance, they also point out structural vulnerabilities that can become critical during wildfire events.



In Alaska, these problems are even more accentuated due to geographic isolation and limited infrastructure. Many communities are accessible only by air or water, making evacuation and emergency response significantly more complex. [Trainor et al.](#) emphasize that rural and Indigenous communities in Alaska face heightened vulnerability to wildfire impacts due to these logistical constraints, as well as reduced access to healthcare and emergency services. This means that the health impacts of wildfire, such as smoke exposure and displacement, can be more severe and longer-lasting in these regions.

In addition to direct health impacts, wildfires also intersect with food security and subsistence practices, particularly in Indigenous communities. The [USDA Climate Hubs](#) highlight how climate change and wildfire disruptions can affect food systems in Alaska by altering wildlife patterns, damaging habitats, and delaying the transportation of goods. Smoke may interfere with hunting and gathering activities, while fires can damage berry patches, fish habitats, and other critical subsistence resources. These impacts extend beyond physical health, affecting cultural practices, food sovereignty, and community resilience. This broader perspective reveals that wildfire is a social and environmental justice issue. The communities most affected by wildfire are often those with the least access to resources and the least influence over management decisions. This shows broader structural inequalities in how risk is distributed and managed, generating crucial questions about whose needs are prioritized in wildfire policy.

Importantly, Indigenous fire stewardship offers potential pathways to address some of these public health challenges. By reducing fuel loads and promoting more frequent, low-intensity fires, cultural burning practices can help prevent the large, high-intensity wildfires that produce the most harmful smoke and ecological damage. In this way, Indigenous fire stewardship is a preventative public health approach, reducing the severity of wildfire impacts before they occur. However, as with other aspects of wildfire management, the utilization of these practices remains limited. Public health frameworks often operate independently of land management strategies, and there is relatively little research that explicitly links Indigenous fire stewardship to health outcomes. This amounts to a significant gap in the literature and an important area for future research.

Ecological Consequences of Fire Exclusion



A second major finding is the ecological impact of prolonged fire suppression, which has produced significant changes in forest structure and increased wildfire severity. Observations of forest density in Florissant revealed clear signs of fuel accumulation, including dense understory vegetation, fallen limbs, and layers of woody debris throughout the forest floor. These conditions create what is often called a “fuel ladder,” allowing fire to move from the ground into the canopy, increasing both the intensity and the spread of wildfire. While the landscape may appear healthy at first

glance, these accumulations reflect a departure from historical fire regimes in which frequent, low-intensity fires would have regularly cleared excess vegetation.

These observations are consistent with ecosystem research demonstrating that fire exclusion alters forest composition and disrupts natural disturbance regimes. In fire-adapted ecosystems, periodic burning plays a key role in preserving open forest structures, restoring nutrients, and supporting biodiversity. When fire is suppressed over long periods, these natural processes are interrupted, leading to denser forests, greater competition among species, and greater susceptibility to disease, pests, and extreme fire events. In this way, suppression does not eliminate fire risk but instead transforms it into a more severe and less predictable threat.

[Elder et al.](#) further demonstrate that wildfire activity in Alaska is increasing due to both climate change and historical land management practices, with major implications for carbon emissions. Their study indicates how fire suppression has contributed to larger, more severe fires that release substantial amounts of stored carbon into the atmosphere, reinforcing climate feedback loops. As these fires burn hotter and across larger areas, they not only consume surface vegetation but also deeper organic soils, particularly in boreal regions where carbon is stored in permafrost and peat layers. This creates a cycle in which increased fire activity intensifies climate change, which in turn creates conditions for more frequent and intense fires.

Similarly, [Vynne et al.](#) emphasize Alaska's critical role within global climate regulation, noting that the region's ecosystems store vast amounts of carbon and support significant biodiversity. Disturbances such as wildfire threaten both of these functions, possibly transforming Alaska from a carbon sink into a carbon source. [Sundquist et al.](#) further underscore that terrestrial carbon sequestration is highly sensitive to disturbance, particularly fire, highlighting the global implications of shifting fire regimes. Together, these studies show that wildfire in Alaska is not only a regional issue but part of a larger climate system with extensive consequences.

Importantly, these ecological changes are not only the result of climate change but are also deeply tied to previous land management decisions. The long-term exclusion of fire from landscapes illustrates a management philosophy that prioritizes control over ecological processes. As a result, ecosystems that once relied on regular fire for regeneration have become increasingly vulnerable to extreme disturbances. This reinforces the idea that wildfire severity today is, in part, a product of past management practices rather than an entirely natural phenomenon.

This evidence indicates that suppression-based approaches may be counterproductive over time, as they contribute to fuel accumulation and increase the likelihood of high-intensity wildfires rather than preventing them. While suppression remains necessary to protect human life and infrastructure, relying on it as the primary strategy for wildfire management fails to address the underlying ecological conditions that drive fire behavior. This highlights the need for alternative approaches that restore more natural fire regimes and reduce fuel loads in a controlled,

intentional way. In this context, the limitations of suppression-based management further support the relevance of Indigenous fire stewardship practices, which have historically maintained these ecological processes through regular, low-intensity burning. By reintroducing fire in ways that align with ecosystem dynamics, these practices help reduce the severity of future wildfires while also supporting broader environmental resilience.

Bridging Toward Action: Integrating TEK into Wildfire Mitigation in Alaska

While this article has identified significant shortcomings in current wildfire mitigation strategies, particularly their use of suppression-based frameworks and their marginalization of Indigenous knowledge, the central research question requires moving beyond critique to ask: How can wildfire mitigation strategies in Alaska better incorporate TEK? Addressing this question requires first establishing a clear understanding of existing mitigation strategies, identifying their structural limitations, and then outlining actionable pathways for integration.

Wildfire mitigation strategies in Alaska are largely determined by state and federal fire management systems, which emphasize suppression, fuel reduction, and risk management. [The Alaska Division of Forestry and Fire Protection](#) highlights key strategies, including fuel breaks, prescribed burning, and CWPPs. These approaches are designed to reduce fire intensity near communities and protect infrastructure, particularly in the wildland-urban interface. In rural Alaska, mitigation efforts are further shaped by [geographic isolation and limited infrastructure](#), which often require prioritizing resource allocation and emergency response capacity. Fire management decisions are frequently centralized, with agencies determining which fires to suppress based on risk categories such as critical, full, or limited protection zones. While these strategies are effective at triaging resources, they often reflect a top-down governance model that leaves little space for local or Indigenous decision-making. Although prescribed burning is included within these protocols, it is typically implemented within a highly controlled and regulatory context that differs significantly from Indigenous cultural burning practices. As a result, current mitigation strategies tend to treat fire as a hazard to be minimized rather than as a process to be actively and relationally managed.

The limited integration of Indigenous fire stewardship into wildfire mitigation strategies reflects deeper structural and institutional barriers. One key barrier is the dominance of Western scientific frameworks within fire governance, which usually prioritize quantifiable data, risk modeling, and technical expertise over relational and place-based knowledge systems. In addition, legal and policy frameworks can restrict the use of fire in the landscape. Permitting requirements, liability concerns, and risk-averse institutional cultures make it difficult to implement cultural burning practices at meaningful scales. These constraints are intensified by [historical legacies of colonization](#), which have systematically excluded Indigenous communities from land management decision-making processes. Another barrier is the tokenization of Indigenous knowledge, where TEK is acknowledged in principle but not truly integrated into

governance structures. In many cases, Indigenous communities are consulted but not given decision-making authority, limiting the extent to which their knowledge can shape wildfire management outcomes. This indicates broader issues of power imbalance and epistemic inequality, where certain forms of knowledge are privileged over others.

Moving toward integration requires rethinking wildfire mitigation as a collaborative and co-designed process. Co-designed fire strategies would involve Indigenous communities not as stakeholders, but as partners and leaders in land stewardship. This could include:

- Tribal co-management agreements that give Indigenous communities shared authority over fire planning and implementation.
- Cultural burning programs led by Indigenous practitioners, supported by state and federal agencies
- Incorporation of TEK into CWPPs, guaranteeing that community wildfire plans reflect local knowledge, seasonal timing, and cultural priorities
- Intergenerational knowledge transmission programs, where Elders and youth engage in fire stewardship practices
- Adaptive management frameworks that integrate scientific monitoring with Indigenous observation and feedback

Examples from other regions show that these approaches are both feasible and effective. Indigenous-led fire programs in Australia, such as those supported by the [Firesticks Alliance Indigenous Corporation](#), show how cultural burning can restore ecosystems while strengthening community resilience. Similar collaborative models are emerging in parts of the United States and Canada, suggesting that co-governance is not only possible but increasingly necessary.

Structuring wildfire mitigation around TEK offers clear benefits across the three dimensions central to this project:

Culturally Responsive

Current wildfire strategies often fail to account for the cultural significance of fire and land. Integrating TEK assures that fire management is consistent with Indigenous values, practices, and relationships to the land. This entails recognizing fire as part of cultural identity, subsistence practices, and community well-being, rather than solely as a hazard.

Equitable

Integrating Indigenous fire stewardship confronts longstanding inequities in wildfire governance by shifting decision-making power toward Indigenous communities. Co-governance models create opportunities for more just and inclusive management systems, where those most affected by wildfire have a meaningful role in developing responses.

Ecologically Effective

Indigenous fire stewardship practices are inherently adaptive and place-based, making them well-suited to managing complex and changing ecosystems. By reintroducing low-intensity, frequent burning, these approaches can [reduce fuel loads, enhance biodiversity, and restore more resilient fire regimes](#). This is consistent with ecological research showing that [suppression alone is not adequate to address wildfire risk](#).

Toward a More Integrated and Just Approach

Taken together, these conclusions and proposed integration pathways reinforce the argument that current wildfire mitigation strategies remain incomplete and insufficiently holistic. While suppression and risk reduction continue to play an important role in protecting human life and infrastructure, they do not fully address the underlying ecological conditions that drive wildfire severity, nor do they account for the diverse cultural relationships that determine how communities understand and live with fire. As a result, dominant approaches often remain focused on control and containment, rather than engaging with fire as a dynamic ecological process and a culturally embedded practice.

Building on the integration strategies described in the previous section, this article demonstrates the call for a more comprehensive and polyvocal approach to wildfire management, one that brings together scientific knowledge, Indigenous fire stewardship, and community-based perspectives in valuable and actionable ways. Incorporating TEK is not simply an additive process; it requires a change in how wildfire is conceptualized, governed, and practiced. By centering Indigenous fire stewardship within mitigation strategies, wildfire management can move toward approaches that are technically effective, culturally grounded, and ecologically responsive.

Crucially, this shift also calls for addressing the underlying power dynamics that shape wildfire governance. As discussed, meaningful integration of Indigenous knowledge depends on moving beyond consultative inclusion toward genuine co-governance, where Indigenous communities hold authority in decision-making processes. Without this transformation, efforts to incorporate TEK risk remaining symbolic rather than substantive, thereby bolstering existing inequalities rather than challenging them. The integration strategies described in this study, such as co-management agreements, cultural burning programs, and the inclusion of TEK in CWPPs, offer concrete pathways to redistribute power and support more equitable fire governance systems.

