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RESILIENCY PRACTICES IN ACADEMIC INSTITUTIONS: THE ROLE OF BIOCULTURAL DIVERSITY AND ENVIRONMENTAL LITERACY IN CAUSAL MECHANISMS

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DEDICATION

This dissertation is dedicated to Geandy mi amor, whose love and support helped me accomplish this life-long dream. It is also dedicated to mis chiquiticos bellos, Emmette and Esmond, who have given me more motivation to fulfill this goal than I could have ever imagined.

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ABSTRACT OF THE DISSERTATION

RESILIENCY PRACTICES IN ACADEMIC INSTITUTIONS: THE ROLE OF BIOCULTURAL DIVERSITY AND ENVIRONMENTAL LITERACY IN CAUSAL MECHANISMS

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The organized actions of people that occur within institutions impact and influence socioecological systems in both positive and negative ways. When these actions alter the environment in unfavorable ways, society and the environment are harmed. This harm leads to negative and disproportionate impacts on underrepresented groups like those of Latin communities. When institutions implement resiliency practices, this harm can be reduced, and positive impacts on the system may be realized. This research analyzed causal mechanisms within academic institutions that led to resiliency practices that were beneficial for socioecological systems. The causal mechanisms (also called events) leading to institutional resiliency practices at academic institutions were process traced using the theoretical framework of biocultural diversity and environmental literacy. According to the identified causal mechanisms, environmental actors' integration of biocultural diversity and application of environmental literacy supported the implementation and continuation of inclusive resiliency practices. These causal

mechanisms had four purposes: to exchange knowledge, to refine resiliency practices, to procure funds, and to develop external support or partners. These four types of mechanisms led to long-term engagement and partnerships from individuals outside of each institution that helped support their resiliency efforts. These findings indicate the potential to develop inclusive resiliency practices within organizations and their socioecological systems and provide a pathway forward to create professional development opportunities that support these practices. Causal mechanisms impacted by biocultural diversity and environmental literacy aided in establishing, refining, and ensuring that inclusive resiliency practices persisted.

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CHAPTER 1

INTRODUCTION

The well-being of people is intertwined with the sustainability and resiliency of socioecological systems (Carpenter et al., 2005; Folke et al., 2016; Walker et al., 2004). The bio-geo-physical components encompassed by particular ecosystems and the issues that occur within them make up socioecological systems (Gardner et al., 2013; Gunderson & Holling, 2002; Knoot et al., 2010). A system's ability to exist in a specific state for an extended period of time is known as sustainability (Chapin et al., 2010). In contrast, environmental resiliency is the ability for a system to recover after experiencing a disturbance (Chapin et al., 2010). The difference between sustainability and resiliency is the state in which a socioecological system exists (Carpenter et al., 2005), either stable or resisting disturbance and/or recovering from a disturbance. The ability for a system to resist a disturbance or recover from one should also include the system's ability to remain stable, therefore resiliency is inclusive of sustainability. Following from this definition, resiliency practices are the activities or habits of people that contribute to a socioecological system's ability to resist and recover from disturbances.

The importance of ensuring resiliency within socioecological systems has been noted by scholars (e.g., Ostrom et al., 2002) and institutions are a component of this (Hadad & Găucă, 2014). Recommendations that have been made regarding sustainability focus on the reduction of natural resource depletion and keeping a steady state to improve human well-being (Daily et al., 2009; Fischer et al., 2012). Furthermore, Hadad and Găucă (2014) state that institutions are social actors that can positively change social norms that impact socioecological systems through resiliency practices.

Interconnected within complex socioecological systems are the biological, cultural, and linguistic diversities that dictate human life and are known as biocultural diversity (Maffi, 2007; Maffi & Dilts, 2014). Due to this interconnectedness of biocultural diversity, resiliency of these systems is necessary for the well-being of people, and the practices of institutions influence a system's resiliency (Maffi, 2004). Biocultural diversity in systems is manifested in a variety of ways. For example, cultural interaction with nature may manifest in a system as the value assigned to an animal. In some biocultural perspectives, animals, such as insects, may be considered a nuisance and devalued by people despite their ecological importance. However, another biocultural perspective may respect insects based on their intrinsic value. Together, these manifestations of biocultural experiences (e.g., value placed on animals) represent biocultural diversity in a system that should be taken into account when developing resiliency practices to create culturally informed responses to change (Maffi, 2007; Maffi & Dilts, 2014). These culturally informed responses to change are what form inclusive resiliency practices. When the manifestations of biocultural diversity are aligned with resiliency practices, then the practices are likely to be supported by people from those biocultural backgrounds and can have positive impacts across the social, ecological, and economic aspects of the system. In the example of insects, this may mean resiliency practices need to address the value people place on insects as well as more ecological responses, such as reduction of pesticides that harm the ecosystem by negatively impacting native species.

Calls for institutional change seeking to reduce how organizations impact socioecological systems have failed to include cultural concerns. In response, researchers

have sought to understand institutional dynamics that involve biocultural diversity (Chapin et al., 2010); yet, organizational change frameworks have struggled with its inclusion (Jacobs et al., 2013). An important step to improving cultural inclusion in organizations will be understanding how biocultural diversity has been integrated into resiliency practices of institutions that have multi-cultural members. In this way, these examples can be used as descriptive evidence of including biocultural diversity and the process that was used may serve as a guide to other organizations seeking to promote institutional change that includes biocultural diversity.

The potential of developing inclusive resiliency practices is improved when combined with environmental literacy (Hollweg et al., 2011). Environmental literacy consists of the skills necessary to address environmental problems in addition to nurturing awareness and concerns about nature (Hollweg et al., 2011). Efforts made to implement resiliency practices that do not integrate environmental literacy can lead to impacts on socioecological systems that seem to improve conditions while in reality worsen them. For example, switching to lithium batteries was thought to be a resilient practice due the batteries' ability to be recharged. While the rechargeable battery reduces the amount of waste produced from the disposing of depleted batteries, production of this type of battery should also be taken into consideration. During the production process, mining for lithium negatively impacts the environment and has the potential to harm human health (Kang et al., 2013). In this case, the resiliency practice of using rechargeable batteries is aligned with the values of users based on their biocultural interaction with nature, but when environmental literacy is applied to the entire process of developing batteries, the positive impact is less clear. In this way, it is not enough to only

align practices with manifestations of biocultural experience, but environmental literacy must be applied to ensure the development of practices that are a benefit to the socioecological system. This example includes both individual choices to use lithium batteries as well as the practices of organizations that develop and integrate these batteries. Organized actions of people that occur within institutions can impact and influence socioecological systems in both positive and negative ways. Therefore, research should examine how to create professional development based on the role of environmental literacy in resiliency practices and the relation between biocultural diversity and the application of environmental literacy.

This study addresses these concerns through three overarching research questions. First, how can biocultural diversity be integrated in resiliency practices that develop in an institution and contribute to the practice's inclusiveness? Second, how can environmental literacy be applied in those practices to ensure positive impacts on socioecological systems? Third, what is the relational aspect of biocultural diversity and environmental literacy that led to inclusive resiliency practices?

Theoretical Framework

The theoretical framework that guides this work consists of biocultural diversity and environmental literacy (Hollweg et al., 2011; Maffi & Dilts, 2014). These theories were chosen to highlight how resiliency practices can avoid the current challenges that occur when socioecological systems are harmed. Many of these environmental problems are caused by organizations that do not take into consideration how their practices impact surrounding communities (Gochfeld & Burger 2011; Guidry et al., 2018). Motivated by these two notions, this study used the theoretical basis of biocultural diversity and

environmental literacy to investigate the mechanisms in organizations that result in inclusive resilient practices.

Biocultural diversity highlights the interactions that developed and led groups to inclusive practices based on the contextual features of biology, culture, and language (Maffi, 2004; Maffi, 2007; Maffi & Dilts, 2014). Biocultural diversity is a collection of the experiences that manifest when people from various biocultural backgrounds interact. These manifestations include biocultural knowledge, actions, needs, tolerance, attachment, and value (Vierikko et al., 2015). For example, the environment can influence a religious practice while the religious practice can lead to the protection of a certain species. This need leads to the use of nature to fulfill a cultural practice.

Environmental literacy highlights the knowledge, dispositions, competencies, and environmentally responsible behaviors (Hollweg et al., 2011) that were applied in the implementation and sustaining of the resiliency practices. Environmental literacy likewise displays itself in different ways when people interact with nature. For example, a person may be conscious of the impact they are having on the environment while fishing, this disposition could lead them to catch and release their fish. Releasing the fish back into the water, an environmentally responsible behavior, could lessen the negative impacts on that system.

The manifestations of biocultural diversity and the dimensions of environmental literacy and their operationalization are discussed in detail in the manuscript chapters that follow.

Research Design: Ontological and Epistemological Perspectives

This research was guided by a postpositivist paradigm. Postpositivist paradigms take into consideration a researcher's perspective as well as its influence on research and outcomes (Patton, 2015). I apply this paradigm by exploring findings that are grounded in participants' experiences and by placing value claims that are based on these representations of reality and not necessarily based upon generalizable statistics. Some may consider this perspective to be an interpretivist paradigm. However, I also employ external checks for rigor such as triangulation and peer debriefing, which others would argue are grounded in positivists perspectives. Thus, a postpositivist paradigm best describes this work. The research conducted for this dissertation implemented qualitative approaches. Qualitative research involves "making sense of the world" (p.432) and "our relationship to the world," (p. 432) which in turn reveals personal findings while simultaneously understanding the phenomena being studied (Patton, 2015). This process of investigation views people's stories as data that can reveal broader meanings due to its connections between the cultural, sociological, psychological, political, and various dimensions of the human experience (Myers, 2000). This provides the appropriate tools to use when studying the intricate and delicate phenomena of inclusive resiliency practices in socioecological systems.

The postpositivist paradigm also takes into consideration the context in which phenomena occurs (Guba & Lincoln, 1994). This influenced the choice of conducting a case study. Case studies provide an in-depth and "holistic description" (p.139) of phenomena within particular context like institutions (Yazan, 2015). These approaches are a reasonable way to study resiliency practices within institutions because they align

with the dimensions of the human experience that are included in biocultural diversity and environmental literacy. In particular, qualitative approaches ensure that descriptions that are made by researchers, which are based on first-person perspectives, match how they were experienced by the individuals sharing their stories (Zahavi, 2003). They are appropriate for the research questions, which seek to identify descriptions of the role of biocultural diversity and environmental literacy in resiliency practices as well as the relations between them.

Qualitative approaches emphasize transferability (Guba & Lincoln, 1994; Patton, 2015), rather than generalizing. Transferability uses context as a means for others to apply findings to their own challenges. This purpose aligns with recognizing and integrating the diversity that influences and impacts aspects of socioecological systems into inclusive resiliency practices.

Overview of Case Study Methods

This research assessed resiliency practices within two academic institutions to understand how biocultural diversity and environmental literacy played a role in them. Causal mechanisms that led to those practices were identified to provide details into relational aspects of biocultural diversity and environmental literacy. Causal mechanisms consist of the specific, real-world realizations of theory-based explanations. The results of this type of analysis are descriptions of applications of the theoretical framework and evidence of how these applications contributed to resiliency practices (Bennette & Checkel, 2015). This has implications for the design of professional development that other institutions might apply to implement their own inclusive resiliency practices.

Prior to the commencement of this study, approval was granted by the Institutional Review Board at the university (Appendix A). Upon the study's approval, three different types of institutions were contacted. This included the resiliency division of the county, an ecotourism-based business (hotel), and a local non-profit organization dedicated to working with academic institutions. The individuals leading the county's resiliency division, the ecotourism's environmental programs, and the director of the non-profit organization were contacted. Meetings were requested and granted. These meetings served the purpose of learning more about the types of resiliency practices that local institutions implemented and discussing the purpose of this study. Upon doing so, it was determined that academic institutions would be appropriate for this study because they had the variables and outcomes necessary to conduct the analysis of this study.

Once academic institutions were determined appropriate for this study, the contact at the local non-profit organization served as a guide in choosing institutions with the variables and outcomes of interest required for this study. After meeting with the director of this organization, three institutions and the seven individuals leading the resiliency practices within those institutions were identified.

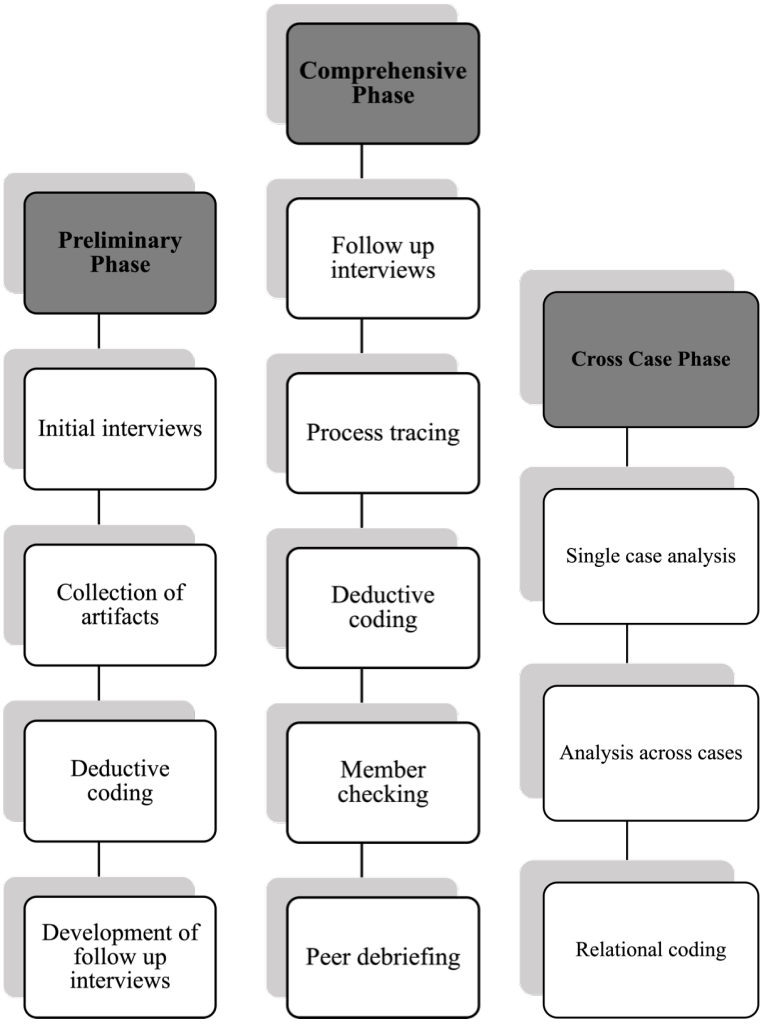
The seven individuals were contacted and invited to participate in the study. Of the seven individuals, five agreed to participate. After initial communications and gathering general information on the resiliency practices held at their institutions, two of the three institutions were deemed appropriate for this study. These institutions were considered appropriate for this study because they implemented more than one type of resiliency practice, the institutions were in socioecological systems that were susceptible to environmental challenges like sea level rise, and were composed of culturally diverse

students, parents, and staff. The three manuscripts in the upcoming chapters provide detailed methods of the investigations into the resiliency practices within these institutions. An overview of the analysis process follows next.

The analysis process followed a multiphase case study design (Figure 1.1). In the preliminary phase, the cases (academic institutions) were chosen. Next, the school district's Research Review Committee was contacted to request approval for this study (Appendix B), which required obtaining permission from the principals at the two institutions. Once approval was obtained from the principals and the school district's Research Review Committee, four individuals from the institutions were contacted again and initial interviews were scheduled.

Figure 1.1

Case Study Design



Initial interviews were developed using open-ended questions to capture as much information about the institutions, participants, and the resiliency practices as possible. This allowed for the identification of the participants' background, the institutions' historical context, and all resiliency practices conducted by the institutions regardless of where they were implemented and how often. It used an exploratory approach to identify key aspects of the resiliency practices that were investigated in the comprehensive phase.

This included conducting interviews, transcribing the interviews, collecting artifacts (Table 1.1), performing an initial analysis to identify secondary participants, and developing follow-up interviews.

Table 1.1

Case study data sources and quantities

Data Source	Quantity
Interviews	12
Pictures	111
Videos	1
News articles	4
Books	2
PowerPoint Presentations	2
Award Notifications/Certificates	4
Organizational publications (internal practice announcements and external partner publications related to practices)	13
Publicly available data (legal descriptions, "about" sections of organizations' websites, social media, external partner publications related to practices)	51

After the preliminary analysis, five additional informants were identified. Two of the five additional informants agreed to participate. Initial interviews were conducted, the interviews were transcribed, additional artifacts were collected, initial analysis were conducted, and two follow up interviews were developed. In total, this case study collected, transcribed, and analyzed twelve interviews, for initial and follow up interviews.

