

Analyzing the Impacts and Challenges of Community Involvement in Environmental  
Initiatives

Thesis

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## **Abstract**

Community participation and involvement in environmental initiatives plays a crucial role in addressing environmental challenges and shaping sustainable behaviors. These initiatives may include projects focused on improving environmental quality, or environmental outcomes. Environmental outcomes might include projects focused on habitat restoration, improvements in water quality and air quality, reduction of waste, and the conservation of natural resources. This thesis explores the vast topic of community engagement in environmental initiatives, including citizen science projects. Furthermore, this study examines community engagement case studies while focusing on the impacts, challenges, and outcomes of involving residents in environmental projects. This thesis analyzes a variety of literature, including peer-reviewed journals and government sources to determine the effectiveness of community engagement in citizen science projects. Findings reveal that involvement has been proven to enhance scientific knowledge, attitude toward science, science self-efficacy, and mental health. Additional findings reveal that community-based projects can lead to strengthened communities, and empowerment, and contribute to a sense of belonging for participating individuals. This research contributes valuable insights into the transformative potential of community involvement and its ability to inform future environmental initiatives and policy advocacy around the world.

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## 1. Introduction

Community involvement in environmental initiatives may also be commonly referred to as citizen science, public participation, or community engagement (Bonney et al., 2015). Researchers commonly argue that public participation in environmental initiatives and projects gained traction in 1995 in response to the book *Citizen Science: A Study of People, Expertise, and Sustainable Development*, by Alan Irwin (Bonney et al., 2015). In contrast, research by Cogan and Sharpe (1986) proposes that participation in various forms may have begun long before 1995, dating back to before ancient Greece. As described by Irwin, citizen science involves members of the public in science initiatives and decision-making (Bonney et al., 2015). Furthermore, citizen science began to spread around the world to collect data and develop solutions to environmental problems. Today, community involvement has been acknowledged for its benefits to participating individuals, communities, and the environment. The participation of universities, external organizations, and researchers also play a key role in the success and outcomes of citizen science and community projects (Gruber et al, 2015).

Community involvement in environmental initiatives manifests through a wide variety of participatory options, encompassing diverse forms of engagement for participants. Some of the most common forms of participation include collaborative decision-making, active participation in environmental projects, involvement in data collection and analysis, and educational workshops. Examples of engagement opportunities include water quality monitoring, environmental health surveys, and endangered species conservation projects. Research by Bonney et al. (2015) proposes

four project categories of citizen science: data collection, data processing, curriculum-based, and community science. Given a variety of options, individuals can participate in environmental initiatives that align with their interests and skills. This not only promotes widespread participation but also enhances the effectiveness and sustainability of environmental initiatives within communities.

This thesis asks how community involvement and engagement approaches impact participating individuals, communities, and environmental outcomes. Furthermore, it will analyze several forms of community engagement and involvement, including the outlying challenges and common critiques. In addition, this thesis will touch on how community involvement can effectively be increased within environmental spaces through many outlets including public activism, citizen science, and civic participation.

To answer these questions, this paper relies on existing data and research on citizen science projects and their effectiveness. Throughout the paper, effectiveness will be determined by the extent to which the engagement succeeds in providing benefits to participating individuals, communities, universities, organizations, and the environment. This paper includes a review and analysis of various literature sources, such as scientific and peer-reviewed journals and government sources. With this, it will pay close attention to the entities involved in environmental initiatives, including individuals, government agencies, organizations, and universities. It will begin by discussing the benefits of community involvement in environmental initiatives, followed by common challenges. It will then discuss four case studies that display successful examples of community engagement. Finally, this paper will end with recommendations for future research, and

recommendations for individuals and organizations that wish to be involved in community environmental initiatives.

## **2. Findings**

### **2.1 Benefits of Community Involvement in Environmental Initiatives**

Extensive research has shown that community involvement in environmental initiatives and citizen science projects provides a variety of benefits. Not only does community engagement result in positive outcomes for communities, but it also provides benefits to participating individuals and participating universities and organizations. Furthermore, citizen science projects have been proven to provide benefits to environmental health, environmental policy, and activism.

### **2.2 Benefits to Participating Individuals**

One of the most significant attributes of community engagement projects in environmental initiatives is that they result in substantial benefits for participating individuals. Arguably the most notable benefits include increases in scientific knowledge, improvements in individual attitudes toward science, and enhanced science self-efficacy.

Participation in environmental initiatives and citizen science projects by the community contributes to a heightened level of scientific knowledge among the participants. Research by Bonney et al. (2015) shows that engaging citizens in scientific projects and data collection can increase the knowledge of participants related to the subject of investigation. With this, data collection projects have also been shown to increase public awareness of conservation, biodiversity, and environmental health (Bonney et al., 2015). For example, participants in avian conservation projects at the Cornell Laboratory of Ornithology showed increases in bird biology knowledge and knowledge of scientific concepts (Brossard et al., 2005). As a result, by educating



community members and involving them in citizen science projects, we can effectively increase environmental stewardship and comprehension of environmental issues. Increasing both comprehension and stewardship of environmental issues could potentially have positive impacts on the environment in a transition to more sustainable behaviors. When individuals are more knowledgeable of these issues, they are more likely to act in ways that benefit the environment, rather than harm it.