In this way, the findings both confirm and extend existing research. They reinforce established evidence that suppression-based strategies increase wildfire severity by disrupting natural fire regimes and allowing fuels to accumulate. At the same time, they extend the conversation by demonstrating that effective wildfire mitigation must also engage with cultural narratives,

governance structures, and lived experience. By combining literature analysis with place-based observation, visual methods, and reflective inquiry, this study highlights how wildfire is experienced on the ground and how those experiences are shaped by broader systems of knowledge and power.

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Water Security, Climate Adaptation, and Environmental Justice in Pacific Island Communities

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ESH-540-01: Capstone Project

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Abstract

Dramatic effects resulting from climate change will be felt most acutely by Pacific Island communities, where increasing water insecurity is a significant issue. The rising sea levels will cause saltwater intrusion and changing rainfall patterns will increase pressure on already vulnerable freshwater resources. However, these issues go beyond just environmental or technical concerns; they also involve issues of governance, historical pathways of development, and the marginalization of Indigenous knowledge systems.

The purpose of this project is to use qualitative content analysis of peer-reviewed literature, policy documents, and case studies to assess how water security and climate adaptation are influenced by the interrelation between environmental pressures, governance systems and knowledge systems. Intense competition is seen between centralized and externally driven adaptation strategies versus decentralized and community driven strategies. Ultimately, this demonstrates the need for participatory governance, recognition of Indigenous Knowledge & locally based solutions to achieve long-term resilience.

The communities in the Pacific Islands are experiencing the most rapid and devastating effects of climate change with the first impacts being felt through increasingly insecure water supplies fueled by rising sea levels, salt water intrusion and changes in rainfall patterns. This article explores how the challenges related to securing a reliable source of water actually represent much more than simply a technical or environmental problem – they are also shaped by governance structures; the historical development paths these regions have taken; and the systemic marginalization of Indigenous knowledge systems. To illustrate this, the project uses qualitative analysis of peer-reviewed scholarly literature, policy documents and case studies to highlight key tensions that arise when using centralized, externally-driven adaptation strategies versus decentralized, community-led adaptation approaches. The results of the project demonstrate the role of participatory governance; recognition of Indigenous knowledge systems; and nature-based, locally-appropriate infrastructure solutions in promoting long-term climate resilience. By reconceptualising water security as an issue of justice, the project adds to a broader dialogue regarding sustainability, environmental justice and equitable adaptation to climate change.

Introduction

Climate Change has been characterised as a global environmental challenge through the use of high recorded average global temperatures; CO₂ emissions data; and large-scale changes to ecosystems. For many communities living on Pacific Islands however, climate change is not an abstract or future phenomenon, it is instead an everyday reality that is being lived in relation to their land; water; and weather. One of the most significant ways that this reality is experienced is as the increasing challenge of water insecurity. Rising sea levels; salt-water intrusion; changes in patterns of rainfall; and an increase in the intensity of weather systems are placing unprecedented exertion on the existing fragile freshwater systems essential for physical survival, food production, health, cultural continuity, and governance.

For a number of the Pacific Island populations, freshwater is a commodity that is neither plentiful nor easily replaced. Atoll nations located on low-lying land often rely on a very shallow freshwater lens of the ground that rests directly above the seawater of the ocean and thus are especially vulnerable to pollution and contamination from any number of things, including a minor increase of sea-level or a more significant event like a storm surge, which would make all sources of groundwater unusable. In addition, continued long-term drought conditions, which can occur anywhere, would further limit the possibility of developing additional water supply options. Many times, these environmental pressures are viewed as technical issues requiring an engineering solution. Viewing it this way runs the risk of oversimplifying a very complex problem. Water insecurity in Pacific Islands is not just a result of climate variability; there are also historical legacies of colonial rule, uneven development pathways, and the current climate adaptation framework, which often prioritize externally developed engineered infrastructure instead of locally-developed indigenous knowledge based systems.

The argument of this article is that the issue of water security in the Pacific Islands community is one of violence and justice rather than just technology. The central focus of this research is to answer the question: How will water security initiatives in Pacific Islands communities enhance climate adaptation in a manner that is environmentally sustainable, culturally based, and related to environmental justice? To address this question requires consideration of not just the physical impact of climate change but also the governance mechanism, funding systems, and the epistemic framework in which climate adaptation is developed and executed.

In this article, I examine the tension between centralized, externally driven models of adaptation and decentralized, locally community-driven models of adaptation based on Indigenous knowledge systems and local governance practices. I contend that equitable and adaptive climate adaptation will only be achieved when the value of these place-based approaches is recognized, and a critical analysis of the power dynamics that shape which solutions are prioritized at regional and global scales is conducted. This study aims to contribute to the dialogue on environmental justice, sustainable transitions, and the agency of communities in shaping future climates by reframing water security as a site of intersection of environmental, social, and political processes.



Caption:

Figure 1.

Coastal flooding caused by an increasing sea level is a danger to freshwater sources for communities located on islands in the Pacific Ocean. The research ultimately indicates that long-term resilience will depend on three factors: democratic governance that includes all stakeholders' participation, respect for local/indigenous knowledge, and developing locally based solutions.

Literature Review

Climate Vulnerability and the Pacific Island Context

Considerable academic research has identified Pacific Island groups as among the world's most susceptible to climate change. The Intergovernmental Panel on Climate Change has designated Small Island Developing States (SIDS) at “high confidence” of experiencing risks related to sea-level increase, coastal flooding and contamination of freshwater (IPCC 2022). These risks are particularly severe with respect to atoll countries, such as Kiribati, Tuvalu and the Marshall Islands where there is minimal elevation above sea-level, and freshwater resources are particularly fragile.

According to Barnett and Campbell (2010), the vulnerability to climate change of Pacific Island communities must be understood as socio-political contextually. Environmental exposure is certainly one of the central determinants of vulnerabilities, but it cannot be viewed in isolation from other determinants of vulnerability, such as a community's historical implications of colonisation, its economic status and the extent to which infrastructure investment has been made within the community. This way of thinking about climate change vulnerability in terms of the colonial legacy, economic dependency and the failure to invest in infrastructure, directly counters the notion of vulnerability being an inherent characteristic of the island geography and, instead, frames it as a product of global inequality.

Kelman (2018) likewise argues against the idea that Pacific Island people are passive victims of climate change by critiquing dominant climate narratives that depict them as passive victims of climate change. He argues that such narratives create "climate reductionism," by only attributing climate and environmental change as causes for social and political issues (Sovacool, 2018). Creating narratives about the Pacific Islands as passive will ultimately limit their adaptability to climate change solutions because it discounts the agency of the people living in these islands.

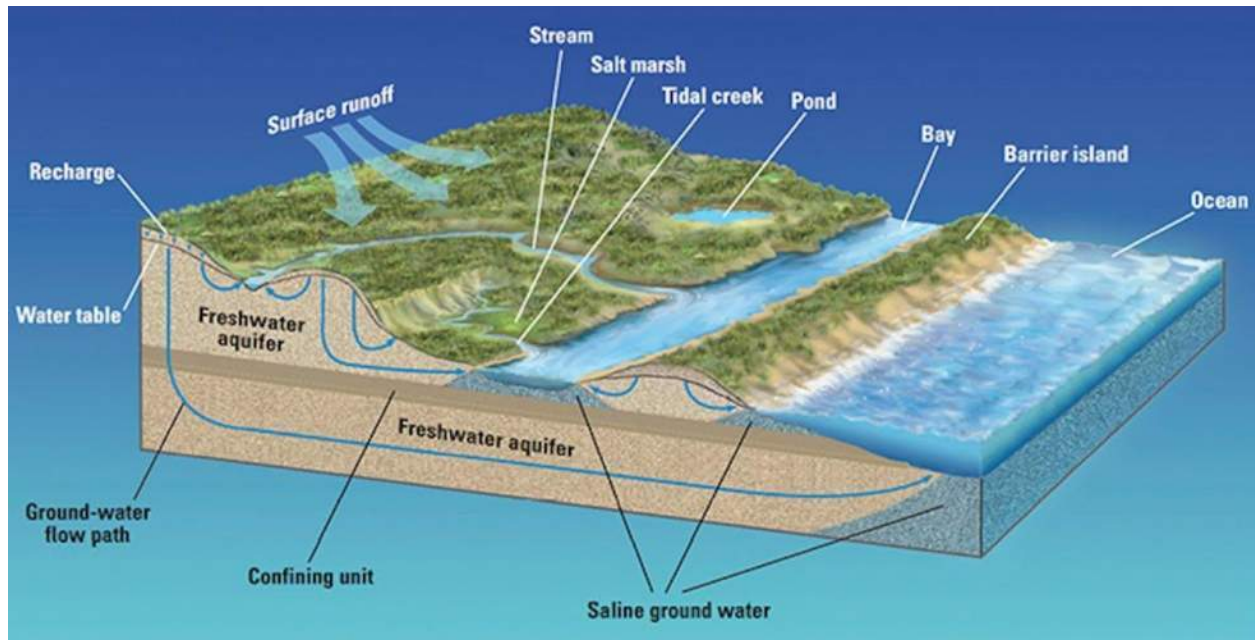


Figure 2. Freshwater lenses located in an atoll's environment can be severely impacted by intrusions from the ocean (i.e., saltwater) if there are small changes in their surrounding environment. This illustrates the delicacy of freshwater lens systems as even the smallest environmental shift may have a great effect on them.

Water Security and Environmental Change

Water security is critical to the Pacific Island context when it comes to climate vulnerability. The authors describe how freshwater in an atoll environment is found within a thin layer of ground water, which is susceptible to saltwater intrusion. Rising sea levels, increased storm surge, and changing rainfall patterns all affect the ability to use the aquifers as a freshwater source.

Much of the literature that has analysed water security has focused on technologic adaptations to solve them. Adaptations such as using desalination, monitoring ground water, and building a centralised water infrastructure are often used as popular adaptation strategies for developing Pacific Island countries. However, Sovacool (2018) critiques the technological solution approach for a number of reasons, including that they typically have a high upfront cost, require ongoing maintenance, and require skilled workers who may not be available in remote areas; therefore, it causes people to rely on outsiders for funding and expertise, which raises an issue about future sustainability.

On the other hand, decentralized methods (e.g., rainwater harvesting and community-managed water systems) are typically much more flexible than centralized sources based on geography. According to McMillen et al. (2017), Indigenous knowledge systems also contribute to social-ecological resilience through a combination of ecological observations, cultural practices, and joint (collective) governance. The technical effectiveness of these systems, combined with their socio-cultural embeddedness, means that they are generally more likely to be sustained long-term.

Governance, Power, and Adaptation

Governance is a major factor determining the success or failure of climate adaptation measures. Adaptation strategies are typically affected by external sources, such as donor institutions, international organizations, and development agencies, according to Nunn and Kumar (2018). While external funding sources provide valuable financial support, they may impose structures that do not correspond with local needs or knowledge systems.

Scholarship in environmental justice gives a useful perspective for understanding these issues. Schlosberg (2007) names three different forms of justice: distributive, procedural and recognitional. Distributive justice refers to how resources and risk are allocated, procedural justice refers to how people participate in decision-making, and recognitional justice refers to recognizing and supporting culturally diverse knowledge systems and identities.

