Balancing Environmental Remediation, Environmental Justice, and Health Disparities: the Case of Lake Apopka, Florida

ANNE SAVILLE AND ALISON ADAMS
University of Florida, Gainesville, FL, USA
Email: savillea13@ufl.edu

ABSTRACT
Agricultural production in the United States provides numerous economic contributions from the national scale to the local, providing farmworker and laborer jobs for hundreds of thousands of people [1]. Unfortunately, conventional agricultural operations are often associated with pesticides, herbicides, and fertilizers, which can cause environmental degradation and health problems. Large-scale conventional agriculture is often using pesticide, herbicide, and fertilizer intensive, and these chemicals may contaminate natural environments, harming wildlife, and degrading water quality. When contamination incidents occur, government agencies and non-profit organizations respond in various ways, including environmental remediation. These efforts can be successful in restoring water quality and improving biodiversity. But, what happens when clean-up efforts are able to improve the physical environment but do not address human health? We use the case of Lake Apopka, Florida, to analyze a case of agricultural contamination that resulted in damage to the environment and the health of the farmworkers who were exposed to these harmful chemicals. Our analysis explores how government agencies and non-profit organizations were successful in their conservation efforts, but failed to help the farmworkers and other people who were sick as a result of exposure to toxic chemicals. We conclude with recommendations for policy makers and environmentalists to better address and include marginalized or vulnerable communities in environmental remediation projects.

INTRODUCTION
The American agricultural industry feeds and employs millions and contributes significantly to the global economy [2]. Because of shifts in crop production trends such as acres planted and types of crops, the use of chemical applications—pesticides, herbicides, and fungicides—has increased over time. This increase has led to environmental problems such as decreased water quality, as well as human health problems stemming from exposure to toxic substances. Previous work on environmental justice highlights how minority and other vulnerable populations are often at higher risk for these types of exposures [3–6]. The environmental justice framework provides scaffolding for investigating not only cases of exposures to hazards [7] but also highlights the importance of institutional processes, such as decision-making and community-level participation [8–10].

These issues are particularly relevant for migrant and minority workers in the agricultural industry in the US [11–13]. Environmental justice scholars have noted that farmworkers and their families are disproportionately exposed to various hazards [14, 15]. Many studies have documented the negative impacts of pesticide exposure, including cancer, Parkinson’s disease, asthma, diabetes, and autoimmune diseases [13, 16, 17]. Despite the widespread incidence of environmental illness among farmworkers, many people remain unaware of these issues, and farmworkers continue to deal with the consequences of chemical exposure [11, 15, 18].

Scholars have documented the difficulties of making concrete connections between occupational exposures and long-term illnesses [19–22]. Physicians can ignore chemical exposures as a cause of illness. Even when patients suggest exposure as a cause, they can be met with considerable resistance. A contested environmental illness is a disease or a condition that “engenders major scientific dispute and extensive public debate over environmental..."
cases” ([23] p. 214). Ambiguity often characterizes environmental exposures due to uncertainty about past exposures to environmental hazards, unknown effects of long-term exposures, and the compounding effects of environmental toxins in the body [19, 24].

In cases of agricultural contamination, both the environment and human health are at risk. Given the complexities of environmental illnesses, it may be easier to assess and address environmental problems than to assess human health. Efforts to remediate contamination can be evaluated in a number of ways. But, what if the case is successful by some ecological measures, but unsuccessful in resolving problems with human illness and exposures? We use the case of Apopka, Florida, to ask what happens when cases of environmental remediation are successful in the context of conservation, but failures in terms of environmental justice. Apopka experienced significant contamination and community exposure to agricultural chemicals, such as organochlorine pesticides. Once the extent of the chemical and nutrient pollution was assessed, state agencies and environmental conservation groups became involved and tried to push for remediation measures to protect the water, soil, and wildlife in the area. Yet, comparatively little help was given to the workers and surrounding farmworker community affected by exposures to these chemicals.

