THE SOCIAL-ECOLOGICAL RESILIENCE OF DIVE OPERATORS IN THE
US VIRGIN ISLANDS

A Thesis in
Geography
by
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ABSTRACT

This study uses a five-part resilience framework to investigate the social-ecological resilience of dive operators in the US Virgin Islands. The findings show that, on the one hand, dive operators’ greatest source of resilience is their ability to adapt and self-organize. Dive operators’ greatest challenge to establishing resilience, on the other hand, lies in their inability to participate in the adaptive co-management of the social-ecological system. The study also assesses three other parts of the social-ecological system to determine the relative extent to which each part contributes resilience to the system or erodes the resilience of the system. These additional parts are: the nature of the link between the social and ecological portions of the system, the influence of cross-scale drivers of change, and the health of the ecosystem. The additional parts show that the nature of the link between the social and ecological portions of the system contributes resilience, while the influence of cross-scale drivers of change and the health of the ecosystem erode resilience. Semi-structured interviews with dive operators were used to acquire data; quantitative and qualitative methods were used to analyze data. This research provides a case study in the nascent field of resilient tourism studies. It also contributes to the larger field of sustainable tourism studies by offering suggestions for better addressing climate change and other local environmental and social impacts of tourism.
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I would like to thank my friends, my family, my committee, and the people of the US Virgin Islands. Let us all find resilience and sustainability in our own lives.
CHAPTER 1

Introduction

This thesis was inspired by the fourteen months I spent working as a tour guide for Virgin Islands Eco-tours in the US Virgin Islands (USVI) in 2005. Although I was unfamiliar at the time with academic definitions of sustainability, I could plainly see that the system that I was part of could not go on forever. Every day thousands of cruise ships tourists disembark in the USVI. They spend the day shopping, eating, and going on tours. At the end of the day they file back onto their ships and float into the setting sun. Multiple large airports in the territory also supply tourists to the continually developing international resort industry. The ecosystems and social systems in the USVI absorb the impacts of mass tourism day after day.

The ecological impact caused by the visitation of over two million tourists per year, and the resulting tourism-related development, is exacerbated by a local government that is notorious for its corruption and ineffective policies. When I lived in the territory the feeling of residents seemed to be that local government officials do not value environmental protection because they are preoccupied by the large profits generated by mass tourism. This feeling was corroborated by the data I gathered for this thesis. The USVI depends on its natural environment to attract tourists, but these same tourists are responsible for slowly destroying the environment. Eventually something is going to give.

Driven by my experience working in the USVI tourism industry, I set out to produce a thesis that offers insights into the specific situation in the USVI and into the more general global-scale quest for sustainable tourism. To accomplish these goals I begin by offering a broad review of sustainable tourism literature in Chapter 2. In the first section I claim that sustainable tourism research has reached an impasse. This impasse, I argue, is defined by the field’s
inability to adequately address the sustainability challenges of climate change and tourism’s local environmental and social impacts. In light of these challenges some tourism researchers are proposing that the field of tourism studies abandon the pursuit of sustainable tourism.

I am unwilling to abandon the pursuit of sustainable tourism, however, and I believe that the impasse can be transcended. In the second section of Chapter 2 I review an emerging body of literature that is moving sustainable tourism research in a promising new direction. This body of literature is applying the insights of resilience theory to the study of tourism. Resilience theory emerged from the field of ecology and scholars increasingly understand it as an effective framework for enhancing the sustainability of many types of systems.

I review some key concepts from the resilience literature and lay out a five-part resilience framework for the study of tourism systems. The resilience framework I propose is intended to further synthesize resilience theory with sustainable tourism research and help sustainable tourism research transcend its current impasse. In the last section of Chapter 2 I focus on dive tourism research. I show that dive tourism is faced with the same sustainability challenges as the larger tourism industry and that no existing research has approached dive tourism from a resilience perspective.

In Chapter 3 I explain the research project that I designed to test the usefulness of a resilience framework for studying sustainable tourism. The USVI provides an excellent location for such a case study because of its economic dependence on tourism. Within the USVI tourism industry, I focus on dive operators. Dive operators present an excellent subject for resilience research because they are part of a linked social-ecological system. The social part is defined by the dive operators, dive tourists, and the larger cultural context and the ecological part is defined
by the marine environment that dive operators depend on to draw dive tourists. The social-ecological resilience of dive operators in the USVI is the driving concern of this thesis.

In the second section of Chapter 3 I show how the five-part resilience framework maps onto the specific social-ecological system that I am interested in. Each part of the resilience framework represents a different part of the social-ecological system that is defined by USVI dive operators. The five part of the system represented by the framework are: (1) ability to participate in the adaptive co-management of the system, (2) the nature of the link between the social and ecological portions of the system, (3) the ability of the social portion of the system to adapt and self-organize, (4) the influence of cross-scale drivers of change, and (5) the health of the ecological portion of the system.

The three research questions that I constructed to achieve the research goals are also presented in this section of Chapter 3. The first question investigates the different factors that influence the resilience of dive operators to environmental and social changes. It also investigates the direction and extent of each influencing factor. The second question investigates which part of the social-ecological system each of the resilience-influencing factors belongs to. By understanding which factors belong to which parts of the system, I am able to determine which parts of the system contribute resilience and which parts erode resilience. The third research question investigates how the findings from this case study can be used to suggest new paths forward for sustainable tourism research.