For Pacific Island adaptation, these three forms of justice all interconnected. Funding systems from external sources may support large-scale infrastructure projects that meet the funders' objectives, but community initiatives may not be able to secure any support from these funding sources. As a result of the differences in access to resources and differences in power to make decisions, there is a major imbalance between external funding sources and local communities.

Indigenous Knowledge and Epistemological Tensions

The rise in available research on the role of Indigenous knowledge systems in assisting communities adapt to climate change is becoming clearer and well documented. As suggested by Whyte (2017), Indigenous ways of knowing and being provide different

understandings for the way we understand environmental changes that is predicated upon connected relationships, reciprocity and long term responsibility to the environment. These understandings can be argued to directly counter the existing dominant Western paradigms that tend to focus primarily on efficiency, scale and control of technology.

For example, in the Pacific Islands, various Indigenous ways of knowing relate very closely with land, water and community-based governance. Indigenous peoples' traditional practices, such as agroforestry, managing the reef and using water seasonally for agriculture and fishing, are rooted in the understanding of the workings of the local ecosystem. However, in most instances, these systems of knowledge have historically been excluded within existing formal policy frameworks that have primarily legislated the use of science and technology.

The marginalisation of Indigenous knowledge systems within policy frameworks illustrates the broader hierarchy (i.e. epistemology) of Indigenous knowledge within the governance of climate change. Although often cited in some form of policy discourse, Indigenous knowledge is usually regarded as an additional or supplemental source of information to the policy maker's decision-making process, which has limited the role of Indigenous knowledge in the adaptation of Indigenous peoples.

Gaps in the Literature

Though many researchers are now aware of these issues, there remain multiple gaps in the literature regarding how they should be studied. First of all, the vast majority of studies that have been performed still utilize institutional perspectives rather than the voices of those directly impacted by climate change. Second, the overlap of environmental, social and political aspects is still largely absent from a common analytical framework (i.e., most case studies look at either infrastructure, governance or community adaptation). Lastly, existing research continues to reinforce the dependency of local communities on external solutions through their dominant narrative(s) of vulnerability, which may cause a failure to recognize that many local communities have the means to adapt without assistance from outside sources.

Contribution of This Project

This research adds to the body of literature by developing a "justice-based" framework for understanding water security and climate adaptation through the interplay between environmental forces, governance systems, and knowledge systems and their effects on the overall picture of climate adaptation in Pacific Island countries.

In developing a justice-based framework to assess climate adaptation through assessing the impacts of environmental stressors on governance systems and knowledge systems, this research demonstrates that Pacific Island communities should not be perceived as passive recipients of assistance but rather as active participants in the creation of sustainable resilience to climate change. The emphasis on community driven approaches and Indigenous knowledge systems challenges conventional wisdom regarding effective means of climate adaptation and illustrates the need for locally driven solutions.

Introduction to Methodological Approach

This project employs a qualitative, interdisciplinary, and justice-oriented methodology for analyzing water security and climate adaptation within Pacific Island communities. Instead of producing new empirical field data, the research is based on the analysis and synthesis of existing literature, policy documents and case studies. This approach is deliberate; there have already been extensive documents around climate adaptation in Pacific Island contexts by various sources, however these knowledge systems frequently remain fragmented across disciplines and shaped by different epistemological assumptions. Thus, the goal of this methodology is not necessarily to add more data, but to reinterpret the existing knowledge through a critical and justice-focused lens that prioritizes governance, power and Indigenous knowledge systems.

This methodological direction additionally represents a broader commitment to engage with MESH frameworks rather than relying only on technical definitions of sustainability issues; in addition it recognizes that environmental issues (particularly climate-change related) are fundamentally intertwined with social, political and cultural processes. This project will seek to develop knowledge that is both analytically rigorous and ethically

grounded by integrating environmental justice theory, Indigenous epistemologies, and political ecology.

Research Question and Analytical Focus

The primary research question for the project is:

What is the method by which water security efforts in Pacific Island populations can assist with climate change adaptation in ways that will provide environmentally sound, culturally appropriate, and justly achieved results?

To answer this question, the methodology is designed around three interrelated analytical dimensions:

Environmental Conditions – How does climate change impact the water systems (e.g., through sea level rise, saltwater intrusion, and rainfall variations)?

Governance Structures – How are climate adaptation strategies developed, financed and implemented?

Knowledge Systems – Whose knowledge is recognized and prioritized in the climate adaptation process?

These analytical dimensions are not viewed as discrete categories but instead as mutually dependent elements of one interrelated system. Thus, the systems approach to analysis enables identification of patterns and relationships across multiple contexts, rather than merely describing individual case examples.

Data Sources and Collection

This project relies on **multiple forms of qualitative data**, including:

1. Academic Literature

The basis for this project comes from scholarly publications and their associated; peer-reviewed journals and books on climate vulnerability, water security, equity and justice issues, and Indigenous knowledge systems as they relate to Pacific Islands. Academic literature also provides information regarding the dominant narratives, the

theoretical frameworks within the discipline, and the ongoing debates that exist within the discipline.

2. Policy and Institutional Reports

The reports produced by bodies such as the IPCC, UNDP and a number of other Pacific regional organisations provide the opportunities to examine how climate adaptation has been framed at a policy level and provide insights into potential solutions, funding priorities, and governance structures. In addition to their value as information sources, policy and institutional reports were also subjected to critical analysis to examine how institutional perspectives shape the discourse of adaptation.

3. Case Studies

The use of case studies published in regards to water management/ climate adaptation initiatives serve as context evidence examples. There are both centralised infrastructure initiatives (e.g., desalination systems) and decentralised initiatives (e.g., rainwater harvesting, community governance models). The use of case studies allows for comparative analysis and illustrates how theoretical principles are implemented in practice.

Data Analysis Approach

The analysis is interpretively thematic in nature, meaning that the purpose of the analysis will be to highlight the patterns that recur across all of the data. In addition, rather than utilizing a formal coding system, the analysis will be themed based upon the key themes that surfaced throughout the process of interaction with the data.

The following themes can be categorized as primary analytical categories during this analysis:

1. Centralized adaptation strategies versus decentralized adaptation strategies
2. Institutional governance models versus community-based governance models
3. Technical means versus cultural means of adaptation
4. Narratives of vulnerability versus narratives of resilience
5. The inclusion of Indigenous ways of knowing versus the exclusion of Indigenous ways of knowing

Each of these themes will be utilized to organize the Results and Discussion portions of the paper. The purpose of organizing the findings in this manner is to provide an interpretive understanding of how the themes are related and how they will help inform adaptation outcomes.

Theoretical Frameworks

The analysis is built on three theoretical frameworks related to social equity. These frameworks are:

The concept of environmental justice offers a basis for understanding the inequitable distribution of climate impacts and the related adaptation strategies across communities. Utilizing Schlosberg's (2007) dimensions of justice, this project examines;

- 1) Distributive Justice reflects who receives the benefits of adaptation resources and who incurs the risks associated with them.
- 2) Procedural Justice pertains to who is included in decision-making opportunities regarding the use of adaptation resources.
- 3) Recognition Justice involves whose knowledge and cultural practices are acknowledged as valid.

Together the three dimensions of justice assist with evaluating the impacts of adaptation efforts and identifying inequities within the governance system structure

Epistemologies of Indigenous peoples are based on the interconnectedness of land, water, and community. In the Pacific Islands, these indigenous ways of knowing are woven throughout traditional practices and the practice of environmental caretaking. The Indigenous epistemology lens will be used to confront the dominant western assumptions regarding multiple ways to manage natural resources and provide additional options for sustainability.

The field of Political Ecology places environmental issues into larger power and government systems. Political Ecology looks at how political, economic and institutional factors affect environmental outcomes or results. Political ecology gives us a great lens to view how the international climate change policies and funding impact local adaptation strategies.

Both of these areas will be used to assess adaptation strategies and identify inequalities in the governance systems.

Reflexivity and Positionality

One of the most important parts of this methodology is reflexivity. Reflexivity is critically analyzing yourself relative to the research process. I want to acknowledge how I view the Pacific Islands from my own perspective as an academic who has had traditional training, comes from a specific cultural background, and has access to certain types of knowledge.

This understanding has informed the following methodological decisions:

Prioritise sources which provide Indigenous and community voices,
Critically review the dominant narratives in academic and policy literature, and
Avoid making assumptions that solutions from the outside are always going to be better than solutions from the inside.

Instead of trying to establish objectivity, this project accepts that all knowledge is situated and attempts to involve a number of different perspectives in an open and ethical way.

Limitations of the Methodology

Although this method is effective in examining what information can and cannot be accessed through existing publications about community members and peoples' perspectives, there are limitations associated with this methodology (for example the availability and accessibility of existing publications) can limit the data collected as many aspects of communities may exist as oral histories, or local publications, hence not being documented in an existing publication. Second, there were many more institutional and academic sources used in comparison to other sources of information represented in the data set; however, the efforts to include other types of sources do not resolve the fact that certain voices are involved less than others (for example certain communities that experience systematically less representation) due to structural inequities in how knowledge is produced and distributed. Finally, the absence of field work means that many real-time experiences and interactions may not be documented; however, there is some balance to the methodology through the reach of an extensive body of knowledge both conceptually and ultimately, in order to identify overall themes.

Toward Polyvocality

Polyvocality (having multiple voices and/or perspectives) will be included in a variety of formats, including literature written by indigenous scholars, case studies illustrating community-led climate adaptation initiatives, and grey literature and media that depict the lived experiences of communities in the Pacific Islands.

This project considers polyvocality as an essential part of both how it approaches methodology and how it analyzes data rather than simply an extra effort. Climate adaptation in the Pacific Islands is complex; it involves environmental, social, cultural, and political issues, and no one perspective can adequately account for all those complexities. Therefore, the incorporation of a variety of knowledge types will allow this project to move away from dominant narratives that generally prioritize technical or institutional points of view.

As an illustration, while reports on a policy level often express infrastructure needs (e.g., desalination systems for large-scale water supply), successful examples of community-based practices that utilize local knowledge and collective governance (e.g., rainwater harvesting systems in Kiribati or Tuvalu) demonstrate the potential for this

type of response to be more sustainable and culturally appropriate than larger infrastructure projects. Similarly, Indigenous scholars have contributed an understanding of water within a larger ecological and cultural context, which is missing from most technical analysis. Media and community narratives also illustrate how these strategies are experienced at the community level in terms of successes and challenges to implementation.

The lack of primary fieldwork means this research will not include real-time experiential data or direct community engagement. Nevertheless, through synthesizing multiple, diverse sources and identifying similar patterns across those sources, the research is able to mitigate some of the limitations associated with this absence. By actively engagement in research with a diversity of voices and perspectives; the research seeks to produce a more comprehensive and ethically sound understanding of climate adaptation than what would otherwise be available due to limitations of distance and lack of representation.

Methodological Contribution

This methodology contributes to the area of climate adaptation research. It creates a holistic and equity-focused way to look at research in climate adaptation. This methodology looks beyond the fragmented ways of analysing climate challenges, highlighting that Climate, Environmental, and Social challenges are all connected. Therefore, the methodology uses a systems thinking perspective to understand how climate change is a systems issue and not just a technology problem.

The methodology also goes against existing climate discourses by challenging assumptions of existing climate physical adaptation discourses and emphasises the importance of governance, culture, and knowledge systems in achieving successful outcomes.

