“If the earth is a body, den a dam is a blood, watch wa gowin’ awn”

The relationship between embodied knowledges of space and perceptions on climate change adaptation in St. Croix

Chaprece Henry & Beatrice Klein

Master Thesis Series in Environmental Studies and Sustainability Science,
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A thesis submitted in partial fulfillment of the requirements of Lund University International Master’s Programme in Environmental Studies and Sustainability Science (30hp/credits)

LUCSUS
Lund University Centre for Sustainability Studies

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Abstract:

As climate change adaptation becomes more mainstreamed there has been an increasing focus on incorporating local knowledge to ensure equitable adaptation pathways. However, adaptation discourses prioritize scientific understandings of climate change, ignoring epistemological differences in knowing climate change. Interventions treat space as inert and fail to consider how spatial relationships constitute valid ways of knowing. By approaching adaptation as a spatial phenomenon, we challenge the current politics of knowledge around adaptation. We apply a relational ontological approach, conducting phenomenological study of residents in West St. Croix to unpack knowledge-making practices. We reveal that embodied mapping shapes understanding of environmental change, and subsequently informs views of adaptation processes. Residents view adaptation interventions as a technical apparatus apart from the lived experience. Our study demonstrates that knowledge is multiple, situated within socio-historical processes, and embedded in spatial practice. An inclusive adaptation framework needs to embrace plurality to inform a broader discussion of solutions.

Keywords: climate change adaptation, relational space, knowledge politics, embodiment, cross-scalar, U.S Virgin Islands

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Table of Contents

1. Introduction **1**

1.1 Research Aim and Objectives 3

1.2 Contribution to Sustainability Science 4

2. Climate change adaptation in St. Croix **5**

2.1 Natural Characteristics 5

2.2 Watershed governance 6

3. Theory **8**

3.1 Setting the Theoretical Scene 8

3.1.1 Why a socio-spatial perspective is important for understanding adaptation 9

3.2 Our Theoretical Approach: Relational Spatial Ontology 10

3.2.1 Relational Space and Embodiment (Knowledge) 11

3.2.2 Contestations over scalar knowledges 12

4. Research Design and Strategy **13**

4.1 Data Collection 14

4.2 Data Analysis 16

4.3 Positionality 18

4.4 Scope of study 18

5. Results **19**

5.1 Role of Government's Responsibilities 20

5.2 Embodiment 21

5.2.1 Bodily presence: senses and affect 22

5.2.2 Recalling the Past 23

5.2.3 Practices 25

5.3 Perceptions 27

5.2.1 Perceptions of watersheds 27

6. Discussion **32**

6.1 Embodied mapping 32

6.2 Power, governance and implications for CCA 34

6.2.1 Knowing the solution through embodied practices 34

6.2.2 Embedded power relationships 35

6.2.3 Practical implications 36

7. Conclusion **37**

8. References **39**

1. Introduction

The IPCC sixth assessment report provides a grim warning: despite global progress on climate change nations must prepare for the worst and accelerate climate change adaptation (CCA) programs. Adaptation planning should be inclusive, involving not only a diverse set of stakeholders but incorporating the local knowledges[1] of affected communities (IPCC, 2022). This, they emphasize, will reduce vulnerability to climate change impacts (IPCC, 2022). Yet, even with these declarations, the IPCC report itself fails to 'practice what it preaches.' It relies heavily on Western scientific modeling and assumptions, incorporating little if any, alternative knowledge systems (Jasanoff, 2010). Such an omission reflects a deeper problem within dominant adaptation discourse and practice. Climate change knowledge, on which adaptation practice is based (Schipper et al., 2021), remains disconnected from embodied experiences of environmental change that inform communities' responses to adaptation initiatives (Goldman et al., 2018; Tschakert, 2012).

Similar to the asteroid hurtling towards Earth, as depicted in the film *Don't Look Up*, so too is climate change framed as a globalizing, external threat to an otherwise well-functioning human society (Nightingale et al., 2020; Taylor, 2015). Within this imaginary, lies a sense of urgency to quantify impacts and craft actionable solutions. Consequently, CCA policy and practice remain largely "technical" with a focus on instituting "new infrastructures'' or seeking to "create biophysical changes" in local environments (Nightingale et al., 2020, p. 344). The technical nature of adaptation demands specific climate change knowledge, one that travels between specificity, objectivity, and local and global (Jasanoff, 2010). Overall, this knowledge makes universalist claims on both how climate change can be known and addressed. It attempts to make climate change impacts knowable, despite the widespread agreement of its uncertainty, due in part to multi-scalar and non-linear effects (Kates et al, 2001). This politics of knowledge is power-laden and has an unusual penchant for omitting alternative ways of knowing. It has what Hulme (2010) calls a global instinct that…

> erases geographical and cultural difference and in which scale collapses to the global. Rather than the view from nowhere, global kinds of knowledge claim to offer the view from everywhere (p.559).

[1] We refer to "knowledges" in plural form to put emphasis on the diverse ways of knowing

The abstraction of knowledge to global limits the exploration, both in research and practice, of local knowledge-making practices and context-specific experiences of environmental change (Murphy, 2011). As a consequence, adaptation practices may fail to consider the local social contexts in which they're embedded and fail to build upon existing local knowledge resources (Nightingale et al., 2020). To address this gap, current adaptation literature has focused on local and traditional knowledge-making practices. These studies highlight co-production research processes that integrate both Western and local knowledge systems (Bremer & Meisch, 2017). Adaptation research often aims to develop guidelines on how actors can co-produce "meaningful knowledge" in local contexts (Bremer & Meisch, 2017, p. 5). However, co-production research upholds the hierarchy of knowledge systems, with some studies declaring that traditional knowledges were 'wrong' if it diverged from climate science models (Klenk et al., 2017). Decisions of the relevancy or validity of knowledge demonstrate that co-production still operates within the global climate knowledge regime.

In attempting to measure local knowledges against the dominant scientific regime, it also discounts embodied experiences of climate change as knowledge (Yeh, 2016). Rather than emanating solely from the mind, knowledge is interactive, stemming from social relations in surrounding environments (Ingold & Kurttila, 2000). When studying Sami in Finnish Lapland, Ingold and Kurttila (2000) show how perceptions of changing climates were shaped by memories, and everyday tasks carried out in physical environments.

On the surface, these practices would appear to suggest that local knowledge is static and confined to spaces that communities inhabit. Indeed, many studies have come to this conclusion (Goldman et al., 2018; Klenk et al., 2017). However, as Popke (2016) reminds us, climate change experiences "assembles together human and nonhuman entities, diverse ways of knowing, variable spatialities and multiple temporalities." (p. 1) In other words, local knowledge practices are relational and traverse across multiple spatial and geographical scales (Ahlborg & Nightingale, 2012).

Viewing ways of knowing as relational and interactive allows for a deeper analysis of knowledge-making practices. It allows the exploration of the diverse range of meaning-making practices, that include affective responses, bodily senses, memories, and everyday practices (known as embodiment)(Head et al., 2011; Tschakert et al., 2013; Wright et al., 2021). Importantly, relational approaches do not ignore the "peculiarities of place", as with global climate knowledge, (Hulme, 2010 p. 559) but pay close attention to the role of spatial relationships in meaning-making practices (Blok, 2010).

Goldman et al. (2018) provides an example:

> For instance, for Maasai villagers, climate change is often experienced as temperature and precipitation changes but also as changes in their ability to predict the weather, changes in vegetation and animal behavior, and changes in their own livelihood practices of pastoralism/agropastoralism, which both impact local climatic patterns (such as drought) and are immediately impacted by such changes (p. 2).

A close reading of Goldman et al. (2018) reveals how Maasai not only come to know environmental change through spatial interactions but also their practices come to shape space itself. It elucidates how ways of knowing are linked to acting in the world, and transforming it (Goldman et al., 2018). This aligns with current theories in Human Geography, such as non-representational theory (Anderson & Harrison, 2010), and relational space theories (Murdoch, 2006) which posit that individuals and space are mutually constitutive (cf. Geografiska Annaler, 2004).

Climate change, as it is scientifically conceptualized, poses challenges to climate change adaptation as it takes place on spatial and temporal scales that are far beyond the traditional scope of planning and design (Goh, 2015). Governments all over the world are proposing ambitious plans to respond to climate change impacts. These measures involve intense reconfiguration of built and "natural" spaces, sourcing massive economic resources. While these interventions are understood as technical, they involve intractable social decisions including how, who and what to protect and adapt to respond to climate change (Goh, 2015). These reconfigurations of space are highly tied to knowledge paradigms, as planning processes are an operative link between knowledge and action (Angell & Stokke, 2014). Communities' responses to these proposals are shaped by their socio-spatial relationships. In other words, the ways people relate to and know environmental changes in space may influence how they relate to adaptation interventions.

1.1 Research Aim and Objectives

We study a case of CCA in St. Croix, U.S Virgin Islands. These islands are in the process of rebuilding after being struck by two category 5 hurricanes in 2017. The islands have planned to 'build back better' through planning future adaptation approaches (USVI Hurricane Recovery and Resiliency Task Force, 2018). Our study explores locals' perceptions of these proposals in general and watershed management in particular, by delving into embodied knowledge and experiences of climate change. Our thesis aligns itself with a growing body of work that conceptualizes knowledge-making as embodied experiences of spaces (Country et al., 2016; McElias et al., 2021; Simonsen, 2007; Tschakert, 2022). We introduce an innovative approach by bringing together relational space

approaches and theories of embodiment to explore how local communities in St. Croix perceive environmental changes and governmental responses to them. If adaptation represents an ontological (world making) and epistemological project, then we hope to explore how communities situate themselves within these environments.