In the final section of Chapter 3 I present the methods I employed to answer the research questions. The methods included semi-structured interviews with dive operators. I analyzed the interview data by counting the number of dive operators who mention each of the resilience-influencing factors. I also applied a significance weighting to each dive operator’s mentioning of
each factor. I partly based the significance weighting on a qualitative analysis of dive operators’ perceptions. The final step of analysis was to calculate a Total Resilience Score for each part of the social-ecological system and for the overall system as a whole.

In Chapter 4 I present the research findings. I found 30 factors that influence dive operators’ resilience. I define each factor and present its resilience score. I also present which factors belong to each part of the social-ecological system and the Total Resilience Score (TRS) for each part of the system. Parts of the system that contribute resilience are: the nature of the link between the social and ecological portions of the system and the ability of the social portion of the system to adapt and self-organize. Parts of the system that erode system resilience are: lack of ability to participate in the adaptive co-management of the system, the influence of cross-scale drivers of change, and the health of the ecological portion of the system.

I use three charts in Chapter 4 to display the findings. The first chart shows how many dive operators mentioned each factor and whether they describe it as increasing or decreasing resilience. The second chart shows the significance of each factor after weighting. The third chart shows the Total Resilience Score of each part of the system and the system as a whole.

In Chapter 5 I discuss the findings and how they answer each of the research questions. In the first section I highlight major themes that emerged from the 30 resilience-influencing factors. I explain each theme and show areas where the resilience framework that I applied suggests new paths forward for dive tourism research. In the next section I elaborate on the findings pertaining to the Total Resilience Score (TRS) for each part of the social-ecological system. I discuss the relative contributive or erosive significance of each part of the system to overall system resilience. In the final section of Chapter 5 I discuss the significance of the findings for the larger field of sustainable tourism research. I use the part of the system that
received the highest TRS (i.e., the ability of the social portion of the system to adapt and self-organize) as an example for discussing paths forward for addressing climate change. I use the part of the system that received the lowest TRS (i.e., lack of ability to participate in the adaptive co-management of the system) as an influence to discuss paths forward for thinking about the local environmental and social impacts of tourism.

In Chapter 6 I conclude by first summarizing the findings. I then offer my hopes and suggestions for the future of the USVI and for the future of resilience-based sustainable tourism research. Figure 1 shows the progression of the thesis. It begins at the broad scope, narrows in on a specific case, and then expands back to the broad scope at the end.
CHAPTER 2

Literature Review

Introduction

In this chapter I bring together three bodies of existing literature to create the frame for the thesis. The three bodies of literature are: sustainable tourism, resilience, and scuba diving. I first give a broad overview of sustainable tourism literature. This overview argues that the field of sustainable tourism studies has reached an impasse. This impasse is created by the sustainability challenges of (1) climate change and (2) other local impacts of tourism on environments and communities. Partly as a result of this impasse, sustainable tourism scholars are turning to resilience theory in order to find new paths forward.

Second, I review the small amount of literature that has attempted to apply resilience theory to sustainable tourism studies. While this body of literature is promising for overcoming the current impasse, it fails to present any original empirical evidence of the effectiveness of a resilience framework for studying sustainable tourism. I then give a broad overview of resilience literature. I focus on five resilience theory concepts that are useful for constructing a resilience framework that can be applied to find new paths forward for sustainable tourism research. Each part of the resilience framework represents a different part of the social-ecological system that I am examining.

The third thing I review is the existing dive tourism literature. This review shows that (1) dive tourism research faces the same impasse that the broader field of sustainable tourism research faces and (2) no existing research has used a resilience framework to examine dive tourism. I argue that the advantages offered by using a resilience framework to examine dive
Sustainable Tourism

Gössling, Hall, and Weaver (2009) provide a historical account of the emergence of the sustainable tourism paradigm. Beginning in the years following World War II, tourism became very common. In this period, people began expressing concern over the environmental and social changes resulting from the often rapid and unplanned development of popular tourist destinations. Coinciding in time with the early discussions of the need for sustainable tourism was the emergence of a United Nations (UN) led international agenda of development. Sustainable tourism and development quickly became intertwined ideas, and the UN saw tourism as a method for promoting economic development (e.g., ICLEI, 1999).

In 1987 the international community realized that unrestrained economic development often had undesirable environmental and social impacts. That year the World Commission on the Environment and Development famously articulated sustainable development as,

... development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987: 43).

This definition of sustainable development played a fundamental role in defining the contemporary understanding of sustainable tourism. Led by the UN World Tourism Organization, the international community began viewing tourism as a mechanism by which the goals of sustainable development could be achieved (e.g., UNWTO, 2007).

*Sustainable tourism development* was the term used to describe the process by which sustainable tourism was achieved, and sustainable tourism was understood to be tourism that met the goals of sustainable development. The genesis of the sustainable tourism paradigm is linked
to the definition of sustainable development. The contemporary understandings of the topics are highly interrelated. The vagueness of the UN’s definition of sustainable development also plagues the implementation of sustainable tourism (Hunter, 1995).

Tourism Studies: Conventional Approaches, Critiques, and the Current Impasse

Within the academic field of tourism studies, the tourism destination lifecycle model (Butler, 1980) marks the beginning of sustainability research. As Figure 2 shows, Butler’s model suggests that tourism destinations pass through multiple phases of economic viability. Once a destination has reached the critical range, it has the potential to decline in economic viability. This decline is caused by factors including outdated tourist infrastructure and lack of destination novelty.

In this model, the potential economic decline of a tourist destination can be avoided though destination rejuvenation. Rejuvenation includes building new tourist infrastructure and marketing an updated destination image in order to create new demand for the destination.