Conclusion of Methodology

The objective of this project is to investigate water security and climate adaptation using multiple types of qualitative data (e.g., literature reviews, document analysis, case study analysis). An important focus of this research is to understand how environmental change is impacted by various levels of political and governmental frameworks, along

with various forms of knowledge systems that are used in the various spaces occupied by Indigenous populations.

This will be done primarily through an analysis of patterns-based relationships, as opposed to isolated data points. The methodology used in this project therefore provides a foundation to support the analysis of these complex interactions that impact our ability to achieve water security and adapt to climate change.

The findings obtained through this methodology will then be examined more closely in the Results and Discussions section where these patterns will be linked back to the broader literature

Researcher Reflection

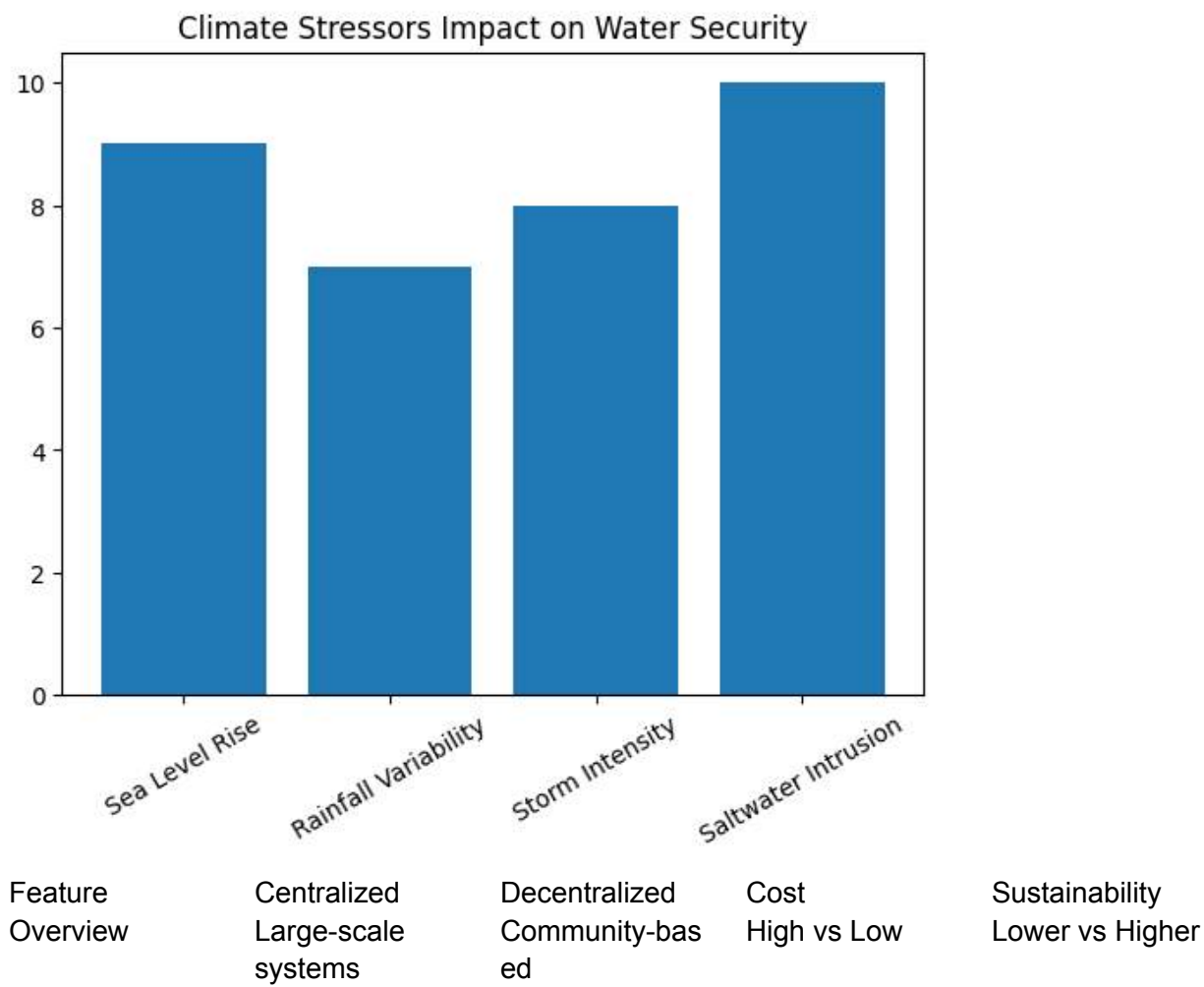
As someone who studies Pacific Island communities as an outsider, I have formed opinions about the issues facing the communities based upon my experiences with sources and the frameworks I use to interpret those sources. In order for this project to be true to the intention of centering knowledge and justice-based approaches towards a community, acknowledging that I am limited from capturing a person's, or a community's, actual experience without having previously engaged with them directly, is critically important to recognizing how important it will be for researchers moving forward to continue to examine the dominant culture's narrative of the communities researched and to seek out all available ways of obtaining all perspectives from these communities. As researchers continue their work, it will be critical to include community voices within the final analysis and to include Indigenous-authored work if researchers are going to provide a relevant final analysis.

Results and Discussion

The literature, policy document and case study review outlined in this section provide an indication of how climate adaptation and water security in Pacific Island communities are shaped by a complex interaction between environmental pressures, governance structures, and knowledge systems. There is clear and measurable risk from climate change - e.g., sea level rise, saltwater intrusion, changing precipitation patterns -

however, the sustainability and effectiveness of adaptation strategies is heavily influenced by how these risks are interpreted and responded to within wider social and political contexts.

The research findings do not define adaptation as a simple response to environmental change; rather they expose a number of tensions that shape adaptation outcomes, including: tensions between centrally and decentrally governed infrastructure; tensions between externally versus locally governed infrastructure; tensions between technical and relational knowledge systems; and, tensions between vulnerability based and resilience based narratives. By exploring these tensions this section goes beyond simply describing the variety of adaptations and provides a critical analysis of how adaptation strategies are formed as well as to whom and what interests they ultimately serve.



This research shows that Pacific Islands' community water security cannot be solved through technical fixes. Water security also must be seen as complex: because it occurs where environmental pressures meet governance and knowledge systems. While climate change presents real physical threats, the implementation of adaptation strategies will rely on those who have authority to determine what constitutes a problem, develop proposals for solutions, and implement required changes.

Therefore, future climate adaptation efforts must prioritize community-driven solutions; support Indigenous knowledge; and create equitable governance systems if they are to achieve fair and sustainable results.

Environmental Pressures and the Limits of Technical Framing

The main finding of the research undertaken in this project is that environmental pressures have a strong and well-documented impact on the water systems of Pacific Island communities. The rising sea levels are contaminating freshwater lenses, while increased storm intensity and irregularity of rainfall create further instability in the availability of water for these communities. In coral atoll ecosystems, where freshwater exists as a very thin layer of water on top of seawater, minor changes in an environmental variable may have a disproportionate impact.

The literature does not support the concept that environmental stresses are the primary causes of problems associated with water insecurity, but is dominated by technical frameworks that depend too heavily on scientific and engineering methods, isolating only the environmental variables affecting water availability; such as salinity, precipitation, etc., and failing to consider the social and institutional issues associated with the management of the water systems of the Pacific Island communities.

For instance, two communities that are faced with equal amounts of saltwater intrusion can experience different levels of impact based on how they are governed, their resource availability and their ability to organize together for collective action. Therefore, vulnerability is contingent not only upon the environment but also on social and political capacity as well as a host of other variables.

There is a strong technical framing component of all aspects of the policy discourse as many problems, especially those related to water. Problems are typically

framed or represented by how to maintain or create infrastructure improvements, monitoring systems or engineering interventions. While these types of solutions do play an important role in solving the problem, they are not always given the proper context that ultimately gives rise to water insecurity. By concentrating their primary focus solely on measures of the environment, technical approaches result in a symptom-oriented approach to identify corrective action while ignoring the real underlying problem.

Decentralization versus Centralization

One of the most glaring distinctions in the data analysis was a tension borne out of a dichotomy between community-based or decentralized solutions for managing water compared to centralized ones.

Centralized "top-down" solutions

One of the most common examples of a centralized solution are desalination and/or large, centralized water distribution systems, which governments tend to promote through policy frameworks and development assistance. The justification for government-supported centralized solutions is based on traditional models of developing physical infrastructure; however, these models tend to emphasise scalability implementation speed and the production of quantifiable outputs at predetermined or set times.

Centralized systems are typically established with grants or technical assistance from a development partner or donor country. As these grants are provided to establish the centralized water system, communities may experience immediate improvements related to water access as a result of the newly-created centralized system (i.e., by virtue of its establishment, it now exists). However, the long-term success and sustainability of any of these centralized systems are uncertain and unattainable.

Centralized infrastructures face several challenges, such as:

- 1) High operating and maintenance costs
- 2) Reliance on outside expertise

- 3) Remote area system failures
- 4) Little to no community involvement in decisions made concerning these systems

The issues above demonstrate a broader issue that centralized systems typically place a higher emphasis on technical performance, while not emphasising social integration. Therefore, centralized systems may have difficulty adapting to new situations and the needs and wants of local communities.

Decentralized Adaptation Strategies

By comparison, decentralized adaptation methods, such as rainwater harvesting, community-managed water storage systems and local governance structures, are usually more flexible and sustainable over time than are centralized approaches.

The main features of these methods include:

(e.g., precipitation and temperature patterns)

- Lower costs and reduced maintenance
- More compatible with local environmental conditions
- Increased community ownership and participation
- Integrate with local culture and traditional knowledge systems.

Particularly, rainwater collection has been demonstrated as popular means of achieving Water Supply Security, as these methods collect and store rainwater at individual homes or at the community-level to lessen reliance on centralized infrastructure, and provide for a more dependable source of fresh water.

Decentralized systems are not only about implementing technology but also having to do with the social dimensions and governance surrounding them. In particular, the success of decentralized systems relies upon community organizations working together, as well as individuals taking on a shared responsibility, and using experience and knowledge of the local environment.



Caption:

Figure 3. Decentralised and community-based solutions to accessing water sources through rainwater harvesting systems.

This example illustrates how local management systems can provide sustainable, locally viable solutions for alleviating water scarcity.

Comparative Analysis

The comparison between both centralized and decentralized approaches identifies an important conclusion; adaptation includes not only the advancement of technology but includes solutions compatible with local courts of authority and democracy.

Decentralized infrastructures may have a place for use but many times there are limitations in terms of sustainable development and communities' access to them. Whereas on the other hand decentralized approaches provide a model of adaptation which is both technically suitable as well being socially embedded in these locales.

As a result, these findings challenge the precept that larger scale and more complexity are the clear path to achieving better outcomes. On the contrary, this indicates smaller scale and community based solutions are likely to yield more effective and equitable results.

Decision Making, Governance, and Authority

The second significant aspect discovered through this initiative is that adaptations are impacted greatly by the way in which those involved make decisions within their respective communities, along with how much authority they have over decisions.

In addition, environmental and built infrastructure both impact water security; thus, there are environmental and built infrastructure contexts in which adaptation strategies will occur.