Furthermore, benefits become even more noticeable when participants are fully involved throughout the entire project process. Research by Haklay (2015) finds that involving individuals in all stages of a research project gives participating individuals an increased sense of knowledge and understanding. For example, when community members are involved in project planning, data collection, data analysis, and decision-making, researchers find that scientific knowledge increases greatly (Bonney et al., 2015). Effective project design can lead to increases in scientific knowledge and positive attitudes toward science (Bonney et al., 2015). Further research by Peter et al. (2021) also argues that knowledge and skills were strongly related to the design of the project. With this, projects that focused on providing “information, training, social interaction, and feedback” from participants greatly increased the knowledge and skills gained by participants (Peter et al., 2021)

Citizen science and community-based projects also have the potential to improve participants' attitudes toward science, resulting in a more positive outlook toward data collection. As corroborated by Bonney et al. (2015), a multi-year project initiated by the Florida Museum of Natural History found that over 62 percent of participating individuals communicated that their attitude and interest in science positively increased.

Additional data shows that after just 6 months of participation in conservation projects, participants noted a more positive attitude and view toward science and data collection (Bonney et al., 2015). With this, exposing individuals to science can improve their perception of science, likely increasing the chances that they will participate in future projects and initiatives.

Furthermore, the knowledge gained in these projects provides an increase in scientific confidence or science self-efficacy (Bonney et al., 2015). As participants may not have any previous experience in the science fields, this increase in confidence can help participants design projects and conduct science by themselves. Similarly, research by Harris et al. (2019) finds that when community members are provided with the ability to help form and lead community projects, their confidence grows significantly. For example, further research by Harris et al. (2019) provides support that science self-efficacy outcomes increase further in projects that are co-created by community members and participating organizations.

### **2.3 Benefits to Participating Communities**

By participating in community-based projects, participants can expect to form emotional relationships with surrounding community members and local organizations, contributing to strengthened communities (Zhang et al., 2020). Similarly, research by Schmitz et al. (2019) provides support that community-based projects can pave the way for organizations and universities to bring communities together through the mobilization of resources and education. Additionally, citizen science projects have resulted in strong and trusting relationships between conservation organizations and community members (Schmitz et al., 2019).

Focusing on improving communities also has the potential to empower and strengthen communities by bringing them together to focus on the betterment of their shared futures in a shared environment (Schmitz et al., 2019). The benefits of strengthened communities and stronger bonds between community members can also contribute to a sense of empowerment within communities (Zhang et al., 2020). Zhang et al. (2020) expands on the empowerment provided by community projects as eliminating economic stress and inequalities, while promoting and the cultural practices of local communities. Furthermore, capacity building is especially important in vulnerable communities and areas with little access to resources. For example, coastal areas are especially vulnerable to the effects of climate change like coastal erosion and rising sea levels. Projects focusing on combating these changes have resulted in a stronger sense of adaptability within communities. Moreover, as discussed by Hillerdal et al. (2016) this adaptability can help communities understand the effects of climate change while providing them with the resources to embrace change.

Participation in citizen science projects can help form a stronger relationship between individuals and their environment, also known as a place-based attachment (Zhang et al., 2020). Place-based attachments are strong bonds that can provide individuals with a sense of belonging in their communities and their natural environments. Additionally, research by Zhang et al. (2020) proposes that community members' sense of place can be strengthened even further through their participation in the conservation of protected areas.

## **2.4 Benefits to Participating Universities and Organizations**

The outcomes of community engagement in environmental initiatives are strongly enhanced through the participation of universities and organizations. These entities are acknowledged for their key participation and the provision of knowledge, tools, and resources to communities in need (Burgos et al., 2013). They are often responsible for developing project plans, connecting communities with external resources, and bridging the gap between communities and local decision-makers. Without their involvement, it is likely that citizen science projects would not gain as much traction as they do today. Furthermore, trusted organizations can help build community projects in areas that need it the most (Burgos et al., 2013). While individuals and communities receive a wide variety of benefits from the participation of universities and organizations, the benefits received by these external entities are often overlooked. The relationship between participating communities and participating universities can, and should, be seen as a mutually beneficial partnership.

As a result of projects and data collection, universities and organizations often seek to influence policy and create change. On their own, external entities can collect a wide range of data. However, without the participation of local community members, this data will exhibit a huge gap. As explained by Gruber et al. (2015), community participation in environmental initiatives and citizen science projects is crucial in incorporating unique traditional knowledge, cultural perspectives, and community beliefs into policy creation. Local knowledge, cultural perspectives, and beliefs are not always well documented in literature or research. With this, universities and organizations have the opportunity to expand their knowledge of local and cultural perspectives directly from

local community members that they may not have been able to learn from traditional research (Hillerdal et al., 2019). In addition, the incorporation of community members in citizen science projects can be helpful in collecting data. Having more members collecting data leads to a larger data set that can be used to influence policy and change. Furthermore, the data collected throughout these projects can be used to develop and establish new educational material for university programs.

Research by Gruber et al. (2015) also proposes that relationships between universities and local communities can provide purposeful job and internship opportunities for students, staff, and alumni. With this, citizen science projects provide unique learning opportunities for students and staff, where their contributions make a huge difference (Wyler and Haklay, 2018). Additionally, the participation of universities and organizations in citizen science projects can contribute to a more positive reputation and recognition from individuals, contributing to a more trusting view of universities (Wyler and Haklay, 2018). When trust is built between society and universities, it can contribute to stronger relationships between universities and local organizations, citizens, and decision-makers (Wyler and Haklay, 2018).