Hence our overarching research question is:
How is environmental change experienced in an embodied way in an adaptation setting?

to support this we also ask:

What spatial relationships are expressed by the Crucian communities? How does this inform perceptions of adaptation governance? What are the practical implications of this for adaptation governance?

1.2 Contribution to Sustainability Science

We wish to contribute to sustainability science engagement with the climate change adaptation concept by embracing plurality and alternative ways of knowing. Sustainability science depends on concepts like climate change adaptation to help us think through complex problems. However, these concepts are incomplete tools for portraying 'reality' (Nightingale, 2016).

As Sustainability science emerged from recognizing the need to seek solutions through multi- and interdisciplinary research (Shrivastava et al, 2020), we are not arguing that there is one correct way to enter the understanding of climate change adaptation. Rather, we call upon the importance of including knowledge from social science, humanities and the arts to enable for sustainability science to question its own research and avoid falling into an apolitical trap (Schipper et al, 2021; Shrivastava et al, 2020).

This calls for examining the unexplored layers that influence adaptation solutions and 'barriers' (Ober & Sakdapolrak, 2019). The climate change adaptation conversation has, in large amounts, revolved around 'barriers' of adaptation, including institutional shortcomings such as knowledge and expertise (Ober & Sakdapolrak, 2019). As moving forward, Biesbroek et al (2013) makes the case that the climate change adaptation research must move beyond asking 'if' and 'which' barriers to adaptation exist and begin asking 'how' and 'why' barriers emerge. This is partly on the basis that "most studies on the barriers to the governance of adaptation are still implicit in their ontological and epistemological assumptions' (Biesbroek et al , 2013, p. 14), not reflecting deeply on their own assumptions (Ober & Sakdapolrak, 2019). As a consequence, we need new ways of generating

knowledge that does not limit our vision or narrow the evidence base to examine concepts that are deeply rooted in relationships between the biosphere and human systems (Schipper et al, 2021).

Through relational understandings of residents' perception of adaptation spaces, we broaden the understandings of knowledge and meaning within the field of adaptation, informing what boundaries within the current adaptation framework that needs to be reconsidered. In exploring situated knowledge we are steering away from conventional ideas of cause-solution relationships (Erikssen et al, 2015). We provide alternatives to post-political, techno-managerial, expertise driven narratives (Lövenbrand et al,2014) and introduce how deeper understandings of sociospatial and relational knowledge can come to inform a more democratic debate and contestation.

2. Climate change adaptation in St. Croix

This section will provide a brief overview of St. Croix, the current adaptation proposals and related governance structures. We will situate watershed governance in terms of governmental structures, historical information as well as natural characteristics.

2.1 Natural Characteristics

St. Croix is the largest island of the U.S. Virgin Islands and the most easterly possession of the United States. The island is a little more than 22 miles long, from east to west. St. Croix is characterized by a mountainous area in the north and northwest flanked by a rolling plain to the south. The mountains are broken by many narrow, steep valleys through which intermittent streams or “guts” discharge in southerly and southeasterly courses across the plain. Besides St. Croix, the Virgin Islands consist of three other additional inhabited islands: St. Thomas, St. John, Water Islands and 50 cays. St. Croix is distinct as it has a large agricultural and with ten major ecosystem types: semi-evergreen forest, deciduous forest, thorn woodland, thorn scrub, mangrove swamp forest, littoral woodland, beach ecosystem, savanna, man’s monoculture, and man’s diverse ecosystem (Forman, 1974). It has a population of 50,601 (US Census Bureau, 2021), and two major centers: Frederiksted on the West and Christiansted on the East. Frederiksted is known locally as “Freedom City” where emancipation took place for the enslaved Africans population in 1848.

As with many small islands around, global environmental changes are slowly changing natural ecosystems (Rudge, 2021). In St. Croix, this has manifested as severe drought, an increasing

frequency of extreme weather events, such as tropical storms and hurricanes. In 2017, Hurricanes Irma and Maria struck the Virgin Islands within 14 days, causing millions in damages to public infrastructures and homes. In response, the USVI government and institutional collaborators, e.g., the private sector and NGOs, established recovery programs, some of which employ adaptation strategies.

2.2 Watershed governance

In response to climate change and natural hazards, watershed protection emerged as a central adaptation project. Watersheds describe a geographical area that drains rainfall (and/or snowmelt) into streams and rivers, and eventually into a single outlet, such as the ocean (NOAA, 2021). Led by the Department of Natural Resources (DPNR), watershed initiatives aim to mitigate the effects of pluvial flooding caused by climate variability and development practices (Department of Planning and Natural Resources, 2021). Western St. Croix experiences severe floods, some of which resulted in fatalities. Many attribute the flooding to both climate change and mismanagement or altering natural stream waterways (VITEMA, 2016). As a result, DPNR will target the Diamond watershed (Figure 1) for future efforts while continuing to implement previous watershed initiatives in the West. Given this, we chose to focus our study on Western St. Croix.

Figure 1

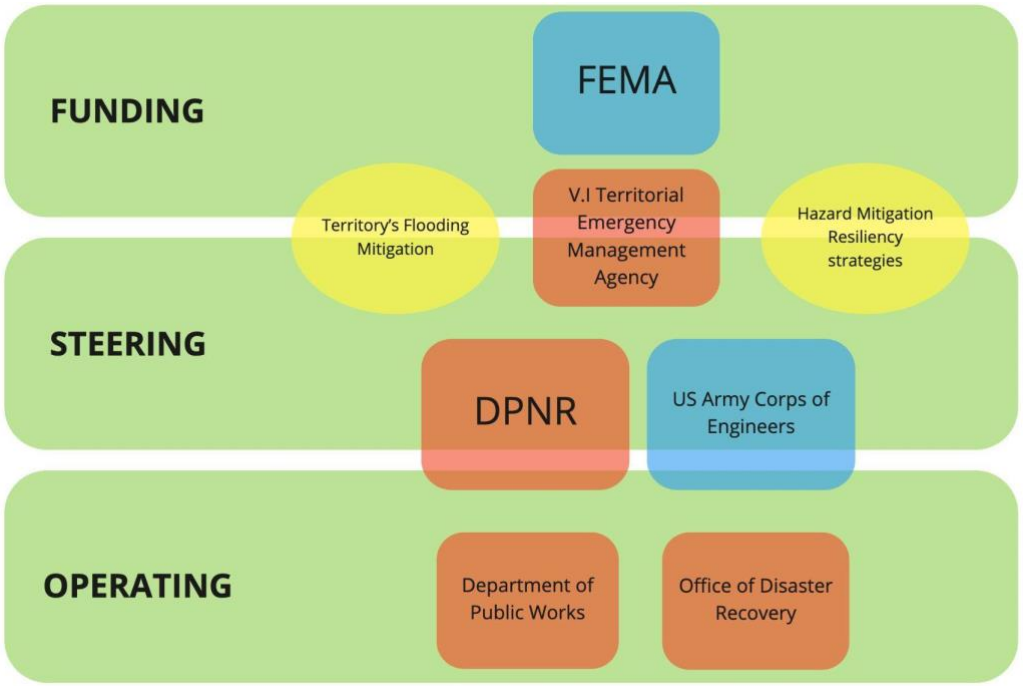
Map over Diamond Watershed

Note: Map over St. Croix with the Diamond watershed area marked, conducted from (Department of Planning and Natural Resources, 2021)

However, as Watershed delineates the boundaries of an ecological scale, which does not neatly translate into a defined government jurisdiction (Cohen & Harris, 2014), the management and implementation of watershed projects involve several local and federal agencies (see Figure 2). Watershed projects in Western St. Croix are primarily financed by the U.S Federal Emergency Management Agency (FEMA). They fall under the Territory's Flooding Mitigation and Hazard Mitigation Resiliency strategies. Both are components of a "Territorial Hazard Mitigation''plan. This umbrella report outlines key programs and other plans that support disaster recovery and long-term CCA planning. FEMA recently granted the territory 99.11 million as part of Hazard mitigation grant program, a portion of which is allocated to support watershed projects (Resilient VI, 2022).

Figure 2

Illustration over watershed governance structure in St. Croix



Note: A brief overview of the main actors in watershed governance in St. Croix, red boxes represent local agencies and blue boxes represent federal agencies. Yellow circle represents steering documents produced by the local government together with partners, mandated by FEMA. Green boxes are abstract representations of steps in the governance structures.

Remnants of colonial governance structures are present today. St. Croix was colonized by seven nations. The Danish had the longest-ruling period of the Virgin Islands from 1671 to 1917. During

their rule, over 100,000 enslaved Africans arrived on the island (Highfield & Tyson, 2009). Before the arrival of Europeans, distinct groups of indigenous populations migrated from South America to inhabit the islands. However, the advent of colonization decimated local indigenous populations (Wilson, 1997).

Today, the Virgin Islands is legally defined as an unincorporated territory of the United States, meaning it is "dependent on the absolute power of the US Congress, as well as the US armed forces exercise extensive control over it." (IGI Global, 2022). In other words, the U.S constitution partially applies to the islands, but the United States federal government oversees all local governing affairs. Given its unique history and recent exposure to severe natural hazards, St. Croix serves as a good example for understanding locals' understanding of environmental change and how they come to inform perception of CCA governance.