Other aspects of decision making and authority are affected by how external funding sources provide resources through a network of international agencies and development assistance organizations, and thus influence (or do not) adaptation strategy execution.

The majority of adaptation strategies created in Pacific communities are funded via donor funding streams or controlled (dictated) via foreign entities providing resources from outside (external resources). However, while this form of support is critical to the ability of these communities to create meaningful adaptation outcomes, donor funding creates new forms of power dynamics for influencing which adaptation strategies will be supported and implemented by Pacific island governments.

In addition, while donor funding creates new dynamic power dynamics, it is typically allocated/attached for specific adaptation outcomes sought by the donor. For example, many donors seek adaptation strategies that produce measurable results, can scale to multiple locations, and/or utilize more technology than community based or culturally rooted adaptation strategies. Consequently, many donor funded adaptation strategies will not meet the needs of many Pacific Island communities.

As a result, while the adaptation strategies will be driven by local community needs, they will also be driven by the limitations and/or expectations of the external resources that funded them.



Caption:

Figure 4. If communities do not participate, they cannot make equitable decisions on more effective approaches to climate adaptation

This reinforces that it is important to include local voices in social decision-making to ensure equitable social outcomes.

Procedural Justice

From an Environmental Justice perspective, these aspects also prompt discussion about Procedural Justice by examining who actually has a "say" in decision-making processes. The results of the research suggest that community involvement is typically acknowledged as being of prime consideration, however, it is rarely realised in practice. In very few cases is community input offered via an opportunity for decision-making rather than simply through consultation, and these methods of community support often produce adaptation strategies that do not adequately represent community priorities and/or knowledge systems.

Justice through Recognition

An important part of this is recognition of justice. Indigenous knowledge systems have been increasingly recognized in discussions about climate adaptation, however these systems are usually recognized as complementary rather than central to discussions of climate adaptation policies. Once again, this is an example of a larger epistemological hierarchy in which scientific and technical forms of knowledge are privileged to experiential and relational; thus, much of the wisdom of Indigenous people may go unappreciated and unused in climate adaptation efforts.

Indigenous Knowledge Systems & Adaptive Practices

An important conclusion of the research is that Indigenous knowledge systems play a critical role in developing effective adaptation strategies.

Features of Indigenous Knowledge Systems

Indigenous knowledge systems, as found in Pacific Island cultures, exemplify:

- Long-term observation of environmental phenomena
- Holistic integration of environmental, cultural and social knowledge
- Focus on the interrelationship of humans and ecosystems
- Collective governance and collective decision making

In developing Indigenous knowledge systems compared to Western systems--resource management will differ significantly. For example, whilst Western systems are typically focused on controlling water through human intervention--Indigenous systems emphasise stewardship and sustainability.

Water Security Applications

Indigenous knowledge is used in many adaptation approaches, including:

- Sustainable water use
- Seasonal resource management

- Integration of water and land management
- Community-based decision-making.

These approaches are sustainable and culturally relevant, reflecting the direct link between environmental sustainability and social wellbeing.

Challenges and Opportunities

Indigenous knowledge systems are valuable resources for climate adaptation; however, they are regularly omitted from most formal adaptation programs. As a result, they are not held in high esteem and limit the number of strategies available to improve climate adaptation. Recognizing this issue is critical if we are going to be able to incorporate Indigenous knowledge into adaptation initiatives. In order to successfully incorporate Indigenous knowledge into adaptation programs, we need to create more effective governance for Indigenous peoples and their knowledge systems.

Narrative Framing of Vulnerability and Resilience

The Representation of Climate Change Issues in The Pacific Islands are dominated by a Narrative about Vulnerability which has significant implications for Pacific Island Communities.

The Narrative of Vulnerability has been used in many policy documents and media reports to frame Pacific Island Communities as being at risk and highly vulnerable to the impacts of Climate Change. Framing Communities as being vulnerable to Climate Change may assist to highlight and bring awareness of the current challenges that Pacific Island Communities are facing however, it also creates other unintended consequences that may impact on their overall resilience.

The emphasis on vulnerability may also reinforce other narratives of dependency and therefore, portray these communities to be helpless and reliant upon international assistance for survival and recovery by creating a narrative that they are incapable of addressing their own challenges, as well as being able to develop their own adaptive strategies.

The emphasis on vulnerability may also reduce the recognition and visibility of indigenous and local agency. Local Knowledges and Practices of resilience of many Pacific Island Communities are deep and complex and are often not recognised in favour of perpetuating narratives that purely portray these communities as victims.

Agency and Resilience

Conversely, through a resilience-based lens, communities have inherent abilities to adapt to, and respond to, climatic changes in their environment. This is not to disregard the impact of climate-related issues, however putting emphasis on what communities know; how governance structures exist within local regions; and developing innovative techniques towards the development of solutions all work together to shape the final outcome.

Adaptation's Definition and Applicability

The definitions and framing of adaptation have policy implications and ramifications that extend beyond just climate change. Generally, vulnerable communities rely heavily on top-down government interventions, whereas resilient communities can typically implement community-led solutions. Therefore, an appropriate re-framing of the definitions of climate adaptation and including agency and cultural diversity as components is an important condition to achieving more equitable and effective solutions.

Environmental Justice Integration

A number of critical aspects of Environmental Justice have been identified through this project which can provide a more detailed analysis of the findings.

1. Distributive Justice focuses upon unequal distribution of resources/infrastructure across communities. Access to many essential services, such as clean water, health care, and transportation, is virtually inaccessible for many marginalized populations therefore they are disproportionately impacted by environmental hazards and climate change. Recognizing these disparities will help ensure that all communities have equitable access to the resources needed to achieve a healthy quality of life.

2. Procedural Justice emphasizes the importance of including marginalized communities in decision-making processes. Often marginalized communities do not have adequate opportunities to engage in Environmental Governance/Public Policy. Their voices are often not included in the decision making process therefore they are not reflected in the decisions made regarding their needs and priorities. Fair representation of and meaningful participation by all stakeholder groups (with emphasis on groups historically underrepresented within an environmental arena) must be ensured in order to develop appropriate and fair Environmental Policies.

3. Recognition Justice addresses the ways that Indigenous knowledge and perspectives have been disregarded in Environmental Management. Historically, Indigenous Communities have been routinely disregarded in favor of Western science, despite possessing knowledge and traditional practices that promote sustainability and conservation.

Summary of Findings

The findings provide valuable information that outline a number of key components for successful climate adaptation in the Pacific Islands:

1. The need to tailor infrastructure and project design and delivery to the specific environmental, cultural, and other characteristics of the community in which those projects are developed and delivered so that the infrastructure is not only functional, but can withstand different climate related challenges that may be faced by those islands.

2. Building capacity for community governance (i.e. empowering local decision makers) is an important element to developing adaptive capacity in the community. It is also necessary to enhance decision-making, foster participation and ensure transparency of decision-making, so that communities can increase their ability to respond to the climate change impacts that may be experienced in their communities.

3. Understanding Indigenous Knowledge Systems: The traditional knowledge of many Indigenous peoples around the world includes a wealth of relevant and useful information about sustainable and resilient practices that have been developed and adapted infinitely throughout history. Including these forms of traditional knowledge in modern adaptations will improve both the efficacy and applicability to local communities.

4. Challenging Mainstream Perceptions of Vulnerability: It is critical to assess and change the dominant views that exist about those in the Pacific Islands who are impacted by climate change, portraying them only as helpless victims rather than addressing the many positive attributes and resources within each community as well its ability to adapt and succeed with innovative solutions.

The overall findings of this study contribute to our understanding of how many different kinds of things influence water security in Pacific Island communities, including: (a) environmental issues; (b) social issues; and (c) political issues; and show that climate change will worsen these communities' existing issues; and (d) our ability to adapt successfully is dictated by our ability to determine both the challenges we face in

adapting to climate change, and what successful responses to those challenges look like.

The data I've presented in this study supports moving away from a "technical" lens to addressing water security, to one that incorporates to integrate issues of (a) environmental justice, (b) attributes of effective governance, and (c) alternative knowledge systems into how we conceptualise climate adaptation, to ultimately lead to an improved understanding of climate adaptation in a more complex fashion than just being able to understand how resources will be allocated because they become available; but, to include also social aspects, like equity of access and community engagement, to the totality of newly emerging issues associated with providing clean water to communities.

These findings will provide evidence to support the last section of the paper where the main findings of the research are summarised and their implications explored for future research as well as the practical applications of those findings. Those implications will include a need to implement an interdisciplinary approach and work collaboratively with stakeholders to build resilience among Pacific Island communities due to ongoing climate changes affecting the region.

Future Implications

This project's findings suggest future climate adaptation in Pacific Island communities requires a shift from short-term fixes towards long-term community centered solutions. Climate impact will increase necessitating new adaptation frameworks including consideration of current and future climate impact will increase necessitating new adaptation frameworks in addition to existing climate frameworks as well as creating or increasing current structural governance/decision making processes that allow for local decision making and integration of local knowledge into adaptation efforts. Future climate adaptation frameworks should also include consideration of funding mechanisms that enable Pacific Island communities to take ownership of adaptation projects regardless of whether the funding is provided by external sources.

Future efforts to adapt to climate change need to strengthen the integration of Indigenous knowledge into the formal policy framework. Although the role of Indigenous people in the climate discourse is becoming more widely recognized, their knowledge does not have equal standing with other forms of knowledge when making decisions about how to adapt to climate change. Institutions need to modify their decision-making

processes so that Indigenous knowledge is considered a core part of the way decisions are made, rather than an additional source of information.

An additional implication to this is reframing climate narratives. Moving away from vulnerability-focused narratives towards resiliency and agency-based narratives will change how adaptation is considered in relation to developing and implementing strategies. This shift could also serve as a means to alter funding mechanisms, governance structures, and overall objectives of climate policy.

This study examined water security for communities located within Pacific Islands. Water security can be affected by many factors, including climate change, government and institutional structures, and knowledge systems (Cohen et al., 2020). While climate change creates additional stressors that are easy to measure (funct.mgsl.gu.ac.ae., such as, rising sea levels, increased saltwater intrusion, and changing rainfall patterns), this research found that none of these environmental issues can be assessed or addressed independently of each other. Therefore, in order to have a complete and accurate view of water insecurity, we must also take into account the related issues of power dynamics; institutional decision-making; and, the recognition of various forms of knowledge.

This project identified several key tensions through an analysis of academic literature, policy reports, and case studies that shape outcomes of climate adaptation; the most significant include those between; centralized and externally driven approaches to developing infrastructure, i.e., large-scale technological solutions, and decentralized and community-led systems, i.e., rainwater harvesting and local resource management; the influence on local decision-making that external funding and governance structures present; and the continued marginalization of Indigenous knowledge systems within recognized adaptation frameworks. While large-scale technological solutions may provide immediate benefits, they are usually limited in terms of cost, sustainability and community integration. Therefore, decentralized systems demonstrate a greater ability to be adaptive while being more culturally compatible.

This study contributes significantly to the understanding of climate adaptation by looking at how the principles of environmental justice can be used to analyse climate adaptation. Specifically, it looks at the distributive, procedural and recognitional justice aspects of climate adaptation. It thus argues for fair distribution of resources, enabling meaningful community input into decision making and incorporating Indigenous knowledge systems. These issues cannot be separated from the technical aspects of

climate adaptation but rather, they are critical components to achieving success in implementing technical responses to climate change.