A major aspect of the analysis was process tracing. Process tracing identifies causal mechanisms (events) leading to an outcome of interest (resiliency practices) within

institutions (Bennette & Checkel, 2015). Defining "positive-positive" cases ensures that the variables (biocultural diversity, environmental literacy) and outcomes (resiliency practices) of interest are present to develop causal explanations (Beach & Pedersen, 2018).

Process tracing was conducted in combination with deductive coding. Deductive coding was based on the theoretical framework of biocultural diversity and environmental literacy. Coding was completed with the use of Nvivo and at times, manually with a pen and paper. The combination of process tracing with deductive coding led to the identification of events that led to the resiliency practices and how they had been impacted by biocultural diversity and environmental literacy.

In alignment with my postpositivist paradigm, rigor of this study was ensured by practicing reflexivity, conducting member checks, and peer debriefing. Throughout the entirety of this study reflexivity was practiced. This involved ongoing journaling of the researcher's experience, thoughts, and emotions to reveal biases (Watt, 2007). Once narratives were written, member checks were conducted. This process involved the participants reading the narratives and confirming the credibility of the researcher's interpretations (Candela, 2019). After the participants confirmed the accuracy of the narratives, peer debriefing occurred. Peer debriefing involved reviewing select quotes and pertaining codes with two other researchers, one of which was otherwise uninvolved in the project. This served the purpose of clarifying interpretations and refining the codebook.

Positionality

A researcher's positionality influences how a study is designed, implemented, and analyzed (Holmes, 2020). As a qualitative researcher, I am an instrument in this study and therefore, include my positionality for transparency. I grew up in a realm of mixed world views. I am half Cuban, half Argentinean born and raised in Miami, Florida. From cultural to political paradoxes, the person I am today is a merging of those worlds. It has helped me grow into an individual that takes into consideration various perspectives and most importantly, one that understands that things are not as straightforward as they may seem.

Part of this cultural mashup holds a tie to nature. I grew up seeing my Cuban abuela Gladys making tea with cundeamor leaves she grew in her backyard. She would drink this tea to help lower her blood sugar. I also heard stories like those of my mom and abuela Meche gathering eucalyptus leaves from the forest across from their home in Argentina. They would use these leaves to soothe cold symptoms by putting them in water over a kerosene stove. This may just be part of the reason that I have always been attracted to my natural surroundings. This fascination was further nurtured by my abuelo Cuqui. He spent his days working as a veterinarian and his nights tending to his garden. One of his close friends called him, "el veterinario pobre", the poor veterinarian. A title that perfectly summed his constant need to help others even if it meant financial loss.

In my research, this identity and worldview has led me to focus on the environment as a tool for helping people. As Savin-Baden and Major (2013) rightly note, "the context in which a researcher finds themselves impacts how they approach a problem" (p. 68). The perspective I bring enhanced my research by allowing me to look

at my work through various lenses, from the perspective of a Latina, an American, a nature enthusiast, and a people-conscious individual. This could potentially have introduced bias by projecting my preconceived notions onto my data, such as how I believe people should interact with their natural environment. For example, I think our natural environment should be used to aid in the development of society while still ensuring its intrinsic values, but I have taken steps to be aware of this. By practicing reflexivity that involved detailed journaling and respecting the voice of those sharing their stories with me, I ensured that who I am is clearly reflected in my analysis and assumptions.

Significance of the Dissertation

Understanding how academic institutions develop resiliency practices and which institutional aspects may interfere with their development can guide other institutions toward practices that reduce their impact on socioecological systems. In particular, uncovering this process by examining causal mechanisms expresses the intricate relational aspects that lead to social occurrences and influence individual behavior (Bennett & Checkel, 2015; Voltolini & Eising, 2017). The impact of biocultural diversity and environmental literacy on these mechanisms can improve professional development that leads to inclusive and resilient institutional practices.

Overview of Manuscript Chapters

The following chapters are a collection of three manuscripts developed from this case study. Each manuscript answers a subset of research questions within the overarching questions of the case study and provides more details on the relevant theories and methods for each analysis. The first manuscript focuses on the impacts of biocultural

diversity on the events leading to the resiliency practices at an academic institution. This paper details the historical context surrounding the resiliency practices, the background of a participant from the school, in what ways biocultural manifestations were present within the case, and how those manifestations impacted the resiliency practices. The results revealed aspects of socioecological systems integrated into the resiliency practices that included self, others, organisms, technology, and pedagogy.

The second manuscript focuses on the impacts of environmental literacy on the events leading to one academic's institution's resiliency practices. This paper details the historical context surrounding the resiliency practices, the background of two participants from the school, their application of environmental literacy in implementing two gardens, and how that application of environmental literacy impacted the practices. Environmental literacy optimized the resiliency practices implemented at this school by providing the knowledge, competency, and environmentally responsible behaviors needed to positively impact the socioecological system.

The third manuscript analyzed two academic institutions for relational interactions between biocultural diversity and environmental literacy that led to resiliency practices. In particular, this manuscript studied the subconstructs of these theories that are action oriented, cultural inclusivity and environmentally responsible behaviors. Results revealed themes of events that are important for integrating these theoretical constructs of environmental literacy and biocultural diversity into resiliency practices. These themes were exchange of environmental knowledge that impacted the resiliency practices, refinement of resiliency practices to improve their impacts on socioecological systems,

procurement of funds and resources that aided resiliency practices, and development of external support that contributed to sustaining those practices.

Definitions

Biocultural diversity: the biological, linguistic, and cultural diversity that forms the basis of human life (Maffi & Dilts, 2014).

Environmental literacy: environmental and socioecological systems knowledge that provide the tools and skills necessary to prevent and resolve environmental problems (Hollweg et al., 2011).

Inclusive resiliency practices: the actions and behaviors of groups within an institution that impact socioecological systems through the consideration and involvement of diverse social and cultural groups.

Process tracing and causal mechanisms: the identification of events (causal mechanisms) leading to outcomes of interest (e.g., inclusive resiliency practices) (Bennett & Checkel, 2015).

Socioecological systems: the interconnected and dynamic environmental, social, and economic systems that impact human well-being (Gunderson & Holling, 2002).

CHAPTER 2

BIOCULTURAL DIVERSITY: A CASE STUDY OF ENVIRONMENTAL RESILIENCY PRACTICES IN AN ACADEMIC INSTITUTION

ABSTRACT

The diversity of biological, linguistic, and cultural elements that form the basis of society, known as biocultural diversity, are necessary components for resiliency. In this case study, the manifestations of biocultural experiences are explored to identify their influence on the resiliency practices implemented by an academic institution. Results indicated that manifestations of biocultural experiences impacted the events leading to the inclusive resiliency practices of this case through its application by an environmental actor. In some instances, these manifestations represented integration of diverse experiences resulting in inclusion of biocultural diversity, while other instances were driven solely by the biocultural experiences of the environmental actor. Impacts of manifestations of biocultural experiences on resiliency practices included establishing the practices, refining them, and increasing the practice's ability to persist. These impacts can be useful for managers interested in implementing resiliency practices within their institutions.

INTRODUCTION

Resiliency in environmental science is a system's ability to bounce back from a disturbance (Chapin et al., 2010). These environmental systems consist of three categories of components across the environment, society, and the economy and are known as socioecological systems (Gunderson & Holling, 2002). Within those categories, various aspects have been the focus of studies, including institutions and their

policies; the resiliency and ability of social systems to adapt and transform, and aspects of those systems that are unobservable and influence the system's ability to respond to change in a resilient manner (Anderies et al., 2004; Carpenter et al., 2005; Walker et al., 2004). For example, Maclean and colleagues (2014) state that as part of the society category of socioecological systems, community infrastructure, which encompass academic institutions, are essential because they impact nature.

When people are part of a socioecological system, the ability to recover efficiently includes balancing biodiverse environments with the culture and languages that form them (Hanspach et al., 2020). These societal influences on the socioecological system and vice versa are called biocultural diversity, that is, the interconnected biological, cultural, and linguistic diversity that forms the basis of all human life (Maffi, 2007; Maffi & Dilts, 2014). These influences manifest in various ways including: the types of green spaces created by people, the way these manmade green spaces impact nature, and the resulting activities that stem from those interactions (e.g., gardening, picnicking, and religious rituals).

Supporting environmental resiliency is the responsibility of all people. However, when groups of people work together to develop resiliency practices, they can realize a larger impact from their efforts. An example of a group of people who can coordinate resiliency practices are those who share membership within institutions, such as workplaces. When these organizations implement environmental practices that take biological, cultural, and linguistic differences into consideration, they may impact a system's resiliency through inclusion (Merçon et al., 2019).

Studies have shown that inclusion within an organization's resiliency practices can positively impact on the environment Merçon et al., 2019; Stålhammar & Brink, 2021; Tavanti & Sfeir-Younis, 2013). Inclusive resilient practices within organizations could have an effective impact on creating environmental resiliency yet, the most efficient way to do so remains in debate (Merçon et al., 2019; Stålhammar & Brink, 2021; Tavanti & Sfeir-Younis, 2013). Indeed, when designing environmental resiliency practices, organizations do not often explicitly attend to biocultural diversity. Thus, research is needed to explore the ways that manifestations of biocultural diversity might be integrated with organizational resiliency practices.

This case study is the analysis of the inclusive resiliency practices of an academic institution. Particular attention was given to the historical context and the sequence of events which led to the inclusive resiliency practices in order to analyze the relevant manifestations of biocultural experiences. The case study highlights the influential role of an environmental actor who led resiliency practices within their academic institution. In doing so, this case study is descriptive in its analysis of the manifestations of biocultural experiences in implementing inclusive resiliency practices. The inclusive resiliency practices include man-made green spaces that support interactions between different cultural groups, gaining environmental knowledge, and societal values. These results have implications for other organizations seeking to promote and sustain inclusive, environmental resiliency practices.

BIOCULTURAL DIVERSITY

Biocultural diversity is essential to developing culturally informed responses to change and implementing inclusive, resilient practices (Maffi, 2007; Maffi & Dilts,

2014). Biocultural diversity is a broad concept that is inclusive of all the ways people and culture impact a socioecological system. However, considering the different manifestations of biocultural diversity helps to guide analysis of its impacts on resiliency practices.

Biocultural diversity manifestations include biocultural knowledge, actions, needs, tolerance, attachment, value, and identity (Table 2.1). *Biocultural knowledge* refers to the long-term interactions between culture and gained environmental knowledge that modify nature (Vierikko et al., 2015). *Actions* refers to the activities that are deemed important by different cultural groups and are held in nature (Vierikko et al., 2015). *Needs* refers to the use of nature for religious or cultural practices, and/or physical activity (Vierikko et al., 2015). *Tolerance* refers to different cultural groups interacting in nature and tolerating differences of opinions (Vierikko et al., 2015). *Attachment* refers to the management of natural areas that develop and/or strengthen bonds to nature (Vierikko et al., 2015). *Value* refers to perceptions of what is useful in nature and its impact on the modifications made to natural areas (Vierikko et al., 2015). *Identity* refers to the personality traits that shape a person's perception of nature, therefore their bond to nature (Vierikko et al., 2015).

Table 2.1

Definitions of Prominent Biocultural Diversity Manifestations

Manifestation	Definition	Example(s)
Biocultural knowledge	Gained environmental knowledge that changes nature	Creating a native garden based on lived experiences
Actions	Events inspired by nature	Partnering with an environmental expert to enhance nature. Researching how to enhance natural area
Needs	Use of nature to fulfill social practices	Gardening, using nature to fulfill work requirements, picnicking
Tolerance	Interaction and acceptance between different groups in nature	Socialization, multicultural interactions, and/or social cohesion occurring in an edible garden
Attachment	Management of natural areas that create bonds with nature	Inviting people to harvest produce leading to co-management
Value	Socially defined characteristics of nature	Creation of native gardens, edible gardens, and/or aesthetic gardens
Identity	Personality traits that impact interactions with nature	Positivity and perseverance

Note. Definitions are adapted from "Identifying, Quantifying and Qualifying Biocultural Diversity: Assessment of Biocultural Diversity" by K. Vierikko and colleagues (2015), Green Surge.

Researchers have analyzed biocultural diversity in relation to socioecological systems. Because biocultural diversity and socioecological systems are extensive concepts with many dimensions, previous work has highlighted a variety of aspects, from the type of discourse that surround biocultural diversity (Merçon et al., 2019) to the relative importance of aspects of biocultural diversity on socioecological systems (Winter et al., 2018) and avoiding narrow views of the ways biocultural diversity manifests in socioecological systems (Stålhammar & Brink, 2020). These studies identify the subtle distinctions that emerge from biocultural diversity and the context in which it is bound.

Merçon and colleagues (2019) studied the context of intergovernmental organizations who hope to improve responses to environmental changes. They completed an in-depth review of the history of biocultural diversity and the rapid losses it is facing. In their paper, they note how the biocultural diversity paradigm has been integrated by intergovernmental organizations, in part because of the connections the paradigm makes between human well-being, nature, and sustainability efforts. In particular, the paradigm's cultural aspects, could "imply a greater contribution to sustainability, from local to global scales" (Merçon et al., 2019, p.4) by producing appropriate knowledge, sustainability practices, and policies by different individuals. Therefore, four major discourses of biocultural diversity are used in sustainability. These include social-ecological systems and sustainability science; anthropology and ethnobiology; indigenous rights movements and political ecology; and intergovernmental bodies. With respect to the focus of this study on manifestations of

biocultural diversity, this work identified the sustainability discourses within which the various types of manifestations would likely occur.

Winter and colleagues (2018) focused less on the context where discourse occurred regarding biocultural diversity and took a narrower focus to analyze the impact of different aspects of biocultural diversity. They employed quantitative approaches to identify and measure keystone elements that are irreplaceable components of biocultural diversity. They also identified redundant elements that could be removed without hurting a system. In this work, the authors argue that manifestations of biocultural diversity that are lost can diminish resiliency of a system, but they also may not have a large impact. This result has implications for the analysis of manifestations of biocultural diversity in resiliency practices in academic institutions. It is expected that some manifestations identified within this study will be essential for creating, maintaining, and improving inclusive resiliency practices while others may be present but not play a major role in the practice.

Although some biocultural diversity manifestations may be keystone elements, Stålhammar and Brink (2020) warn against taking too narrow of a focus on specific aspects of biocultural diversity. They explored the manifestations of biocultural diversity in urban centers. They argued that narrow views of biocultural diversity that focus on what nature provides for society miss out on the complexity and diversity of biocultural diversity manifestations. They suggest using the manifestations listed in Table 2.1 to ensure that the nuances of biocultural diversity are included in the story.

This previous literature is relevant to the present study. First, to consider biocultural experiences, it is important to explore the many manifestations of its diversity.

This will ensure a nuanced understanding of its impact. However, it is reasonable to expect some of these aspects will have large impacts on what happens in the system (i.e., development of resiliency practices) while others may not. Finally, it is expected that the findings of this research will have implications across the different contextual discourses that implement the concept of biocultural diversity in sustainability.

METHODS

This study was one case of two that were collected as part of a comparative case study analysis (Yazan, 2015). An academic institution was the unit of analysis. An initial informant was identified through a local environmental group and secondary informants were identified after an initial interview. Data were collected through interviews and artifacts. Interviews, coding, and process tracing were applied as qualitative approaches to understand how the manifestations of biocultural diversity impacted resiliency practices. Data included details on resiliency practices, manifestations of biocultural diversity (Vierikko et al., 2015), and environmental impacts. This study was approved by the academic institution's Research Review Committee and the university's Institutional Review Board. The focus of the present analysis is one case (the Redlands School), its resiliency practices, and an environmental actor whose integration of biocultural experiences led to the continued existence of the practices.

The academic institution, the Redlands School, was an elementary school that had earned awards from a local non-profit for their resiliency practices. These awards indicated a "positive-positive" case (Beach & Pedersen, 2018) by highlighting that the Redlands School had implemented and been recognized for resiliency projects. Being a "positive-positive" case means that the case had the variable of interest (manifestations of

biocultural diversity) and outcomes (resilient practices) necessary for the development of causal explanations between the cause and the outcome.

Four questions guided this case study:

- What was the historical context of the school's resiliency practices?
- What sequence of events led to the implementation of the organization's resiliency practices?
- What role did biocultural experience and/or biocultural diversity play in the process of developing and sustaining the resiliency practices?
- What aspects of socioecological systems were integrated by the environmental actor?

This first question explored the conditions where the resiliency efforts took place. The second question addressed the role of biocultural experience and biocultural diversity in realizing these practices. A distinction is made between *biocultural diversity*, the collection of peoples' experiences according to their interactions with the biological, cultural, and linguistic features of a system, and *biocultural experiences* which are these same types of experiences only they are attributed to a single individual. The third question examined how manifestations of biocultural experiences and diversity influenced the resiliency practices. The fourth question considered how the socioecological system, among its many dimensions, was present within the case. For this report, the first three case study-level questions were focused on analyzing the sequence of events that led to a specific resiliency practice of a garden and the actions of an environmental actor who led this practice. The final question refers to aspects of the

socioecological system that were engaged by the environmental actor throughout her time at the school.