3. Theory

3.1 Setting the Theoretical Scene

This thesis is concerned with how communities know and experience environmental changes in space, and how this shapes perceptions of CCA interventions. Overall, traditional adaptation literature and frameworks neglect communities' spatial relationships (Goh, 2015), and their role in knowledge production (McMichael et al., 2021). Instead, there is a binary classification of physical/nonphysical categories and a view of knowledge as confined to local scales (Nightingale et al, 2020). Additionally, scholars have highlighted how power relations between actors at various scales influence local adaptation decisions (Adger et al., 2005). This literature rarely discusses how communities' knowledge practices shape understandings of these processes. To overcome these challenges, we treat CCA as a socio-spatial phenomenon. Socio-spatiality explores the material and social relationships of society. People interact in diverse social spaces and places, create meanings from these relationships, and construct life expressions to make sense of their world (Turunen, 2017). Thus, we aim to understand how individuals come to relate to and know spaces. We will demonstrate how communities' way of knowing and understanding spaces/places are context-specific, reflecting a range of responses (sensory, affective, visual) that emerge from spatiality. We also utilize feminist

theories of embodiment to incorporate the senses and affect as important ways of making sense of, and thinking through everyday life.

This section will be structured as follows. First, we outline the treatment of socio-spatial perspectives in current adaptation literature. Secondly, we will introduce relational spatial ontology and embodiment theories. Lastly, we will discuss how scalar configurations impact ways of knowing spaces through embedded power relationships.

3.1.1 Why a socio-spatial perspective is important for understanding adaptation

CCA literature, with some exceptions (e.g Christmann & Ibert, 2012 ;Goh, 2015;Lapointe et al, 2019; Dujardin & Dendoncker,2019), rarely discusses sociospatial relationships (Goh, 2015). If discussed, it concerns scalar qualities of vulnerability(e.g Downing et al, 2005; Zografos et al, 2016), inequality (e.g Anguelovski et al, 2016; Anguelovski et al, 2019; Schofield & Gubbels, 2019; Shi et al, 2016) and local planning (e.g Mabon et al, 2019; Boon et al, 2019). Few examples within the academic literature address embedded relationships in space, and how they are contested by adaptation interventions. Overall, adaptation literature either conceives adaptation as technical or socio-political endeavor, often treating space as inert. Adaptation planning affects social and spatial arrangements, as it is bound in space and shaped by ecological and political-economic histories (Goh,2015).

Furthermore, Goh (2015) stresses the importance of shared experiences and local knowledge in organizing against dominant adaptation proposals (Goh,2015). This dissertation introduces several important sociospatial topics, such as the role of historical power relationships and cross-scalar understandings of adaptation projects to which we wish to contribute.

While insightful, Goh's (2015) work fails to parse communities' knowledge practices or the ways they perceive spaces of adaptation. Such an exploration challenges the knowledge politics of adaptation planning and allows for the exploration of affective and embodied knowledge practices (Nightingale et al, 2020). Meaning emerges from embedded experiences that political, impersonal, and universal imaginaries fail to comprehend (Jasanoff, 2010). The thickness of adaptation spaces must be acknowledged, as the environment is not only known scientifically but tied to places and particulars (Jasanoff, 2010).

3.2 Our Theoretical Approach: Relational Spatial Ontology

"Space is more than an empty container in which social relations take place, but instead these relations "project themselves into space, becoming inscribed there, and in the process, producing space itself" (Lefebvre 1991 in Pierce & Martin, 2015) Relationality in space is associated with post-structural thinkers, prompting what is often cited as a 'relational turn', in human geography (Geografiska Annaler, 2004). From a relational perspective, spatiality is conceived as a web of relations, networks, assemblages, and interactions that emerge and mutually constitute space/places. Instead of conceiving space as static, bounded, and fixed in time, post-structuralist influenced theorists view space as open, dynamic, and temporally contingent (Murdoch, 2006). Under this view, space has a fullness (the multitude of relations) yet remains open allowing for new trajectories to emerge, as a result of evolving relations and societal processes. Taking space as "open, multiple and relational, unfinished and always becoming, is a prerequisite for history to be open and thus a prerequisite, too, for the possibility of politics" (Massey, 2005 p. 59). This allows us to embrace a dynamic understanding of CCA spaces, through mappings of sociospatial relations across space and time.

We follow Massey (2005) understanding of space as the sum of embedded material practices, of communities and wider socio-political processes (e.g., capitalism). Communities mutually constitute space through everyday practices, as well as affect and emotive responses (Massey, 2007). Due to these interrelations, space becomes "open, multiple and relational, unfinished and always becoming" (Massey 2005 p. 59). Thus, communities are both shaped by the material changes of environmental change, and adaptation interventions (Nightingale, 2020), and the multiple ways to know and respond to these forces shapes space itself.

Additionally, the ways people know space is not contained to the local as places themselves are articulations of multi-scalar power relations (Pierce & Martin, 2015). Massey (2007) states:

> If space is conceptualized relationally, as the product of practices and flows, engagements, connections and disconnections, as the constantly being produced outcome of mobile social relations then local places are specific nodes, articulations within this wider power-geometry (p 167).

Moreover, this conceptualization of space/place acknowledges the role of space in the co-production of individuals and more-than-human objects (Massey, 2005). Inspired by anti-essentialist thinkers like Chantal Mouffe, she argues that subjectivities are relationally constructed (Massey 2005). This calls

for approaches that highlight how everyday practices constitute space/place and a dissection of how subjects (individuals, communities) derive meaning and 'know' their world (Simpson, 2017). We build upon Massey's thoughts on knowledge practices by utilizing feminist notions of embodiment to uncover how communities know adaptation spaces.

3.2.1 Relational Space and Embodiment (Knowledge)

To investigate communities' knowledge practices, we draw upon feminist geographers who have shown that embodiment is a way of knowing. Feminist theories emphasized the situated nature of knowledge as being context-specific, partial, and shaped by an individual's societal position (Haraway, 1988). They highlight how constitutive interactions between objects-bodies-spaces shape subjectivities and knowledge practices. Specifically, they draw upon the notion of embodiment, to articulate how the ways of 'knowing' are corporeal (Moss and Dyck, 2003). Individuals (bodies) derive meaning through relations and places that they inhabit. They develop distinct embodied practices developed through everyday life, which allow them to gain meaning from social relations and through space/place itself (Simpson, 2017). These embodied practices are expressed through bodily senses, and affective responses, in addition to reasoning and thought.

Embodied practices are active doings and also include affect and memories. Affect, refers to feelings and emotions that are "attached to things, people, ideas, sensations, relations, activities [and] ambitions" (Sedgwick, 2003 in Thein 2015 p.451). Similarly, non-representational theorists, such as Thrift (2004) note that affect is 'thought in action, the body's active response to situations and events, representing a "continual becoming that is provided chiefly by bodily states and processes" (p. 60). Embodied practices give meaning to space/places, while spatiality shapes the relations and processes that shape individuals.

Through embodiment, adaptation spaces can be understood from the scale/level they are experienced (Ahlborg & Nightingale, 2012). Notions of embodiment overcome the Cartesian mind/body divide that has influenced modern natural and social sciences (Grosz, 1994). It denies the purity of 'objective' scientific knowledge, allowing for the recognition of a multiplicity of knowledge and experiences (McMichael et al., 2021). In contrast, embodiment attempts to elevate the body (sense of self) as the site of production of knowledge, feelings, emotions, and history" (Probyn, 2003). By recognizing the embodied experiences, we contribute to the field of adaptation by broadening the view on what constitutes viable sources of knowledge on adaptation planning.

3.2.2 Contestations over scalar knowledges

This section discusses relational theories about scale. We hope to provide insight into how residents perceive and relate to scalar relations, as this has implications for adaptation decision-making processes. Developing on the idea that scale is socially produced, this step moves us away from normative ideas of scale eg., for example, the idea that local scale is better than global (Brown & Purcell, 2004). As stated by Brown & Purcell (2004) "if we start from the assumption that there is nothing inherent about scale, we cannot assume priori what social and ecological outcomes rescaling will have"(p.614).

Several social scientists, mainly from the field of geography, have engaged in a debate over space and scale over more than the last three decades (Norman et al, 2012). This has emerged into a branch within scalar thinking under the name the *politics of scale*. In broad terms, these scholars treat social life as process-based and scalar configurations as the outcome of socio-spatial processes (Swyndegow, 2008; Norman et al, 2012; Brenner, 2001). In short, the politics of scale advocates aim to show how scalar configurations serve as a tool of power.

Feminists have criticized the early scholars of the politics of scale for failing to recognize the subjective and plural ways of experiencing and making use of scale (Ansell, 2009). They show interest in the more intimate scale of the body and home, highlighting the importance of emotions and culture (Ansell, 2009). This critique has served as an arena for an academic debate on how social and spatial differences, based on subjective positions gain meaning (Brenner, 2001; Jones et al, 2012; Martson & Smith, 2001). Few studies have developed on how embodied experiences draw upon multiscalar power geometries that move beyond a local-global nexus.