This study concludes that achieving long term sustainable water security for Pacific Island communities can only occur through implementing culturally appropriate, participatory, locally driven models of climate adaptation. Future research in this area should centre on community voices, identify methods of applying Indigenous knowledge within wider policy frameworks and critically assess the power relations that determine how climate adaptation occurs on both a global and local level. By doing so, climate resilience initiatives will have an enduring impact and will also be more just.

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Who Acts When Wildfires Blaze?

By Macy Merrell



Abstract

The CZU Fire Complex of 2020 devastated Santa Cruz County following a dry lightning storm that ignited various fires in densely canopied redwood forests. The fire exposed critical gaps in wildfire management and mitigation strategies across all stages of preparedness and response systems. This paper argues that wildfire disasters in Santa Cruz County are not solely environmental events but systemic governance failures shaped by fragmented policy, inequitable recovery measures, and the exclusion of Indigenous land stewardship practices. Addressing these challenges requires integrated, multi-level mitigation strategies that center ecological knowledge and social equity. By analyzing fire severity data, governance frameworks across local, state, and federal levels, and incorporating community perspectives alongside Indigenous stewardship practices, this study highlights the interdependent systems that shape wildfire management. Ecological shifts from both the presence of wildfires and the mitigation of their severity are increasingly important to understand as impacts of climate change surge. Rather than treating sectors of fire management as isolated events, this research adopts an intersectional framework to examine the social, political, and ecological complexities of wildfire mitigation in Santa Cruz County.

Introduction:

In August of 2020, Santa Cruz County experienced the most [devastating fire](#) ever recorded in the area. An extreme heat wave, coupled with prolonged drought conditions, contributed to a rare dry lightning storm that ignited multiple fires across the region. These fires burned beneath dense redwood canopies, where insulation effects intensified heat. Under high wind conditions, flames spread rapidly across the landscape. The fires, hidden beneath thick redwood canopy, became extremely hot and fast-moving, ultimately merging into one enormous fire known as the CZU Complex. Due to high winds, drought conditions, and a landscape suppressed by wildfires for years, the convergence of flames produced an unprecedented fire event. The severity of this event cannot be understood in isolation; rather, it is rooted in a longer history of fire suppression policies shaped by colonial land management practices.

The CZU Complex of 2020 was a wildfire on a scale that Santa Cruz County was unprepared to handle. Between 1948 and 2019, there were [15 fires classified](#) as “major” hazards to the county, cumulatively burning 61,455 acres. In comparison, the CZU Complex burned roughly 85,509 acres over the three weeks it took to contain the flames. This scale of destruction, compounded by the high concentration of Wildland-Urban Interface areas and damaged infrastructure, made the CZU Fire Complex the most catastrophic fire event recorded in Santa Cruz history.

Ecologically, the impacts of the CZU Complex varied due to the inherent properties of [redwood forests](#) and the fire's extremes. Redwood forests require wildfire disturbances to thrive, opening their serotinous cones, which contain redwood seeds, allowing the seeds to spread across the forest floor. Additionally, redwood forests contain tannic acid, which forms an almost fire-resistant coating, allowing burns to hollow out the trunks without igniting the entire tree. Redwoods have special mechanisms, including the ability to resprout from burl tissue in their roots, which sprouts have a higher success rate because [fire](#) also clears the understory. These processes were once honored by the Indigenous bands residing in the regions, but were lost as colonization took hold. Although redwood forests rely on wildfires to regenerate, wildfires of different severities affect the efficiency of the ecological services they provide. Due to years of forest mismanagement from logging practices, the loss of prescribed indigenous burning practices, and the overall impacts of climate change, a high-severity fire scorched the topsoil and root systems of many trees, destabilizing the local landscape. Steepened hillsides, barren of stable foliage and underlain by non-porous soil, raised major concerns throughout the county about future mudslides and [debris flows](#) during heavy rains. Wildfires burden communities with layers of devastating consequences that require targeted mitigation and management.

The colonization of California's Central Coast has an extensive history highlighting the assimilation of the [Amah Mutsun Tribal Band](#) in the 18th century, which greatly influenced modern forest management practices and the development of fire mitigation policies. The Amah Mutsun Tribal Band was the primary residents of the San Juan Valley between Monterey Bay and the Pajaro and San Benito rivers for thousands of years until the arrival of the Spanish in the 1700s. The Spanish arrived and began construction of their first Mission in 1770, intending to

return the land to the Mustun communities once the Mission was complete. The Spanish Missionary era brought violence and slavery, family separation, and the loss of cultural knowledge, as well as unkept promises of land return, forcibly removing the tribes from their ancestral land.

Following the Spanish Mission period was the Mexican era in the mid-1800s, when Mexico won independence from Spain and began to take over the Spanish Missions, forcing the Amah Mutsun people from the San Juan Valley to work as Rancheros, furthering their assimilation and subjection to slavery. Although the Mexican period was shorter than the Spanish period, the Amah Mutsun population was reduced by over 50%. Following the devastation of the Mexican period was the California gold rush, which brought more violence, slavery, kidnapping, and abuse to Indigenous people, this time without the promise of returning the land that Anglos were occupying in their search for gold. The gold rush had the most influential effects on policy and prejudice concerning Indigenous people, at one point placing a bounty on the heads of indigenous people as an executive order from the California Governor in 1851.

Another factor contributing to the high level of displacement from the fires is the demographics of people in the [Wildland-Urban Interface regions](#) of Santa Cruz, where a higher proportion of elderly residents have lived in their properties for many years, ultimately defeated by the fires and forced to retreat to the main areas of town. The fire forced over [77,000 people](#) to evacuate and devastated over 600 residences across the county. Following this displacement, many residents discovered gaps or absences in insurance coverage, leaving them vulnerable in an already strained housing market. The lack of coverage forced some people to leave their land altogether and sell, while others began the strenuous process of obtaining permits to rebuild. The CZU Complex not only physically devastated the town but also exposed and underscored pressing social issues in Santa Cruz County, prompting critical examination of the actors involved in wildfire mitigation, planning, and policy implementation.

Literature Review:

Wildfires have become an increasingly frequent and destructive phenomenon across California, with impacts on public health, infrastructure, environmental sustainability, and waste management. The CZU Fire Complex burned nearly 87,000 acres in Santa Cruz County, destroying hundreds of structures and revealing the complex, intersectional challenges communities face throughout the duration of wildfires. In the aftermath of such disasters, post-fire recovery efforts must address not only fire prevention and suppression but also the massive volumes of hazardous and non-hazardous waste, contamination of water and food systems, as well as long-term ecological degradation.

This literature review examines existing research on wildfire waste, contamination, and mitigation strategies, highlighting dominant trends, key gaps, and potential solutions for further exploration. It also situates my Capstone Project within existing knowledge, emphasizing the contributions of a systems-based, ecologically informed approach and the feasibility of various wildfire mitigation strategies in Santa Cruz County following the CZU Fire Complex. The question guides the literature review: **Following the 2020 CZU Fire Complex in Santa Cruz, California, how did actors respond in relation to policies and practices for fire mitigation?**

A dominant trend within the literature is the growing recognition of wildfire as both an ecological process and an anthropogenically influenced hazard. Research from the [National Park Service](#) examines adaptations of redwood ecosystems, which are inherently fireproof, whose

ecological properties rely on point disturbances and low- to moderate-intensity burns to regenerate and maintain balance. Redwood species possess advanced ecological traits, such as thick, tannin-rich bark and the ability to resprout from basal burl tissue, enabling them to survive fires. However, the literature also highlights that not all fire is beneficial. [High-severity fires](#), such as those observed during the CZU Fire Complex, can surpass ecological thresholds, damaging soil systems, destroying root networks, and destabilizing slopes. This distinction between beneficial and destructive fire underscores the importance of management practices in shaping fire behavior and ecological outcomes.

Another major trend in the literature is the emphasis on fuel management and prescribed burning as key mitigation strategies. The [U.S. The Forest Service](#) considers prescribed fire an effective tool for reducing fuel loads and preventing catastrophic wildfires. In addition, planning documents such as the [Santa Cruz Community Wildfire Protection Plan](#) explain how vegetation management, defensible spaces, and fuel reduction are crucial components of wildfire mitigation policy. These strategies reflect a shift away from complete fire suppression toward more holistic and ecologically informed approaches. However, the literature also suggests that the implementation of these strategies remains inconsistent due to barriers such as funding and public concerns about practices like controlled burns, given public health considerations.

The role of governance and institutional authorities greatly influences the shaping of wildfire response. The [County of Santa Cruz Local Hazard Mitigation Plan](#) identifies wildfire as one of the most significant hazards facing the city. It emphasizes the need for coordinated action by federal, state, and local agencies to develop well-informed mitigation strategies. Additionally, the [Sustainability Update Draft Environmental Impact Report](#) integrates wildfire risk into land-use planning decisions, reflecting an increasing effort to incorporate hazard mitigation into broader environmental policy frameworks. These planning documents illustrate how local governments act as key actors in policy implementation, development regulation, and the coordination of preparedness efforts.

In addition to government agencies, the literature accredits the role of non-governmental organizations and Indigenous communities in wildfire mitigation. The [Sempervirens Fund](#) seeks to explain the validity and the importance of Indigenous stewardship practices, particularly the use of low-intensity cultural burning to maintain forest health and reduce fuel accumulation. During colonization, these practices, historically utilized by local indigenous groups such as the Amah Mutsun Tribal Band, were largely suppressed, leading to significant ecological changes and increased wildfire risk. Efforts to reintroduce Indigenous stewardship reflect a societal shift towards more inclusive and ecologically informed models of forest management. This trend demonstrates the importance of incorporating diverse knowledge systems into wildfire mitigation strategies and highlighting historically marginalized groups.

Another dominant trend is environmental contamination across interconnected systems, specifically water, food, and soil. The [Community Alliance with Family Farmers](#) (CAFF) demonstrates how wildfires burden landscapes with smoke, ash, debris, heavy metals, and toxic compounds, compromising food safety and increasing waste. This source emphasizes both the origin and hazards of contamination, as well as potential mitigation strategies. Similarly, the Sierra Club article addresses [water contamination](#) and confusion about water safety after a wildfire, citing Los Angeles as an example, where misinformation contributed to increased bottled water use. Del Castillo provides a localized account of these impacts in Santa Cruz County, documenting how the CZU Fire Complex destroyed [underground pipelines](#), leaving communities without clean water and forcing residents to rely on alternative water sources, such

as plastic containers. These sources collectively show how wildfires disrupt essential systems and increase inaccessibility to vital resources, underscoring the importance of addressing wildfires as a system, including an understanding of the intersectionality of wildfire consequences.