## **2.5 Benefits to the Environment, Environmental Policy, and Activism**

Citizen science projects and community involvement in environmental initiatives can result in positive impacts on the environment, environmental policy, and activism. Many citizen science projects focus on the conservation of sensitive areas or sensitive species. With this, community involvement can be considered one of the most impactful mechanisms for protecting the environment (Zhang et al., 2020). Furthermore, research by Zhang et al. (2020) finds that participation in conservation efforts in protected areas

can be the strongest indicator of an individual's environmental behaviors. With this, promoting positive environmental behaviors can contribute to positive changes in the behavior of individuals. Similarly, research by Kandil (2023) proposes that these positive behaviors may be in the form of cleaning up waste, sorting waste into proper bins, and dietary changes, all of which have positive impacts on the environment.

Community involvement in environmental initiatives, when done effectively, can help to inform environmental policy and increase activism within communities. Research by Haklay (2015) finds that data collected by citizen science projects can result in relevant information that can be used to inform policy. Moreover, universities and organizations working with communities can assist in publishing and sharing collected data with decision-makers to help inform decision-making (Haklay, 2015). Similarly, research by Pakiding et al. (2020) finds that when community members engage with universities and organizations throughout the policy process, it also connects individuals with the ability to advocate for their communities in these spaces. For example, it introduces community members to knowledge, resources, and relationships that they may not have had access to prior to engagement (Pakiding et al., 2020). Projects can involve citizens who may not have knowledge or experience in environmental decision-making. As explained by Bonney et al. (2015), data from an environmental health monitoring project by the University of North Carolina showed that participants demonstrated an increased understanding of how their data can be used to inform policy and decision-making.

## **2.6 Challenges of Community Engagement in Environmental Initiatives**

Community engagement does not come without its challenges. Despite the many benefits to individuals and communities, some researchers and experts' express hesitation toward citizen science. The involvement of average citizens with little to no scientific knowledge, background, or training may potentially pose a risk to trustworthy and accurate data collection (Yang et al., 2023). Similarly, research by Conrad and Hilchey (2010) argues that while citizen science has been proven to have the potential to provide valuable data to the environmental and science fields, data collected in community projects is sometimes overlooked or ignored by politicians and scientists. Furthermore, it prevents the application of citizen science data in decision-making. With this, increasing the reliance on community-collected data is an important boundary to overcome to produce positive impacts in environmental policy and activism. As explained by Conrad and Hilchey (2010), reliance on community data can be increased by creating projects that focus on information and knowledge access, in addition to volunteer training, and participation by specialized organizations and agencies. In comparison, Yang et al. (2023) argues that the use of artificial intelligence (AI) and machine learning may have a crucial role in the future of data validation. With this, technology could potentially ensure that the research conducted, and data collected by community members is accurate and trustworthy.

Additional critiques of community engagement include the labor exploitation of participating community members. Oftentimes, those who participate in community-based environmental projects do so unpaid, dedicating their hard work, skills, and time. As described by Resnik et al. (2015), exploitation in the case of community engagement

would involve the external organizations or universities taking advantage of the labor of participating individuals. Furthermore, this often involves unequal or unjust benefits, the failure to collect participatory consent, or even harm toward participants (Resnik et al., 2015). Unequal benefits are present in efforts where the initiating organizations receive more benefits than the participating community members. Research by Resnik et al. (2015) suggests that scientists and participating organizations should provide community members with an equal distribution of benefit to prevent exploitation. Furthermore, participatory projects should prioritize efforts that provide enjoyment, value, and knowledge to willing participants (Resnik et al., 2015). Resnik et al (2015) also argues that offering citizens authorship on the research and publications that result from such projects is another great way to promote an equal distribution of benefits while preventing exploitation. Similarly, research by Goodwin and Roberts (2019) suggests enhanced communication between organizations and participating community members to support an open space for communities to advocate for themselves.



### **3. Case Studies**

The impacts, benefits, and challenges of community engagement in environmental initiatives and citizen science projects are best illustrated through case studies which display real-world examples of community-based projects. The following case studies have been carefully selected based on the type of project and involvement of community members and organizations. Furthermore, they offer diverse explanations of what community involvement can look like throughout the environmental field. Each case study is structured to examine the projects impacts, benefits, and challenges, along with the crucial role of citizens and organizations.

#### **3.1 Case Study 1: Nunalleq: Archaeology, Climate Change, and Community Engagement in a Yup'ik Village**

The case study of the community-based archaeology project in Southwestern Alaska showcases an excellent example of community involvement in environmental initiatives. Located at the Nunalleq site in Quinhagak, the Yup'ik village faced a severe loss of important archaeological artifacts due to climate change, sea level rise, erosion, and intense storms. In response, the local community teamed up with a local organization and university to initiate an excavation project to recover the culturally important archaeological record of the Yup'ik settlement while empowering the indigenous community.

Quinhagak, with a population of approximately 700 individuals, is a remote area of Alaska that can only be accessed via aircraft, or boat (Hillerdal et al., 2019). The ongoing community-based archaeology project began in 2009, following the warmest

year ever recorded in the Arctic. The increasing severity of erosion and rapid loss of the archaeological record prompted community members to reach out to local and federal agencies. After being turned away by these agencies, the community partnered with the University of Alaska Fairbanks, Qanirtuuq Inc., and the University of Aberdeen (Hillerdal et al., 2019).

The archaeology project had an overarching goal of engaging individuals of all ages to educate them on their Yup'ik cultural background. In addition, the community members recognized the urgency of the archaeology project upon discovering artifacts along the shore that had been preserved by permafrost that was now melting. Therefore, they formed a goal of uncovering as many archaeological artifacts as possible. The project sought to bridge the gap between the oral history of Yup'ik culture and the true history before contact.

The researchers and archaeologists engaged in the project aimed to assess how rising sea levels and coastal erosion were affecting cultural resources within the region. One of their goals was to cultivate expertise within the local community to tackle these impacts. Additionally, they sought to generate educational and economic possibilities for the participants in the community (Hillerdal et al., 2019).