Therefore, we outline how subjective understandings of scale are situated in the embodied experience of historical power structures. Geographical and scalar borders and ordering mirror a desire for order and certainty, grounded in western knowledge paradigms (Collinge, 2005). We draw from black feminist theory arguing that scale cannot be understood outside of historical processes, from which identity and subjectivity are constructed. Black feminists argue that this is rooted in dualistic hierarchical ideas, for example, nature/culture, that organize geographical thoughts (Collinge,2005). As modernity cannot be understood outside of coloniality (Quijano,2007), we must take a critical stance toward how scalar ordering serves to constitute adaptation solutions. As a result, ideas of coloniality and development are nested through an articulation of scale (Swyngedouw, 2015; Collinge, 2005). Relational understanding fosters the cross-scalar notion needed to address how adaptation measures are legitimized.

We align with Massey and the thinkers of relational politics that move beyond views of regions as fixed territories. We propose viewing places as a "series of open and discontinuous spaces connected by the networked social relationships that variously stretch across them" (Allen & Cochrane, 2007). Space is continuously constructed through political processes and everyday practices and relations (Blok, 2010; Meegan, 2017). Therefore, we challenge current knowledge politics around adaptation by focusing on the embodied way of knowing adaptation spaces, stretching beyond space and time.

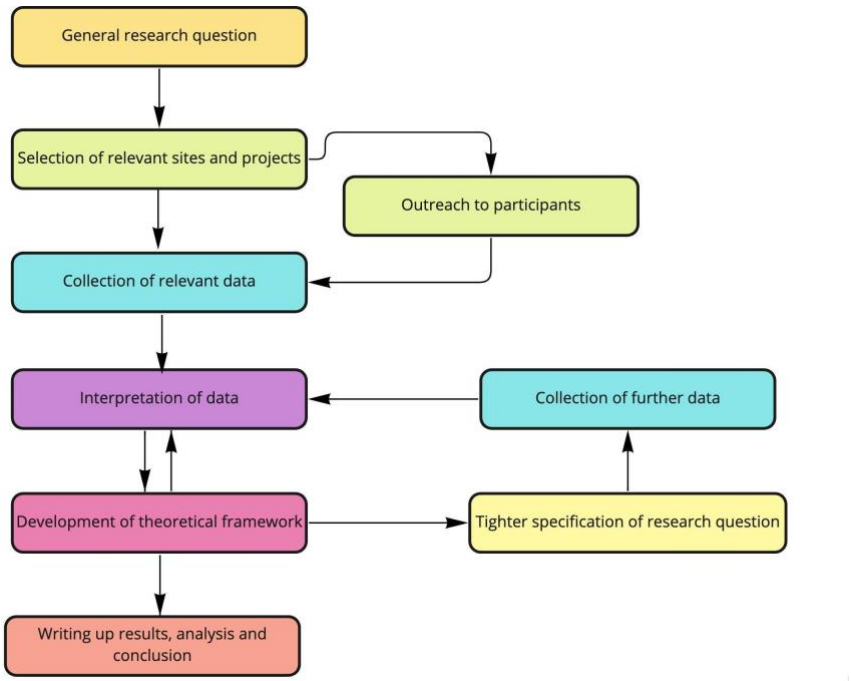
4. Research Design and Strategy

To address our research questions, we utilized a single case-study design. Cases can focus on the events in specific locations, capturing everyday life and social relations within those places (Yin, 2009). Through a detailed examination of phenomena, researchers can explore "how" or "why" they occur (Yin, 2009). We focus on memories and emotions associated with those spaces, hence our use of a case study design. Our findings are limited to the specific context that we studied, and thus we do not draw conclusions about wider populations' perceptions of CCA proposals. The nature of case studies lets us reveal the nature of phenomena in particular space and time. (Yin, 2009).

Additionally, we utilized a qualitative research strategy obtaining data primarily through interviews. Qualitative research strategies are often associated with an inductive approach to theory and research (Bryman, 2012). In our case, we took an abductive reasoning approach, see figure 3, allowing our observations and findings to interplay with novel theoretical understandings, but more importantly grounding our research in the "language, meanings, and perspectives that form [participants] worldview"(Bryman, 2012, p. 401). The outline below illustrates our overall research strategy.

Figure 3

Overview of the main steps in our qualitative research



Note: An abstract illustration of our abductive research approach. Authors own creation, adopted by Byrman, 2012

4.1 Data Collection

As discussed, we wish to add theories of embodiment and relational space to the adaptation research. During the 8-week fieldwork period, we interviewed native Crucians or residents that have lived in St. Croix over 10 years, who reside, or raised in western watershed areas. Throughout our fieldwork, we kept reflective notes, these both helped in developing our theoretical insights as well as gaining knowledge on how our own assumptions might affect our understanding (Larkin & Thompson, 2012). By having daily meetings with each other, reflecting over our individual observations and exploring theory, we created an iterative relationship between our data and theory. We kept an open and creative attitude moving into the analysis process, generating and testing codes.

Interviews centered on topics of experience of environmental changes, knowledge, understanding of watershed projects, and the role of nature in everyday life (see Table 1). We modified interview questions as themes appeared in other interviews. For example, we incorporated questions around inclusion in adaptation decision-making processes, as well as future sustainable development planning. In keeping with our methodological approach, our open-ended interview structure allowed Crucians to share oral stories about the spaces they inhabit. These stories moved across spatial and

temporal scales, which in turn allows interviewees to describe the world based on their own individual relations.

Overall, we conducted 15 semi-structured interviews, which have been transcribed and given anonymous pseudonyms. In doing the semi-structured interviews, we aim to find what people think and feel, recall their experiences and reconstruct events in which we did not participate (Dilley, 2004). Interviewees were chosen based on purposive and snowball sampling methods. 9 of the interviews lasted between 45 minutes to 1.5 hours. Our main local contact, a researcher at the University of the Virgin Islands, introduced us to events where we met our first interviewees, and we asked for referrals thereafter. The rest of the interviews were collected during a door-to-door method in select areas prone to flooding conducted with help from our contact person at the University of Virgin Islands. During one day, our contact person drove us around in areas that frequently experience flooding. Our contact person made initial contact with households and once they agreed to participate, we conducted shorter interviews with these participants (see Table 2). This act of interviewing more directly captures the physical environment and allows for reflections directly related to place. From a phenomenological point of view, where the body takes place is a determining factor in how the environment is experienced (Kusenbach, 2003). Prior to collecting data (via interviews), we conducted a series of informational meetings to provide necessary contextual information and establish local contacts. Information gained through this research, along with site observations informed our interview questions. We hoped to capture the fullness of residents' everyday experiences and knowledge of watershed spaces. Therefore, interview questions were designed to extract detailed and reflective descriptions (Larkin & Thompsson, 2012).

Table 1

Interview-guide semi structured interviews

Main category	Questions
Interviewee Profile	1. Tell us a little bit about yourself, who are you? What do you do for a living? 2. How long have you lived in ST. Croix?
Relationship to St. Croix	1. What makes St Croix unique? 2. Can you tell me about the area where you live? How do you feel about it? How has it changed?
Perception of Space/Place and Non-Human objects	1. How have you perceived environmental changes in your neighborhood? 2. Can you think of any specific place in your neighborhood where you have noticed change in the environment? Could you tell us more about that?
Perception on Adaptation Interventions	*Introduce Adaptation interventions on the West side, afterwards ask:*

	1. What is your overall impression of climate change adaptation projects/hazard mitigation for the islands?
Recognition/Participation	1. Do you feel part of/heard of the decision-making process?
Local Culture	1. What role does nature play in local culture?
Adaptive Responses	1. If something is going on (*e.g., flooding, watersheds)* in your neighborhood, what do you do? Who do you contact?
Summary/Closing questions	1. What development would you like to see on St. Croix? 2. Anything you want to add?

Note: Main questions guiding our longer interviews

Table 2

Interview-guide door-to-door interviews

Main category	**Questions**
Perception of Space/Place and Non-Human objects	How have you perceived environmental changes in your neighborhood?
Perception on Adaptation Interventions	*Introduce Adaptation interventions on the West side, afterwards ask:* What is your overall impression of climate change adaptation projects/hazard mitigation for the islands?
Recognition/Participation (Justice)	Do you feel part of/heard of the decision-making process?

Note: Main questions guiding our shorter door to door interviews

4.2 Data Analysis

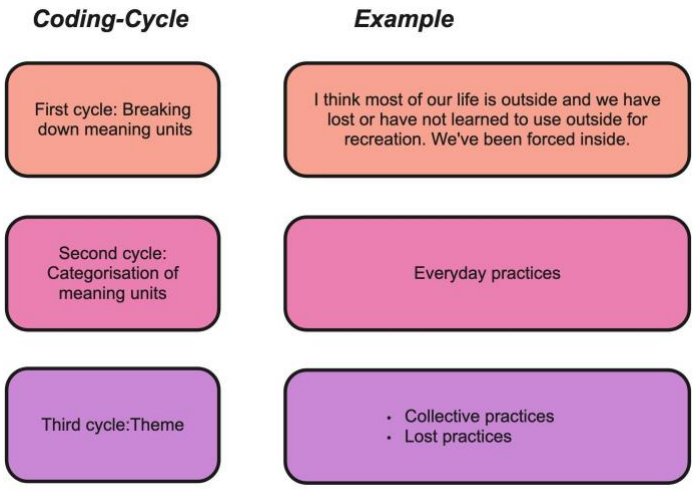
To provide insight into residents' experience of adaptation governance, we apply an Interpretive phenomenological analysis (IPA) to our collected data. IPA is a phenomenology method concerned with processes and meaning rather than events and causes (Larkin & Thompsson,2012). IPA methods are applied to understand people's experience with space(e.g Corazon et al, 2019; Karimimoshaver et al, 2021; Moulay & Ujang, 2021; Yap, 2000) and how people relate to CCA (Horne et al, 2021).