The garden was divided into two areas. One functioned as an organic edible garden, and the other housed native plants. These practices were chosen as the focus of this analysis because they were managed by the organization and ongoing (as opposed to one-time events, such as beach clean-ups). Other resiliency practices occurred but did not take place entirely within the organization and/or occurred annually rather than daily. Two phases of data collection and analysis took place: preliminary and comprehensive analysis.

Phase 1 Preliminary Analysis

The preliminary analysis included an initial interview with the key informant (who was identified through analysis as the main environmental actor) and coding with the theoretical framework of biocultural diversity. The interview consisted of open-ended questions about the resiliency practices at the organization, manifestations of biocultural diversity, and contact information for secondary informants. For example, questions such as "would you be able to share some of the challenges that have been faced while implementing those practices?" provided details on the process of accomplishing resiliency practices at the organization.

Photographs of the resilient practices, student work, and publicly available documents (e.g., newspaper articles) were collected as artifacts. These artifacts were used to triangulate data. Triangulating data helped researchers confirm that the collected data were reliable (Leuffen, et al., 2013). The process of triangulation included comparing the participant's interview with the artifacts to confirm consistency and verify details. In

doing so, the researchers confirmed consistency about the school's historical context, the implemented resiliency practices in the school, the events leading to those practices, and the collaborators helping fulfill those practices. Once consistency was confirmed, the researchers practiced reflexivity. This was done by noting instances of emotional attachment that arose from reading the narrative. Reflexivity allowed for the disclosure of assumptions, beliefs, and bias (Watt, 2007)**.** For example, at one point the participant mentioned an interaction that occurred in the school's organic edible garden. This led the researcher to remember a similar occurrence that was mentioned in the other case that makes up the larger research project. This made the researcher feel intrigued. Pausing to note this emotion and ensure it did not affect the researcher's interpretation of data reduces researcher bias. This reflexivity process was practiced throughout all phases of analysis.

Interviews were analyzed using deductive coding. Coding for this analysis was based on the manifestations of biocultural diversity. The operationalized definitions for these codes were based on the work of Vierikko and colleagues (2015). Phrases were then identified in the narrative that aligned with the definitions in the codebook and coded. This process was used to develop in-depth questions for follow-up interviews. To provide details into the manifestations of biocultural diversity, the questions developed allowed participants to elaborate parts of their narrative that included the relevant codes. For example, in the case of tolerance (interaction and tolerance between groups), it would be useful to know about the specific instances of tolerance and which groups were involved. Questions such as "who participated in these practices?" and "how were those people

involved?" allowed researchers to analyze for notions such as "tolerance" without creating questions that were leading.

Phase 2 Comprehensive Analysis

The comprehensive analysis involved conducting follow-up interviews, process tracing, a second round of deductive coding, along with ensuring reliability and credibility of the work that was guided by Creswell and Miller (2000). Defining causal mechanisms through process tracing provides insight into how changes occur in groups or organizations (Beach, 2017; Beach & Pedersen, 2013; Bennett & Checkel, 2015; Collier, 2011; Falleti, 2006; Lorentzen et al., 2017; Ricks & Liu, 2018).

Revealing how resiliency practices were developed can be done by analyzing causal mechanisms, the linking of causes and outcomes through process tracing. These causal mechanisms articulate the interconnected structures that affect individual behavior, lead to social phenomena, and drive organizational practices (Voltolini & Eising, 2017).

Process tracing includes three main steps: identifying outcomes of interest, unveiling related events and historical context, and employing a theoretical concept to explain causes that have led to the outcome of interest (Beach, 2017). Once an outcome of interest is noted in the narrative, in this case a garden, the events and historical contexts surrounding the development of the garden are analyzed. Analyzing these events and historical context aids in identifying potential causes leading to the outcome. After potential causes are identified, hypotheses can be formed regarding what cause is linked to an outcome by comparing the identified causes with relevant theoretical concepts (Bennett & Checkel, 2015). Recommendations can then be developed based on identified causal explanations to inform transferability of findings, in this case, how other

organizations incorporate inclusive resiliency practices. For clarity, relevant causal mechanisms that led to the implementation of the gardens will be referred to as the sequences of events.

After causal mechanisms were identified, deductive coding was once again applied to the sequence of events with the same codebook to provide details into the role of biocultural experiences and diversity in the events leading to the implementation of, and the maintenance of the resiliency practices. For example, there was an event that included the destruction of native plants. To stop this destruction, the environmental actor placed tags on the plants to help identify them. The codebook was used to identify the potential cause of these two events, according to the manifestations of biocultural diversity.

After the preliminary and comprehensive phases were conducted, narratives of the events that led to the resiliency practices were written. Narratives were then shared with the participants in order to conduct member checking (Candela, 2019). Member checking confirmed credibility by allowing the data and interpretations to be verified by the participants. Peer debriefing (Patton, 2015) was conducted once the participants confirmed the credibility of the researchers' interpretations. During peer debriefing, exemplary quotes and their codes with the codebook definitions were reviewed with two research members. One of the two researchers was an independent, qualified researcher. This was done to refine and clarify the operationalized codebook and the interpretation of the quotes.

Axial coding was then applied (Saldana, 2016). This involved describing the aspects of socioecological systems that were integrated through instances of biocultural experiences of an individual or biocultural diversity across multiple people. Following

this process, the emerging themes were then discussed among the researchers to refine the categories of sociological aspects (Saldana, 2016). The results of axial coding were the aspects of socioecological systems that were integrated in the practice.

Quotes were edited for clarity by removing noises, side stories, etc. Here is an example of the type of edits that were made to the quotes:

> "And from that I have many, many examples over the years where our parents and our children who are now some of them in college, some of my former students are parents and they've come back and said... Or even two years ago, whatever it was, they've come back and shared, Do you remember when you talked to us about this? Or I remember when, or we weren't doing recycling where I worked and so we started it." We get that all the time."

This is how it would be edited:

> "And from that I have many, many examples over the years where our parents and our children who are now some of them in college, some of my former students are parents and they've come back and.., shared, 'Do you remember when you talked to us about this?'"

RESULTS

Context

Environmental actor, Penny

Penny was a 2nd grade teacher at the Redlands School. She led the environmental efforts and resiliency practices at the school. This included leading the school's implementation of pilot programs for banning plastics, participating in green conferences, and creating environmental learning opportunities for teachers, students, and parents. She

fulfilled these efforts by collaborating with colleagues, non-profit organizations, and other schools. She grew up in Europe in a military family, leading her to embrace many worldviews and develop a curiosity about nature, environmental issues and how humans impact them. Penny was identified as an environmental actor based on the details she shared about herself. These details highlighted her passion for nature, her concern for the well-being of people, and her interest in nurturing that passion and concern in others.

Redlands School

The Redlands school is in a city within South Florida. As a suburb of a larger city and agricultural area, the city commits to the environment by emphasizing the prevention of littering, planting native plants, and recycling. The city's proximity to two major national parks and its low elevation places the Redlands school in a diverse environmental location.

The Redlands school started as a small elementary school primarily serving the families of a nearby military base. It was one of the first schools to desegregate in South Florida. After Hurricane Andrew, a category 5 hurricane that devastated the area in 1992, the school was scheduled to close due to extensive damage. Instead, it was re-envisioned as a magnet school. As a magnet school, it emphasized cultural inclusivity and an international education theme.

Numerous opportunities to learn about environmental resiliency were created at the school. These opportunities came from partnerships fostered with local environmental organizations. Eleven years prior to the interview, Penny collaborated with a local historic site that provided environmental education through a program developed to nurture environmental stewards. It provided students with environmentally based

presentations, lessons, and field trips to the historic site for hands-on experiences. Another partner was a South Florida based non-profit organization that sought to empower students to be leaders against climate change and positively impact environmental challenges. They work toward accomplishing this by helping schools reduce their environmental footprint. Finally, various environmental experiences at the Redlands School are supported by a local public university. Environmental experiences supported by this university include fundraising to purchase water pumps and provide water education for an African village, field trips to gardens, and the opportunity for students to present at a Recycling Energy Forum.

These partnerships have all come together to earn Redlands School various awards including the United States Department of Education Green Ribbon School Award, Florida Green School Award, and awards from the Green Education Foundation, and other local environmental organizations. These aspects also aided in the acquisitions of external funding to support their resiliency practices. In particular, two gardens that became staples within the school.

Sequence of Events and Biocultural Manifestations

Events pertaining to the development of the school's gardens provide insight into how these resiliency practices began and continued. Penny, the environmental actor, integrated seven biocultural manifestations that were related to the resiliency practices. This included biocultural knowledge, actions, needs, tolerance, attachment, value, and identity manifestations. The roles played by Penny's integration of her biocultural experience and biocultural diversity in the sequence of events (Table 2.2) are described below. Three roles were noted: establishment, refinement, and persistence. Establishment

refers to a practice starting. Refinement refers to actions taken to improve an existing practice. Persistence refers to events that aided in the continuation of a practice. These roles are the ways that the environmental actor's biocultural experience and integration of biocultural diversity contributed to the development of the resiliency practices.

Table 2.2

Biocultural Experience and Biocultural Diversity Impacts on Sequence of Event

Sequence of Events	Manifestations of Biocultural Experience (& Diversity)	Role	Outcomes
1. Permission to create garden requested	Biocultural knowledge	Establishment	Outdoor classroom created (garden)
2. Garden expanded	Identity	Refinement	Butterfly, wildflower, and sensory garden developed
3. Research on native plants conducted	Actions	Refinement	Native plants added to school campus
4. Funds and donations obtained to purchase plants	Biocultural knowledge & Action	Establishment	Native garden developed
5. Environmental expert contacted	Value (Diversity)	Refinement	Native plants to support native species planted
6. Additional donations acquired	Actions (Diversity)	Establishment	Two garden boxes built
7. Agricultural experts contacted	Biocultural knowledge & Needs (Diversity)	Refinement	Organic gardens developed

Sequence of Events	Manifestations of Biocultural Experience (& Diversity)	Role	Outcomes
8. Produced and shared harvest	Biocultural knowledge, Action, Needs, Tolerance, & Attachment (Diversity)	Persistence	Bonds with nature nurtured

Native Gardens

With a campus full of green grass, Penny was inspired to ask the principal at the Redlands School if they could start a garden (Event 1). This garden started as a single outdoor classroom (garden) that was expanded to include a butterfly, wildflower, and sensory garden (Event 2). This led Penny to research plants that could be used to house and feed native butterflies and birds (Event 3). Native plants and trees were then installed throughout the school campus in an effort to restore native ecosystems. She obtained funds through fundraising, grants, and donations and used them to purchase the flowers needed to fulfill this goal (Event 4). This included: Milkweed, Wild Buttonwood Sage, Coontie, Firebush, Penta, Corky-stemmed Passionflower, Pineland Croton, Lantana, Blue Porterweed, Golden Dewdrop, Wild Lime, Spanish Needle, American Beautyberry, Frog Fruit, Bloodberry, Jatropha, Rouge Plant, Necklace Pod, Desert Senna, Christmas Senna, Sweet Almond, and Tickseed.

The role of Penny's biocultural experience in these events became evident when Penny explained the process that occurred to sustain the garden. First, she shared how her cultural heritage was the source of her biocultural knowledge and led her to pursue the native garden in the way that she did. As mentioned in the previous section, Penny grew

up in Europe which nurtured her interest in nature. She was part of a military family that allowed her to see different social and cultural ideologies including how people in different places interacted with nature. She described this experience as, "when we came here to the United States, I was kind of comparing the different countries. I think [it] kind of sparked my interest to why are things so different in some places than others?" This biocultural knowledge led her to see a "green canvas" that was capable of housing different gardens. After gaining permission from the principal, the garden was established (Event 1 & 2).

Penny's biocultural experience was manifested as *action* when Penny researched, obtained, and planted native plants in the school campus (Event 3) and highlighted how nature was a driving force that led to planting the gardens. As part of Penny's desire to create a wilder, more interesting ecosystem she took her actions a step further. She found an environmental expert on South Florida native plants and animals. This researcher focused on a particular butterfly, the Atala. Penny integrated the biocultural experience of the expert to refine (Event 4 & 5) a green space so that it would serve as a habitat for this species. Penny said:

> "the Atala has a great Florida history…I found out about the Florida connection to the history of our United States and what happened to this animal and the plant and as a result of the cause and effect relationship to the animal, to the butterfly. And so I researched, what do I need, how do we need to do it, got the resources."

This *value* manifestation of biocultural diversity highlights Penny's integration of the expert's biocultural experiences to discover the connection between the coontie plant and

it being a historical species leading to her use of it in the school's garden. Implementing this garden came with challenges. For example, Penny said:

> "I had some people on staff, they weren't buying this wildflower garden stuff. They wanted to trim little green rectangular bushes that to me are not green. They're just green boxes. And they thought that was the fun, and that's not. So, I'd been working trying to push this snowball uphill for quite a while."

In this example, contrasting perceptions of *value* emerged. Penny's biocultural experience led her to view native plants as important, while her colleagues' biocultural experience led them to prefer manicured gardens. Although Penny was open to different perspectives, she recognized that a wilder garden would be beneficial for resiliency rather than "little green rectangular bushes". In this instance, *value* of manicured lawns had the potential to be harmful to the socioecological system. While these events aided in the implementation of the native gardens, others aided in sustaining it.

Penny's manifestation of *identity* from her biocultural experiences helped move the school forth with developing gardens that resembled natural environments and prevented them from becoming manicured. Her previously described childhood experiences led her to embrace multiple worldviews that understood the relationship between nature, people, and how people impact it. This identity nurtured a close bond with nature. As she stated in another instance, "it takes a lot of perseverance, it takes a lot of positivity. It takes a lot of just the passion of realizing the importance of reaching the children, of reaching the adults." This passion and persistence manifested through her identity and motivated her to create and sustain the native gardens.

In relation to the native garden, Penny's biocultural experience manifested as biocultural knowledge (green canvas potential), identity (multicultural lived experience impact on perceptions of nature's purpose), actions (research and expansion of the garden to be beneficial for the socioecological system), and value (creating wild spaces). In addition, Penny integrated biocultural diversity into the realization of the garden by seeking input from ecological experts (value). However, she also chose not to integrate the biocultural experiences of some school members who valued manicured green spaces because it would have reduced the garden's role as a resiliency practice. Not only were these biocultural manifestations present, but they also provided an explanation for the sequence of events that led to implementing and sustaining the garden.

Organic Gardens

After obtaining donations to create two garden boxes for organic gardens (Event 6), Penny contacted a company that taught her and others how and what to plant (Event 7). Throughout the years, expansion of the organic garden boxes led to individual classroom gardens. Organic foods grown included parsley, tomatoes, lettuce, broccoli, green beans, cabbage, pineapple, rosemary, green onion, thyme, chives, carrots, and stevia. These foods were harvested by students at the school and shared with their families (Event 8). Older students collected and gave produce to younger students. The produce was also used in the cafeteria to feed students and the staff.

For example, Penny's students collected berries from the garden to share with the cooks in the cafeteria. The cooks then used a recipe Penny found to make Beautyberry jam for several classes. Parents were invited to interact with the organic gardens. They

harvested foods and shared recipes from their countries. Penny described these types of interactions as:

> "I would have parents [that thought] 'Oh, you have this Rosemary, we use this in wherever.' And they would say it in their language. And they [would say], 'well, you do this and this and this.' So they were standing there over the garden, sharing recipes from different countries. And that was just like, oh my gosh, this is awesome. So we talked about having a recipe exchange kind of a thing and it is an idea that also meets our magnet criteria"

In this example, the first instance of biocultural experience manifested as the individual *action* of identifying experts (Event 6). Next, biocultural diversity was manifested as a shared *need* to develop a garden as a social practice and was enabled by experts (Event 7). In addition, *biocultural knowledge* was manifested through Penny's knowledge of how to successfully maintain a garden that provided a harvest (Events 7 and 8). The sharing of recipes indicated cultural heritage. The social event of exchanging recipes was hosted by Penny, which highlighted how biocultural diversity was manifested by different groups' *actions* and *needs* (Event 8). Inviting parents to share their diverse cultural backgrounds with each other emphasized *tolerance* (Event 8). In addition, another feature of implementing this practice was that the recipe exchange helped fulfill the school's requirements as a magnet program. These interactions also motivated students and staff to participate in maintaining the garden by harvesting produce from it. Penny said, "when I realized how receptive our parents were to donating and interested our students and staff were to participate, the gardens grew -expanding after beginning about thirteen years ago". This process helped Penny manage the garden while also

strengthening bonds to the garden which note *attachment* by various groups (Event 8). Biocultural diversity within the realization of the garden is evident in the variety of ways that different groups interact with it.