The Nunalleq archaeology project was entirely started by members of the community. Local residents of all ages actively participated in all aspects of the project, including excavation and preservation. Community members provided the traditional ecological knowledge necessary for navigating the site and uncovering artifacts. Additionally, their cultural knowledge allowed researchers to make connections between the artifacts discovered at the site, and written Nunalleq cultural history. The community

members participated in educational workshops and training which incorporated an exchange of knowledge and experience with researchers and experts.

Participation by the University of Aberdeen, archaeologists from the University of Alaska Fairbanks, Qanirtuuq Inc., and Quinhagak Heritage Inc. was crucial to the success of the Nunalleq project. Each university and organization supplied the resources and tools necessary for excavation. Qanirtuuq Inc. was responsible for collaborating with board members and external organizations to plan and make effective decisions for the direction of the project. Quinhagak Heritage Inc. is a nonprofit organization near the Nunalleq site that provided the necessary funding and fundraising for the project. The archaeological team was headed by archaeologists, students, staff, and volunteers from the University of Aberdeen. Each organization brought knowledge and expertise in archaeology, preservation, and history of the present ecological systems. Using this knowledge and expertise, they provided education, training, and archaeological experience to members of the community.

The Nunalleq project was highly successful. As of 2019, they had uncovered over 75,000 artifacts, making it the most significant archaeological collection ever unearthed in Alaska (Hillerdal et al., 2019). With the success of the project, it prompted other communities and villages to start their own archaeology projects. One of the most significant findings was the discovery of several artifacts that displayed an attack on the Nunalleq which had only previously been corroborated by oral history (Hillerdal et al., 2019). Furthermore, their discoveries of the archaeological history of the Nunalleq site showed abandonment and development patterns that may have been due to climate change or social struggle (Hillerdal et al., 2019).

Community members have found that the project has had positive impacts on community knowledge, traditional connection, and sense of place. With this, researchers argue that the project has resulted in community engagement outside of the project, such as the growth of traditional Yup'ik dancing. Before the project, archaeology seemed unattainable and foreign to the village. However, over time the process was found to be extremely impactful to the life, culture, and history of the community. Furthermore, the project has increased the resilience of the community in the face of climate change. Allowing them to connect with their heritage and history has positively impacted engagement and interest while encouraging them to embrace change (Hillerdal et al., 2019).

The project was mutually beneficial to the participating Universities and organizations, which gained insight into the Nunalleq culture and history. Furthermore, students and staff from the University of Aberdeen gained hands-on experience and knowledge through job and internship opportunities at the archaeological sites. Ultimately, the project resulted in a Nunalleq museum located in Quinhagak which is home to the many artifacts discovered in the region. The museum is run by Quinhagak Heritage Inc. and serves as a place of cultural significance and education for the youth and community members.

The project would require a long-term investment from all parties. With this, skepticism was challenging to navigate. Community members were initially skeptical toward archaeology as it was unknown how excavation would impact their spiritual and cultural connections with the site and their ancestors (Hilerdal et al., 2019). In conjunction, distrust toward researchers and universities prompted hesitation from the

community. The accessibility of the Nunalleq site remained a significant challenge, requiring dedication and hard work from community members and participating organizations. Furthermore, hosting a research team of over 50 participants was increasingly challenging in such a remote area.

The archaeology project at the Yup'ik village stands as a model for successfully addressing the impacts of climate change on archaeological artifacts in an important cultural site. The project merges traditional ecological knowledge rooted in the local community with academic research methods from universities and organizations to reconstruct the prehistoric origins of contemporary Yup'ik culture. The project showcases an effective community-driven, bottom-up approach that stands as an inspiring model for other communities seeking to initiate comparable projects. In conclusion, it provides support for the benefits of universities and organizations involving local communities in environmental initiatives, particularly in monitoring and evaluating endangered sites, especially amidst the challenges posed by climate change.

### **3.2 Case Study 2: Public Participation Guide: Community Involvement in the Management of Environmental Pollution, Tunisia**

The Case Study of Community Involvement in the Management of Environmental Pollution (CIMEP) highlights a collaborative effort among community members, policymakers, and stakeholders in mitigating air quality and pollution in two rural areas of Tunisia. The project's overarching goal was to not only identify and evaluate environmental hazards and risks in the observed areas but also to involve citizens in finding solutions and promoting behavior changes throughout the community using a public participation approach.

Initiated by the United States Agency for International Development (USAID) and the Environmental Health Project (EHP), the CIEMP project began in 1995, lasting 18 months (Kandil, 2023). The observed areas of Tunisia are highly populated and lack reliable access to basic city services such as sanitation, and clean water (Kandil, 2023). Given their location and economic condition, the observed cities often hold little agency over local policy and decision-making, leaving them especially vulnerable to health hazards from pollution and climate change. Individuals residing in economically disadvantaged communities bear the greatest burden, often without adequate attention or resolution from local governments or agencies.

One of the main goals surrounding this project was to connect and enhance basic city services such as sanitation and water to the urban environment and rural neighborhoods within Tunisia (Kandil, 2023). This included the improvement of housing, streets, sewage pipes and infrastructure, and properly designated waste bins. Another underlying goal was that well-being, safety, and health would improve with the introduction of better infrastructure. Furthermore, the project was designed to bring together individuals from all backgrounds to increase knowledge and understanding of environmental health hazards to promote changed behavior.