Following IPA guidelines we conducted a number of iterative coding cycles (Eatough & Smith, 2008; Horne et al). We transcribed all interviews using inductive coding for each individual participant. Following IPA methods, we ensured that individual accounts are not subsumed in the process. We analyzed the data on a case-by-case basis while formulating a structure to describe overarching themes. To do so, we develop a layered interpretative process, or an iterative coding process (Eatough

& Smith, 2008). We coded in three cycles, see Figure 4. In the first cycle, we looked for meaning units entailing descriptions of watershed spaces, embodied ways of knowing, and how they relate to environmental change and watershed adaptation measures. As embodiment was our focus, we paid attention to descriptive words related to bodied experiences; words such as “see” or “feel” were particularly important as well as when the participant related to first-person experiences and emotions. Our second cycle was a thematic abstraction of the meaning units. We then categorized the meaning units in categories of different types of embodiments, for example, affect and memories. In our third cycle, we generated themes across our dataset, as well as individual descriptions and patterns relating to phenomena. While staying true to the intention of the participants, we thematically ordered the meaning units into themes within each category. This served to build narrative explanations as the last step of the IPA process (Moulay & Ujand, 2021)

Figure 4

Overview of coding analysis



Note: Abstract illustration of coding cycles. Author's creation. Adopted from Horne et al. 2021

IPA aligns with our ontological approach, as it views humans, the environment, and objects within it as mutually constitutive (Larkin & Thompson,2012). Given its focus on experience, the insights gained are context-specific. We can understand how people make sense of events in specific contexts, which reflects the embodied and situated nature of individuals’ positions (Eatough & Smith, 2008). The dynamics and relationships of the Crucians’ experience are important for our analysis. By focusing on embodied experiences, we can draw together different notions, acknowledging the embodied space from which human experience takes on a material and spatial form (Low,2003).

4.3 Positionality

Conducting fieldwork allows us to meet with Crucians directly to discuss their relationships with watershed spaces and perceptions of adaptation proposals. Fieldwork, while framed as objective or neutral, is ultimately shaped by our social positions and subjectivities as researchers (Sharp & Dowler, 2011). Our positionality ultimately shapes how we collect, analyze, and interpret data (England, 1994). Our positions as privileged researchers from a prestigious European institution also affect our relationships with the Crucian communities we studied. The Crucians we interviewed adjusted details of information provided to us given that one of the researchers is a Virgin Islander, and at times after they learned of our affiliation with our local contact. This became evident as they more freely spoke Crucian with her or referenced Virgin Island proverbs, landmarks, and cultural activities. Therefore, our understanding of watershed spaces and the residents that inhabit them is constantly shifting. As such, we refer to Haraway's assertion that knowledge is inherently partial and localized to recognize the situatedness of our thesis (Haraway, 1988).

Additionally, The notion of reflexivity suggests we approach the research process with "epistemological unease" by scrutinizing our methodological decisions throughout our fieldwork and working to undo, wherever possible, how they may create shortcomings in our research (Sweet, 2020, p. 924). Admittingly, it was a difficult process. However, we took guidance from Staffa et al. (2022) by utilizing an "ethos of care" in our research practice. This entails endeavoring in research that "fuel[s] hope and imagination for transformative action" by incorporating reflective research practices rooted in "caring" research relationships (Staffa et al., 2022, p. 48). By inquiring about the daily lives of interviewees outside of our interview sessions and allowing them to steer the conversations, we attempted to fulfill these goals. Finally, as we hope to demonstrate in our Analysis section, the data provided here does not "speak for" research participants. In documenting the everyday lives of villagers in Senegal, post-colonial filmmaker Trinh T. Minh-ha commented "I do not intend to speak about. Just speak nearby" (Minh-ha, 1982). We also hope to embody this practice.

4.4 Scope of study

Our study focuses on revealing embodied knowledge practices of Crucians, and how they come to understand and relate to watershed spaces (as well as proposed changes to them). However, we recognize that adaptation interventions are a relational, socio-political process (Eriksen et al., 2015). Interventions take place within existing social relations, which in turn influence how spaces are

represented (visually and discursively), as well as the actors granted authority to manage adaptive processes (Taylor, 2015). Given that our data is sourced from interviews with Crucians, it does not feature how material and discursive practices are utilized by the government to justify adaptation structures. Instead, the background section of this thesis provides an outline of adaptation governance structures and historical information that influence present-day governance structures. Also, a comparison between residents' depictions of watershed spaces and prevailing watershed discourses were not included in our analysis. It is not our intent to reveal potential mismatches between governance knowledge of adaptation and Crucians' understanding of watersheds. Finally, governance decisions of 'who' decides what's adaptive, and related circulation of scientific truth claims to justify these decisions are ultimately questions of power (Eriksen et al., 2015). Our data does not explore how power operates within these structures, how it shapes individuals' subjectivities or differentiated experiences of power by our research participants. We believe future research can focus on these areas. Despite these limitations, we hope to demonstrate the multiple ways of knowing to contrast the "truth regimes" associated with environmental governance (Bäckstrand, 2004).

5. Results

In this section, we will show how the participants come to understand space through embodiment, which affects their perception of watershed spaces and adaptation governance. Our three key findings are a) participants consider the role of government in the management of natural and historical spaces when appraising adaptation governance; b) participants understand spaces and environmental change through a process we call embodied mapping of the environment; and c) therefore, our participants view adaptation interventions as a technical apparatus apart from the lived experience. Beginning with section 5.1, we start with how our participants view the role of the government. Followed by a thorough description of how our participants come to assess embodied knowledge through senses, affect, recalling the past, and practices. Lastly, in section 5.3 we will present how these practices of embodiment come to shape the participants' perception of watersheds. We show that our participants come to understand space, environmental changes, and adaptation interventions through meaning practices situated outside of the scientific realm. In the Discussion section, we will map out and expand on the connection between these aspects, outlining some practical implications for an inclusive CCA framework.

5.1 Role of Government's Responsibilities

A key finding within our data centers on participants' perspectives on the role of governmental agencies in managing both environmental and social affairs. They view natural spaces as having an environmental and historical (and cultural) significance. Given this, they view government agencies as responsible for the long-term preservation of these spaces, as part of effective adaptation governance. The nature of how the government should achieve this vision differs among participants. Often, their values shape their views. For example, Breya often mentions the importance of preserving landscapes and the cultural heritage of St. Croix. She links watershed projects to the broader role of government in ensuring the "sustainable management of resources". Philippa shares similar values to Breya, however, she also emphasizes the need for economic development and fiscal responsibility. She recalls that after Hurricanes Irma and Maria "there were billions of dollars that have been mobilized for restoration of the islands and very little of it is getting to the people that really need it, and it is very slow."

Despite these differences, several participants believe the safeguarding of historic and cultural spaces should be incorporated into adaptation projects. Fleurina presents a planning scenario that encapsulates this idea:

> So let's say the mitigation requires you cutting through a road that is important to the people because that's the road we walk during our path of freedom. The erasure of that piece of identity […] Like because we are looking at it from one lens and doesn't [sic] understand the community values, should these changes occur we don't have a plan […] that allows us to secure our identity.

Like Fleurina, other participants believe adaptation projects should consider the historical and cultural contexts of spaces. For Breya, lacking this consideration has led to "mismanaged, unplanned non-strategic development.". Past experiences of other governmental efforts that ignored this connection led other participants to express a similar disenchantment. Charles' experience with hurricane recovery shapes his views. He points to an old bridge in a nearby area that has not been fixed "for years". He states:

> These things need to get [..] fixed but for some reason or another, it seems as if the powers that being, they are not truly interested in getting the work done as much as they're interested in getting a paycheck.

Participants note foreign influences of federal agencies and overseas consultants as influencing adaptation processes. Describing this process, Phillipa states:

> [I]t was like there was an imaging process. It was like we are gonna stay up here, we are gonna photograph all of this, take it and identify all the trees, pavement, and then we know the effects. But it was an imaging, like 'Ok, we are gonna tell you what it is'.. But we already know. And then, million dollars later consultants did make a lot of money, where is the policy?

Like Phillipa, some participants view government agencies as lacking local's knowledge and connection to spaces. Fleurina states:

> West End has a legacy that people feel should be silent sometimes because it is the space of the Fireburn of 1878. It is the space where the more rebellious of descendants of enslavement resided and then that's just known

Additionally, this disconnect leads to poor maintenance of roads that cross through guts. For example, many participants mentioned the need to repair Mahogany Road, as it is both personally significant and in their view, integral to healthy guts. Ayanna attempts to get the road "fixed". She explains:

> because a lot of that mess that is there, with all the pieces of road missing. And everything has to do with a lot of the water, […] coming from up higher and going down, the watershed.

Given these sentiments, participants felt excluded from watershed planning. When asked if they felt included in planning processes, all participants with no exceptions, stated no. Damien remarks: "the people that are behind the organization, they really think 'Oh we are really doing our best to reach out to everybody who need to reach' but they never do reach the people that need to be reached". At times, lack of inclusion did not mean an overall sentiment to participate in processes, as mentioned above, many felt disenchanted with the government's ability to safeguard spaces of importance to participants.

5.2 Embodiment

This section will outline three different types of embodiment that constitutes our participants' environmental understanding.