Our analysis of this case highlights how environmental remediation efforts can be successful in restoring and protecting the biological environment; yet, if they fail to engage with marginalized groups they can perpetuate environmental injustices. We conclude this paper with recommendations for policy-makers, outreach professionals, and decision-makers in cases of agricultural contamination.

CASE EXAMINATION
The research design for this study employs a qualitative approach to historical case studies [25, 26]. The data included extensive interviews with farmworkers, medical professionals, previous and current government officials, and members of the Farmworkers Association of Florida (FWAF) (n = 32) in the Lake Apopka area; news coverage of the contamination and clean up; and archival materials documenting the history of the community. A semi-structured interview protocol was used to guide interviews with participants. The protocol included a series of questions intended to give participants space to discuss their background, experiences with the muck farms, health experiences, perceptions of the tactics used by the Farmworkers Association, activism experiences, and assumptions about the lack of justice for the farmworkers. We examined several local and regional newspapers including the Orlando Sentinel, Orlando Weekly, WUFT News, and the Iguana. To find the relevant articles, we drew upon the archival library at Rollins College, which contains archival materials and newspaper articles regarding the FWAF. Additionally, we used Google to search for any articles on Lake Apopka, the muck farm buyout, and the Farmworkers Association. These data were coded and analyzed to understand the historical context of the case, how farmworkers described their exposure and illness experiences, and responses from NGOs and state agencies. During the first phase of coding, a line-by-line coding scheme was used for the interview data that allowed us to look for pre-conceived themes related to our research questions, such as exposure and illness experiences, themes related to environmental justice, and explanations for injustices. We then used an interactive approach to coding to allow unanticipated themes and meaning to emerge from the data [25, 27]. Our initial search for salient themes was guided by a critical environmental justice and contested illness framework. The same approach is also applied to the newspaper coverage and archival data.

THE HISTORY OF AGRICULTURE IN THE LAKE APOPKA AREA
Apopka, Florida, is situated in the northwest section of Orange County in Central Florida and contains Lake Apopka, one of the most polluted lakes in the state. Before becoming contaminated, Lake Apopka was known as an “angler’s paradise” and was home to 29 fish camps in the 1920s and 1930s [28]. The agricultural industry took root in the area in 1883 after the Apopka-Beauclair Canal was constructed, revealing rich sediment in the marshlands. The nutrient-rich sediment, known as muck, attracted a variety of vegetable farmers. By the 1940s, the Lake Apopka area had become a hotspot for agricultural work. A levee was constructed in 1941 to expose more marshland for agriculture, and to make lake water available for weed control during the off-seasons. As a result, 20,000 acres of muck farms were established surrounding Lake Apopka.

Thirty-five farms comprised the north shore muck farms, including Duda & Sons, Zellwood Farms, and Long & Scott Farms. Throughout the 1940s, these 35 farms
started using DDT and other organochlorine and organophosphate pesticides, such as miticide and dicofol as well as heavy amounts of fertilizers rich in phosphorus [29]. Although DDT was banned in 1972, it can persist in the environment for years, posing risks of exposure. Following the ban, farmers continued to utilize organochlorine and organophosphate pesticides and high levels of fertilizer. The farmers would flood the muck farms during the off seasons with water from the Lake Apopka. When it was time to grow again, the water on the fields would be pushed back into Lake Apopka along with all the residual pesticides and fertilizer. This pattern of pushing the water back and forth continued throughout the history of the muck farms. The agricultural and nutrient waste runoff wreaked havoc on the ecology of Lake Apopka.

ENVIRONMENTAL REMEDIATION AND ECOTOURISM
Restoration Attempts
In 1968, the Lake Apopka Technical Committee—a committee created to investigate the health of Lake Apopka—received a federal grant of US$12,000 to clean up the lake. The grant stipulated that the farmers were expected to contribute to clean up efforts. Throughout the 1970s, there were multiple attempts to clean up Lake Apopka including a proposal for the muck farm owners to dike off 500 acres of the lake for nutrient pollution holding ponds that would filter the lake water [30]. With little improvement to the overall health of the lake, the state government passed the Lake Apopka Restoration Act in 1985 and the Florida’s Surface Water Improvement and Management Act in 1987 to more aggressively tackle the environmental contamination [31]. The main goals of restoration were to remove and reduce the amount of phosphorus in Lake Apopka and restore the north shore farmlands to wetlands [31]. The budget for the project was US$2.265 million [30]. Neither of these acts addressed the significant pesticide contamination problem in the area.