In addition to environmental and ecological impacts, economic and political aspects prevail. The Santa Cruz County Civil Grand Jury highlights the challenges residents faced in rebuilding after the CZU Fire, including delays in permitting processes and limited housing capacity. Furthermore, local journalism sources such as Lookout Santa Cruz highlight the growing insurance crisis in Santa Cruz County, where many homeowners have been pushed onto the California FAIR Plan after private insurers withdrew from high-risk wildfire areas. The FAIR Plan provides homeowners with basic fire insurance; however, it often entails significantly [higher premiums](#) and limited coverage, requiring homeowners to purchase additional policies to protect their properties fully. The California FAIR Plan functions as a [state-mandated](#) insurer of last resort, designed to provide basic fire coverage for homeowners unable to secure private insurance, such as those in rural communities or those located in WUI zones. However, its limitations are significant. Policies typically offer restricted coverage, requiring homeowners to purchase supplemental “wrap-around” insurance to achieve comprehensive protection. Recent reporting indicates that premiums under the FAIR Plan in high-risk areas such as Santa Cruz County can exceed \$20,000 annually, placing substantial financial strain on residents. These rising costs highlight how wildfire risk is increasingly transferred onto individual homeowners, raising concerns about long-term housing stability and equity. The economic dynamics highlight a broader trend that wildfire mitigation and recovery are deeply embedded within political and economic systems. Decisions made by insurers, regulators, and policymakers influence not only how communities respond to wildfires but also who can recover and remain in affected areas. This perspective expands the analytical scope of wildfire research beyond ecological and technical solutions to include questions of equity, access, and governance.

The [insurance crisis](#) also illustrates the political influence of wildfire mitigation policies. As climate change and decades of fire suppression have increased wildfire risk across California, insurance companies must incorporate these risks into their pricing structures. In response, state regulators have attempted to reform insurance policies to stabilize the market and encourage insurers to continue operating in high-risk regions, thereby protecting California residents. While these reforms are intended to maintain insurance availability, they also raise questions about equity, as residents in wildfire-prone areas often face dramatically higher insurance costs despite limited control over broader environmental conditions, such as climate change and regional land-use patterns. As a result, the financial burden of wildfire risk is frequently borne by individual homeowners rather than distributed across broader policy frameworks.

Accountability within wildfire governance, therefore, extends beyond the immediate actions of firefighting agencies or local governments. The CZU fire revealed systemic challenges involving insurance markets, land-use policy, and regulations that collectively shape wildfire risk and recovery outcomes. Addressing these challenges will require coordinated policy reforms that integrate environmental mitigation strategies with social equity advancements, such as economic protections for vulnerable communities. Without such reforms, the increasing cost of insurance and reconstruction may gradually push residents out of fire-prone regions, reshaping the social and economic landscape of communities such as those in the Santa Cruz Mountains.

Despite these contributions, there is room for expansion in mitigation approaches, particularly regarding integrated wildfire mitigation, regional specificity, and feasibility analysis. There is a notable lack of systems-based integration across the wildfire cycle, as most sources focus on a single phase of disaster management, without examining how decisions made at one stage cascade over time. For example, the U.S. Forest Service emphasizes preventative burning, while the Civil Grand Jury focuses on post-fire recovery challenges. However, few sources cohesively connect these phases into a cohesive framework that addresses how pre-fire mitigation practices influence post-fire waste, contamination, or rebuilding. This lack of integration limits the development of systems-based strategies that address the full disaster cycle.

A second gap is the underrepresentation of localized perspectives centered in communities in wildfire-prone regions such as Santa Cruz County. While Del Castillo and the Civil Grand Jury provide region-specific insights, much of the broader literature remains generalized or focused on other regions of California. There is limited representation of community voices, including rural residents, farmworkers, and Indigenous communities who experience disproportionate impacts from wildfire disasters.

A third gap lies in the challenges with future implementation. While many sources propose mitigation strategies such as prescribed burning, defensible space, and improved land-use planning, there is less critical examination of the barriers to implementing these strategies at scale. Regulatory constraints, funding limitations, insurance market dynamics, and public resistance all influence whether mitigation strategies can be implemented. The inclusion of sources such as [Ojeda](#) begins to address this gap by highlighting how economic factors, particularly insurance affordability, shape the feasibility of living in fire-prone areas.

This literature review demonstrates that wildfire mitigation is not solely an environmental or technical challenge but a complex system involving ecological processes, governance structures, economic systems, and social dynamics. By identifying key trends and gaps, this review positions my Capstone Project to contribute a more integrated, systems-based approach that connects mitigation, waste management, and recovery within a localized Santa Cruz County context.

Methodology

The research methods involved thematic coding while compiling news articles on various wildfires in California to gain a broader perspective on wildfire-related issues, and archival document analysis was conducted once gathered. A variety of sources, including policy documents, news articles, and historical records, were analyzed to identify patterns in wildfire response and recovery. This approach allowed for the identification of overlapping challenges and systemic trends across regions while maintaining a focus on Santa Cruz County. Additionally, centering residents' voices establishes a primary perspective on lived impacts, rather than relying solely on media narratives. Unveiling commonalities and themes in wildfire response systems enabled a greater analysis of the actors involved in the responses, analysis of the actors involved, rather than examining policy in isolation from the institutions that produce it.

This method has generated qualitative, more narrative-based knowledge about wildfire impacts, including anecdotal and community experiences, as well as institutionalized responses.

These sources have helped identify recurring themes, such as hazardous waste accumulation, water contamination, housing loss, infrastructure damage, and a lack of financially accessible resources. They have also provided insight into how communities experience wildfire recovery, which is essential for making the issue tangible rather than abstract in policy discussions. This phase served as an exploratory, foundational moment to identify key themes and discussion points from the documents.

Scholarly sources that were found helped provide analytical data that shows the science behind the surface issues felt by the affected victims. Additionally, the environmental science aspect will help nourish the environmental restoration and sustainability niche throughout the research. Incorporating journal articles, academic case studies, and government and institutional reports provides combinations of qualitative and quantitative data on wildfire behavior, environmental contamination, waste management, ecological restoration, and engineering mitigation strategies. These sources enable the research to move beyond descriptive accounts and engage with scientific models, environmental assessments, and policy analyses. This shift will strengthen the analytical rigor of my project and allow me to connect community impacts to underlying ecological and infrastructural mechanisms.

The document analysis portion of my Capstone Project involves working to understand how to integrate systems-based approaches into wildfire mitigation, rather than the current approach, which addresses wildfires as individual events. The data that provides information on current solutions for wildfires can be analyzed as a blueprint rather than a solution, considering significant limitations in proposals and feasible implementation. The analysis will compare proposed mitigation and recovery strategies using criteria such as scalability, environmental impact, community acceptance, and long-term sustainability. Rather than treating solutions as universally applicable, the discussion focuses on wildfires as a system, assessing how actors have responded with proposed mitigation strategies that fit the specific geographic, social, and infrastructural context of Santa Cruz County.

The voices most present in my dataset are those of scientists who have conducted environmental testing to identify hazardous pollutants, and those of residents who are suffering the impacts of wildfires. Voices notably underrepresented include Indigenous communities with knowledge of wildfire mitigation and land stewardship practices. Discourse analysis is present in the results and discussions concerning the roles of Indigenous cultural practices and their integration into wildfire management and response. Imbalances reflect a broader theme in wildfire literature, where scientific and institutional perspectives dominate, while traditional ecological knowledge and community-based practices remain underrepresented. Recognizing these gaps is essential for developing more inclusive and culturally responsive wildfire mitigation strategies.

To introduce more polyvocality into my project, I am going to allocate a section of my Capstone Project to include the voices of Indigenous people and their cultural strategies that have developed over lifetimes to mitigate wildfire intensity. Incorporating these perspectives will allow the project to reflect a broader range of knowledge systems, including traditional land stewardship practices, community-based resilience strategies, and environmental justice frameworks. This polyvocal approach strengthens the ethical and analytical depth of the project

by ensuring that wildfire mitigation strategies are informed not only by scientific and technical data but also by lived experience, cultural knowledge, and social equity considerations.

Results and Discussion

The aftermath of the CZU Lightning Complex Fire forced widespread reflection on the effectiveness of wildfire governance and the responses of the actors involved in Santa Cruz County. While the fire itself exposed disruption of [ecological processes](#) caused by decades of fire suppression and forest mismanagement, the recovery process revealed deeper institutional challenges surrounding accountability, permitting frameworks, and economic systems tied to wildfire risk. The limitations of local governance, insurance markets, and mitigation policies became increasingly visible as residents attempted to rebuild homes and rural communities. These intersectional issues demonstrate that wildfire disasters are not merely environmental events but can be understood as political and institutional crises shaped by regulatory decisions and economic structures

Santa Cruz County is an ecological haven teeming with flora and fauna, a synergy that has been greatly disrupted by anthropogenic influences such as forest and waste mismanagement, which are deeply intertwined with wildfires, as well as the expansion of WUI. The similarities between wildfire and waste mitigation are the need for preventive measures rather than band-aid solutions that address disasters after they strike. Wildfires that rage through urban areas pose numerous hazards to both the environment and human health. Fires are a uniquely dangerous natural disaster, as they leave behind toxic ash and microscopic pollutants that can be swept into the air, polluting clean air, water resources, and land. As Wildland-urban Interface ranges expand, and climate change progresses, wildfires increasingly intersect with waste in ways far more complex and far more dangerous than flames and ash.

Waste and wildfires are related on a more complex level than the accumulation of biowaste that increases the chances of fire ignition; they are also closely related to the extent of the burn and unpredictable amounts of time after being extinguished. When wildfires rage, the strategies society has cultivated rely on large amounts of [chemicals](#), which disturb vulnerable ecosystems such as those in the Santa Cruz Mountains. Fire retardants are allies to firefighters amid the chaos that arises when fires burn; however, they are extremely disruptive to the environment because they contain a variety of chemicals and heavy metals. As of 2024, it was estimated that over [830,000 pounds](#) of toxic metals were applied between 2009 and 2021..

Fire retardant is a chemical contaminant deposited on land that becomes a waste product in the environment after the flames have been extinguished. Compounds in fire retardants often contain ingredients similar to those in synthetic fertilizers, which can have downstream impacts, contributing to imbalances in waterways. Fires expose land to erosion and rain can transport these residues into waterways, causing eutrophication and algal blooms that harm aquatic life. Fire retardant also complicates agricultural recovery. The chemical contamination from fire retardants and the byproducts of fire destruction also impacts soil quality, with lasting effects on the food chain, as lingering residues on land, infrastructure, and burned materials further contribute to the growing volume of toxic debris that must be handled, transported, and stored. Despite wearing [protective equipment](#), cleanup workers remain at risk from these residues, which degrade slowly and pose inhalation and contact hazards. These cleanup measures require

specific policy implementation to ensure the community and landscapes are protected from the effects, a major gap found throughout the archival analysis process.

[Persistent organic pollutants](#), also known as POPs, are toxic chemical waste that can linger in the tissues of organisms and bioaccumulate through the food chain as they are present for extended periods of time in the environment. Persistent organic pollutants result from burning plastic products and cause a range of adverse health effects due to their endocrine-disrupting properties. These compounds resist degradation, accumulate in soils, and ultimately migrate into plant and animal tissues. In addition to disrupting a regulated endocrine system, cancers and immune toxicity can also be risks of exposure to POPs, posing long-lasting public health concerns in the wake of a wildfire.