5.2.1 Bodily presence: senses and affect

The participants' understandings centered around what spaces they have been in, and by extension, their sense guides the participants' personal knowledge. This bodily act becomes activated several times during our interviews. Participants suggest walks, or other activities, in order to share their knowledge by showing us. In an interview at Charles's place, he puts the act of showing into practice. He asks us to stand up and look over his yard, while he explains what happened during a drought:

> Stand up for a minute and just take a walk around. If you look right here, that is a moringa tree, that's a mango tree right underneath it. You see a dry thing? That was a coconut tree, and I watched it, there were two of them.

Senses are also key to how the participants come to understand environmental changes. Elias chose to film and show us how a familiar beach had changed from corals to gray stone. Likewise, Damien refers to how hiking is an active part of how he comes to understand that environmental changes are happening:

> Something change… even Salt River, you go to the back, you know how the winds are, there was a major area of water running through. It was believed to have a river there, many, many years ago. An actual river that ran through that part of the Island. That's dry! I did a hike there this year and it was dry. So, something has happened, something, something is not the same.

Perceptions of environmental change may be personal. Ayanna believes air pollution is a form of environmental change, as it causes herself, her neighbors' and trees to become ill.

As seen in Table 3, embodied experiences illustrate an active interaction between the human and the object that constitutes knowledge while also constituting spaces. These sensory experiences also evoke emotions. Fleurina expresses how she feels love when she sees St. Croix.

Table 3

Senses and affect

Senses and affect		
	Senses	Affect

Spatial learning	Now **you're looking down** here t**his has been zoned as agricultural land, but it's for cattle grazing**, yeah if you look..(Charles)	I have a **deep deep deep deep deep deep love** for this place(…) **when I see STX** on a plane like I could be coming from saint thomas, not even from the states, like when we get to the point **where I can see the cusp of the island** my heart just like swells. (Fleurina)
Environmental changes	Yes, you could **see** the fresh coral years ago, no they are murky(…)I took some videos yesterday of the beach that I use to grow up on *Showing video.* B: Why did you want to film this? M: To **show the difference** (Elias)	The water that used to flow through my moms yard when I was a kid was at least 5-6 feet high and flowing, and when I say flowing, I mean if I throw a stick in there it swish - flowing. That gut is still as wide, its the same width, but y**ou doesn't see the type of water that you used to see.** I mean water, I would stand there **like "wow".** (Lesly)

Note: This table demonstrates how participants come to understand spatial learnings and environmental change through senses and affect.

Some participants move beyond their own embodied understanding of space and chose to describe the space itself with body terminology. Within this terminology lies a meaning of social and historical processes ascribed to the space. Damien describes Fredriksted "Fedrekisted holds a different kinda pride because a lot of the older locals would say, Fred is freedom city". By doing this, the city gets its own emotion of pride, which seems to be obtained by the freedom fights that have taken place there and the older generations that have inhabited the place. Other participants describe nature's function in bodily terms, Breya for example says that "nature knows how to heal herself", which is a personification of nature. At Creque dam, someone has written "If the earth is a body, den a dam is a blood, watch wa gowin' awn". Further, Fleurina, who is overall emphasizing her feelings towards St. Croix prescribes the island of agency, using the body terminology. When talking about what makes St Croix unique, she says:

> it gives off a unique vibration like it has a pulse about it and it's calming. (...) like you just have a steady beat of safety, I feel like when people come here they're attracted here because it cares for you.

5.2.2 Recalling the Past

Participants often recollect personal, or collective memories to describe their relationships to watershed spaces. A major theme surrounds moments in which they first learned of the physical features and spatial characteristics of a place. For example, Harrison states that his mother told him that he's "buying a land in a swap, because when she was a kid, they came over here to catch water living animals." Iris learns that a noni bush has medicinal use as that's what "grandparents of

grandparents of grandparents" taught communities. These memories are personal, but also shared, as they describe a generational knowledge of space. Places discussed may be in surrounding areas or represent other places of importance. For example, Fleurina learns that a local beach experiences flooding during heavy rainfall, when her aunt told her: "oh you see, ain't got no crab down in dah crab hole, dah mean rain coming, it'll probably flood" (see more examples in Table 4).

Table 4

Recalling the past

Recalling the past	
Spatial learnings	"The water that used to flow through my mom's yard **when I was a kid** at **least 5-6 ft high** and flowing, and when I say flowing, I mean if I throw a stick in there—swish, flowing. That gut is still as wide, is the same width" (Damien)
Weather events	**The hurricanes have changed** the way we live here in the Virgin Islands the point that, like I said, you have to build where is the structure is going to stand up (Charles)

Note: This table shows the ways in which participants describe past memories or events.

The spatial features discussed vary among participants but are often of personal significance. Charles and Fleurina recall local beaches and family events where they first learned about the environment. Damien mentions guts as these were located at his home or areas he enjoyed as a child.

Memories of spatial characteristics are also developed through experiences of extreme weather events. Nearly all participants recall Hurricane events, and for some, this represents a way of learning about the environmental features of a space, and the ways in which they can change. Judith notes that the stream in her neighborhood was a "small stream" but after experiencing the rains of Hurricane Lenny she learns that "when you have heavy rain, it floods".

Additionally, people recall weather events as a collective experience. Our door-to-door participants describe the death of a local woman, as a sudden traumatic experience that shapes how people perceive the risks of extreme weather. All our participants give examples of where they were and how they have reacted to weather events and a majority place these memories in relation to how they cared for family and friends. How people acted or were affected by extreme weather shape collective memory of these events.

Experiences of community members trigger a learning process. Marvette mentions that although she has not personally experienced flooding, the loss of a friend during a flooding event changed her practices and knowledge of the area. She says: “[y]eah and I think because of her experience that tells me I stay on the hill until time has passed and the water has receded.” These behavioral changes are often described after learning about the spatial features of their surroundings.

5.2.3 Practices

Through everyday practices, the participants develop values and reasoning around spaces. While descriptions of everyday routines are personal and place-specific, learnings have a more general character. Place and time situated the learning process. For example, Damien describes how he has come to learn about the importance of guts through how his mother took care of them:

> Where my mom lives, where I grew up, is a gut literally in her yard. And she has learned a long time ago that you don't cover a gut, you protect a gut. Stones, you plant plants like the snake plant that holds the soil.

As seen in Table 5, participants often describe a discrepancy between the present and past. Elias reflects on changes in past everyday routines: ”It use to have a whole lot of these fruits called coco-plum, when they grow by the beach, and that's where we go and get a whole lot of coco-plum and go fishing.” This reflection also captures environmental changes in place of importance to him. We first met Elias during an organized hike at Sandy Point (see Figure 5), and for him, this is an example of a changed way of interacting with nature “You know what I mean... I feel like, Sandy point, we used to walk that whole beach just to go fishing, no I took a little hike hehehe.”

Figure 5

Hike in Sandy Point

Note: Picture taken during a hike at Sandy Point, february, 2022.

Table 5

Understandings through everyday practices

Everyday practices		
	Past	*Present*
Learnings	You know, between home and **school we would actually gather our own lunch and snacks** because **we could pick seasonally**, and between home and going to church or synagogue or temple we would pick our, you know we would have snacks. (Breya)	I don't know if this is what you're talking about, **but the trees get like a black something or other on them,** the fruit trees, and you have to really get all that stuff, **even the bougainvillea tree.** When **I was cutting it the other day, I noticed there were a lot of problems with some of the leaves** (Ayanna)

Note: This table demonstrates how participants come to understand space and environmental change through everyday practices

Another strong theme in the data is collective practices. Overall, the participants express an appreciation for the collective everyday practices and understand them as part of the Crucian culture. Collective practices are interpreted as something that bounds people over generations and across the island. As seen in Table 6, the collective practices are cherished by the participants. Their reflections show that environmental change may be associated with the loss of practices, or culture. Lesly explains how she actively thinks about keeping cultural practices through accent and languages and worries about the younger generation losing cultural connections by spending more time inside in

front of screens. Lastly, our participants recall how their relationship with nature has changed over time.

Table 6

Collective practices

Collective practices		
	Past	*Present*
Cherishing	(…)but we do cherish our history a lot, even when it comes to like **story telling**, you know, **keeping the culture alive**, even like you know, **keeping the accent, or the language.** (Lesly)	On Saint croix easter camping is a huge deal. It's big family gathering. **Family-friends gathering on the beach** people tent tent camp or bring generators (Gloria)
Losing	**We were** more into nature, **we use to** make our toys from wooden sticks, tops to spin or sling shots, use different fruits, like wonka lokas**, so we take** the seeds and put them in a sting, make the whose in it we got a drill a whole with our hands. (Elias)	I think most of our life is outside and **we have lost or have not learned to use outside for recreation**. We've been forced inside. (Fleurina)

Note: This table demonstrates participants' collective practices.