Throughout the project, citizens were involved at all levels to help reach the long-term goals of connecting the community to necessary services and improving infrastructure to enhance health and safety. Members of the community were placed into diverse teams containing individuals from a variety of professions and backgrounds. Furthermore, they participated in team training and workshops to build the skills needed to assess environmental health (Kandil, 2023). Community members were involved in

roundtable dialogues and community meetings to help in the development of projects, proposals, and criteria for assessing infrastructure and health impacts (Kandil, 2023).

A local Tunisian environmental team, non-governmental organizations and representatives, policymakers, and local officials actively collaborated in every phase of the project. The Tunisian team and local officials were responsible for the initial 4-week assessment of the cities to establish project plans and targets. Furthermore, they provided skill-building workshops for community members and participants. Non-governmental organizations participated in the municipal teams to help assess environmental health and infrastructure, providing their knowledge and skills. As the final step, all participating parties came together to establish the development and prioritization of community projects focused on environmental health, resulting in several project proposals. Participation by policymakers played a key role in the development of community-level projects. In addition, they provided their input and support throughout roundtable dialogues (Kandil, 2023).

The Environmental Health Project (EHP) in Tunisia met its goals by providing improvements to housing, infrastructure, sewage pipes, street paving, and waste bins. These improvements were found to positively impact the communities' knowledge and understanding of environmental health issues. In addition, it positively impacted behavior throughout the community. For example, researchers saw an increase in individuals who began to house their animals, use toilets and outhouses, and clean up litter and garbage (Kandil, 2023). With this, researchers found that the behavior changes improved physical and mental health throughout the community (Kandil, 2023). The project was successful in bringing together local individuals and organizations. Through questionnaires and

surveys, researchers found that local officials developed a more comprehensive understanding of the resources that the communities have to offer (Kandil, 2023). Moreover, this prompted local officials to work more closely with the community following the project to develop future initiatives to improve environmental health (Kandil, 2023).

One of the greatest challenges of the Environmental Health Project was gaining public participation and support. When the project was first introduced, officials sought participation from the community through free labor and funding (Kandil, 2023). However, after redefining public participation to where the community members were able to participate in chosen and created projects, participation increased greatly. Furthermore, redefining the scope of the project altered how Tunisian officials and community members interacted, resulting in mutual respect for one another (Kandil, 2023).

Another challenge came when examining the environmental health challenges within the cities. They found that some of the sanitation issues were not the result of improper waste treatment infrastructure, but rather a result of individual behaviors. For example, solid waste was being used for livestock feed in some cities, prompting members of the community to dump their waste in the streets (Kandil, 2023). Developing a broader understanding of the root of these behaviors was crucial in providing an effective solution.

Furthermore, the initial data was collected by Tunisian officials. However, this data was not entirely trusted or accepted by all officials, especially higher-level government members. To increase trust, the researchers recommend that data ownership



must be granted to stakeholders and local officials if it is to be trusted or used to implement projects and policies.

The Environmental Health Project in Tunisia exemplifies the potential of community involvement in environmental initiatives to achieve long-term improvements in community well-being, pollution mitigation, and environmental health. The case study is an example of the effects of long-term commitment from officials, policymakers, organizations, and local community members to come together for the betterment of their environmental conditions. Furthermore, it displays the importance of clear and defined guidelines for community involvement to promote overall participation and understanding.

### **3.3 Case Study 3: Community Engagement: An Integral Component of a Multifaceted Conservation Approach for the Transboundary Western Pacific Leatherback**

Indonesia's Abun Nesting Beach Program exemplifies a multifaceted initiative aiming to improve conservation efforts for the Transboundary western Pacific Leatherback Sea turtle through community engagement and empowerment. The program focuses on engaging local communities in safeguarding at-risk turtle nests along their coastlines. Furthermore, it emphasizes community empowerment by addressing local needs, creating employment opportunities, boosting income, and promoting equity.

Bycatch in marine fisheries poses severe threats to the conservation and biodiversity of migratory species. Threats to the critically endangered Transboundary western Pacific Leatherback have been previously mitigated through at-sea measures. However, over time these measures have proven to be difficult, expensive, and ineffective. For example, their populations have seen a 90 percent decline due to habitat

loss, bycatch, and egg harvesting (Pakiding et al., 2020). Research has found that over 75 percent of turtle nesting occurs year-round across the coastline of Indonesia (Pakiding et al., 2020). Beginning in 2017, in Papua Barat, Indonesia, researchers and community members took a hands-on approach to demonstrate the importance of community engagement in species conservation efforts.

Before the start of the project, only 35 percent of nests in Papua Barat were protected (Pakiding et al., 2020). The main objective of the Abun Nesting Beach Program was to increase the percentage of protected nests through protective measures and relocation. With this, the project sought community engagement to establish a long-term conservation program through community involvement. Furthermore, the project would focus on enhancing the empowerment, welfare, and equity of the local community, including the introduction of livelihood improvements (Pakiding et al., 2020).

Community members of all ages were involved by building protective structures enclosing nests, placing shade over nests to reduce sand temperatures, and relocating nests to stable areas (Pakiding et al., 2020). Additionally, community members participated in questionnaires and social surveys throughout the project to determine the impacts and benefits of their involvement and to gain insight into their perspectives and opinions. With this, they participated in educational training and workshops on conservation, turtle biology, and enhanced cleanliness throughout the village (Pakiding et al., 2020). Community members were also employed to interact with landowners, trap predators, and patrol the coastal areas.