Wildfires have an important relationship with food systems having the potential to impact both livestock and produce agriculture. As previously discussed, POPs can remain in the fatty tissues of organisms, enabling their levels to magnify as they move up the food chain. Livestock and poultry that have been exposed to smoke for a prolonged period can suffer respiratory issues and hormonal disruptions that affect reproductive success and efficiency. Santa Cruz is home to numerous [family](#) and commercial farms, raising concerns about food safety in the region. The response to farmers revealed gaps in coordinated support and centralized resources.

When landscapes containing long-standing chemical residues burn, POPs are not destroyed; they are mobilized as heat volatilizes pesticide residues and industrial chemicals embedded in soils or vegetation. Once airborne, they redeposit over wide areas, settling on plants, water sources, and grazing territories. This makes the toxins newly available for uptake by animals, even in regions far from agricultural zones, extending contamination beyond the burn zone. Minimal exposure to POPs can transfer POP levels stored in animal tissues to humans through ingestion and prolonged exposure.

The [toxicity](#) of fires persists in neighborhoods that have been torched, even in the buildings that are still standing. After a major wildfire, buildings don't simply burn; they disintegrate into hazardous material, releasing toxic particulates from plastics, metals, insulation, electronics, and treated wood. Smoke damage to home goods like bedding and couches necessitates the disposal of these items to protect inhabitants from toxicity and ensure their safety. Smoke and heat damage, along with residual chemicals in the infrastructure, can render the space unsafe for inhabitants and lead to complete abandonment and demolition.

The response to the CZU Lightning Complex Fire revealed the interdependent nature of wildfire governance in California. Wildfire mitigation and recovery operate across multiple institutional levels, including federal agencies, state authorities, county governments, and local planning institutions. Each of these actors carries a different responsibility within wildfire policy, community support, and emergency management. The CZU event demonstrated both the strengths and weaknesses of this layered governance structure, highlighting how institutional coordination, regulatory frameworks, and resource constraints shape the county's abilities to prepare for and respond to future catastrophes.

Federally, wildfire governance in the United States has been shaped by the U.S. Forest Service and its outdated fire suppression policies. Throughout the twentieth century, federal land management institutions supported aggressive suppression policies rooted in the belief that fire was a destructive force rather than an ecological process. They were designed to extinguish all wildfires as quickly as possible, without regard for the ecological services that fires provide to certain adapted species. However, over time, federal agencies began recognizing the ecological

role of fire in maintaining forest health, and prescribed burning became recognized as a preventative strategy that could reduce the likelihood of severe wildfires by removing excess vegetation and understory materials that serve as fuel for large-scale fire events. The U.S. Forest Service then emphasized the benefits of prescribed burning for reducing accumulated fuel loads and restoring ecological balance within forest systems that had been disturbed since the Spanish Missionary period, which first assimilated local indigenous bands and practices.

Indigenous burning practices were lost alongside other cultural customs as the Amah Mutsun people were [forcibly dispossessed](#) of their ancestral lands. Colonial practices rooted in greed, especially during the California Gold Rush, completely altered forest composition through management practices that lacked essential forestry knowledge. Indigenous land management reduced fuel accumulation and maintained ecological balance through intentional burning and species management. The forests managed by Amah Mutsun communities were maintained strategically to reduce excessive material from accumulating on the forest floor and to prevent the felling of specific, mapped-out trees, allowing light pockets to peek beneath the forest canopy. However, widespread logging during the Gold Rush eradicated previous efforts to maintain a balanced forest, allowing species like Douglas Fir and Madrone to regrow aggressively and compete with White Oaks for dominance, throwing the ecosystem out of balance. The [assimilation](#) of the Amah Mutsun people not only devastated their population numbers but also disrupted their seasonal, environmental management cycles that included low-intensity burns of forested areas, strategic thinning of canopy cover and specific care for tree species, such as oak and white sedge, that rely on fire and point disturbances for growth to maintain a clear understory, lowering fuel sources and the chances of high-intensity fires.

Despite this shift in federal understanding, implementing prescribed burning remained difficult due to [regulatory complexities](#), safety concerns, and limited funding. Federal agencies must navigate environmental review requirements, air quality regulations, and coordination with state and local governments before initiating controlled burns, creating procedural barriers that slow the rollout of widespread preventive fire management. The Santa Cruz Mountains are unique in that [land ownership](#) is distributed among federal forests, state parks, private property, and local jurisdictions, creating an interdependent web of complex regulations and overlapping levels of authority over designated regions. As a result, preventive strategies that are widely supported in theory often remain difficult to implement because they require coordination among various authorities on a scale sufficient to reduce wildfire risk.

At the state level, wildfire governance in California is primarily coordinated through the California Department of Forestry and Fire Protection. [CAL FIRE](#) operates as both a firefighting agency and a regulatory authority responsible for wildfire mitigation planning across the state's wildland areas. CAL FIRE, in cooperation with local governments, develops [Community Wildfire Protection Plans](#) (CWPPs) that identify priority areas for vegetation management, fuel reduction, and infrastructure protection. In Santa Cruz County, the Santa Cruz Community Wildfire Protection Plan provides a framework for coordinating mitigation strategies among state agencies, local firefighting units, and community organizations.

The CWPP emphasizes a variety of mitigation strategies designed to reduce wildfire risk in the Wildland Urban Interface (WUI). These strategies include vegetation management programs, defensible space requirements around structures, evacuation planning, and community

education initiatives. The expansion of residential development into forested areas significantly increases the importance of these strategies, as homes built within the WUI are especially vulnerable to wildfire destruction. According to the [CWPP](#) update, the Santa Cruz Mountains contain a high concentration of structures in densely vegetated landscapes, heightening the risks where human settlements and wildfire-prone ecosystems intersect. This heightened risk requires policy integration specific to the area and informed by actors who know how to coexist with nature rather than forcing it to fit in the confines of society, as exemplified by Indigenous cultures that once dominated the landscapes.

State agencies also play a key role in emergency response during wildfire events. When the CZU Lightning Complex Fire ignited in August 2020, CAL FIRE mobilized firefighting resources from across California to assist local crews. The scale of the fire required coordination between multiple teams, support units, and resources to ensure structural protection. While these efforts ultimately helped contain the fire after several weeks, the event underscored the limitations of emergency response systems when fires exceed anticipated sizes. Local residents also [assisted](#) firefighting efforts, reflecting gaps in formal response capacity. Increasing fire intensity, driven by drought conditions and fuel accumulation, places increasing pressure on firefighting resources across the state.

County-level governance represents another critical layer of wildfire management. Local governments are responsible for land-use planning, infrastructure regulations, and hazard mitigation strategies designed to reduce vulnerability to disasters. In Santa Cruz County, wildfire risk is addressed through the [Local Hazard Mitigation Plan](#) (LHMP), which outlines policies and preparedness measures intended to protect communities from natural hazards. The CZU fire forced reassessment of infrastructure vulnerabilities. For example, a considerable amount of public infrastructure was damaged, including seven miles of high-density polyethylene (HDPE) pipeline, which connected some of the community's water sources to the San Lorenzo Valley Water District treatment plant. The damaged pipelines disconnected hundreds of residents from a viable water source, creating another distribution issue, as community members who were fortunate enough to have their houses spared now needed a place to live with access to water.

When burned, a high-density polyethylene (HDPE) pipeline releases volatile organic chemicals, such as benzene, which pose major health concerns upon exposure. The plastic pipeline melted into the water sources, prompting a "do not drink" order to be in effect for the county immediately after the CZU Complex. In addition to damaged pipelines, there was severe damage to water tank storage systems, wasting millions of gallons of water and resulting in an even higher reconstruction cost estimate. Infrastructure damage alone exceeded \$340 million in the immediate aftermath, without considering cleanup and rebuilding efforts. The plan identifies wildfire as one of the county's most significant environmental threats, due to the region's terrain, dense forests, the expansion of development in high-fire-risk areas, and the various public health impacts.

The LHMP emphasizes that proper wildfire mitigation requires a combination of land-use regulation, infrastructure improvements, and public education programs. For example, building codes in high-risk areas require fire-resistant construction materials and defensible spaces that act as barriers between vulnerable vegetation and structures, thereby reducing [structural vulnerability](#) during wildfires. However, the implementation of these policies often encounters

resistance from property owners who perceive mitigation requirements as costly or burdensome. Disparities between regulatory enforcement and property rights reflect a broader challenge in wildfire governance of balancing individual autonomy with collective safety for communities.

In addition to regulatory authority, county governments play a role in coordinating recovery efforts after wildfires. Following the CZU Fire, Santa Cruz County agencies were responsible for managing debris removal programs, rebuilding permits, and infrastructure restoration projects. These tasks required close communication with state agencies such as CAL FIRE and with federal disaster assistance programs. The complexity of the recovery process exemplifies how wildfire governance extends far beyond firefighting operations, encompassing long-term planning decisions that shape community resilience.

Additionally, and debatably more importantly, non-governmental organizations contribute to wildfire governance in the region. Land conservation groups such as the [Sempervirens Fund](#) have partnered with Indigenous organizations and government agencies to promote ecological restoration and sustainable forest management to reconnect individuals with the land from which their ancestors were dispossessed. [San Vicente Redwoods](#) is a non-profit program that seeks to integrate Indigenous ecological knowledge into modern land management practices to restore social dynamics, include informed and experienced perspectives in the conversation, and shift how current forests regenerate. Indigenous stewardship practices historically relied on frequent low-intensity burns to maintain forest health and reduce fuel accumulation. Reintroducing these practices represents both [ecological restoration](#) and a shift in governance approaches. Collaborative governance models that incorporate Indigenous knowledge, therefore, play an increasingly important role in future wildfire mitigation strategies.

The CZU Lightning Complex Fire ultimately showed that wildfire governance is not controlled by a single institution but instead operates through a dynamic network of agencies, policies, and stakeholders. Federal research institutions shape the scientific understanding of fire ecology; state agencies coordinate firefighting and mitigation planning; county governments regulate land use and infrastructure policies, and community organizations contribute to ecological resilience and restoration efforts. Although this multi-level governance structure enables a wide range of expertise and resources to be mobilized during wildfire events, it also introduces challenges related to coordination, policy implementation, and institutional accountability. Fragmentation across governance levels limits the effectiveness of wildfire mitigation policies and as wildfire risks continue to increase across California, improving collaboration among these actors will remain essential for strengthening regional resilience.

Summary:

The CZU Fire Complex revealed the complexities embedded in natural disaster response strategies in Santa Cruz County after devastating the community. Ecological stressors traced back to the assimilation and displacement of Indigenous land stewardship practices influenced the severity of the fire event and highlighted the need for shifts in forest management that incorporate Indigenous stewardship. The reintroduction of Indigenous stewardship practices represents not only an inclusion of marginalized knowledge systems but also a corrective response to the ecological consequences of colonial fire suppression policies. Coordinating efforts across multiple actors, including local, state, and federal agencies, has proven complex but

remains essential. Gaps around feasible implementation remain, as well as inequities affecting individuals impacted by inadequate insurance systems and exclusionary governance structures. Inviting marginalized voices into fire stewardship can broaden understanding of the ecological aspects of fire mitigation strategies while also addressing social disparities that become evident in the face of disaster. Revisions to Local Hazard Mitigation Plans, prompted by the CZU Fire, demonstrate an increasing recognition of the intersectional nature of wildfire response strategies and the need for integrated, multi-level governance approaches..

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