Butler’s model is important because it explicitly acknowledges that tourism is not inherently sustainable and can only persist through conscious management. Butler’s model is also an important representation of early era tourism studies, which exhibited a dominant focus on the economic aspects of tourism.
In the decades after Butler’s model, and following the lead of the UN, tourism researchers began recognizing that economic sustainability is impossible to achieve without considering environmental and social aspects as well. Thirteen years after his tourism destination lifecycle model, Butler suggests that sustainable tourism must be,

... developed and maintained in an area (community, environment) in such a manner and at such a scale that it remains viable over an indefinite period and does not degrade or alter the environment (human and physical) in which it exists to such a degree that it prohibits the successful development and well-being of other activities and processes (1993: 27).

This definition of sustainable tourism moves beyond the economic definition that dominated the early era of tourism studies. This definition ushered in a second era that looked at economic, environmental, and social elements of tourism development. During this second era the concept of eco-tourism came into popularity (Carter & Lowman, 1994; Scheyvens, 1999; Carter & Carter, 2007).

Also during the 1990’s, scholars from academic fields other than tourism studies encouraged a definition of sustainable tourism that considered more than economics. From the field of Geography, Hall and Lew (1998) write,

Some of the more recent research on tourism by geographers is starting to reflect some of the wider debates in the discipline [of geography] about the processes of modernization and development, issues of gender and identity, place marketing and promotion, and the relationship between globalization and economic and cultural change (5).

This passage points out that critical human geographers (e.g., Marxists, poststructuralists, and neocolonialists) are beginning to research tourism. The realm of critical tourism studies yields a much different understanding of sustainable tourism than did the economics-dominated early era of tourism studies (e.g., Ateljevic, Pritchard, & Morgan, 2007; Daye & Chambers, 2008;
Pattullo, 1997). The critical approach to tourism studies often focuses on the negative impact of tourism on local environments and communities.

For example Stonich (1998) represents the critical approach to tourism studies by implementing a political ecology approach. Her research throws into doubt the UN’s position that tourism development is a good tool for helping poor people in developing countries. Citing her case study in the Bay Islands of Honduras she shows,

...that while the Islands’ freshwater, land, and marine resources are jeopardized by unchecked tourism development, adverse affects are not distributed equally among various stakeholders...significant environmental degradation is attributed to the actions of powerful national and international stakeholders, [but] it is the Island’s impoverished ladino immigrants and poor Afro-Antillean residents who are the most vulnerable to environmental health risks emanating from those activities (25).

Stonich brings the negative aspects of tourism development to the foreground by focusing on the health risks of marginalized populations. Research in this vein, which focuses on tourism’s negative local impacts, greatly complicates simplistic notions of sustainability. Sustainable tourism researchers have yet to mount an adequate response to these types of critiques.

Gössling (2003) also approaches tourism research from a political ecology approach. He summarizes the history of tourism scholarship and its current state as follows,

...the need to ‘make tourism sustainable’ is usually emphasized, but it is generally not questioned if the fundamental problems underlying sustainable tourism development can be resolved (16-17).

Following in the wake of Stonich, Gössling further shifts the emphasis of tourism scholarship away from the quest for sustainability and towards the impacts of tourism on previously ignored stakeholder groups and the environment. In doing so, he offers a partial articulation of sustainable tourism’s current impasse.
In addition to the local impacts critique, the second major complication for the concept of sustainable tourism comes from the international community’s recent focus on climate change (IPCC, 2007). Climate change is caused by anthropogenic greenhouse gas emissions and the greenhouse gases emitted by traveling - an inherent element of tourism - are especially problematic to the quest for sustainability (Scott, 2010). Climate change is also predicted to cause significant alterations to many environments that attract tourists (Becken & Hay, 2007). The dual needs for climate change adaptation and mitigation within the tourism sector poses significant challenges to sustainability.

This challenge was recognized at the 2nd International Conference on Climate Change and Tourism organized by the UN World Tourism Organization (UNWTO, 2007). The UNWTO declared that the tourism industry needs to rapidly adapt to climate change and simultaneously mitigate the sector’s carbon emissions on the global scale. This relatively recent focus on wide scale adaptation and mitigating has led tourism researchers to question whether the goal of sustainable tourism should be abandoned all together because it is unachievable (Weaver, 2010).

The impasse at which sustainable tourism research finds itself is represented by Sharpley (2009). He contends that despite multiple decades of extensive academic attention, neither is there a single agreed upon definition of sustainable tourism, nor is there much evidence of sustainable tourism in practice. He proposes that tourism researchers should give up on sustainability because,

... like any business operation within a capitalist system, destinations seek to exploit their resources or assets in order to make a ‘profit.’ Thus, tourism development should be based on the exploitation of those assets ... (176).
Sharpley understands the impasse that the field is at, but rather than looking for creative paths forward he proposes a shift back to the economic-centered mode of inquiry represented by Butler’s 1980 destination lifecycle model.

Many tourism theorists think that this type of theoretical regression is unacceptable and refuse to abandon the idea of sustainable tourism (Cole & Morgan, 2010; Jones & Phillips, 2011; Lumsdon & Dickinson, 2010; Sofield, 2003). While the challenges of climate change and other local impacts caused by tourism are very real, there is still hope for a type of tourism that makes holistic sense over the long run. Conventional methods of inquiry have proven inadequate, however, and so a new approach is needed.