In relation to the organic garden, Penny's biocultural experience manifested as action (identifying experts and recipe sharing). Biocultural diversity from multiple groups and people were manifested as need (building a garden to provide food to different groups), biocultural knowledge (harvesting of foods for different purposes), and tolerance (the exchange of recipes). These manifestations are the answer to the second research question, "What role did biocultural experiences and/or biocultural diversity play in the process of developing and sustaining the resiliency practices?" These manifestations led to the establishment, refinement, and persistence of the implemented resiliency practices.

The manifestations of biocultural experience of the environmental actor and biocultural diversity of different groups who connected with the garden impacted these practices amidst a global pandemic. Penny said:

> "So for us, for this year, and for so many other schools… the priority is obviously the personal health and safety of everybody at the school and at home. And so it's almost like our lives have now taken on a snail's pace. And so all of the things that were on our list, really the priority is it's down here [signals with hands] now and rightly so. And so how do we continue this?"

Answering her own question, she shared how their timeline for completing other practices like "green pledges" occurred later than usual. More importantly, Penny shared how her absence from the school's campus did not bring the practices to an end. She said, "some people are continuing with their version of these things and it might not be to the

depth that I would like it to be, but right now, that's all I can do." While Penny felt that the practices were not being done how she would have preferred, this highlights how the manifestations of her biocultural experience and the integration of biocultural diversity influenced the practices even without her presence at the school.

Aspects of Socioecological Systems

The fourth research question investigated aspects of socioecological system that were integrated by the environmental actor. Several aspects of socioecological system emerged. In particular, Penny emphasized five aspects of socioecological systems (Table 2.3) notions of self, others, organisms, technology, and pedagogy. Self describes moments where the individual directly served as part of the solution for an environmental issue and/or resiliency practice rather than delegating those responsibilities. Others refers to instances when the Penny included students, parents, administration, and/or outside partners like environmental experts in addressing environmental issues and implementing resiliency practices. Nature describes the use of plants, animals, and/or other life forms in helping resolve an environmental issue and/or implement a resiliency practice. Technology refers to the use of modern tools such as computers to create electronic presentations that share pictures, books, or the news regarding environmental problems and/or resiliency practices. Pedagogy describes the application of methods and practices of teaching to mitigate environmental problems and/or impact environmental resiliency practices. For example, interdisciplinary approaches cover topics across various schools of thought.

Table 2.3

Definitions of Socioecological Aspects

Aspect	Definition	Examples
Self	Environmental actor directly impacts nature.	Leading by example; gardening, obtaining resources
Others	Main environmental actor includes others in impacting nature.	Involvement of students, parents, staff, and/or environmental experts.
Nature	Environmental actor involves and/or includes living organisms to impact nature.	Incorporation of plants and animals.
Technology	Environmental actor uses technology to impact nature.	Electronic presentations depicting water pollution.
Pedagogy	Applying method and practice of teaching to impact nature.	Teaching across various topics.

Penny integrated herself as an aspect of the socioecological system involved in the resiliency practice. She acknowledged that everyone has different interests and needs space and time to focus on those interests. Penny's actions based on her own environmental interests encouraged others to also take interest in the garden. In this way**,** while working on the garden, Penny was challenged to address divergent priorities among others. However, she also used her own interests (manifestations as value and identity) to help spark similar interests in others. Penny shared a story about how she strived to engage people by leading by example through her direct work with nature. She said, "while I might present to you something on one environmental issue, you might be interested in another, and that's fine. You take on what you care about." Penny said that sharing her efforts with others helped them develop environmental consciousness. In

doing so, this would bring them back to help resolve the environmental issues she was focused on. Penny's "self" aspects of the socioecological system were integrated into the resiliency practice and contributed to its success through leading by example to excite similar behaviors in others.

The aspect of others also emerged. Penny involved students, staff, parents, and people from outside of the school to help with her resiliency efforts. The way she involved them stood out. She said, "Well, the idea is that when you present issues to children and you guide them to seeking solutions, they take that ownership". This is an example of how Penny nurtured manifestations of biocultural experiences like attachment in others. When describing how students took ownership in resolving environmental issues, she shared how they "become engaged and they want to act" leading them to manifest actions that helped resolve environmental issues, even outside of the school. For example, they would influence their family by involving them in solutions like reducing water waste by taking 5-minute showers. Penny shared how helping children take ownership of environmental issues changes the habits of adults. She said, "It takes maybe a little bit longer, maybe a little bit more convincing, but when they hear it from a child, the adults take on a new way of perceiving, a new way of taking it in whereas if I'm telling you one-to-one like this, it might not have the same impact." She said this happens because "as parents and grandparents, we know that if our child or children are interested in something, we're going to have a new perspective, a new willingness if you want to be part of what is important to them." The process of having children share their ideas and interest in nature brings in people to participate in addressing environmental concerns.

Nature was noted as another aspect of socioecological systems integrated through the gardens. Penny made sure to plant three to four thousand types of plants to, “make the ecosystems something a little more wild and interesting to the children and particularly the staff” (value and action). She was also interested in ensuring that these practices were “more impactful” and connected to Florida’s history (value), therefore highlighting how manifestations of action, and value were integrated into the system.

Technology is an aspect of socioecological systems that were also integrated through Penny’s manifestations of biocultural experience, such as tolerance. Technology can be considered part of a socioecological system because it is intertwined in the social aspects that influence our communication and management of knowledge systems. Using electronic presentations, Penny taught students about different environmental problems like water pollution and the negative impacts it has on people. In these presentations, she included sources such as pictures, books, or the news that highlighted diverse groups of people, places, and the environmental issues they face. Penny then connected these depictions to local environmental issues. She said, “there [are] visual images that we remember. There are things that we have done or seen somebody else do that are impactful. And those things stay with us more in the long-term memory.” This statement not only clarifies how Penny used technology to nurture tolerance, but leads us to our next aspect, pedagogy.

Pedagogy emerged as an aspect of socioecological systems integrated through the manifestation of identity and attachment. Penny said she taught at “an interdisciplinary level” because “to teach these things in isolation, it doesn't work as well.” This practice of teaching is an aspect of socioecological systems that creates in-depth knowledge of

concepts such as those of environmental problems. As Penny said, “the idea of interdisciplinary means that it's more meaningful and you're teaching more than one solitary skill or one solitary subject”. When a subject is more meaningful and you are teaching various skills, it helps with, “coming up with solutions and being innovative” which is necessary when it comes to resolving the complex environmental problems being faced and how they can be impacted from within an organization and socioecological system like a school.

DISCUSSION AND CONCLUSION

Environmental actors who incorporate the manifestations of biocultural experience and biocultural diversity that support environmental resiliency impact the institutions by establishing, refining, and creating experiences of inclusive environmental resiliency practices. In this case, inclusion was embedded into the resiliency practices through the environmental actor’s biocultural experience and actions. The environmental actor invited people from different social and cultural groups to interact and engage with the practices. In doing so, this embedded biocultural diversity by integrating diverse perspectives and forms of knowledge and helped develop resiliency practices which were valued by many groups of people. When this occurs not only do resiliency practices become inclusive, but they are also more likely to be continued when the environmental actor no longer leads the implementation of the practices.

It is necessary to remember that biocultural diversity manifests across socioecological systems and its features. Environmental actors should consider how a variety of these sources can be connected with resiliency practices. A danger of a too narrow focus may result in missing manifestations that are “keystone” features of the

socioecological system (Winter et al., 2018). For example, in this study the environmental actor favored native gardens over ornamental gardens that were preferred by a group of teachers. While the native gardens better served the environmental resiliency of the socioecological system, dismissing the biocultural perspective of the teachers interested in ornamental gardens took away from the practice's inclusivity. In contrast, engaging in biocultural diversity across the sources of biocultural perspectives and experiences increases the likelihood of positive impacts on resiliency practices by including various parts of the socioecological system. Rather than moving forth without ornamental gardens, the environmental actor and the teachers could have worked together toward a common goal that included both perspectives and/or combined them. Therefore, increasing the inclusivity and resiliency of the practice by integrating diversity.

The environmental actor in this case had a broad range of experiences that stemmed from her childhood. Penny grew up with global perspectives. This may not always be the case within other organizations and likewise, may not be a necessary feature an individual must have. Instead, organizations could identify environmental actors that have connections with the socioecological system in which the institution resides. They could also train environmental actors to identify manifestations of biocultural diversity to incorporate into resiliency practices. If professional development is not an option, leadership could invite someone from outside of the organization to serve as the environmental actor. These external partners should have direct ties and history with the socioecological system in order to implement resiliency practices that are inclusive.

The findings of this study are transferable to different discourses of sustainability to develop environmental actors across contexts (Merçon et al., 2019). Transferability is a key feature of qualitative work that allows for broader application of results (Patton, 2015). The purpose of the first research questions in this study was to provide enough detail for readers to consider how these findings might apply to their context. For example, consider the context of an intergovernmental organization. It is possible that the environmental actors in this type of institution may already know how to identify the manifestations of biocultural diversity due to the context of their employment or from their own biocultural experiences. In this setting, the environmental actors could incorporate the use of technology to influence the socioecological system by teaching others how to identify biocultural diversity and nurture tolerance in the process.

CHAPTER 3

ORGANIZATIONAL RESILIENCY PRACTICES: THE CASE OF THE ENVIRONMENTAL ACTORS OF AN ACADEMIC INSTITUTION

ABSTRACT

Environmental literacy provides the skills necessary to address environmental problems that impact resiliency. In this case study, dimensions of environmental literacy that were applied by two environmental actors in the implementation of resiliency practices within an academic institution are examined. Results highlighted how knowledge of Earth systems, management of natural resources, identification of multiple solutions to environmental problems, persuasion of others to partake in resolving environmental issues, and obtaining financial support aided in implementing and sustaining the resiliency practices held within this institution. Results from this study highlight the types of environmental literacy that should be integrated into professional development to nurture environmental actors within organizations.

INTRODUCTION

Organizations and the individuals that form them play a key role in mitigating environmental issues (Farooq et. al, 2021; Soderstrom & Heinze, 2019). Leaders of organizations have been seeking to become environmentally resilient (Ones & Dilchert, 2012; Schneider & Clauß, 2020), and many have made efforts to mitigate environmental issues by reducing greenhouse gas emissions, developing renewable energy applications, and reducing waste (Soderstrom & Heinze, 2019). While these are some of the more common practices enacted within organizations, they do not always encompass the entirety of what it means to be environmentally resilient. To be environmentally resilient,

organizational practices need to address the social and environmental components of resiliency alongside economic components (Ones & Dilchert, 2012; Schneider & Clauß, 2020; Soderstrom & Heinze, 2019). Social, environmental, and economic components of resiliency are part of a large, complex, and intertwined system (McKay et al., 2017). These systems, known as socioecological systems, depend on incorporating the social, environmental, and economic components that form them in order to optimize resiliency (Folke et al., 2016; Gunderson & Holling, 2002).

Studies have shown that organizational support aids in the implementation of environmentally resilient practices, that individual employees are necessary for the success of those practices, and that the individual's environmental behaviors also impact the success of those practices (Cantor et al., 2012; Cugueró-Escofet et al., 2019; Farooq et al., 2021; Lamm et al., 2015; Ramus 2001; Paillé et al., 2020). Leaders of organizations, who hope to implement optimized resiliency practices, need to identify members who have knowledge of socioecological complexities and are willing to lead and sustain organizational practices that aid in the prevention, reduction, or resolution of environmental problems (Soderstrom & Heinze, 2019). Suggestions for supporting those individuals through professional development have been proposed (Farooq et al., 2021; Ficapal-Cusí et al., 2020; Lamm et al., 2015) yet, the context of what professional development should include remains vague. For example, Lamm and colleagues (2015) state that it is possible for leadership to provide additional support for resiliency efforts by incorporating training and communications, but they do not address what type of knowledge the training and communications should include.

Studying individuals that have led and sustained resiliency practices within an organization can provide details about the type of professional development that would support resiliency efforts. For this study, the individuals who fulfill these practices in organizations are called environmental actors. Environmental actors have the ability to help organizations incorporate environmental, social, and economic components of resiliency that are necessary to mitigate environmental issues. Specifically, understanding an individual's environmental literacy will identify in what ways this knowledge and skill should be incorporated in the professional development provided. Environmental literacy refers to expertise related to the environmental, social, and economic components of socioecological systems. The domains of environmental literacy include knowledge, competencies, disposition, context, and environmentally responsible behaviors (Hollweg et al., 2011; McBride et al., 2013).

Understanding how environmental actors apply environmental literacy within an organization to promote and sustain environmentally resilient practices could help incorporate environmental, social, and economic aspects of resiliency. Ensuring that all these aspects of resiliency are incorporated into practices mitigates issues that arise from excluding them. For example, ignoring social aspects of resiliency while only addressing environmental and economic ones can negatively impact surrounding communities. These communities are typically made up of people from underrepresented groups and are left to deal with disproportionate, negative impacts such as increases in health problems including asthma and cancer (Gochfeld & Burger, 2011; Tessum et al., 2019). Ensuring the incorporation of all aspects of resiliency, environmental, social, and economic, addresses these problems.

Organizations of all types can contribute to protecting socioecological systems, from government agencies to non-profit organizations. Academic institutions are a type of organization (Bidwell, 2001; Corwin, 1975) and impact their natural surroundings. As Folke and colleagues (2010) state that society needs to find ways to nurture the resilience of manageable socioecological systems and add to environmental resiliency while considering how we create environmental issues through our disruption of socioecological systems. Academic institutions and their local communities are manageable socioecological systems (Allen & Vella-Brodrick, 2016; John-Akinola & Gabhainn, 2015) and have the potential to provide guidance on how to address this call to action made by Folke and colleagues (2010). They are also likely to have environmental actors that hold environmental literacy due to their educational backgrounds and may apply that knowledge outside of their classrooms to address organizational needs in a way that is transferable to other organizational types.

This study investigated the role of environmental literacy in the efforts made by environmental actors that led and sustained resiliency practices within an academic institution. The sequence of events leading to resiliency practices were also identified. Identifying events provided insight into the conditions that led to specific outcomes (resiliency practices). In doing so, this study has implications for how environmental literacy can be applied by other organizations seeking to promote and sustain environmentally resilient practices.

ENVIRONMENTAL LITERACY

Environmental literacy incorporates awareness and concerns regarding environmental problems as well as the tools needed to address them (McBeth & Volk,

2010; McBride et al., 2013). These tools integrate knowledge of environmental, social, and economic concepts through the application of the domains of environmental literacy: knowledge, competencies, disposition, context, and environmentally responsible behaviors (Table 3.1).

In environmental literacy knowledge consists of concepts that are applied to respond to environmental problems. This includes knowledge of Earth systems, environmental problems, their solutions, actions to obtain those solutions as well as knowledge of social, cultural, and political systems (Hollweg et al., 2011). Competencies refers to the skills needed to consistently address environmental problems by applying knowledge. This can be noted by properly judging information regarding environmental problems and identifying the proper resources to resolve those problems (Hollweg et al., 2011). Dispositions are an individual's attitude or emotion toward the environment. These dispositions impact individuals' ability to recognize and become involved in solving environmental problems (Hollweg et al., 2011). Context is knowledge of the circumstances surrounding events that occur, either human or naturally caused that disturb nature and lead to environmental problems. Environmentally responsible behaviors bring together and express the knowledge, dispositions, and competencies that impact environmental problems within a context. Environmentally responsible behaviors support learning and the development of new behaviors. These domains cover the environmental, social, and economic systems of socioecological systems.

Table 3.1

Definitions of Environmental Literacy Domains

Domain	Definition	Examples
Knowledge	Earth systems, environmental problems, their solutions	Understanding feedback loops within Earth systems
Competencies	Skills needed to solve environmental issues	The application of knowledge to resolve an environmental issue
Dispositions	Attitude or emotion toward environment	Appreciation of nature
Context	Circumstances surrounding environmental problems	Storm damage causes flooding
Environmentally Responsible Behaviors	Expression of environmental literacy outcomes in form of behaviors	Picking up litter

Note. Definitions adapted from "Developing a framework for assessing environmental literacy" by K.S Hollweg and colleagues, 2011, Washington, DC: North American Association for Environmental Education, 122.

Environmental literacy also includes subdivisions of domains into components for details, see Hollweg et al. (2011). In this study, these domains and their associated components were used as a lens for analysis of the process of implementing and sustaining organizational resiliency practices. However, not every component and domain were prominent in the results. Instead, four components of environmentally responsible behavior and one component of knowledge were particularly important for interpreting the data. They included persuasion, ecomanagement, problem solving, and financial action within the domain of environmentally responsible behavior and Earth systems knowledge within the domain of knowledge (Table 3.2).