Shutting Down the Muck Farms
After efforts by multiple stakeholder groups including the St. Johns River Water Management District (SJRWMD) and one of the primary farms in the area (Duda Farms), levels of phosphorus and turbidity decreased in Lake Apopka, but the progress was not aggressive enough. Many of the farm owners were not making efforts to reduce nutrient pollution. The SJRWMD decided that the best solution to cleaning up Lake Apopka was to cease all agricultural work. The Florida Legislature passed the Lake Apopka Restoration Act of 1996, which set a phosphorous criterion for the lake, gave the SJRWMD legal authority over the criterion, and provided financial support to buy out the muck farms since the goals of phosphorous reduction were not being met [30]. The last farm closed in 1998 leaving 2,000 farmworkers unemployed [32]. Importantly, the remediation efforts in the area focused heavily on nutrient reduction rather than addressing persistent pesticides in the environment.

SJRWMD was quick to reflood the farms to turn them back into wetlands. As such, migratory birds and other animals returned to Lake Apopka. In 1999, over 1,000 migratory birds died while on the lake. A number of different institutions, including the U.S. Fish and Wildlife Services, SJRWMD, and the Environmental Protection Agency (EPA), were called in to evaluate the situation. After numerous tests, it was concluded that pesticide poisoning was the likely culprit of the bird deaths [33]. In addition, the SJRWMD conducted studies on the soil composition of Lake Apopka and found that the environment was still contaminated with DDT and other organochlorine pesticides. At the same time, researchers at the University of Florida noticed a decrease in the alligator population and found their reproductive systems were mutated, which they attributed to the endocrine disrupting effects of the pesticides that polluted the lake [34, 35].

Environmental Successes in the Lake Apopka Area
Lake Apopka has received attention from a multitude of stakeholder groups. Restoration attempts and the buyout all brought positive outcomes for the environment. An active member of a local environmental organization spoke about their organization’s praise for the remediation attempts stating:

I think the water management district has done a wondrous job as far as the lake is concerned. And that’s their job, is to clean up the lake. And the lake is getting better. And the fact that there are so many ospreys out there, eagles, all these fish and birds. All the waders and all that. Obviously, they [the birds] are not being affected negatively at this point in time.

Restoring Lake Apopka continues to be a central concern for environmental organizations and the SJWMD.
The SJRWMD was able to decrease the amount of nutrient pollution in the lake and create a less polluted environment for migratory birds and other wildlife. One SJRWMD employee detailed:

It’s not as green and the data shows that the phosphorus levels have gone down . . . And it’s a slow process . . . And the clarity has increased. Native vegetation is coming back. So that’s a good sign.

Additionally, environmental conservation organizations such as Friends of Lake Apopka (FoLA) garnered resources to develop ecotourism attractions around Lake Apopka. FoLA created an eco-drive, Oakland Nature drive, through the previous muck farms turned wetlands. The success of the Oakland Nature drive is considered a huge environmental victory. A key FoLA member explained:

We’ve designed a loop trail around the lake where even elderly people can drive and stay in their cars and they drive through the marsh and see these birds. We have traffic jams. When the bird season starts its amazing. It’s just a huge number of people. Fishing is increasing now . . . Now Apopka is basing their economy on Lake Apopka.

**LASTING EFFECTS ON FARMWORKERS’ HEALTH**

In spite of the significant improvements to Lake Apopka, very little was done to address the farmworkers’ ongoing health issues that resulted from their exposures to these chemicals. Farmworkers recounted numerous instances of direct exposure to pesticides and having their grievances about the harsh conditions and health effects ignored. One farmworker elaborated:

The growers were allowed to put farmworkers any place they needed to put them whether it was dangerous or not. They knew it was poisonous. They cared more about their crops and their profits than they do the people.