The Shift towards Resilience Theory within Sustainable Tourism Research

The shift towards incorporating resilience theory into sustainable tourism research was started by Farrell and Twining-Ward (2004). Their foundational argument is that tourism researchers have failed to effectively facilitate sustainable tourism because they have not kept abreast of advances in other scientific fields. Farrell and Twining-Ward highlight complex adaptive systems science, the field from which resilience theory emerged. Insights from this field suggest that sustainable tourism researchers must start conceptualizing tourism as a holistic, complex, and adaptive system that is moving through time, rather than as a series of static, isolated relationships. They coin the term Complex Adaptive Tourism System (CATS) to describe their proposed subject of inquiry. They make clear the connection between complex adaptive systems science and new approaches to sustainability:

In the light of recent advances in science, the concept of sustainability has been reassessed. The old myth of how living systems function based on linear reductionism, harmony, and equilibrium
This passage highlights a key concept of resilience theory: complex adaptive systems exhibit non-linear behavior, which increases uncertainty when trying to predict how the system will behave.

Farrell and Twining-Ward (2005) build upon their initial call for the incorporation of new knowledge by offering specific steps for implementing a resilience approach to sustainable tourism. The seven steps they offer include working from an interdisciplinary perspective and facilitating a transition in the system. These steps suggest new ways of approaching the challenges of climate change and other local impacts of tourism. By incorporating insights from other disciplines and doing applied research the sustainable tourism impasse can be transcended.

In addition to their seven steps, Farrell and Twining-Ward contribute to sustainable tourism research by arguing that sustainability is not an achievable end-point but rather a process of continual adaptive change. “Sustainable development,” they write, “must be viewed as an evolving complex system that co-adapts to the specifics of the particular place, and especially to the aspirations and values of local people” (110). Understanding sustainable tourism as a context-specific process, rather than a determinable end-state that can be generalized suggests some new paths forward. Well-accepted ideas in sustainable tourism research, like carrying capacity, might need rethinking. Since systems have the potential to behave in unpredictable manners, the carrying capacity one day may be different the next day.

While Farrell and Twining-Ward’s work is theoretically successful, it lacks empirical evidence that demonstrates the effectiveness of a resilience framework for studying sustainable tourism. Plummer and Fennell (2009), offer a review of existing case studies regarding protected area tourism and adaptive co-management (ACM). ACM, they explain, is an approach to
managing complex adaptive systems that attempts to incorporate the insights of resilience theory, particularly the recognition of system uncertainty and the specific social context of every system. ACM accomplishes these goals by (1) treating policy decisions as experiments, monitoring results, and making appropriate changes, and (2) integrating diverse stakeholder groups in the management process. By focusing on ACM’s role in tourism management, Plummer and Fennell’s article marks the beginning of the application of resilience theory to specific complex adaptive tourism systems.

Plummer and Fennell conclude that ACM, while not a universal answer, holds significant potential for enhancing the resilience of complex adaptive tourism systems and can therefore make tourism more sustainable. While one of the main components of ACM (the ‘co’ part) refers to the inclusion of multiple stakeholder groups in the governance of the system, there is no guarantee that every stakeholder group will be included in any given case. Plummer and Fennell’s focus on ACM offers little insight into the resilience of groups who are not part of the ACM process. This same critique is valid for Plummer and Armitage (2007) who offer a resilience framework for assessing ACM. Nonetheless, the demonstrated ability of ACM to enhance the resilience of social-ecological systems (e.g., Tompkins & Adger, 2004) is a major contribution of resilience theory to the field of sustainable tourism.

Strickland-Munro, Allison, and Moore (2010) use a resilience framework in yet another way in their tourism research. They ask the question, how resilient are local communities to tourism? This research is similar to the political ecology approach to tourism research, which focuses on the impacts of tourism on local environments and communities. The resilience approach to tourism impacts departs from the political ecology approach, however, because it focuses on the ability of the tourism system to adapt. Rather than focusing solely on the impacts
to local communities, a resilience approach is interested in facilitating a transformation in the system that can lead to enhanced resilience.

Lambert, Hunter, Pierce, and MacLeod (2010) offer the first specific case study that applies a resilience framework to sustainable tourism research. They attempt to answer the question, how resilient is whale watching tourism to climate change? They explain the linkages between resilience and sustainable tourism as follows:

Where resilience can be enhanced, the goal of sustaining visitor numbers in the light of [global climate change] would have greater chance of longevity. From here operators would be in an improved position to adapt and evolve alongside [climate change’s] effects on [whale] occurrence (423).

Lambert et al.’s research goal is to quantify the resilience of tourism operators. However, at the time of this writing, they had not yet published the results of their study. Their study still illustrates the potential of resilience theory to offer new paths forward for sustainable tourism research interested in climate change adaptation.

Tourism operators face many challenges to their resilience other than climate change, however. Accordingly a resilience framework for sustainable tourism should have a wider scope than just climate change.

So far I have reviewed the academic literature that begins to synthesize sustainable tourism research and resilience theory. Most of this research is theoretical or draws upon previous case studies. The literature makes clear that resilience theory holds significant potential for advancing sustainable tourism research past its current impasse. Resilience theory offers a more holistic, system-based perspective for understanding climate change and other environmental and social impacts of local human activities. Resilience theory also offers a method of research that is concerned with actively facilitating a transformation to a more
resilient system. This emphasis on applied research can help tourism researchers feel less helpless when facing the challenges to sustainability.

**Resilience Theory and the Five-part Resilience Framework**

Resilience theory emerged from the empirical research of ecologist C.S. Holling. Holling (1973) showed that ecosystems transition between multiple steady states, rather than always bouncing-back to a single equilibrium state as previous ecological theory posited. Holling explained this observed behavior through the concept of adaptive cycles. An adaptive cycle consists of four discrete phases that ecosystems pass through over time. Every time an ecosystem passes through a certain phase of the cycle, it has the potential to adapt and either return to its previous steady state or transform into a different steady state. Ecosystems passing through adaptive cycles are complex because they are influenced by multiple factors at smaller and larger spatial scales. Cumming, Cumming, and Redman (2006) expand on the difficulty of understanding cross-scale drivers of change but conclude that it is of the utmost importance for understanding the resilience of social-ecological systems.