Ecomanagement is the way a person interacts with the physical environment through environmental restoration projects. These projects encompass environmental aspects of socioecological systems. Ecomanagement is an aspect of the environmentally responsible behaviors domain. In the process of conducting restoration projects, an individual needs the ability to apply Earth systems knowledge. Earth systems knowledge is an aspect of the knowledge domain. It is relevant ecological knowledge that includes human dimensions, such as how to address conflicts that arise from access to resources. This knowledge encompasses social and environmental aspects of socioecological systems. In many cases these efforts may fall short if financial action is not taken. Financial action is another aspect of the environmentally responsible behaviors domain. Financial action is an individual's use of monetary support to resolve environmental problems. This action takes into consideration the economic aspect of socioecological systems. Persuasion includes the approaches an individual or group can use to convince others to take action in addressing environmental issues. Persuasion is also an aspect of the environmentally responsible behaviors domain and encompasses social aspects of socioecological systems (Hollweg et al., 2011).

Table 3.2

Definitions of Prominent Environmental Literacy Domain Aspects

Domains	Components of Domains	Definition
Knowledge	Earth Systems Knowledge	Ecological and Earth systems concepts including human variables
Environmentally Responsible Behaviors	Ecomanagement	The ways individuals prevent or resolve environmental problems

Domains	Components of Domains	Definition
Environmentally Responsible Behaviors	Problem Solving	Knowledge of multiple solutions to environmental problems
Environmentally Responsible Behaviors	Persuasion	Convincing others to correct environmental problems
Environmentally Responsible Behaviors	Financial Action	Financial support or pressure to address environmental problems

Note. Definitions adapted from "Developing a framework for assessing environmental literacy" by K.S Hollweg and colleagues, 2011, Washington, DC: North American Association for Environmental Education, 122.

The role of an individual's behavior and that behavior's impact on organizational resiliency practices has been studied by various researchers. In these studies, researchers highlight influences on an individual's behavior toward the environment. Because context influences an individual's ecological behavior within institutions, previous work has highlighted environmental consciousness and how it is affected by leadership (Farooq et al., 2021), how the individual is as important as leadership in impacting practices (Lamm et al., 2015), social behaviors and exchange of knowledge (Ficapal-Cusí et al., 2020), and the importance of trust and job satisfaction in influencing actions toward nature (Paillé, & Raineri, 2016). In the following section, influences on an individual's behaviors toward the environment are elaborated.

Farooq and colleagues (2021) argue that environmental challenges such as climate change are impacted by organizations. They studied factors influencing employee ecological behavior by applying qualitative methods that involved interviewing 24

professors from Malaysian universities. This approach was used to uncover challenges and solutions that supported employee ecological behavior in the workplace. They found various challenges to supporting employee ecological behavior that included lack of environmentally conscious behaviors and inadequate support from leadership. Solutions that could enable support of such behaviors included communicating change that makes individuals more aware of their environmental actions and training programs that are related to green practices. In this work, the need to implement training that develops knowledge of green behaviors are noted, but there are many domains of environmental literacy that are not discussed.

Lamm and colleagues (2015) also note the need for training. They state that leaders are increasing their implementation of sustainability practices for the success of their organizations while addressing environmental, social, and economic challenges. They argued that the role of individuals within the organization are just as important as the roles played by leadership. They sought to provide leadership with the tools to encourage sustainability in their organizations. They did this by studying the relationship between perceived organizational support toward the environment and organizational citizenship behaviors toward the environment. After collecting 1,225 online surveys they applied the New Ecological Paradigm scale, 7-point Likert-type scale, and Spreitzer's 12-item scale to analyze the surveys. Their findings included the relationship of perceived organizational support toward the environment to an individual's sustainability behaviors and that psychological empowerment relates to perceived organizational support and job satisfaction. They suggest providing individuals with information on the environmental impacts of various actions, increasing voluntary sustainability-oriented behaviors,

training, and communications. This work similarly indicates a potential for the application of domains of environmental literacy in the opportunities created for individuals to support resiliency practices.

Like Farooq et al. (2021) and Lamm et al. (2015), Ficapal-Cusí and colleagues (2020) note the importance of prosocial organizational behaviors, its impact on developing sustainable organizations, and the need for knowledge sharing. They proposed and tested a model that studied the relationship of individual organizational citizenship behaviors and perceived organizational support. They linked these notions by collecting online surveys from 1,350 individuals throughout 28 organizations in Spain. Their analysis included using a 7-point Likert scale partial least squares structural equation modeling, and a variance-based structural equation modeling method. Their findings included the need for organizations to combine different strategies that create prosocial behaviors by increasing knowledge sharing. This would help support organizational standards that implement environmental, social, and economic objectives supported by the domains of environmental literacy.

Thus far, the research has explored how an individual's environmental behaviors impact an organization's resiliency practices. Paillé, and Raineri (2016) reversed this relationship and investigated how existing organizational practices influenced an individual's interactions with nature. They pointed out that organizations seeking to be sustainable positively influenced individual's actions toward the natural environment. The organization's leadership added to this influence. They studied the relationship between an individual's trust in leadership, job satisfaction, psychological contract breach, and pro-environmental behaviors. After collecting 731 surveys from a large

Canadian university, they measured perceived organizational support using a 4-item scale. They found various levels of impacts on pro-environmental behaviors depending on the combination of perceived organizational support, levels of psychological contract breach, job satisfaction, and trust in leadership. For example, individuals tend to engage in pro-environmental behaviors if they feel supported by leadership and trust them. This study reveals the expansive impact that embedding resiliency practices in organizations can have on how their members behave outside of the workplace.

The need for environmental training in organizations seeking to implement resiliency practices is known. However, it is not clear what aspects of environmental literacy are needed to be successful in promoting implementation of practices. Yet, when the leadership supports these efforts, organizational members will respond positively and take their new knowledge to other contexts. This reveals the potential for organizations to contribute to resiliency of local socioecological systems, as well as the need to explore what type of professional development in environmental literacy can support these efforts.

METHODS

This study is part of a larger case study (Yazan, 2015) that collected data in two cases. The unit of analysis was an academic institution. Qualitative approaches that included interviews, collecting artifacts, and coding were applied to understand how resilient practices were initiated and sustained at the organizational level. It was approved by the university's Institutional Review Board and the school district's Research Review Committee. The data collected via interviews and artifacts included details on resiliency practices, manifestations of biocultural diversity (Vierikko et al., 2015), domains of

environmental literacy, and environmental impacts. The focus of the present analysis is one case (the Marina School), its exemplary resiliency practices, and the environmental actors whose literacy supported the practices continued existence.

The Marina School earned awards for their participation in a local non-profit's, "Green Schools Challenge", which reduced their carbon footprint while promoting long-term community sustainability. These awards highlighted that the Marina School had implemented and been recognized for resiliency projects, indicating a "positive-positive" case (Beach & Pedersen, 2018). This means the case had the variable of interest (environmental literacy) and outcomes (resilient practices) present to allow for the development of explanation of causes and the outcomes. The purpose of this focus is to guide leaders of institutions that are interested in activating environmental literacy that can aid in the initiating and sustaining of resiliency practices in their day-to-day activities.

Two questions guided this analysis:

- What historical context and sequence of events led to the implementation of the organization's resiliency practices?
- How did the individuals apply domains of environmental literacy to support their efforts?

This first question explored the conditions within which the resiliency efforts took place. The second question addressed the role of an environmental actor's literacy in leading the practices. In this study, these case study-level questions were narrowed to focus on the sequence of events and environmental literacy that led to two resiliency practices, an edible garden and butterfly garden. These practices were chosen as the focus of this

report because they were ongoing and located within the organization. Other resiliency practices occurred annually but not daily and/or took place within the community and not at the organization's location. Data collection and analysis took place in two phases: preliminary and comprehensive analysis. As described in the following section, reliability and credibility of this work was fulfilled following guidance from Creswell and Miller (2000).

Phase 1 Preliminary Analysis

The first phase, preliminary analysis, included an initial interview with two participants at the school and coding with the theoretical framework of environmental literacy. These interviews asked open-ended questions about the resiliency practices at the organization, domains of environmental literacy, and contact information for secondary informants. For example, questions such as "what resiliency practices are implemented at your organization?" and "could you please describe the resiliency practices at your organization?" provided details on the practices held at the organization.

Artifacts such as photographs of the resilient practices, student work, and publicly available documents (e.g., newspaper articles) were collected. This allowed for the triangulation of data. Triangulation of data allowed the researcher to confirm the reliability of collected data (Leuffen et al., 2013). This included comparing all participant interviews for consistency and verifying details with the artifacts. In doing so, the researchers confirmed consistency about the historical context of the school, the resiliency practices being implemented in the school, the events leading to those practices, and collaborators aiding in the fulfillment of those practices.

After confirming consistency, the researchers practiced reflexivity. Reflexivity allowed for the disclosure of assumptions, beliefs, and biases (Watt, 2007). This was done by writing moments of emotional attachment to pieces of the narrative. For example, at one point the participant mentioned their niece's love for nature. This led the researcher to think of their own niece and her love of nature, making the researcher feel happy and connected to the participant. Pausing to note this emotion and ensure it did not affect the researcher's interpretation of data reduces researcher bias. The process of reflexivity was practiced throughout all phases of analysis.

Deductive coding was used to analyze interviews that were collected. This involved developing a codebook based on environmental literacy. The operationalized definitions for these codes were based on the work of Hollweg and colleagues (2011). Coding then occurred by identifying phrases in the narrative that aligned with definitions developed in the codebook. This phase allowed for the development of in-depth, follow-up interviews. To develop questions that provided insight into environmental literacy, participants were asked to elaborate on parts of their narrative that included those codes. For example, in the case of ecomanagement, it would be useful to know about the specific challenges that were overcome through the application of this environmental literacy domain. Questions such as "were any challenges faced while conducting these practices?" and "how were those challenges addressed?" allowed researchers to analyze for notions such as "ecomanagement" without creating leading questions.

Phase 2 Comprehensive Analysis

The comprehensive analysis involved conducting follow-up interviews, a second round of deductive coding as well as ensuring reliability and credibility of the work

conducted. Follow-up interviews were based on the preliminary phase and used semi-structured questions developed using the theoretical concept to obtain more detailed information on the domains of environmental literacy. This involved noting statements in the narrative that were related to the theoretical concepts. For example, when asked, "what resiliency practices are implemented at your school?" a response included a statement such as, "we have gardens, but no one wants to care for them." This would have been noted as related to the problem-solving component of the environmentally responsible domain. This helped develop questions such as, "You mentioned no one wanted to care for the gardens. How was the garden maintained?" The participant then responded, "we brought in students to fulfill volunteer hours by working in our garden". This provided details into how the issue of garden maintenance was resolved. This process of developing follow-up interviews was repeated for four participants and the interviews were conducted with the four participants.

Process tracing was then applied. Process tracing defines the causal mechanisms that lead to changes within organizations or groups (Collier, 2011; Beach, 2017; Beach & Pedersen, 2013; Bennett & Checkel, 2015; Falleti, 2006; Lorentzen et al., 2017; Ricks & Liu, 2018). Studying organizations where resilient practices exist can reveal how organizations develop these practices. Specifically, this process can be uncovered through the analysis of causal mechanisms. Causal mechanisms move organizational processes and articulate the complex relational structures that lead to social phenomena and affect individual behavior (Voltolini & Eising, 2017).

Causal mechanisms link causes and outcomes. Causes and outcomes can be identified through the historical contexts and events detailed in narratives shared about an outcome

of interest, such as resilient practices (Beach, 2017). When an outcome of interest is noted in the narrative, for example a garden, the historical contexts and events surrounding the development of the garden are unpacked. Unpacking these events helps identify potential causes that led to the outcome. Once potential causes are identified they are then compared with theoretical concepts to explain which cause is linked to the outcome (Bennett & Checkel, 2015). These causal explanations allow for the development of recommendations that can inform the incorporation of resiliency practices in other organizations. For the purposes of this study, causal mechanisms will be referred to as sequences of events.

Deductive coding was once again applied for the four interviews with the same codebook. In this phase, deductive coding provided details into the role of environmental literacy during the sequence of events leading to the implementation and maintenance of the resiliency practices. For example, an event occurred such as a teacher noticing the potential of a barren green space and then converting it into a garden. The codebook was used to identify what was the potential cause leading to the creation of the garden, such as Earth systems knowledge.

After completing the preliminary and comprehensive phases, narratives that led to the resiliency practices were written based on the previously described process. These narratives were then shared with the participants. This served the purpose of member checking (Candela, 2019). This took data and interpretations back to the participants to confirm credibility. After the participants confirmed the credibility of the researchers' interpretations, peer debriefing (Patton, 2015) was conducted. Peer debriefing involved reviewing exemplary quotes and their codes with the codebook definitions with two

research members. This served the purpose of refining and clarifying the operationalized codebook and interpretation of the quotes.

In the following sections, quotes were edited for clarity. Noises, side stories, etc. were removed. Here is an example of the type of edits that were made to the quotes:

> "They could upcycle something that they found lying around the house they could create a habitat like a birdhouse or a watering station or something…the dogs scratching… now the dogs are coming in… so I had like 5 different choices, and it was amazing. I was blown away because you talk about engagement I had, ah OK so I probably had, I don't think... I had 50 students, but I think some of the students did more than one project."

Here is how it was edited:

> "They could upcycle something that they found lying around the house. They could create a habitat like a birdhouse or a watering station. So, I had like 5 different choices and it was amazing. I was blown away because you talk about engagement. I had 50 students, but I think some of the students did more than one [recycling] project."

RESULTS

Environmental Actors & Historical Contexts

Two environmental actors, Desi and Ann, were teachers at the Marina school and led these resiliency practices. As leaders, they were responsible for the initiation and continued success of the resiliency practices. The resiliency practices included a butterfly garden, edible garden, solar ovens, aquaponic tanks, and participation in environmental cleanups. Desi was the lead for the implementation of the edible garden and Ann was the

lead for the implementation of the butterfly garden. Together, Ann, Desi, and a third teacher who supported their efforts worked as a team on the school's resiliency practices.

Desi

Desi was a science and mathematics teacher. She was also the school's Science, Technology, Engineering, Arts, and Mathematics (STEAM) designation liaison. In this role, she facilitated projects between the school district's STEAM department and teachers at the school. She joined the Marina school when it started implementing aquatic studies. She aimed to connect with the school's community. She built bridges through partnerships with neighboring schools, the local community, and non-profit organizations. Her background included working with non-governmental organizations and she had been trained as a Florida Master Naturalist (https://masternaturalist.ifas.ufl.edu).

Ann

Ann was a teacher for the gifted program. At the time of this study, she was the newest member of the Marina School. She had been working at the school for 3 years. Ann was an avid gardener. She grew her own spices, housed butterflies in her classroom's butterfly cage, and had aquaponic tanks in her classroom. She involved other teachers in environmental education by showing them how simple it was to accomplish these types of projects and how it positively impacted student demeanor. Ann said she hoped to encourage those involved with the school to use nature as a means of calming students. She maintained a network of volunteers from outside of the school who helped support her environmental efforts and encouraged the surrounding community to start their own resiliency practices.

Marina School

The Marina School is an elementary school that was designated as a center for aquatic nature studies when it first opened but did not have the curriculum to support its designation. A teacher who had been working at the school (before Desi was hired) had tried to involve other teachers from the Marina school in resiliency practices, but those teachers did not join her efforts. When Desi joined the school, this teacher was no longer interested in continuing efforts to implement resiliency practices at the school and the lack of curriculum and low enrollment were still issues. To help address those issues, she began working on various resiliency practices with her students. The principal asked Desi what they could do as a school to bring in more students. This led to the development of the Aquatic Visionary Explorers academy. Starting this academy helped bring the school closer to its designated purpose as a center for aquatic nature studies and incorporated resiliency practices.

When a new principal was hired by the school, they tried to encourage teacher commitment to the resiliency practices led by Desi, but the teachers felt it was adding to their workload rather than being part of it. After failing to gain teacher commitment, this principal decided to end the school wide implementation of the Aquatic Visionary Explorers academy. Desi tried to keep the academy implemented school wide but had to compromise and downscale to a small afterschool program.

After the Aquatic Visionary Explorers academy was converted to an afterschool program, the Marina School was given a Science, Technology, Engineering, Arts, and Mathematics (STEAM) designation. Schools holding this title competed against a point structure to earn bronze, silver, or gold statuses. To earn points, schools needed to follow

a three-part process involving the classroom, professional development, operations, and school wide competitions held through community-based partnerships. This designation aided in increasing teacher involvement with resiliency practices.

Following these events, the school began partnering and collaborating with other organizations dedicated to the environment. At the time of this study, there were four other organizations involved with the school. The first partnership that developed was with the local non-profit organization that held the Green Schools Challenge. This non-profit sought to empower individuals to be leaders against climate change and local environmental challenges. The Green Schools Challenge allowed the Marina school to earn small grants which helped fund some of the Marina school's resiliency practices. Another collaborator was a local tropical botanic garden. The local botanic garden conducted a yearly environmental science competition that allowed the school to earn additional funding that supported their resiliency practices. A local historical site was another partner. The local historical site provided educational programming by hosting field trips. During those field trips students had the opportunity to participate in various environmental activities. These activities helped students learn how they could support resiliency practices at the school. Finally, outdoor experiences were provided for students at the school through support from an American conservation group. This partnership helped the school use its greenspaces as outdoor classrooms and laboratories. In turn, this added to maintaining resiliency practices like some of the school's gardens.