Another detail being directly sprayed, stating:

A plane would drop pesticides on top of us. Rain it down. Some days you could look up and see them laughing . . . We’d fall on the ground and cover up our heads with our clothes and stuff.

The vast majority of people working on the muck farms were African Americans, Haitians, or Latinx; however, African American women were most likely to face pesticide exposure. People working on the farms at the time of the chemical applications experienced various health problems ranging from skin rashes and headaches to miscarriages and long-term illnesses, such as lupus [36, 37]. These symptoms are consistent with exposures to DDT and other types of pesticides or agricultural chemicals [13, 38]. While epidemiology is often difficult in the case of environmentally sourced illness due to a multitude of factors, the time between exposure and illness, and a lack of medical intervention [19–22], the farmworker community argued that the common variable among people experiencing these illnesses was that they had spent significant amounts of time working on the muck farms. Female farmworkers shared similar horror stories about their pregnancies. One respondent told her story:

I got pregnant, and I was workin’ in the fields with the pesticides. I carried him six months, and he was stillborn. I got pregnant again, still workin’ in the fields. I carried him seven months, and he was a stillborn.

A spokesperson for the community explained how the problem became so significant and widespread:

The problem is threefold. Many farmworkers are not aware that these signs may be related to pesticide exposure. Healthcare providers are not trained to identify these symptoms in their farmworker patients, and they do not generally take an occupational health history of their clients. And, most farmworkers cannot afford to miss a day of work and/or they are too afraid to complain about their health problems for fear of being labeled a troublemaker.

In 2011, the community of former farmworkers noticed a pattern. The illnesses of the muck farmworkers and their families were proving fatal. Many community members recalled attending five to ten funerals for former farmworkers a week, and they noticed common illnesses throughout the community. In spite of the seemingly clear links between their exposures working on the farms and their ongoing health issues, residents in the area were frustrated by the lack of attention and resources from state and federal agencies.
ENVIRONMENTAL CONSERVATION VS. ENVIRONMENTAL JUSTICE

The farmworker community’s frustrations were exacerbated when the community saw the outpouring of effort and resources to remediate the surrounding area. The fact that proposals to develop ecotourism potential were getting funded regularly angered the farmworker community and those advocating for them. Tension between government and local environmental conservation agents and environmental justice organizations increased. Instead of working together to gain a better understanding of the contamination in the area, these organizations were at odds. Farmworker advocacy organizations felt betrayed by the conservation organizations that were instrumental in ending the muck farms because they felt that these efforts were made with little consideration for the future of the farmworkers in the community. A participant stated: “She [lead member of the farmworker advocacy organization] and I clashed... She blamed me for killing the farmers’ livelihood. And I told her repeatedly, ‘We’re doing you a favor!”

While the environmental organizations and SJWMD were crusaders for the birds, alligators, and other species of Lake Apopka, farmworkers and farmworker advocates felt environmentalists further marginalized the health issues of the farmworkers who were exposed to the same pesticides as the wildlife. The disparity between support for the environment and support for the people affected was even noted in local news outlets. One local newspaper reporter wrote:

Over $113 million of state taxpayer dollars went to purchase the farms and millions more to study the lake and the wildlife, while not a dime ever reached the human casualties of Lake Apopka. [A previous farmworker] herself speaks out saying: “There are people in South Apopka actually dying from the stuff (pesticides). They had the bird deaths, they had the fish deaths, nobody did research on us to see what was plaguing our bodies.”

This coverage expanded to larger media outlets as well. National newspapers came to interview the farmworkers about their frustrations. As a former farmworker states in the Orlando Sentinel (2015): “It makes me so angry for them to spend millions of dollars on buying the farms and for the birds and other animals on Lake Apopka, but we can’t get anything.”