Feedback loops and thresholds add to the complexity of ecosystems. A positive feedback occurs when an ecosystem behavior results in more similar behavior, eventually pushing the ecosystem state towards a transformation threshold. A negative feedback occurs when an ecosystem behavior results is less of that behavior and stabilizes the system in its current state. A threshold is the point after which a given influence (such as a positive feedback or a cross-scale driver of change) will cause a system to transform, or flip, into a different state (Gunderson & Holling, 2002).
Resilience was the term used to describe the amount of perturbations an ecosystem could absorb before it flipped into a different state (Holling, 1973). Later, the term *Panarchy* (Gunderson and Holling, 2002) was coined to capture the unpredictable nature of systems that are driven by these complex relationships. The applied aspect of these findings is that once Panarchy is accepted as reality, ecosystems that are in a desirable state can be managed in a way that enhances resilience.

The ideas presented by this initial research on ecological resilience were so compelling that social science researchers began applying them to social systems. Adger (2000) argues that social resilience is, “the ability of communities to withstand external shocks to their social infrastructure” (361). He suggests that the concept of social resilience is especially appropriate for communities that are highly dependent on particular ecosystems because the resilience of the ecosystem influences the resilience of the social system. Gunderson (2003) focused on the co-evolutionary connection between resilient ecosystems and resilient social systems. This research emphasized the role of time in social-ecological resilience, and further advanced the idea that social and ecological systems are linked and driven by the laws of Panarchy.

Following Adger and Gunderson, I define a social-ecological system as a system of human and nature relationships, over time and space, where the social and ecological portions are mutually influential. Folke (2006) explains why resilience researchers tend to make social-ecological systems the subject of research:

_A human society may show great ability to cope with change and adapt if analyzed only through the social dimension lens. But such an adaptation may be at the expense of changes in the capacity of ecosystems to sustain the adaptation ... Similarly, focusing on the ecological side only as a basis for decision making for sustainability leads to too narrow and wrong conclusions. That is why work on resilience stress linked social-ecological systems._”(260)
It is important, however, not to overemphasize the similarity between social and ecological systems. A notable difference between social and ecological systems in regards to resilience is that social systems possess the ability to consciously adapt to influences, while ecosystems arguably do not (Nelson, Adger, & Brown, 2007).

Berkes, Colding, and Folke (2003) suggest that researchers must be conscious of accurately understanding the link between social and ecological systems in different cultural contexts. They contend that social systems are not always as closely linked to ecosystems as has sometimes been portrayed. Abel, Cumming, and Andereis (2006) describe the importance of self-organization for the resilience of social systems. Self-organization means the ability of a given community to act in a manner that enhances resilience, including the ability to adapt to changes. Ability to self-organize is influenced by context specific factors like institutional memory, social capital, financial capital, and leadership (Olsson, Folke, & Hahn, 2004).

Based on these concepts, I define social-ecological resilience as the ability of a given linked social-ecological system to deal with changes while maintaining its primary function and characteristic. In the case of dive operators in the US Virgin Islands, social-ecological resilience means the ability of the dive operators to deal with environmental, economic, and social changes, while staying in business.

In order to understand the social-ecological resilience of the linked system I have chosen to study, I will apply a five-part resilience framework based on the resilience concepts I presented in the preceding sections of this chapter. The five resilience theory concepts I use to construct the resilience framework are:

1. The ability of the researched community to participate in the adaptive co-management of the social-ecological system of which they are a part
2. The nature of the link between the social and ecological portions of the system
3. The ability of the social portion of the system to self-organize and adapt
4. The influence of cross-scale drivers of change in the system
5. The health of the ecological portion of the system

This five-part resilience framework is intended to offer insights into the five most important parts of any social-ecological system under investigation. Each concept represents a major theme in the field of resilience. Understanding each of the five parts individually and how they interact will lead to a nuanced and holistic understanding of any given social-ecological system.

Understanding the resilience of social-ecological tourism systems in this manner will advance sustainable tourism research. In the next section I demonstrate that sustainable tourism research has not adequately incorporated the insights of resilience theory by addressing dive tourism literature, a subset of sustainable tourism literature.

**Dive Tourism Literature**

Dive tourism research represents a good example of the impasse at which sustainable tourism research finds itself. Like other realms of sustainable tourism research, dive tourism research faces two main challenges in facilitating sustainability. The first challenge is reconciling the idea of sustainability with the realities of climate change. Rising sea temperatures associated with climate change are expected to cause major coral bleaching events in the future (Glynn, 1991; Hoegh-Guldberg, 1999, Hughes, et al., 2003). Ocean acidification caused by increasing concentrations of carbon dioxide in the earth’s atmosphere is also expected to negatively impact coral reefs (Anthony et al., 2011; Kiessling & Simpson, 2011). The double threat of rising sea temperatures and ocean acidification poses a threat to the sustainability of
Dive tourism because the health of coral reefs has been positively correlated with the satisfaction of dive tourists (Urraya, et al., 2005; Urraya, Watkins, & Côte, 2008).