Along with support from the school's leadership, the combination of these events and collaborations resulted in the school earning various awards for their resiliency practices. The resiliency practices included an edible garden, a butterfly garden, an

annual marina cleanup, and an annual environmental fair with collaborators and the surrounding community. Two practices, the butterfly garden and edible garden, were located within the school's socioecological system and had ongoing impacts on environmental resiliency. The following sections describe environmental literacy that enabled Desi and Ann as environmental actors.

Sequence of Events & Articulation of Environmental Literacy

The events that led to the resiliency practices of the gardens explained how they were implemented and sustained. Desi and Ann were able to lead and sustain the butterfly and edible garden at their academic institution despite a lack of support from other teachers. Desi said it was her and "a small core of people" that kept these practices going because they were, "doing it for children and the planet" and were "all highly motivated". Desi and Ann applied five components of the domains of environmental literacy during these events to support their efforts. These components include Earth systems knowledge, ecomanagement, problem solving, persuasion, and financial action.

Butterfly Gardens

The city, in which the Marina School resided, donated plants to create a butterfly garden. Employees from the city brought in the plants and spent a day working with teachers and students to build it. It served as a source of education for students, a wildlife haven, and a source of community building between the school and the surrounding community. While initiated by the city, Desi led and sustained this practice. Her environmental literacy added to the garden's resiliency and environmental impacts.

Despite serving as a source for these interactions, various teachers at the school wanted to remove the garden. Desi said these challenges occurred because "we're asking

people to do things outside their comfort zone". These teachers believed the butterfly garden was ugly and wanted a more manicured garden. By applying *Earth systems knowledge,* Desi argued against this change. She emphasized that it was a gift from the city and its importance as a wildlife habitat. Ann, the other environmental actor, said that Desi told the teachers, "these plants are authentic to butterflies" which highlighted her knowledge of ecological concepts such as native species. After successfully preventing its removal, the garden was certified as a schoolyard habitat by the previously mentioned American conservation organization.

As time passed, Desi realized the garden could be expanded and converted to also reclaim water. In this process, she demonstrated components of financial action, ecomanagement, and Earth systems knowledge. She said, "any program that you want to run, you need funding", which led her to obtain grants from collaborators. She was able to do so because, "there are always groups out there to help". This application of *financial action* led to improving the butterfly garden by creating a multifunctional space. Having the butterfly garden and then transforming it to also reclaim water demonstrated *ecomanagement*. That is, Desi's direct work with the physical world in preventing and resolving environmental problems such as water waste. She said they were transforming the butterfly garden because, "we could divert water from the sewer and actually have it go back in through reclamation into the aquifer". Through these actions, Desi applied Earth systems knowledge. Working toward converting the butterfly garden into a rain garden that reintroduced water into the aquifer indicated knowledge of relevant ecological concepts (loss of freshwater in aquifers due to over pumping, saltwater

intrusion, etc.) as well as Earth systems concepts and humans as variables in the ecosystem (a person's ability to reclaim water and prevent aquifer destruction).

Problem solving was a feature of this butterfly garden while Desi sustained it. It helped mitigate environmental issues. By serving its purpose as a butterfly garden, it helped pollinators and created habitat space for other creatures. Desi's actions to transform it into a rain garden maintained those aspects while also adding the solution of water reclamation. This action highlighted Desi's knowledge of past, ongoing, and current efforts to reduce water waste and help solve multiple environmental problems (habitat loss, pollinator loss, water waste, education.)

The Edible Garden

The edible garden had existed before Ann worked at the school. It was started by another teacher, but it was not used as an edible garden at the time. When Ann began working at the school, she noticed it and was interested in using part of it for her instruction. When she discovered it belonged to another teacher, she asked if she could use part of it for her instruction. The teacher told Ann that they could no longer maintain the garden and that Ann could keep it. Ann took ownership over the garden and through her application of environmental literacy converted it into an edible garden.

Ann began caring for the garden and used it as part of her curriculum. Along with using the space with her students, Ann also brought staff in to support the garden. She said, "Teachers asked, 'can I have' [produce from the garden]?' or I've even gone out and picked [produce] and brought [it] to people." By encouraging others to take produce from the garden, Ann was applying *persuasion* through an emotional approach. By appealing to people's desire for fruits and vegetables, she encouraged them to take from the garden

and led them to feel comfortable interacting with the garden. This, in turn, helped maintain the garden. In this case, the garden represented the environment. As with most gardens, people need to tend and care for it. Without support or interest from others within the organization, Ann's garden would not thrive. Her efforts to involve school members by sharing the garden's harvest and inviting others into the garden shows how she applied *ecomanagement* to maintain the garden.

Despite involvement from students and staff in the garden, Ann struggled to conserve it. One challenge was the lack of support she received from the custodial staff. They did not want to de-weed the garden despite doing so elsewhere on the organization's campus. Ann said they placed blocks to try to kill the grass growing along the garden box and to try to make it easier for the custodial staff to access the area with a weed whacker. Still, the custodial staff would not de-weed the area. Eventually, the garden needed more than de-weeding and needed to be rebuilt because it started deteriorating.

The challenge with the custodial staff led Ann to go outside of their institution to seek help. She had built a rapport with teachers and staff at neighboring schools, so she contacted them. She said, "we sent flyers because high school students usually need volunteer hours". This led to students and teachers coming together at the Marina school to dig holes, plant, and rebuild the garden. Ann sending flyers to the surrounding schools highlighted her application of *problem solving* as a response to fix the deteriorating garden. Her invitation for students to obtain volunteer hours, a requirement that is necessary to graduate high school, shows how she applied *persuasion*. This helped revive the longevity of this communal space in nature.

Overall, the application of environmental literacy aided in the resiliency practices of both the butterfly and edible gardens. The narratives highlight how components of environmental literacy were applied by Desi and Ann and how the components impacted these practices. Desi applied Earth systems knowledge (e.g., arguing importance of native butterflies), financial action and ecomanagement (e.g., obtained funding to improve functionality of the garden by adding a water reclamation system), and problem solving (e.g., mitigating environmental problems by creating habitats for various species). Ann applied persuasion (e.g., encouraging staff to harvest produce from garden), ecomanagement (e.g., maintain garden via staff involvement), as well as problem solving and persuasion (e.g., inviting students from neighboring schools to fix the garden in exchange for volunteer hours).

DISCUSSION

Environmental actors and their application of environmental literacy impact an organization's ability to lead and sustain environmental resiliency practices. This application of environmental literacy helped the environmental actors in this case optimize the resiliency practices implemented at their academic institution and addressed issues of the socioecological system. They optimized these practices by identifying the needs of their socioecological system and aligning them with their efforts to mitigate and prevent environmental problems. For example, environmental literacy provided the tools necessary to address environmental problems like water waste. Water waste was diminished by adding the feature of a water reclamation system to an existing garden. In this case, due to the school's position near a bay, the water reclamation system aided in

the prevention of saltwater intrusion that occurs when too much fresh water is removed from the underlying aquifer.

Teachers, as environmental actors, at an elementary school may have characteristics that are different from other organizations. Teachers already hold knowledge in various fields and topics. One of the participants was a science and math teacher as well as an environmental advocate with a background working with non-governmental organizations. The other participant was a teacher that taught gifted courses with a background in gardening. Combined with these characteristics, teachers are also known to go above and beyond the call of duty (Elstad et al., 2011). However, as in other organizations support from leadership was important. The environmental actors had support from leadership at their school. This supports findings by Lamm and colleagues (2015) that found that perceived organizational support toward the environment adds to environmentally responsible behaviors.

From the Marina school's narrative, it is clear that engaging environmental actors requires environmental literacy regarding the specific resiliency practices of the organization and support from leaders. This requires leaders to consider their context when promoting resiliency practices. To do so, they would identify potential environmental actors and provide them with professional development that optimizes their ability to influence those particular resiliency practices. This would indicate the organizational support needed for the success of environmentally focused practices (Ficapal-Cusí et al., 2020; Paillé & Raineri, 2016) and help identify the type of training that could be provided to increase environmental efforts, which had remained

unelaborated on by various scholars (Farooq et al., 2021; Ficapal-Cusí et al., 2020; Lamm et al., 2015; Paillé, & Raineri, 2016).

Based on our findings, the type of knowledge needed for the promotion of resiliency practices in the context of this academic institution included earth systems knowledge, ecomanagement, problem solving, persuasion, and financial action. Yet, all these types of knowledge may not be necessary for the optimization of a particular resiliency practice. An example of an application of these findings could occur if organizational leadership identify waste reduction as a resiliency practice that they hope to implement. Without considering our work, they may develop professional development that only focuses on the procedure of waste reduction. Even if they did include environmental knowledge, they may only focus on the impact of waste reduction on the Earth. However, our analysis of resiliency practice through the lens of environmental literacy highlighted the need to focus on ecomanagement, persuasion, and financial action. Ecomanagement provides the environmental actors with the knowledge necessary to identify how much waste reduction would be needed to impact their organization's resiliency efforts and socioecological system. The skill of persuasion would then allow them to engage other individuals in the organization to support those efforts. Including professional development on financial action would then guide the environmental actors to obtain grants from local nonprofits to purchase supplies that innately create less waste, like printers with ink tanks instead of cartridges. Here, the potential professional development concept is expanded to these aspects of environmental literacy that can be key causal mechanisms in realizing the resiliency practice.

In applying components of the environmental literacy domains, organizations could move toward developing their own resiliency practices and optimizing them to best fit the needs of their contexts. Identifying environmental actors and providing professional development based on environmental literacy would aid in increasing environmentally conscious behaviors, provide actors with the tools necessary to communicate change, and foster environmental knowledge that supports resiliency.

IMPLICATIONS AND FUTURE RESEARCH

While this work is limited to the specific context of the case described, it has the potential to help guide organizations of all types toward realizing environmental resiliency practices that mitigate environmental issues and address social and economic issues. It can also provide additional benefits for organizations such as increased employee satisfaction. Future research should explore the extent to which these findings reoccur in similar contexts as well as others. For example, are non-academic institutions that are implementing resiliency practices likely to have the same domains of environmental literacy supporting their efforts? If yes, how does this align and differ from those found within academic institutions and what does this tell us about the potential for these methods to guide different types of organizations toward environmental resiliency?

CHAPTER 4

CULTURAL MECHANISMS AND ENVIRONMENTALLY RESPONSIBLE BEHAVIORS: A CROSS CASE ANALYSIS OF RESILIENCY PRACTICES IN ACADEMIC INSTITUTIONS

ABSTRACT

Inclusive resiliency practices are necessary for human well-being because they mitigate problems within socioecological systems. A challenge facing researchers and managers of these systems is deciding which theoretical lens to apply to decide what actions to take to benefit the system. When making decisions, these professionals can benefit from being able to consider a variety of perspectives at the same time. In this study, the action-oriented aspects of biocultural diversity and environmental literacy were compared within the cases of two academic institutions to note similarities and differences between them. Results revealed themes of events that impacted practices at both institutions. These included exchange of knowledge, refining practices, obtaining financial support, and obtaining support from individuals external to the institution. These results emphasize the bioculturally responsible behaviors and paths taken to inclusive resilience practices that can inform how socioecological systems are investigated and managed.

INTRODUCTION

The biological and geographical features related to individuals and their institutions are known as socioecological systems (Gunderson & Holling, 2002). These adaptive and intricate systems are bound by particular ecosystems and the boundaries of their distribution or functional limits (Gunderson & Holling, 2002). While maintaining

resiliency in these systems is necessary to support current and future societal needs, only focusing on certain parts of the system can negatively affect people (Brown, 2014; Fabinyi et al., 2014; Maclean et al., 2014).

The variety of features that are intertwined within socioecological systems invoke an array of theories for managing and researching them. For example, methods may range from an ecological approach of understanding the robustness of systems (Anderies et al., 2004) to an adaptive cycles approach that describe the state in which systems are in (Walker et al., 2004).

Each theoretical lens highlights relationships within the system. However, while highlighting certain relationships, a theory may diminish others. Researchers and managers of socioecological systems have to choose a finite number of theories from which to operate to accomplish their goals. One divide amongst frameworks are those that highlight ecological systems and those that highlight social systems. However, a challenge in building a theoretical framework is considering how each theory has nearly overlapping constructs or interpretations of phenomenon. A solution to this challenge is to consider these overlapping phenomena and identify the relations among the theories. This can aid in completing analysis tasks by considering both theories simultaneously. The purpose of this paper is to complete this type of analysis using the frameworks of biocultural diversity and environmental literacy.

Biocultural diversity forms the basis of human life through its integration of biology, culture, and language (Maffi, 2007) while environmental literacy consists of the skills and knowledge necessary to resolve and prevent environmental problems (Hollweg et al., 2011). These concepts, which include biodiversity, culture, language, and

environmental knowledge, span across aspects of socioecological systems (Holling, 1973; Maffi, 2007). By analyzing for concepts that overlap, themes can be developed that simultaneously incorporate both perspectives into the development of resiliency practices.

Both biocultural diversity and environmental literacy include action-oriented subconstructs. Cultural mechanisms (biocultural diversity) and environmentally responsible behaviors (environmental literacy) both include actions that individuals should take to improve environmental resiliency, yet, each construct highlights slightly different aspects of action. Assessing the combination of biocultural diversity and environmental literacy can lead to guidance on how to incorporate both theories into research and practice.

The context for this analysis were two case studies of resiliency practices within academic institutions. Previous analysis of these case studies revealed two major findings. First, the application of four prominent dimensions of environmental literacy that were integrated into resiliency practices included ecomanagement, problem solving, persuasion, and financial action (Campo & Quardokus Fisher, In preparation b). Second, biocultural diversity supports the establishment, refinement, and continued existence of inclusive resiliency practices (Campo & Quardokus Fisher, In preparation a). This case provides an opportunity to explore the role of the action-oriented aspects of biocultural diversity and environmental literacy when developing resiliency practices that positively impact local socioecological systems.

CULTURAL MECHANISMS AND ENVIRONMENTALLY RESPONSIBLE BEHAVIOR

Cultural mechanisms are the action-oriented aspects of biocultural diversity. Biocultural diversity refers to the biological, cultural, and linguistic manifestations that form simultaneously and in an interrelated manner within socioecological systems (Maffi, 2007; Maffi & Dilts, 2014). When these manifestations are taken into consideration, they can help groups respond to changes in a culturally informed manner that can lead to inclusive, resilient practice (Maffi, 2007; Maffi & Dilts, 2014). When responses are culturally informed, they also include manifestations of biocultural knowledge, actions, needs, inclusion, identity, and value characteristics (Campo & Quardokus Fisher, In preparation, a).

Cultural mechanisms are "practices or actions that can have (in)direct influence on the environment such as managing, monitoring, protecting and are features beyond the practice such as institutions, knowledge, rituals, beliefs or values" (Vierikko et al., 2015, p.16). These mechanisms include creating, improving, preservation, and managing (Table 4.1). Creating refers to the development of green spaces, rich biotopes, nature reserves, and protected areas (Vierikko et al., 2015). For example, this could take the form of creating a native garden within the grounds of an institution. Improving refers to the improvement of green spaces and increasing its multifunctionality (Vierikko et al., 2015). For example, adding a water collection feature to a green space that recycles water for irrigation. Preservation refers to maintaining biodiversity, agrobiodiversity, natural habitats, and protecting native species (Vierikko et al., 2015). This could take the form of a farm that incorporates its vegetable garden with livestock such as chickens to balance

the system with little human input required. Managing refers to choosing native species, those with the ability to adapt, controlling species that are invasive, and using plants that attract pollinators (Vierikko et al., 2015).

Table 4.1

Cultural Mechanisms

Mechanism	Definition
Creating	Developing green spaces
Improving	Fixing green spaces
Preservation	Maintaining diverse green spaces
Managing	Choosing appropriate species for green spaces

Note. Definitions are adapted from "Identifying, Quantifying and Qualifying Biocultural Diversity: Assessment of Biocultural Diversity" by K. Vierikko and colleagues, 2015, Green Surge.

Environmentally responsible behavior is the action-oriented aspect of environmental literacy. Environmental literacy includes knowledge of physical and ecological systems; social, cultural, and political systems; environmental issues; multiple solutions to environmental issues; and citizen participation and action strategies. It provides the tools needed to address environmental problems by incorporating awareness and concerns regarding those problems. These tools apply the domains of environmental literacy: knowledge, competencies, disposition, context, and environmentally responsible behaviors (Hollweg et al., 2011).