Funding for the project was largely provided by the International Seafood Sustainability Foundation (ISSF). This funding allowed the creation of the Abun

Leatherback Project (ALP) team which consisted of students from the State University of Papua (Pakiding et al., 2020). The ALP team was responsible for conducting interviews throughout the year to understand community members' needs and desires. In response, The ALP team also provided new technology to meet the communities' desire to improve agricultural output and processing (Pakiding et al., 2020).

Furthermore, along with government and non-governmental organizations, ALP provided training and education to community members on hygiene, turtle conservation, and nesting (Pakiding et al., 2020). With the help of The Tambrau District Education Office, ALP also provided a youth-based Turtle Camp each year to educate children in the village (Pakiding et al., 2020). The involvement of ALP has been crucial to the success of the project, providing the community with connections to external organizations and resources. Throughout the project, ALP focused on building trust and connection to the community.

The project hosted a variety of benefits for the conservation of the Transboundary western Pacific Leatherback, in addition to the improvement of well-being throughout Papua Barat. Initial estimates provide support that hatchling production and the presence of nesting turtles have increased dramatically since the beginning of the project (Pakiding et al., 2020). As of 2020, the project was responsible for increasing protected nests by over 50 percent (Pakiding et al., 2020). Moreover, researchers believe that the rise in hatchling production aligns with the growing involvement of community members collaborating with ALP in the project (Pakiding et al., 2020).

Community surveys provide support that the project increased community empowerment and ownership. These surveys were crucial in building trust and support

between community members and members of ALP. In addition, surveys have shown changes in individual behavior and choices. For example, before the beginning of the project, it was common for individuals to consume turtle eggs. However, surveys have concluded that turtle eggs are no longer consumed at home, and there are now negative feelings associated with the consumption of turtle eggs. Additional surveys show that communities have grown an appreciation for the endangered species along with the participation of ALP in their community. Their survey responses indicate an enhanced sense of ownership and protection over the Transboundary western Pacific Leatherback turtles.

Over time, communities adopted the new technology for agricultural processing and production. With these improved technologies, the skills and capacity of production have been drastically enhanced. This has provided communities with the ability to sell their goods in surrounding cities (Pakiding et al., 2020). For example, improvements in coconut oil technology and marketing allowed the community to expand production from 5 to 38 households in just two years (Pakiding et al., 2020). Well-being, income, and living conditions within the community have been further improved through improved production technology and continued employment opportunities.

Another impact was the connection of the community to beneficial organizations and resources. ALP identified several needs and desires in the community and worked hard to fulfill those requirements. With this, the community expressed that they suffered from the absence of medical care and equipment (Pakiding et al, 2020). ALP connected the community to Tambrauw Regency Health offices which continuously provide medical examinations, education, and medicine at no cost. Furthermore, the community

has experienced enhanced health and well-being following consistent access to medicine and health care.

While the project was largely successful, it still came with a variety of challenges. As with many projects, building trust and support within the community was initially difficult. Previous projects for turtle conservation in the community had not involved community input or involvement. Therefore, upon initial introduction, the community was very weary of the ALP team and held negative views of the project altogether. A large majority of the community believed that the implementation of previous efforts was inequitable and only provided benefits to landowners rather than the entire community. Shifting this perspective was incredibly important to ALP, therefore, community feedback was heavily prioritized.

Another major challenge that remained throughout the project was the private ownership of areas along the beaches. With this, landowners had the ultimate say in determining which conservation efforts could occur and where they could be conducted. Increasing trust and community involvement was crucial in overcoming this challenge, however, private ownership ultimately limited the accessibility of community members, thus limiting the extent of protection in those areas (Pakiding et al., 2020).

This case study underscores the overwhelming potential of community involvement in environmental initiatives. Through the prioritization of community welfare and improvement, the project enhanced community well-being and livelihood and increased individual sustainable behavior. Additionally, the project strengthened community empowerment and fostered a sense of ownership over their communities and the conservation of critically endangered species. Furthermore, the Aubon Nesting Beach

Program is an excellent example of increasing conservation and protection of sensitive species, like the Transboundary western Pacific Leatherback Sea turtle.

### **3.4 Case Study 4: Our Environment, Our Health: A Community-Based Participatory Environmental Health Survey in Richmond, California**

The study sites were focused across four close-knit neighborhoods in Richmond, California (Cohen et al., 2011). The four neighborhoods predominantly comprise low-income communities of color. Additionally, they are situated in close proximity to significant sources of pollution, including oil refineries and industries (Cohen et al., 2011). Their location poses a significant environmental justice issue, as polluting facilities have been known to cause health issues, such as asthma and respiratory illnesses. The participatory research survey involves local community members in monitoring, addressing, and advocating against the environmental and health impacts of these polluting facilities.

Community-based participatory research has been found to increase scientific and political knowledge and empowerment within communities, while also providing them with the tools needed to address environmental concerns. Researchers have found that providing communities with advocacy knowledge, experience, and tools, can increase the likelihood that environmental concerns will be addressed by stakeholders and policymakers (Cohen et al., 2011).

The overarching goal of the participatory research survey was to develop a deeper understanding of local citizens' feelings surrounding environmental conditions in their neighborhoods. In addition, the objective was to create a database containing community health issues and concerns related to pollution. Furthermore, this project sought to

involve local citizens at every level of the research process. With this, they hoped to increase policy advocacy and inform future research and environmental initiatives within the community.

Before the project, each participant completed classes and training from Brown University and members of Communities for a Better Environment (Cohen et al., 2011). Over 198 community members completed questionnaires regarding their health and their perception of local environmental issues and pollution (Cohen et al., 2011). Although only 198 citizens were surveyed, the participants answered questions regarding their entire households, resulting in the collection of data for 722 residents (Cohen et al., 2011). Participants were assigned specific tasks or teams based on their interests and experience. With this, a few community members participated by conducting surveys and identifying and recruiting leaders within the community. Moreover, several community members were involved in data collection and analysis in correspondence with organizers. Furthermore, community members participated in meetings and discussions to determine the future of the study along with what health effects would be examined (Cohen et al., 2011).