Secondly, like other realms of sustainable tourism research, dive tourism researchers have touted diving as an eco-friendly option (Kelkit, Celik, & Esbah, 2010). However, also like other realms of sustainable tourism research, diving has more frequently been framed as a human activity that negatively impacts the environment (Dearden, Bennet, & Rollins, 2007). Similar to the political ecology critique of tourism represented by Stonich, diving has even been implicated in contributing to the misfortune of local communities (Klein et al., 2007). This line of argument focuses on the creation of marine protected areas that often benefit dive operators while excluding local resource users. Dive tourism, then, is a good case study for testing the benefits a resilience approach can offer to the sustainable tourism field.

**Summary**

In the face of two major challenges to sustainable tourism (i.e., climate change and other environmental and social impacts of local human activities on environments and communities), researchers need new paths forward. The five-part resilience framework proposed here, which incorporates the major insights of resilience theory, offers tourism researchers a new approach for studying sustainability. The promises of a resilience approach include a more holistic and nuanced understanding of social-ecological systems and an emphasis on positive change. I will test these promises through a case study of dive tourism in the US Virgin Islands.
CHAPTER 3

Research Design

Introduction

In this chapter I explain how I implemented the five-part resilience framework to investigate the social-ecological resilience of dive operators. I first explain the context of the research. This context includes a description of the study area and a conceptual map of the social-ecological system I am investigating. Understanding the context of this research is essential for interpreting the findings accurately.

I then present the research questions. I designed the research questions to fill in the five-part framework with data that could be analyzed to characterize the resilience of dive operators. I then explain the research methods I chose and how the methods correspond to the research questions. Finally, I describe the processes of data collection and data analysis.

Research Context

I carried out the research for this thesis in the US Virgin Islands (USVI). The three main US Virgin Islands are St. Thomas, St. John, and St. Croix. These three islands and the many small territorial cays comprise approximately 134 terrestrial square miles. This US territory is located along the boundary of the Atlantic Ocean and the Eastern Caribbean Sea at about 18 degrees North latitude, 64 degrees West longitude (Figure 3 and Figure 4).

The USVI provides an excellent study area for sustainable tourism research because of its high level of tourism development. Economically 80% of GDP in the territory is generated by
Figure 3: Location of the US Virgin Islands

Figure 4: The US Virgin Islands
tourism. St. Thomas features Charlotte Amalie Harbor; a naturally deep inlet that provided the foundation for what is now one of the busiest cruise ship ports in the Caribbean. In 2008 the USVI hosted 2.4 million visitors (www.cia.gov), the overwhelming percentage of whom were on cruise ships.

Out of the current population of about 110,000, 76% of the people are African-Caribbean descendants of slaves. These people call themselves West Indians and are referred to as *locals* throughout this thesis. The Caucasian population is 13%, with the other 11% being mostly Hispanic and Asian.

**The Social-Ecological System under Investigation**

I chose to focus on dive tourism because it is a tractable subset of tourism that exhibits many of the same sustainability challenges as the larger tourism industry. Two specific sustainability challenges that dive tourism and the larger tourism industry face are climate change and the impact of tourism activities on local environments and communities. I also chose to focus on dive tourism because the scope of the industry in the study area was appropriate for the resources I possessed to conduct the study. A third reason that I chose to focus on dive tourism is because it is a linked social-ecological system, and therefore a good match for the application of resilience theory. This section will expand on the third point.

The initial research revealed that there were approximately 20 independently owned dive businesses and hundreds of recognized dive sites in the USVI at the time of this study. While an economic valuation of diving in the territory has never been carried out, which I learned later, it is reasonable to assume that dive tourism represents substantial economic activity for the territory and contributes to the livelihoods of over one hundred individuals. The social side of
dive operators depend on the marine environment to draw their customers. Divers also impact the marine environment while they are diving. Figure 5 displays a graphical representation of the social-ecological system under investigation.

While I am interested in the entire social-ecological system represented by diving, I am primarily focused on the resilience of dive operator livelihoods. Sustainable tourism research has not adequately engaged tourism operators in the past (Dalton, Lockington, & Baldock, 2007; Rønningen, 2010). Focusing on the operator side of the system could offer new insights for addressing the sustainability challenges of climate change and other environmental and social
impacts of local human activities. The specific concern in this research is the resilience of dive operators to social and environmental changes that could put them out of business.

The five-part resilience framework that I designed is intended to capture information about the most important parts of social-ecological systems in regards to resilience. Figure 6 shows how the five-part resilience framework maps onto the social-ecological system of dive operators in the USVI.

Figure 6: Concept map of the social-ecological system with the five-part resilience framework laid on top of it.
By applying the resilience framework to this system, I will be able to analyze the way in which each part of the system contributes to the resilience of the system as a whole. This nuanced understanding will reveal which parts of the system enhance resilience and which parts of the system erode resilience, and to what extent they enhance or erode resilience. A more intricate understanding of resilience in this system will offer new insights for sustainable tourism researchers.

**Research Questions**

I designed a series of three research questions to link this particular study to the larger research goal of offering new paths forward for sustainable tourism. The first research question is: *What specific factors do dive operators perceive as influencing their resilience and to what extent does each factor increase or decrease resilience?* Answering this question will allow me to understand the factors that make up each part of the social-ecological system in the USVI. Since every social-ecological system is situated in a unique social, environmental, and economic context, it is necessary to begin resilience research at the level of specific resilience-influencing factors. In addition to identifying factors, it is also necessary to determine if each factor increases resilience or decreases resilience and to determine the relative extent of this influence.