The invisibility of farmworkers was underscored as environmental concerns for Lake Apopka and its animal inhabitants gained national attention. Alligators with deformed reproductive systems, a decrease in the number of bass, and the migratory bird die-off spurred a large discussion on the cause of this environmental catastrophe. The health impacts of pesticides became salient discussion; however, the farmworkers remained absent from the conversation. A key farmworker advocate stated:

Farmworkers were exposed to these same chemicals, but nobody was looking at their health problems from chronic occupational pesticide exposure. Millions were spent to study alligators, and later the birds, and to try to restore the “dead” lake. But no money was ever spent to address the health concerns of the farmworkers, who were acutely exposed to these pesticides for years.

The environmental impacts on local wildlife were alarming, yet these were much less contested than the health outcomes in the farmworker population, as seen in this farmworker’s explanation:

If I could change the rules, I would [have] put signs up everywhere to inform the workers when the pesticides are sprayed and keep them out of the workspace until it is safe. When the birds started dying on Lake Apopka, that scared you! If the chemicals were killing the birds, what is it doing to us?

To raise awareness about their struggles, the FWAF—with the help of the former farmworkers—started a quilt project to memorialize the growing number of farmworkers facing the detrimental consequences of pesticide exposure. The effort became so popular that two quilts were ultimately made to hold all of the squares sewn by farmworkers and their family members. The FWAF sent the quilts to multiple locations in Florida to honor the farmworkers who died, and to raise awareness about the health issues in the area.

THE NEED TO INCLUDE FARMWORKERS’ VOICES AND OTHER MARGINALIZED GROUPS

Our analysis of this case provides important lessons for assessing cases of agricultural contamination and environmental remediation. In one way, the case of the Lake Apopka area contamination could be considered very
successful. After the buyout of the muck farms, numerous agencies and organizations went to work on improving the water quality in Lake Apopka and the health of ecosystems and wildlife in the area. As a result of these successes, the area is returning to its former status as an attraction for recreationists and nature-lovers around the state. However, as our analysis shows, not all stakeholders feel that the remediation was successful. The farmworkers, most of whom have spent their whole lives in Apopka, feel that they were excluded from the conversation, erased from the narrative surrounding Lake Apopka, and have had their health problems ignored.

Conservationists and environmental specialists can learn from this case by taking care to assess and include sensitive populations in their clean-up efforts. Human health is directly connected to the health of the environment, and it is important to include all affected groups in discussions about allocation of resources, in assessments of impacts, and decisions about how to comprehensively develop long-term solutions to the problems. This type of community engagement will go a long way in improving clean up solutions and shedding conservation efforts in a better light. Research and policy efforts could also learn from this case by placing more focus on understanding the connections between human health and pesticide exposures. More importantly, policy-makers must work to demand better basic knowledge of the relationship between conventional agricultural practices on the health of workers in the industry. This push for policy has to include epidemiological research on pesticide exposures that take into account the multiplicative effects of exposure to numerous chemicals, as well as providing the medical professional with the resources to identify cases of exposures to environmental toxins.

CASE STUDY QUESTIONS

1. What are the potential barriers to including vulnerable or minority communities in environmental clean-up efforts?

2. In this case study, we asked how cases of environmental remediation are assessed as successful or not. What are some other ways to measure success in clean up cases?

3. In this case, why do you think the farmworkers did not receive the help they needed?

4. How is social justice related to environmental health? What are some reasons that some groups are more likely to be exposed to chemicals or other environmental threats than others?

5. What are the ways that agencies and organizations can make sure that everyone is included in discussions of environmental problems?

AUTHOR CONTRIBUTIONS

AS was responsible for the conceptualization of this project, investigation, and formal analysis. AA was responsible for the supervision of the project as a whole, as well as the data analysis. Both AS and AA contributed to all stages of writing this paper.

ACKNOWLEDGMENTS

We would like to thank the Farmworkers Association of Florida for facilitating interviews with the community and sharing materials pertaining to their story. We also thank all the participants who were gracious enough to grant us their time and told detailed accounts of the muck farms on Lake Apopka.

FUNDING

This project did not receive funding from any agency or organization.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

SUPPLEMENTARY MATERIALS


REFERENCES