The survey was conducted by a California organization, Communities for a Better Environment (CBE) (Cohen et al., 2011). Throughout the study, Communities for a Better Environment worked closely with Silent Spring Institute, Brown University, and the University of California, Berkeley (Cohen et al., 2011). Individuals at CBE provided surveys to residents and developed research questions to better understand their concerns and pollution risks. Each university and institute offered a wide array of knowledge and experience necessary to conduct surveys and data analysis. Additionally, the West

County Toxics Coalition in Richmond actively helped with data collection and analysis, in addition to engaging local citizens.

The project was key in bringing together various communities in combating the negative effects of pollution. While each community experienced the same issues, researchers found that before the survey, the communities saw themselves as separate from one another. Over time, participants in the different communities began to view the surveys as a method of coming together and enhancing cooperation, cohesiveness, and unity between neighborhoods (Cohen et al., 2011).

The provided educational material and training increased scientific knowledge and understanding for participants. Furthermore, it increased community members' knowledge of environmental health terms which increased their ability to analyze public data (Cohen et al., 2011). Community awareness of environmental pollution and health issues were also key impacts of the study. Additionally, the organizers encouraged participation among community members. This encouragement prompted community members to participate in community meetings and advocate for environmental health. (Cohen et al., 2011).

Furthermore, the study enhanced researchers' understanding of environmental health hazards and the public perception of those hazards within these communities. For example, they found that 93 percent of surveyed individuals expressed concern about the nearby industrial pollution (Cohen et al., 2011). The surveys also found that nearly half of surveyed individuals felt that their concerns would not be heard or responded to by policymakers if expressed.



A key challenge was the concern that bias would impact community members' responses to the survey. Additionally, it was not possible to receive responses from every community member. For example, responses were not taken from individuals who smoke out of the theory that it would impact the results. Therefore, it is likely that a portion of respondents were not included, creating a possible gap in data (Cohen et al., 2011).

In conclusion, the participatory research survey conducted across the four neighborhoods in Richmond, California, plays a key role in addressing environmental justice issues prevalent in low-income communities of color. The project sheds light on the significant environmental challenges faced by these communities and highlights the potential health impacts resulting from these environmental injustices. For this study, community involvement was an important factor as it fostered a sense of unity and engagement among the four communities. Furthermore, it lays the groundwork for the continued collaboration amongst communities, universities, and organizations in achieving a healthier and more equitable environment.

## **4. Discussion**

As the impacts of climate change are seen throughout the world in the form of rising temperatures, rising sea levels, and increased wildfires, the importance of community engagement is increasing rapidly. Community involvement in environmental initiatives and citizen science projects can be an effective tool in combating and adapting to environmental issues, like climate change and the conservation of sensitive species. Additionally, it can serve as an important mechanism for strengthening communities and promoting scientific knowledge, and sustainable behaviors.

### **4.1 Improvements in Community Involvement**

While citizen science projects and community engagement have proven to be beneficial in several contexts, it is evident that not all research projects are created equally. The results of such projects seem to be highly dependent on the projects goals, in addition to the benefits provided to participating individuals. With this, there is a desperate need for more effective measurements of changed behavior, knowledge, and attitudes following participatory studies. As noted by Brossard et al., the attitudes and behaviors of individuals are often too complex to measure through the use of observational surveys, questionnaires, or examinations. Therefore, to fully understand how we can create effective citizen science projects in the environmental and science fields, it would be useful to understand the aspects of these projects that promote positive attitude changes and increase scientific knowledge. Only then can the true success of a citizen science project be accurately understood.

Additionally, citizen science projects should be focused on enhancing long-term participation. With this, the enhancement of data collection and research following the conclusion of the project could be extremely beneficial in measuring a project's effectiveness and long-term outcomes. Prioritizing long-term engagement within communities may enhance the effectiveness, impact, and outcome of citizen science initiatives. Additionally, extended involvement could also provide a consistent influx of collected data from sensitive areas. Furthermore, long-term projects may have a more significant impact on local policy and decision-making, contributing to more impactful environmental outcomes.

In general, mechanisms that aim to increase community involvement could be better developed and improved. As seen in environmental health monitoring in Tunisia, community members were involved in every aspect of the project (Kandil, 2023). This meant that they were involved in project planning, decision-making, and data collection. Furthermore, they were involved in discussions with local politicians and decision-makers. Applying this participatory mechanism across all citizen science projects could contribute to increased leadership and representation within communities. Furthermore, it connects communities with resources, bridging the gap between local policy and community members.

Data reliability and the use of citizen-collected data are additional areas of community involvement that could benefit from improvements. When individuals enter science-based projects with little to no scientific background, it is understandable why data reliability is a huge factor hindering its application in decision-making. However, when data collected in citizen science projects cannot be applied to inform local decision-

making, it may decrease individuals' willingness to participate. In contrast, increasing the reliability of citizen collected data could empower communities, and contribute to increased participation in projects and policy advocacy. With this, increased training for community members and the mobilization of knowledge by participating organizations is incredibly important.

#### **4.2 Recommendations for Universities and Organizations**

External organizations and Universities are often acknowledged for their key participation in citizen science projects. Furthermore, by providing tools, education, and training, their participation can determine how successful a project may be. However, restrictions placed on universities and community organizations may create a barrier that hinders sustainability education and involvement in environmental projects and partnerships (Schmitz et al., 2019). Closing this gap is important to pave the way for organizations and universities to bring communities together through the mobilization of resources and education (Schmitz et al., 2019).