Within the domains of environmental literacy, environmentally responsible behaviors are identified as "the point at which competencies, knowledge, and dispositions are brought to bear within a particular context" (Hollweg et al., 2011, p. 4-3). These

behaviors include ecomanagement, persuasion, financial action, political action, and legal action (Table 4.2). Ecomanagement refers to resolving and preventing environmental issues by working directly toward preventing them. For example, creating native habitats for animals and plants and converting greenspaces to restore natural functions (Hollweg et al., 2011). Persuasion refers to how others are convinced to behave in ways that resolve environmental issues. This can be done through "emotional, logical, or coercive" (Hollweg et al., 2011, p.3-13) approaches like creating a social event that involves a greenspace. Financial action refers to using money to resolve or prevent environmental issues, such as through donations or obtaining grants (Hollweg et al., 2011). Political action refers to actions, like voting or lobbying, that pressure political systems to convince them to improve environmental conditions (Hollweg et al., 2011). Legal action refers to the use of the legal system to enforce laws meant to improve and protect the environment (Hollweg et al., 2011). For example, reporting violations like illegal dumping that creates pollution.

Table 4.2

Environmentally Responsible Behaviors

Behavior	Definition
Ecomanagement	Resolving and preventing environmental issues
Persuasion	Convincing others to resolve environmental problems
Financial Action	Use of money to resolve environmental issues
Political Action	Pressuring political systems to improve environmental conditions
Legal Action	Use of the legal system to enforce environmental laws

Note. Definitions adapted from" Developing a framework for assessing environmental literacy" by K.S. Hollweg and colleagues, 2011, Washington, DC: North American Association for Environmental Education, 122.

When comparing the action-oriented aspects that make up cultural mechanisms and environmentally responsible behaviors, one can begin to identify the similar and divergent characteristics they have, such as their role in socioecological systems. Both concepts depend on people to address environmental problems, yet they differ in approaches. Cultural mechanisms place the responsibility of impacting resiliency through direct management practices at the social level, while environmentally responsible behaviors place the responsibility of impacting resiliency on the individual through ecomanagement. In cultural mechanisms, broad categories of action are used to describe the type of management practices necessary for resiliency, while environmentally responsible behaviors provide specific actions that can be taken to impact resiliency. For example, cultural mechanisms suggest preserving diversity. Environmentally responsible behaviors expand on this idea by suggesting preservation of diversity through use of the legal and political systems to enforce laws that protect nature. Another action of cultural mechanisms suggests improving greenspaces, and environmentally responsible behaviors includes applying financial action to accomplish this. If an institution is considering the cultural mechanism of creating a feature like a garden, environmentally responsible behaviors tell us how to convince others to join in the development efforts of those gardens. These two concepts, while similar, provide different lenses for analyzing action-oriented activities in socioecological systems.

The focus of these two concepts on behaviors and actions was appropriate for investigating the relationships between the two theories through cross-case analysis. They highlight when the interaction of environmental literacy and biocultural diversity were connected to the initiation and sustaining of resiliency practices. Identifying the similarities and differences within these concepts provided details on the paths that led to the resiliency practices.

METHODS

The organizations were chosen for the case study due to their participation in programs that won them awards for their resiliency practices. These cases had variables and outcomes that were relevant to this analysis (Beach & Pedersen, 2018), resiliency practices, and individuals who implemented those practices with input from environmental literacy and biocultural diversity. The analysis consisted of deductive coding with the theories and the identification of events that explained the relevant outcomes (Collier, 2011; Beach, 2017; Beach & Pedersen, 2013; Bennett & Checkel, 2015; Falleti, 2006; Lorentzenet al., 2017 Ricks & Liu, 2018).

In this cross-case analysis, events that led to resilient practices were analyzed to investigate the impact of the action-oriented aspects of biocultural diversity and environmental literacy. Specifically, how aspects of cultural mechanisms (biocultural diversity) and environmentally responsible behaviors (environmental literacy) interact. To aid comparison, analysis focused on the use of gardens as a resilient practice that occurred in both organizations.

Two questions guided this cross-case analysis. The first question was “to what extent did the sequence of events that led to both gardens occur in both cases?” To answer this

question, we identified which events were present in each case and in what instances were these the same in both cases. The second question was "in what ways do environmentally responsible behaviors and cultural mechanisms align in these events?" To answer this question, we identified similarities and differences of the mechanisms in these practices. Three phases of analysis led to the answers to these questions.

Phase 1 Single Case Analysis

Single case analysis revealed the domains of environmental literacy and manifestations of biocultural experiences and diversity that contributed to the resiliency practices. This included the analysis of 12 interviews via deductive coding, identifying events that led to the resiliency practices and explaining the purpose of those events using the guiding theories. For example, in one case a participant converted a butterfly garden to include a water reclamation system. Modifying a garden for the purpose of water reclamation was an environmentally responsible behavior.

Phase 2 Cross Case Analysis

The cross-case analysis phase investigated themes of events across both cases. To develop emergent themes a one-to-one comparison of events for both cases was conducted. This involved looking at one event from the first case alongside all of the events from the second case. This process was repeated for all events. The events from the first case and second case were then grouped by themes which aided in the identification of types of events. A codebook with the definitions for the themes that emerged was created.

Phase 3 Relational Coding

Phase three applied relational coding. We compared the roles played by environmentally responsible behaviors and cultural mechanisms in the themes identified in phase 2. Codes for environmentally responsible behaviors within themes were examined. Then coding was conducted for cultural mechanisms within the manifestations of biocultural diversity identified in those themes during phase 1.

Phase 1 focused on what biocultural diversity was present. In phase 3 focus was placed on understanding *how* biocultural diversity was manifested within the themes. This was done by coding for cultural mechanisms and practices within the previously coded manifestations of biocultural experiences and diversity. To ensure the credibility and reliability of this work guidance from (Creswell & Miller, 2000) was followed. This included reflexivity during interviews and coding, peer debriefing of coded events, and audit trails of the coding process.

RESULTS

Historical Context & Environmental Actors

The Redlands School & Penny

The Redland's School was a magnet school that emphasized cultural inclusivity and an international education theme. It was located in a South Florida suburb. This suburb was part of a city and agricultural area that emphasized the prevention of littering, planting native plants, and recycling. The city's proximity to two major national parks and its low elevation placed the Redlands school in a diverse environmental location.

Penny was a 2nd grade teacher at the Redlands School. She led the school's resiliency practices and created environmental learning opportunities for teachers,

students, and parents. She also led the school's participation in green conferences and pilot programs for banning plastics. She collaborated with colleagues, other schools and organizations to support her efforts. Her interest in nature, environmental issues and how they impact humans stemmed from growing up in Europe in a military family.

Penny asked the principal if she could start a garden. From this initial garden various resiliency practices developed and created opportunities for students and staff. In particular, the school's native and organic gardens brought the community together. These opportunities came from partnerships fostered with local environmental organizations.

One partner was a local historic site that provided environmental education through a program developed to nurture environmental stewards. Another partner was a South Florida based non-profit organization that helped schools reduce their environmental footprint by empowering students to be leaders against climate change. Finally, various environmental experiences at the Redlands School were supported by a local public university that provided field trips to gardens and the opportunity for students to present at a recycling energy forum. These partnerships helped the Redlands School earn various awards and funding to support their resiliency practices.

The Marina School, Desi & Ann

The Marina School was an elementary school with a nature-based focus. It was located in a low-lying area near the bay of Florida which made it susceptible to sea level rise. The bay was also part of a national park. Due to this, the city in which the school resided emphasized various green initiatives including the purchase of lands for

preservations and the use of clean energy to mitigate environmental issues that exacerbate sea level rise.

Desi and Ann were teachers at the Marina school and were responsible for initiating and sustaining the school's resiliency practices. Desi was a science and mathematics teacher and the lead for the implementation of an edible garden. She facilitated projects between the teachers at the school and the district's Science, Technology, Engineering, Arts, and Mathematics department, was trained as a Florida Master Naturalist (https://masternaturalist.ifas.ufl.edu) and had previously worked with non-governmental organizations.

Ann was a teacher for the gifted program. She led the implementation of a butterfly garden. She loved gardening and had environmental features in her classroom like aquaponic tanks and butterfly cages. She involved other teachers in her resiliency efforts by showing them how easy it was to incorporate into their lesson plans.

Both Desi and Ann maintained networks that aided in their resiliency efforts. This included contacts with neighboring schools to obtain volunteers and partnerships with other organizations. When Desi began working at the school, she took on various resiliency practices, including the development of a school wide aquatics program. Later on, the school was given a Science, Technology, Engineering, Arts, and Mathematics designation that required professional development and school wide competitions held through community-based partnerships.

The school partnered and collaborated with four environmentally based organizations that were dedicated to teaching students about climate change, involved students in environmental science competitions, provided nature-based educational field

trips, and helped turn green spaces at the school into outdoor classrooms. Many of these partnerships also earned the school awards and funding for their resiliency practices. Two practices, the butterfly garden and edible garden, were located within the school's socioecological system and had ongoing impacts on environmental resiliency.

Bioculturally Responsible Behaviors

The cross-case analysis phase revealed four themes of events. These themes of events describe the combination of cultural mechanisms (biocultural diversity) and environmentally responsible behaviors (environmental literacy) that lead to actions that we have termed bioculturally responsible behaviors (Table 4.3). These behaviors were exchange of knowledge, refinement, procurement, and external support.

Table 4.3

Bioculturally Responsible Behaviors

Theme of Events	Redlands School Events	Marina School Events	Cultural Mechanisms	Environmentally Responsible Behaviors
Exchange of Knowledge	Formal recipe exchange	Casual recipe exchange	Maintaining	Persuasion
Refinement	Addition of native plants to garden	Addition of water reclamation features to butterfly garden	Improving	Ecomanagement
Procurement	Funds obtained from grants	Garden resources donated by city	Improving	Financial Action
External Support	Environmental experts contacted	Flyers sent to bring in volunteers	Improving	Ecomanagement

Exchange of knowledge can be indirect or direct knowledge shared related to the environment. For example, indirect exchange of knowledge occurred as people shared recipes regarding the herbs in a garden. This is indirect because the focus of these conversations were not about environmental processes (how produce grew) rather about a feature of the environment (an herb that grew in the garden) that reminded them of a recipe. Refinement was defined as improving existing resiliency practices. For example, a butterfly garden was converted to reclaim water into an aquifer in one case and native plants were added to an existing garden in the other. Procurement refers to the acquisition of grants or donated materials to implement a resiliency practice or add to an existing one. For example, plants that were donated were used to build a butterfly garden and money obtained through grants was used to add tags identifying plants. External support was noted when help was obtained from people outside of the organization to aid in implementation or maintenance of resiliency practices. For example, people were invited from neighboring organizations to rebuild a garden in one case and in the other, a partnership was formed with an environmental expert.

Exchange of Knowledge

For exchange of knowledge, both cases had instances where recipes were shared. During this exchange, both cases displayed concepts from the two theoretical lenses of persuasion and maintaining. Persuasion was displayed by both cases through an emotional approach. For example, in the Marina school, one participant said, "[culturally diverse staff members] had deep conversations about spices and how you can use them which was eye opening". In the Redlands School, a participant said, "so they were standing there over the garden, sharing recipes from the different countries. And that was

just like, oh my gosh, this is awesome". The participants in both cases noticed cultural ties to the foods found in the garden. They used this information to persuade individuals to use the gardens. In the case of the Marina school, this persuasion helped resolve maintenance issues.

Maintaining was noted in both cases of exchanging knowledge via the interaction that occurred between the environment and the practices of culturally diverse people. In the Marina school, the exchange of recipes occurred by chance. Recipes were exchanged and notes on the use of spices were discussed as individuals harvested items from the garden. In the Redlands School, conversations about recipes went a step further. In this case, a formal recipe exchange was set up. Planning went into this exchange which led to a more deliberate exchange of knowledge that indirectly aided in the maintenance of the gardens as individuals harvested crops.

Refinement

The refinement noted in both cases involved ecomanagement and improving resiliency practices. In both cases this refinement aided in resolving environmental issues and increasing the multifunctionality of the gardens, but in different ways. In the Marina School the participant said, "we were in the middle of doing activities to transform [a] butterfly garden, we have two, but to transform it into a rain garden so that we could divert water from the sewer and actually have it go back in through reclamation into the aquifer." This conversion directly aided in resolving issues with water waste (ecomanagement), while it also created a space that served two purposes, a butterfly garden and water reclamation area (improving).

In the Redlands School, enhancements were made to an original garden that had been established at the school. The participant said, “[the] native gardens was amazing, the transformation. Easily close to three and 4,000 plants, trees we've planted at that school.” Ecomanagement was seen through the creation of habitats for native plants, while the addition of 4,000 native plants improved the space. This helped rehabilitate the space to resemble the original Pine Rocklands that formed the terrain and that were still found neighboring the school’s property.

Procurement

Both the Marina School and Redlands School used donations and grants for their gardens. This procurement of resources reflected their application of financial action and mechanism of improving their practices. The Marina School’s financial action occurred when they obtained donations from the city to build one of their butterfly gardens. This donation aided in preventing loss of habitats for pollinators. Improving was noted through the participants' use of the garden for educational purposes and creating a multifunctional green space.

In the Redlands School, the environmentally responsible behavior of procurement was used to purchase bio tags. After obtaining funds from grants (financial action), the environmental actor purchased zinc tags to use in the garden because the information written on them would not fade. She said, “anybody could walk around and see, oh, that's a bird plant and they would see the name of the plant.” This helped prevent issues of identification in which native plants would be cut down by mistake. Similar to the Marina School, it simultaneously involved the cultural mechanism of improving by creating a

multifunctional green space that served to educate individuals on the species residing in the garden.

External Support

Ecomanagement and improving were noted in both cases when it came to external support. While both cases obtained help from people outside of their organizations in the implementation and sustaining of their practices, the way these behaviors and manifestations came to be were different. In the Marina School, one participant said that they would contact neighboring schools by sharing flyers that invited the students to come fulfill their volunteer hours with the Marina school. To fulfill those volunteer hours, this participant said, "we're offering 10 hours for [the students] if they come and they work with us from 9 to 1…We need to dig holes. We need to plant some plants. We need to rebuild our garden." The participant shared that these students not only gained the volunteer hours they needed, but that they enjoyed working in the gardens with their friends. In this example, the participant sending flyers to neighboring schools simultaneously highlights ecomanagement and improving. In doing so, she responded to the issue of maintaining the garden that highlighted the collective response of individuals coming together to improve the longevity of this communal green space. Serving as a way for students to obtain volunteer hours added to the multifunctionality of the space.

In the Redlands School, the environmental actor said they wanted to create a garden space that was a "little more impactful", so they partnered with an international researcher that was an expert of a butterfly called the Atala. The environmental actor said this butterfly had "a great Florida history". Therefore, she found a plant that was needed to attract that species of butterfly to the garden at their academic institution. In this case,

the participant sought external help from an environmental expert. In doing so, she and this expert began the process of a large-scale environmental restoration process (ecomanagement) and rehabilitation of the gardens as noted through the cultural mechanism of improving.

These themes of events provide examples of the resulting bioculturally responsible behaviors that supported the resiliency practices implemented in the two academic institutions. This included sharing of ideas, improving existing practices, obtaining resources and financial support, and involving people from outside of the school to aid with the practices. The paths taken to fulfill these bioculturally responsible behaviors varied. These paths included the creation of a formal social gathering to exchange ideas, improving a space by creating a multifunctional feature, the addition of native plants, obtaining donations, applying for grants, and obtaining external support.

DISCUSSION AND CONCLUSIONS

The four themes revealed how one might consider both theories simultaneously in analyzing socioecological systems. They include the exchange of knowledge, refining existing practices, obtaining resources or monetary support, and creating partnerships with individuals or groups external to the institution implementing the practices. Under a similar context, these four themes pulled together the strengths of each framework.

Analyzing socioecological systems is both the work of managers of those systems and researchers of them. They are challenged to think about appropriate actions that can be taken to build resiliency in systems. These themes allow researchers or managers to analyze a challenge or phenomena within socioecological systems in an efficient manner by allowing them to view the systems through diverse perspectives. This provides the

flexibility necessary to address issues based on the boundaries and circumstances of the systems.

While we do not expect the findings of this study to be generalizable, the themes developed are transferable to other institutions. The components of these themes are flexible enough that they have the potential to guide other institutions toward the development of inclusive resiliency practices by including the action-oriented constructs of both frameworks. Enacting events within these themes to support resiliency practices would lessen the negative impact of environmental challenges on people (Brown, 2014; Fabinyi et al., 2014; Maclean et al. 2014). Implications of this study include the approaches taken to develop inclusive resiliency practices, for example, either through professional development or integration in the work duties of employees. Future work could explore how different contexts apply these themes and the impacts they have on the system.

The need for, and interest in institutional practices that simultaneously take into consideration the environment and society continue to grow. While efforts are being made by some institutions, others still need more guidance to start the process. This study provides the necessary platform for creating activities that can improve resiliency practices through bioculturally responsible behaviors.

CHAPTER 5

SYNTHESIS

This chapter provides an overview of the three manuscripts shared in this dissertation, their results, and relevant correlations. Following these overviews, implications for future work will be addressed.