5.3 Perceptions

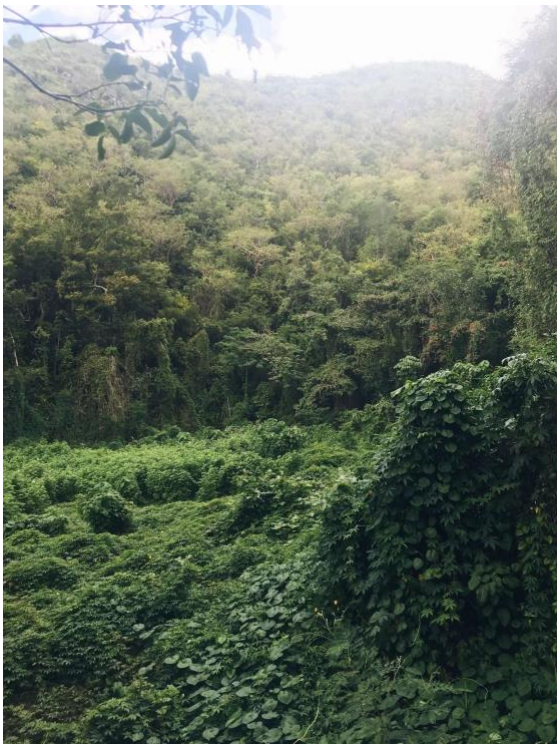
The previous section shows the intricate relationship between embodiment and knowledge of space (environments). In the next section, we will shed light to how our participants perceive watershed adaptation governance. We will explain how participants perceive the government apparatus and adaptation efforts as apart from embodied experiences, and cross-scalar conceptualisations of watersheds.

5.2.1 Perceptions of watersheds

Through embodiment, participants illustrate multiple knowledge of watersheds and relate to them differently. For example, Karima recalls memories of her being in Creque dam (see Figure 6), a place mentioned by a majority of the participants when discussing watersheds. She recalls how her mother used to do laundry in guts and watershed areas. Philippa connects memories of when the waters were running and families collecting shrimp, emphasizing that this is an important part of the shared culture and practices among Cruicians. This will later come to inform how they understand framings of problems and solutions in regards to watershed adaptation.

Figure 6

Creque dam



Note: A photo of Creque dam, spring 2022. No water is running. February, 2022

Overall, knowledge of the DPNR's watershed initiatives varies. Despite lacking knowledge of the project, most participants can describe how a watershed functions, its components, and its physical locations. Regardless, all the participants understand watersheds as something a governmental concern, as seen in Table 7. Participants that are more involved in environmental governance processes through their work perceive the government's work on watersheds as a constructed concept. When Fleurina introduces the concept to us, she does so using quotation signs (“), and when asked why, she explains that the average person may be unfamiliar with the term.

Within the understanding of watersheds as a governmental concept lies different opinions. Damien and Lesly think managing watersheds is worthwhile. Damien thinks that it has become a governmental matter because of environmental and conservation groups of which he is a member. Gloria problematizes how the government conceptualizes the watershed by pointing out that they chose a few areas and therefore created boundaries within the watershed systems. Iris noticed that the watershed is now emerging as a “thing", as more people talk about it. Along with Philippa and Breya, she expresses a feeling of redundancy when it comes to environmental government projects, which the way watershed is conceptualized and operationalized feeds into.

Participants further away from the governmental apparatus tend to understand watershed as a material concern for the government. Through the experience of hurricanes, heavy rain, or infrastructure modifications they see problems with watersheds as something that is within the governmental responsibilities to maintain. Ayanna and Marvette explain direct links between governments' responsibility for public places, as roads that overflow create potholes. Nelson believes watersheds are both a governmental and private concern, drawing upon an example from his neighbor building a water catchment area to prevent flooding. He believes they need more culverts to reroute the water (see Figure 7). Nelson points out a maladaptation "[i]t's because the poor culvert underneath is small. If they had a bigger culvert so the water could run more frequently, it would be much better. " Like Gloria, he reflects on the selection of guts targeted by the watershed projects. From his perspective, guts should be "taken care of" in a more material form. Overall, participants no one personally connects to watershed projects. There is a variety of familiarity and agreement on the governmental framing of watersheds.

Table 7

Watershed as a governmental concept

Watershed as a governmental concept	
Conceptual government product	The **way they've done it** is **they've done one for each watershed** and so if you're interested in the whole island or you know the whole territory you're gonna spend two weeks going to zoom meetings every night. (Gloria)
Material government concern	It's up in the hill in the back here , **they've allowed that to go down to nothing. To try to repair that would be a good thing** (Charles)

Note: This table demonstrates participants' understandings of watersheds as a governmental concern

Figure 7

A watershed running through private property

Note: Picture taken Spring 2022 in a flood prone area. Picture shows property owner's water catchment.March, 2022.

When relating to the meaning of watershed, participants evoke cross-scalar understandings, as seen in Table 8. Whereas Breya focuses on the importance of watersheds for raising her family, Damien relates it to the water demand over the whole island. These scalar meanings are informed by how spaces are embodied and allows for a cross-scalar understanding among the participants. Nelson, who we met during one of the door-to-door interviews could on the spot point out a nearby gut and explains its function as a main gut for St Croix as an island:

> And that gut is one of the main guts, because that comin down from the mountains. That run in the back of me. And that da come off of dis hills and go wide, and come this way, and that way across the street. Over dere too. Water come from this side, same way.

Likewise, Karima tracks watercourses until they reach her neighborhood, and then describes the order of flooding in some areas. She tracks the watercourse from its origins uphill, thus covering a large area (miles long).

The participants easily move between stories of how the watershed serves the household, neighborhood, and the island as a whole. Iris illustrates the cross-scalar relationship when explaining how she resonates with watersheds:

> you might be over here, but the water comes from up here and so everything in between matters to person down here. So again it's sort of like the network and the connection of it is what I think of

In this quote, Iris also introduces the watershed as a scalar configuration. The watershed as a scale is shared by a few of the participants, and expressed differently. Iris and Gloria tend to describe it in more technical and infrastructural terms whereas Ayanna and Damien focus more on the qualities of water being determined for the watershed scale. Ayanna higlights the fluidity of water by ascribing it a subjective will, thereby connecting it to societal development in the area: “Water will go where water wants to go. Just because you have a nice marina, doesn't mean the water is going to respect that and things”.

Table 8

Cross-scalar understandings of watersheds

Scales	
Household-neighborhood	Now in town I'm sure people will tell you about this **water gut that comes down the mountain and goes behind la grange,** behind periodically, it washes the beach out. (Karima)
Watershed	You know so the **technical parts are you know the guts and some of the pounds that collect along the way,** and the flooding that happens, but I very much think about **the connection of that area,** (Gloria)
Island	[t]he sea is pushing in, and the water is coming**, so they meet.** There's no way to go so it floods.” (Harrison)

Note: This table demonstrates that participants understand the meaning of watersheds at different scales

6. Discussion

The previous section presents our key findings. This section will show how embodiment constitutes environmental knowledge through embodied mapping. Secondly, we will show how embodiment shapes the participants' problem -and solution framing and how power and scalar politics come to visualize historical power processes. Lastly, we will dwell on some practical implications for adaptation governance based on these discussions.

6.1 Embodied mapping

Our study demonstrates that knowledge-making practices are dynamic and embodied. Participants perceive environmental change through not only observation but also through bodily reactions, affective responses, as well as collective and past experiences. Embodiment appears as a non-ordered entanglement of emotive responses and spatial practices. Participants often weave spatial-temporal scales, feelings, and memories when describing experiences or events. It's from this web of experiences that participants situate themselves in their environments, personally connect to them and generate knowledge about it. In bridging theories of relational space and embodiment with the results of our data, we developed a novel theoretical concept called embodied mapping.

Embodied mapping is a novel theoretical approach to portray how Crucians mutually constitute space and know environmental change. Participants' descriptions of embodiment demonstrate that embodied mapping is a knowledge-making and sense-making activity; taking shape through a bodily showing, the referencing, and physical pointing to places, as with Charles. This often occurs in tandem with other forms of embodiment, such as discussing everyday practices (e.g., Damien), recalling childhood memories of past activities or tasks (e.g., Elias), and sharing experiences of severe-weather events (e.g., Karima). Mapping expresses their connection and engagement with spaces and molds their knowledge of them (Ingold & Kurttila, 2000). Knowing is an act enacted through everyday embodied practices (Simonsen, 2010; Thrift, 2008).

Embodied mapping contrasts local knowledge studies that frame knowledge as a solely cognitive endeavor (Yeh, 2016), limited to local scales (Ahlborg & Nightingale, 2012). Once oriented in space, participants attempt to make sense of the ongoing environmental change they witness. Mapping allows them to make sense of changes by linking them to various places and temporal events. For example, Damien expresses uncertainty about its origins, stating that "something happened" and

“something changes”, he’s able to make sense of environmental changes by linking environmental change in St. Croix to the loss of a historical river in the East. Damien’s example also demonstrates how embodied mapping allows participants to relate to spaces that lie beyond their immediate surroundings.

The knowledge-making practices associated with embodied mapping also allow participants to define an environmental change in terms of their affective relations, defined here as “how we respond to objects and others” (Nightingale et al., 2022, p. 7). For example, Ayanna associates the effects of air pollution as an environmental change, causing illness not only in her body but in her neighbors’, and in surrounding trees as well. For others, the loss of swimming in guts with family or friends or viewing freshwater shrimps that lived in them are noteworthy changes

These stories describe the relational nature of spatial relationships and knowledge. They also demonstrate the role of affective relations in constituting individuals’ subjectivities or the “surfaces and boundaries” of the ‘I’ and the ‘we’. (Ahmed 2014 in Nightingale 2022). Affective relations may appear as a passive activity, but it shapes actions (Nightingale et al., 2022). Breya values preservation, and thus works towards it in her daily life. Ayanna is taking steps to notify the government about the illness in her community. It also has implications on individuals perceive and engage with adaptation interventions as we’ll discuss in the next section.