Improvements to community involvement in environmental initiatives and citizen science projects also involve the improvement and development of stronger relationships between participating individuals, and participating universities and organizations. Trust and reliability are key aspects in determining the participation of the local community, and the overall success of a citizen science project. As external organizations and universities enter vulnerable communities, it is important to consider the impacts of their presence on the local community. Many citizens often express an initial distrust and skepticism toward the involved organizations. As with the Abun Nesting Beach Program, previous projects may not have involved the input or involvement of community

members (Pakiding et al., 2020). Given past experiences, it can be difficult for individuals to welcome change in their communities that are already experiencing stress and limited access to resources. Therefore, fostering trust and reliability between participating communities and organizations could be crucial to the success of a project.

Building trust within communities can be done by addressing their needs and improving the community's quality of life. As corroborated by Burgos et al., it is crucial to incorporate and improve involvement strategies that encompass the individual needs of each community, especially in rural areas with little access to external resources. With this, it is important for participating organizations to strongly prioritize the input and opinions of the local community. When a community feels that their needs are being seen and heard, it may build trusting relationships which could lead to increased participation and a more positive outlook on the project. An excellent example of this is the Abun Nesting Beach Program, where the participating universities and organizations focused on connecting the community to necessary resources. In providing the community members with jobs and a source of income, they effectively build trust within the community, thus increasing participation and promoting sustainable behaviors.

Another aspect of building trust can be seen in the relationship dynamics between external organizations and participating communities. Universities and organizations initiating projects should view community involvement as a mutually beneficial relationship. While community involvement provides benefits for individuals and communities, it can be equally beneficial for universities and organizations. As corroborated by Harris et al., when there is an equal distribution of power between participating communities and organizations, the outcomes of initiatives can improve

dramatically. The importance of this shift in perspective can be seen in the community-based archaeology project in Nunalleq (Hillerdal et al, 2019). Universities and organizations are often acknowledged for the provision of necessary resources, tools, and knowledge. However, communities, like the Yup'ik, provide a unique perspective and knowledge of the ecological history of the study site that research cannot provide.

Universities and organizations play a key role in the success and outcomes of community projects. Participating organizations that work to address each of these trust-building aspects can expect to see more successful project outcomes. Furthermore, building trust in communities may have the potential to increase community engagement, empowerment, and knowledge building. With this, a deeper sense of trust may lead to a more positive outlook on science and research for participating individuals. Additionally, it may help foster a sense of belonging, leading to long-term engagement and increased involvement in environmental initiatives.

#### **4.3 Recommendations for Future Research**

To this day, there is an extensive literature gap displaying an understanding of how citizen science can benefit the environment and the ecosystems in which the projects take place (Conrad and Hilchey, 2010). Much of the literature focuses on projects designed to benefit the environment and environmental policy. However, many of these benefits are examined on a short-term scale, failing to measure or acknowledge long-term or permanent benefits. Therefore, researchers highlight the need for prolonged studies focused on the long-term environmental health outcomes of community engagement in the environmental field (Ward et al., 2022). Developing prolonged studies can help to

better understand the extent of the benefits provided to the environment by community involvement.

Additionally, monitoring and modeling the benefits of community engagement remains a clear boundary. Human behavior and changes in attitudes can be increasingly difficult to measure. Moreover, the positive outcomes of community involvement may be challenging to recognize if not measured properly. For example, increases in participants' attitudes and interests can be challenging to detect following citizen science projects. Since individuals choosing to participate in citizen science projects are likely already interested in the science and environmental fields, there may not be significant changes in their attitudes and interests because of their involvement in such projects. Citizen science projects often rely on surveys, exams, and questionnaires to determine these changes. However, research suggests that attitudes and behaviors may be too complex to measure through commonly used methods (Brossard et al, 2005).

Furthermore, the literature suggests that there is an increasing need for effective measuring tools when examining the outcomes of community engagement projects. These tools could be more effective by considering the complexities of human behavior and relationships to limit bias (Bonney et al., 2015). Designing effective measuring tools may also have the potential to design more effective projects across the field, thus leading to the best possible results for participating parties (Bonney et al., 2015).

These gray areas of community involvement and engagement call for expanded research into effective models and mechanisms. Future research may focus on models that more effectively measure the long-term impacts of community engagement initiatives. Additionally, expanding research and developing extended studies on the

long-term behavioral and environmental impacts of citizen science projects could be extremely beneficial. This involves research that focuses on understanding not only the immediate outcomes but also the sustained behavioral and environmental outcomes of citizen science projects. Investigating and comprehending these extended effects is crucial for developing effective community engagement models and strategies.

Future research may also focus on developing guidelines and models to enhance data reliability and application in decision-making. Increasing data reliability could be looked at through the use of technologies and the increased involvement of organizations. In addition, it may include the development of training exercises or programs for citizens with no scientific knowledge or background. Furthermore, enhancing the reliability of citizen-collected data is incredibly important in moving forward in increasing participant involvement and the use of data in important decision-making.

Finally, future research should focus on addressing ways that community involvement can be increased. With this, it would be beneficial to develop guidelines for universities and organizations to implement citizen science projects around the world. In addition, this may include research into the benefits and effectiveness of incentives for increasing participation by individuals, organizations, and universities. This approach to future research may have the potential to increase the impact and sustainability of community engagement initiatives in addressing environmental challenges.



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