The second research question is: *How do the resilience-influencing factors fit into the five-part resilience framework?* As part of the analysis I assign every factor to one of the five-parts of the resilience framework. This categorization will allow me to assess which parts of the system contribute the most resilience to the system and which parts of the system erode the most resilience. Understanding the resilience of the social-ecological system in this nuanced, but still holistic, manner will help to identify sites for positive transformations. Parts of the system that
contribute resilience can be drawn on to improve the resilience influence of other parts. This research question will also reveal which parts of the system erode the resilience of dive operators’ livelihoods. By understanding particular sites of resilience erosion within a system, system stakeholders can pursue targeted transformation measures.

The third research question is: *How can this case study of dive operator resilience offer suggestions for sustainable tourism research to more adequately address climate change and the other environmental and social impacts of local human activities?* Answering this question broadens the scope of this thesis back out to where it started. Sustainable tourism research has reached an impasse. This is particularly true for the field’s ability to respond to critiques about climate change and other environmental and social impacts of local human activities. To address this concern, I will identify specific lessons learned from this resilience case study that can be applied to overcome sustainable tourism’s impasse.

**Methods**

I used semi-structured interviews with nine dive operators to gather data on the factors that influence the resilience of their livelihoods. This part of the research addressed the first research question. Six of the nine operators I interviewed were from St. Thomas and three were from St. Croix. Eight of the operators were men and one was a woman. Four dive operators were the sole proprietors of their business. Four of the male operators co-owned their business with their wife and one co-owned their business with four friends. All nine of the operators were Caucasian and had moved to the USVI from the continental US. All of the businesses received some customers from cruise ships but none contracted directly. Two operators reported that about half of their customers came from cruise ships and the others reported less. The operators
received most of their customers from resorts. Two of the operators led most of their dives from a specific beach where their business was located, while the other seven primarily used boats to access dive sites. Each business had between one and five employees – in addition to the owners – at any given time. Overall the dive operators can be characterized as small, independent business owners.

I chose to use semi-structured interviews with dive operators for two main reasons. First, I was interested in understanding the perceptions of the tourism operators themselves (see Budeanu, 2005; Main & Dearden, 2007). Understanding perceptions of resilience from the inside of a system can lead to new ideas for promoting sustainable tourism and overcoming the challenges of climate change and other environmental and social impacts of local human activities.

Second, I wanted to let the factors that influence resilience emerge from the dive operators themselves, rather than guiding them towards the factors that I thought were important (Creswell, 2007). This approach allowed me greater flexibility in gathering social perception data than a structured interview or a survey would have allowed me. The semi-structured approach proved effective, as some of the most significant resilience-influencing factors that emerged were factors I was not aware of before conducting this fieldwork.

When designing the interview questions I assumed that dive operators in the USVI were not familiar with resilience theory in the academic capacity that I am employing it. Therefore, I decided not to ask them directly about resilience but rather to ask about proxy indicators. Since resilience is a holistic framework for thinking about social-ecological systems over time, I used the equally holistic proxy framework of environmental, economic, and social changes. I asked them about what changes they had observed in these three sectors, how these changes affected
their businesses, and how they had responded to challenges. I also asked them about what they expect to happen in the future in these different sectors and how they anticipate responding to this future (See Appendix A for a full list of interview questions). This approach to interviewing allowed me to gather the data I needed while interacting with the dive operators in a way that made sense to them. I also had each dive operator draw the spatial range of his or her operation on a map of the territory (see Appendix B for the dive operators’ maps).

I coded the interview transcripts in reference to the five-part resilience framework. I categorized every factor that was mentioned by a dive operator as influencing their social-ecological resilience into one of the following five resilience theory categories: (1) ability to participate in adaptive co-management, (2) nature of linkage between the ecosystem and the social system, (3) ability to adapt and self-organize, (4) influence of cross-scale drivers of change, or (5) health of the ecosystem. Categorizing the resilience-influencing factors into these five categories helped me identify areas where resilience can be enhanced.

In addition to categorizing each of the resilience-influencing factors into one of the five system part categories described above, I analyzed whether each factor was perceived as increasing resilience or decreasing resilience. This analysis determined the direction of influence of each factor. If a dive operator implied that a specific factor helped to stabilize or increase their profits or the health of the marine ecosystem, it was counted as increasing resilience. If a dive operator implied that a factor decreased their profits or the health of the marine ecosystem, it was counted as decreasing resilience.

Some factors were perceived as increasing resilience by some dive operators and as decreasing resilience by other dive operators. One example is the presence of cruise ships. Some dive operators garner clients from cruise ships and reported being glad they were there.
This type of data was counted as increasing resilience. Other dive operators do not garner clients from cruise ships and cited the negative impact of cruise ships on the marine environment. This type of data was counted as decreasing resilience. The presence of factors that are perceived as both increasing and decreasing resilience indicates the complexity of the social-ecological system under investigation and the fact that dive operators have different resilience perceptions.

To determine how significant each factor is to the livelihood resilience of dive operators, I created a weighting rubric (Table 1). The significance-weighting rubric consists of four levels of significance and assigns a numerical value to each level. The significance of each factor to each dive operator was calculated using this rubric. Each factor received a positively weighted value if it was perceived to increase resilience and a negatively weighted value if it was perceived to decrease resilience. All values were summed to determine a single resilience score for each factor.