Moreover, embodied mapping resembles waterways in its ability to link places, memories, and experiences together. Participants describe the ways in which environments shape their self-hood and varied forms of spatial practices that transform areas around them. Our door-to-door interviews provide a notable case. Many participants recall the loss of life caused by flooding events, even if they were not present. They connect the local woman’s death to their personal experiences of flooding. Participants situate themselves spatially e.g., as living “uphill” or in proximity to guts. They note the location of road infrastructures in relation to guts, and how this affects the severity of flooding events. Participants attributed the floods to maladaptation measures and climate change as both change environments. In responding to these changes, participants also alter their spatial practices.
Thus, their knowledge is the culmination of personal and collective memories, of interactions with space and more-than-human objects (Whatmore, 2002). In this way, their knowledge of environmental change and adaptation demonstrates an open, ongoing, and active process (Goldman, 2018). Knowledges change as space transforms, reflecting Massey’s idea of space as multiplicity, reflecting multiple ways of knowing, and heterogeneous relations that constitute it (Massey, 2005).

Relational accounts of environmental changes also demonstrate that climate itself is a “hybrid” entity. It encompasses “biophysical materialities on the one hand and sociocultural knowledge, affect and practice on the other” (Popke, 2016, p. 1). This also applies to space itself (Massey, 2005). This idea is also exemplified when participants add living qualities to space. Karima attempts to make sense of her and others' flooding experiences by stating “It is just water will go where water wants to go”. Participants thus view spaces and objects within them as more than a backdrop, but as active participants shaping their individual lives as well as their communities’ (Country et al., 2016).

6.2 Power, governance and implications for CCA

6.2.1 Knowing the solution through embodied practices

Embodied mapping also helps participants craft their own definitions of problems and solutions to watershed governance. It demonstrates that even among Crucians, there are multiple and disparate ways of knowing spaces. Plurality in spatial relationships shapes both knowledge and rationales. For example, Breya and Damiens' advocacy against current development and for the preservation of natural areas can be placed in relation to their strong family bond to natural areas, such as watersheds. Charles on the other hand views the flooding problems to be more of an institutional problem, drawing from experience with flooding on nearby roads.

The plurality of knowledges elucidates the problem of generalization of climate science. As outlined by Goldman (2018) generalization is not only an inherent abstraction of the human dimension but also excludes lived (embodied) experiences of climate change.

Embodied mapping should be understood as apart from local knowledge, as conceptualisations of ‘local knowledge’ suffers from power-embedded processes of simplification (Goldman, 2018). Adaptation practice suffers from an instrumental interpretation of the co-production of knowledge, stepping away from the original focus on how knowledge, power, and world-making practices are mutually reinforcing, and rather focuses on isolating the co-production of knowledge to “useful” knowledge (Goldman et al., 2018; Klenk et al., 2017).

6.2.2 Embedded power relationships

By centering knowledge, problems and solution around top-down fixed scalar spaces, ideas of what watersheds are and ought to be gets manifested (Jasanoff, 2010) Hence, in understanding representations of scale, it must be examine how the relationships among scales are continually socially produced, dismantled, and re-produced through political struggle (Brown & Purcell, 2004). In the following section we aim to outline how the participants' scalar perceptions reflect negotiation over knowledge politics.

Space informs how the participants themselves think about watersheds and CCA, and their perception of adaptation agencies and institutions. Several of the participants view watersheds as the “FEMA project”, or the "disaster project”. Participants often refer to FEMA as an agency lacking personal knowledge of space in St. Croix. The participants perceive FEMA as an outsider organization, focused on funding disaster recovery. Their view of FEMA being a foreign entity thus affects how they come to understand watershed adaptation governance. As FEMA is understood to work with disasters, participants start to reflect and connect their environmental experiences to war events taking place in Ukraine, disaster recovery in Louisiana as well as ongoing work and politics across other islands.

Such perceptions activate new scalar relationships. From a relational standpoint, people recognize places as qualities shaped by multiple forces, highlighting the interplay between wider relationships (Haeley, 2004). While scale has no inherent or tangible characteristics, it is associated with particular characteristics of social processes (Brown & Purcell, 2004).

Additionally, scalar relationships between national and local agencies (e.g., DPNR and FEMA) are understood as fiscal relationships. These structures are seen as something that affects the adaptation outcomes and are embedded in USVI's management of environmental change (Eriksen et al, 2015). Participants observe that these structures activate relations between agencies and foreign consultants. They view these structures as lacking a personal connection to space. By citing examples of maladaptation or remarking on overlooked specific historical sites, participants showcase the need for embodied spatial knowledge in adaptation decision-making. Participants view these structures as interpolating “new” knowledge about space that is already known by Crucians. Hence, participants view these efforts as unsustainable.

Our participants' criticism of uninformed, outside, top-down knowledge as steering St. Croix's adaptation efforts reflects colonial historical relationships (Goh, 2015). Through scalar connections,

St Croix is perceived as an object of disaster, connected and dependent on a foreign entity through historical colonial formations. Spaces of disasters mirror colonial "subject-object" relationships that depend on Western knowledge paradigms (Leonardsson et al, 2021; Quijano,2007). Thus far, adaptation efforts have failed to overcome the historical process of colonialism, capitalism, and rationalism denying any other 'subject' outside the western context, i.e, making the colonial order a totality (Quijano,2007). While there are recent efforts to include "traditional ecological knowledge" or indigenous knowledge in adaptation efforts, these knowledges are often met with a condescending and instrumental attitude (Leonardsson et al, 2021). This echoes participants' feelings of being excluded from decision-making processes.

While participants perceive power in the institutional relationships embedded in adaptation governance, they also challenge this relationship. They do so through embodied mapping, connecting their experiences to ecological and socio-political processes across spatial and temporal scales. Embodied knowledge of space allows them to question and discredit adaptation governance. Thus, embodied mapping is an alternative sense-making of space that allows them to negotiate with current western knowledge paradigms and embedded power structures.

Although there are attempts within the field of CCA to endorse "different ways of knowing and being" in modern politics, these attempts fail to realize a subaltern empowered political process that moves beyond a top-down, technoscientific, and singular solution adaptation processes (Haverkamp, 2021).

6.2.3 Practical implications

Our data shows a discrepancy between watershed governance and our participants' embodied knowledge of watersheds. Participants view adaptation governance as a technical apparatus apart from lived experiences. As our participants' perceptions are shaped by the extent of inclusion of situated and embodied knowledge in adaptation governance structure, there lies opportunities in overcoming these barriers by embracing plural forms of knowledge.

Therefore, this calls for recognizing the cross-scalar and embodied knowledge in adaptation governance. Or in the words of Jasanoff (2010) "Living creatively with climate change will require re-linking larger scales of scientific representation with smaller scales of social meaning" (p. 238). If not, when a phenomenon, such as watersheds, is recognized as a set geographical formation, 'mandated by nature' the political and cultural influences of that formation are ignored (Sarna-Wojcicki, 2019). Simplifications of scale and space lead to a treatment of watershed as 'space in itself', ignoring the social relationships that are latent in spaces (Lefebre,1991,). Sarna-Wojcicki

(2019) has shown that by doing so, watershed understandings steer away from discussions about what scales and arrangements are appropriate for community and place. When adaptation is bounded by scalar configurations of space that differ from the residents' embodied experiences, it creates skepticism and hinders opportunities for meaningful participation. Thus, overcoming these historical processes calls for recognition and defense of spaces of Crucian ideas (Haverkamp, 2021). In uncovering embodied mapping as a means to understand environmental change and adaptation governance, we make a stance for inclusive CCA and reconcile different kinds of knowledge that do complement each other (Leonardsson et al,2021). An approach that embraces embodied mapping of environmental changes to truthfully shape adaptation efforts, will help us to challenge embedded colonial legacies of knowledge production (Leonardsson et al, 2021). This is a needed, yet neglected, shift, towards inclusive governance (Burman, 2017).

7. Conclusion

In this thesis, we address the hierarchical knowledge systems shaping adaptation interventions, hindering inclusive adaptation efforts. Drawing from the case of watershed adaptation in western St. Croix, we show that communities draw from embodied experiences in space when understanding environmental changes. In this context we found that Crucians come to understand environmental changes through embodied mapping which entails the entanglement of practices, affect, and memories across spatial-temporal scales. This contrasts static notions of local knowledge as limited to local scales. The discrepancy between their embodied knowledge and their perception of watersheds forms an understanding of adaptation governance as being a technical apparatus apart from lived experience. Our research shows that communities hold plural and personal understandings of environmental challenges, communities consider watershed adaptation as a constructed and governmental concern whereas existing power structures are upheld. This knowledge base neglects situated knowledges and the cross-scalar, inter-relational nature of adaptation interventions.

Our data shows that participants are critical of current CCA practices as it does not account for socio-historical aspects bounded in space and operate from constructed “watershed scales”. We, therefore, suggest that future adaptation planning incorporates community engagement that is not based on constructed watershed scales, as people hold cross scalar understandings of space. Instead, we suggest that future adaptation planning incorporates lived embodied experiences of space by treating community knowledge as a ‘living document’. Specifically, this may involve collaborating with grassroots organizations that hold existing knowledge of communities’ perspectives. As people

expressed that they feel ignored in current adaptation governance, it is important to ensure meaningful strategies from which we hope that this study can be helpful.

8. References

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