Overview of Manuscripts

The collection of papers in this dissertation provides a comprehensive representation of how biocultural diversity and environmental literacy impact resiliency practices within the context of two academic institutions. The first paper (Chapter 2) focused on biocultural experiences and diversity, how these manifestations impacted resiliency practices, and integration of the socioecological system by an environmental actor at one academic institution. This paper provided an example of how biocultural experiences and diversity impacted resiliency practices and the socioecological system. Various data sources were collected and analyzed through qualitative approaches to identify which resiliency practices were being implemented at the institution, who was leading and sustaining these practices, environmental impacts, and manifestations of biocultural experiences and diversity. The results indicated that the manifestations of biocultural experiences and diversity impacted the events leading to the resiliency practices by establishing them, refining them, and aiding in sustaining them. Results also showed that aspects of socioecological systems were integrated by an environmental actor. These aspects involved the environmental actor directly impacting nature, including others in impacting nature, involving other living organisms in impacting nature, incorporating technology in impacting nature, as well as applying methods and

practices of teaching to impact nature. The first paper (Chapter 2) provided the necessary conditions for establishing information needed for exploring relational aspects of biocultural diversity and environmental literacy. This led to the second paper.

The second paper (Chapter 3) focused on environmental literacy. It investigated how environmental literacy impacted the efforts made by environmental actors implementing resiliency practices at an academic institution. This analysis identified the resiliency practices held at the institution, environmental impacts, and dimension of environmental literacy. The results showed that the application of environmental literacy by environmental actors helped optimize the resiliency practices at this institution. In particular, this optimization could be seen through the environmental knowledge held by the environmental actors, the ways they prevented and/or resolved environmental issues, their application of multiple solutions to those environmental problems, their involvement and encouragement of others to mitigate environmental problems, and their use of financial resources to initiate and sustain these practices. This paper provided the necessary conditions for establishing the rest of the information needed to understand relational aspects of biocultural diversity and environmental literacy. These relational aspects were investigated in the third paper.

The third paper (Chapter 4) investigated aspects of biocultural diversity and environmental literacy across both institutions to develop themes of bioculturally responsible behavior. These themes were formed after analyzing manifestations of biocultural diversity and dimensions of environmental literacy that were related to gardens at both institutions. Results from the case study that led to these papers provided the necessary information to conduct the analysis. The third paper (Chapter 4) used

qualitative approaches to develop relation themes. It narrowed in on the cultural manifestations of biocultural diversity and the environmentally responsible behaviors of environmental literacy as action-oriented components. The resulting bioculturally responsive behaviors included exchange of knowledge that enhanced resiliency outcomes, refining resiliency practices, procuring of funds and resources, and obtaining external support in the form of volunteers and environmental experts in sustaining the practices.

The results of these three papers came together to highlight the strengths of the two theoretical frameworks. Examining cultural mechanisms of biocultural diversity in paper three (Chapter 4) brought attention to the behaviors that had direct influence on the environment, such as those of management choices. Examining environmentally responsible behaviors in paper 3 (Chapter 4) identified how environmental literacy created optimal resiliency outcomes under specific conditions. The management choices described in paper 1 (Chapter 2) provided the basis for the analysis conducted in paper 3 (Chapter 4), which identified resiliency practices that simultaneously addressed maintenance concerns (e.g., crop harvesting) and inclusion (e.g., investment in resiliency practices by different social groups). The optimal resiliency outcomes described in paper 2 (Chapter 3) provided the basis for the analysis conducted in paper 3 (Chapter 4) to identify practices that addressed multiple environmental concerns (e.g., one garden that created habitats for native plants and animals and also served as a water reclamation center to reduce water waste).

The first and second papers (Chapter 2 & 3) laid the groundwork to develop the themes of Bioculturally Responsible Behaviors described in paper 3 (Chapter 4). These

themes brought together findings to discuss the relevant actions that can be transferred to other institutions under similar context. In doing so, paper 3 (Chapter 4) also draws on the strengths of the overarching biocultural diversity and environmental literacy frameworks by comparing and contrasting how these notions (while leading to inclusive resiliency practices at both institutions) involved similar, but different paths to the realization of the practices.

Implications

The common implication across all of these studies is guidance for creating professional development based on socioecological system and biocultural needs. For example, when an institution decides to start a resiliency practice, they would first need to identify environmental actors that have environmental literacy. On the other hand, environmental actors may be developed through professional development.

Professional development could lead to well-rounded environmental actors by helping them enact bioculturally responsible behaviors in relation to their resiliency efforts. These bioculturally responsible behaviors can combine action-oriented nuances of biocultural diversity and environmental literacy to produce support resiliency practices that are appropriate for their context. For example, managers could include a combination of Earth systems knowledge (e.g., native plants), tolerance (e.g., acceptance of different social groups, and financial action (obtaining funds) in their professional development. This would give the environmental actors the tools necessary to understand ecological functions, how to involve people with different perspectives, and how to gain the financial support they need to start an inclusive resiliency practice. This would lead to

producing the most effective outcomes when preventing or mitigating environmental problems.

Once identified or trained, the environmental actors work alongside leadership to determine appropriate practices based on institutional needs that also impact socioecological systems. For example, an institutional interest in obtaining a "green business" status that provides the institution with tax deductions is chosen. The environmental actors and leadership could then implement the practice while taking into consideration manifestations of biocultural diversity. This could be done by inviting an individual from outside of the institution to aid in identifying cultural aspects of the local socioecological system. A potential cultural aspect may be a neighboring waterway that is being negatively impacted by surface runoff from the institution's production process and is used as a source of sustenance by a Latino community that resides next to the waterway. Through the environmental actors' application of environmental literacy, such as knowledge of Earth systems, identifying a practice to reduce surface runoff may benefit the system. This practice could take the form of creating rain gardens to surround the institution's property. Once established, these gardens would divert surface runoff from the institution back into the ground while filtering out the pollutants that were negatively impacting the neighboring water way.

The development of this practice would then serve as the basis for additional professional development. The environmental actors could take employees from the institution into the gardens to engage in acquiring environmental literacy through conceptualizing, analyzing, problem solving, and understanding (Blythe,1998). Interactions with the garden and neighboring Latino community could then aid in

identifying more biocultural manifestations. This process may lead to new ways the institution can engage in creating inclusive resiliency practices.

Alternatively, if a hypothetical institution like the one described above fails to identify environmental actors, they could solicit aid from an environmental expert from outside of the institution. Ideally, this expert would be an individual from the neighboring Latino community with the ability to clearly identify the needs of the socioecological system. Then, working together with the institution, aspects of the socioecological system integrated through manifestations of biocultural diversity could be incorporated into the practices developed by the institution.

In essence, I suggest the following for the realization of inclusive resiliency practices:

- Identify or cultivate environmental actors.
- Design events in support of resiliency practices based upon bioculturally responsible behaviors.
- Partner environmental actors with leadership to identify appropriate practices based on institutional needs.
- Have environmental actors use the resiliency practices to develop environmental literacy in other employees.
- Partner with neighboring communities and/or with experts outside of the institution to integrate biocultural diversity that develop inclusive resiliency practices.

These notions allow for this work to be transferable to similar contexts and may also have the potential to guide different types of institutions in varying contexts.

Future Work

Future work in developing, implementing, and sustaining inclusive resiliency practices within institutions should continue to implore qualitative approaches such as those described in the collection of papers in this dissertation. Case studies that collect interviews, apply deductive coding, conduct member checking, and process trace should be used to explore four new directions. First, studies should explore to what extent non-academic institutions are likely to have employees that can serve as environmental actors. Second, studies should address to what extent biocultural diversity and environmental literacy appear within those institutions and how. Third, research is needed to identify what themes of events emerge within those institutions. Finally, transferability of those features should be explored. Identifying commonalities among different types of institutions while remaining true to the specific conditions in which those institutions exist is essential. In identifying common grounds, dialog can be established among different types of institutions. When this occurs, knowledge is shared. This exchange of knowledge creates new perspectives that can help organizations develop inclusive resiliency practices that address problems within their specific context. Furthermore, the use of qualitative approaches to explore the four previously described features would highlight those sharing their stories. When those stories are shared, biocultural diversity increases, environmental literacy is gained, and socioecological systems become resilient.

Closing Remarks

Throughout my years working in the realm of environmental science, I have seen and learned about various impacts we humans have on the Earth. In particular, our impact on our own well-being through our interactions with nature. On the one hand, we recycle,

and on the other, we create products that while recyclable, never fully biodegrade, pollute our natural surroundings, and more so, negatively impact those whose voices go unheard. We create false dichotomies of being "green" or "not green" in regards to meeting the needs of current and future generations, while not taking into consideration *who* within those future generations will benefit. My upbringing has helped me see beyond straight forward depictions of the way socioecological systems function. All these components have come together in this dissertation.

The methods implemented in this study were deliberately chosen based on their ability to highlight the paths toward inclusive resiliency practices that take into consideration the silent voices. Acknowledging this and taking action to consider these ideas are necessary to move toward organizational practices that benefit all.

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APPENDICES

Appendix A: Institutional Review Board

FIU | FLORIDA INTERNATIONAL UNIVERSITY

Office of Research Integrity
Research Compliance, MARC 414

MEMORANDUM

To:	Dr. Kathleen Quardokus Fisher
CC:	Stephanie C. Campo
From:	Maria Melendez-Vargas, MIBA, IRB Coordinator
Date:	June 4, 2020
Protocol Title:	"Causal Mechanisms of Sustainable and Resilent Practices: Informing Environmental Education at the Organizational Level"

The Social and Behavioral Institutional Review Board of Florida International University has approved your study for the use of human subjects via the **Expedited Review** process. Your study was found to be in compliance with this institution's Federal Wide Assurance (00000060).

IRB Protocol Approval #:	IRB-20-0252	**IRB Approval Date:**	05/29/20
TOPAZ Reference #:	108705	**IRB Expiration Date:**	05/29/23

As a requirement of IRB Approval you are required to:

1) Submit an IRB Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved by the IRB prior to implementation.
2) Promptly submit an IRB Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
3) Utilize copies of the date stamped consent document(s) for obtaining consent from subjects (unless waived by the IRB). Signed consent documents must be retained for at least three years after the completion of the study.
4) **Obtain continuing review and re-approval of the study prior to the IRB expiration date**. Submit the IRB Renewal Form at least 30 days in advance of the study's expiration date.
5) Submit an IRB Project Completion Report Form when the study is finished or discontinued.

HIPAA Privacy Rule: N/A

Special Conditions: N/A

For further information, you may visit the IRB website at http://research.fiu.edu/irb.

MMV/em

Appendix B: Research Review Committee

Superintendent of Schools
Alberto M. Carvalho

Miami-Dade County School Board
Perla Tabares Hantman, Chair
Dr. Steve Gallon III, Vice Chair
Dr. Dorothy Bendross-Mindingall
Susie V. Castillo
Dr. Lawrence S. Feldman
Dr. Martin Karp
Dr. Lubby Navarro
Dr. Marta Pérez
Mari Tere Rojas

Assessment, Research, and Data Analysis

School Support

June 29, 2020

Ms. Stephanie Campo
11200 SW 8th Street
Miami, FL 33199

Dear Ms. Stephanie Campo:

I am pleased to inform you that the Research Review Committee (RRC) of the Miami-Dade County Public Schools (M-DCPS) has granted you approval for your request to conduct the study: " Causal Mechanisms of Sustainable and Resilient Practices: Informing Environmental Education at the Organizational Level in order to fulfill the requirements of your dissertation at the Florida International University"

The approval is granted with the following conditions:

1. Participation in this study is at **the discretion of the administrator of the targeted school**. Please note that even with the approval of the RRC, it is still the responsibility of the Principal as the gatekeeper of the school to decide whether to participate or not. As stated in the Board rule, "... the principal of the individual school has the privilege of deciding if RRC - approved research will be conducted within his/her school." A copy of this approval letter must be presented/and or shared with the administrator of each targeted site.

2. Before conducting any research and/or collecting any data in any M-DCPS site, a researcher who **does not** have a valid Level 2 security clearance from the Florida Department of Law Enforcement and the Federal Bureau of Investigation, must obtain a level 2 background security clearance from the M-DCPS Fingerprinting Office. The application for District security clearance can be found at:
http://oer.dadeschools.net/ResearchReviewRequest/ResearchReviewRequest.asp

3. The participation of all subjects (if applicable) is voluntary. The anonymity and/or confidentiality of all subjects must be assured.

4. The purpose of this research is to trace instances that impact the development and implementation of organizational sustainability program(s) and practices.

5. The data collection methodology will not involve any student and will be limited only to online Zoom interviews with select teachers. Staff, and parents at select M-DCPS schools, including Whigham elementary and Air Base K-8 center.

It is your responsibility to ensure that appropriate procedures are followed in requesting an individual's cooperation, and that all aspects of the study are conducted in a professional manner. With regard to the latter, make certain that all documents and instruments distributed within MDCPS as a part of the study are carefully edited.

The approval number for your study is 2415. This number should be used in all communications to clearly identify the study as approved by the Research Review Committee. The approval expires on 06/30/2021. During the approval period, the study must adhere to the design, procedures and instruments which were submitted to the Research Review Committee.

Finally, as indicated in your application, please submit to the RRC an abstract of the research findings by July 2021.

If there are any changes in the study as it relates to MDCPS, the RRC must be notified in writing. Substantial changes may necessitate resubmission of the request. Failure to notify me of such a change may result in the cancellation of the approval.

If you have any questions, please call me at 305-995-7091. On behalf of the Research Review Committee, I want to wish you every success with your study.

Sincerely,

Tarek Chebbi, Ed. D., Chairperson
Research Review Committee

APPROVAL NUMBER: **2415**	APPROVAL EXPIRES: **06/30/2021** (*)

(*): FIU IRB 20-0252 approved May 29, 2020.

Note: The researcher named in this letter of approval will be solely responsible and strictly accountable for any deviation from or failure to follow the research study as approved by the RRC. M-DCPS will NOT be held responsible for any claim and/or damage resulting from conducting this study.

VITA

STEPHANIE C. CAMPO ROJAS

2013	B.A. in Environmental Studies Florida International University Miami, FL
2015	M.S in Environmental Policy and Management Florida International University Miami, FL
2023	Ph.D. in Earth Systems Science Florida International University Miami, FL

PUBLICATIONS AND PRESENTATIONS

Campo, S.C (2018). International Conference on Thinking. Thinkovator presenter: Educating Young Minds for a Sustainable Future, Miami, FL

Campo, S.C. (2019). Florida International University. Department of Earth & Environment. Graduate Symposium. Educating Young Minds for a Sustainable Future.

Campo. S.C. (2019). Florida International University. STEM Transformation Institute. Environmental Education Research.

Campo, S.C (2019). Association for Environmental Studies and Science. Education for a Sustainable Future.

Campo. S.C., (2019) Florida International University. Earth & Environment Seminar. Shifting Toward Sustainable and Resilient Behaviors: An Educational Framework for More Balanced Systems.

Quardokus Fisher, K., Campo, S.C**.**, Saucer, L., Calagna, O., Reano, D. (Fall 2019). Florida International University. STEM Transformation Institute. Geoscience Education Research at FIU.

Salmon, A.K., Campo, S.C**.**, and Barrera, M.X. (2019). Opportunities in the Odds; Exploring Adult-Child Interactions and their Effects on Children's Cognitive and Learning Progress, *IntechOpen*. doi: 10.5772/intechopen.82515.

Campo, S.C, (2020 Accepted/Canceled). Association for Environmental Studies and Science. Qualitative methods discussion symposium, The Role of Diverse Research Methods in Fighting Environmental Injustice; New York, NY

Campo, S.C, Sitomer, A., Quardokus Fisher, K., & Brett-Goodwin, M. (2020, Accepted/Canceled). Council for the Studies of Community Colleges. Paper presentation on psychological ownership, Tempe, AZ Emerging Psychological Ownership: Implications for Advancing Scholarly Inquiry in a Community College Mathematics' Professional Organization

Quardokus Fisher, K., Sitomer, A., Campo, S. C**.,** & Breit-Goodwin, M. (June 2020). STEM Centers and Disciplinary Professional Society Partnerships to Facilitate SoTL-Supported Change. Presented at Network of STEM Centers, Association of Public and Land-Grant Universities. Virtual Meeting.

Campo, S.C. (2021). Florida International University. School of Education. Navigating Coding: Qualitative Research in a Quantitative Realm, Lecture on types of qualitative coding and potential impacts in quantitative dominated disciplines.

Campo, S.C (2021). Florida International University. School of Education. Advance Qual Coding: It Depends..., Lecture on coding and the various approaches available based on researcher's ontology, epistemology, and axiology.

Campo, S.C. (2021). Florida International University. Department of Earth & Environment. Graduate Symposium. Casual Mechanisms of Resilient Practices: Informing Environmental Education at the Organizational Level.