Table 1: Significance-weighting rubric used to determine relative significance of each of the resilience-influencing factors to each dive operator

<table>
<thead>
<tr>
<th>Significance Level</th>
<th>Criteria</th>
<th>Assigned Numerical Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Significance</td>
<td>Factor mentioned multiple times without direct prompting; Factor elaborated upon extensively with language and tone indicating high significance</td>
<td>3</td>
</tr>
<tr>
<td>Medium Significance</td>
<td>Factor mentioned at least once without prompting; Factor elaborated on in some detail with language and tone indicating medium significance</td>
<td>2</td>
</tr>
<tr>
<td>Low Significance</td>
<td>Factor not mentioned without direct prompting; factor not elaborated on</td>
<td>1</td>
</tr>
<tr>
<td>No Significance</td>
<td>Factor was not perceived to influence resilience even after prompting or did not emerge during interview at all</td>
<td>0</td>
</tr>
</tbody>
</table>
In the final step of data analysis I calculated the total resilience score (TRS) for each of the five resilience categories of the five-part resilience framework. The TRS for each part of the system was calculated by summing the weighted scores of all the factors that make up each part. This analysis reveals which parts of the social-ecological system enhance resilience, which parts erode resilience, and the relative significance of each part compared to the others. I also calculated the TRS of the system as a whole. Figure 7 presents the composition of a social-ecological system.

Figure 7: Composition of a social-ecological system.
Summary

I construct a case study of dive tourism in the US Virgin Islands to explore new paths forward for the field of sustainable tourism. Dive tourism is a representative subset of the larger tourism industry. Dive tourism is also an example of a linked social-ecological system. I approach the study by using a five-part resilience framework. Each part of the resilience framework corresponds with a specific part of the social-ecological system under investigation.

I use semi-structured interviews with seven dive operators to gather the data needed to fill in the resilience framework. I present the data in the form of factors that influence resilience and categorize each factor into one of the five-parts of the resilience framework.

By assigning significance values to the resilience-influencing factors I am able to show which parts of the system contribute the most resilience to the system and which parts erode resilience the most. I am also able to calculate a Total Resilience Score for the overarching social-ecological system. This resilience case study can offer suggestions for advancing the field of sustainable tourism research.
CHAPTER 4

Findings

Introduction

In this chapter I first present each of the 30 resilience-influencing factors that emerged from the dive operator interview data. Figure 8 presents how many dive operators identified each factor and whether they identified it as increasing (dark bars) or decreasing (light bars) resilience. I also present the results of applying the significance-weighting rubric to each factor (Figure 9). Each factor is essentially a synopsis of multiple ideas presented by multiple dive operators. Therefore, I define each factor in greater detail than the title provides and explain how each factor is related to the particular part of the five-part resilience framework that I have assigned it to. Factors are presented in their categorized clusters.

I present direct quotes from the interview data that capture the general dive operator perceptions of each factor. I used the direct quotes to help determine the significance value of each factor. By presenting a representative quote for each factor, I intend to support my interpretation of significance values (see Daley, Griggs, & Marsh, 2008 for an example of qualitative environmental perception research related to the marine environment).

Finally, I calculate the Total Resilience Score for each of the five parts of the resilience framework (Table 2 and Figure 10). This calculation is important because it indicates which parts of the social-ecological system most enhance resilience of the overall system and which parts most erode resilience of the overall system. The Total Resilience Score for the whole system is shown.
Times Mentioned and Direction of Influence of Each Factor

The 30 factors that dive operators identified as influencing their livelihood resilience are presented in this section. Figure 8 lists each of the thirty factors and indicates how many dive operators mentioned each factor during their interviews. The research finds that 6 factors were identified as only increasing resilience, 14 factors were identified as only decreasing resilience, and 10 factors were identified as both increasing and decreasing resilience.

The factor that was mentioned the most times as increasing resilience was number 15 - the dive operators’ possession of a diversified product - which was mentioned by 8 of the 9 interviewees. The factor that was mentioned the most as decreasing resilience was number 19 – the economic downturn and resultant tourist frugality – which all nine interviewees mentioned. The two factors that received the closest split, meaning that they were mentioned as both increasing and decreasing resilience, were numbers 14 and 16 – dive operators’ spatial range and view of future. Both 14 and 16 had five mentions of increasing resilience and three mentions of decreasing resilience.

Weighted Significance Score of Each Factor

Figure 9 presents the results of applying the significance-weighting rubric (Chapter 3 page 30) to the data. Each factor had the potential to receive a maximum score of 3 (very significant) for each of the 9 interviews, making 27 the highest possible significance score for each factor. The figure on the following page shows the weighted significance for each factor for increasing resilience and decreasing resilience.

Significance-weighting analysis reveals that the most significant factors that increase dive operator resilience are numbers 10 and 13 – competitive divining conditions and possession of
Figure 8: Dive operators mentioning the resilience-influencing factors, including times each factor was described as increasing and/or decreasing resilience.
Figure 9: Results of applying the significance weighting-rubric to dive operators’ perceptions of resilience-influencing factors.
industry niche. The factors that most significantly decrease dive operator resilience are numbers 3 and 4 – the local government’s lack of marine protection and the locals’ attitude towards the environment and tourism. Other factors that significantly decrease resilience are numbers 6 and 19 – the USVI not being promoted as a dive destination and the economic downturn. Factor 25 – presence of cruise ships – has the closest split when the factors are weighted for significance.

**Resilience Framework Categorization and Total Significance Score of Each Factor**

In this section each of the 30 factors are categorized into the five parts of the resilience framework. The total weighted significance score of each factor was calculated by assigning a positive value to resilience-increasing scores and a negative value to resilience-decreasing scores (as presented in Figure 9 on the last page). The scores were summed and a positive score indicates that the factor overall increases resilience, while a negative score indicates that the factor overall decreases resilience. The score is presented in parentheses following each factor title. A description of each factor and a representative quote from the interview data is provided.

**Part 1: Ability to participate in adaptive co-management (Factors 1-7)**

1. Relationship with local people (-9)

   This factor reflects the manner in which dive operators (DOs) get along with the West Indian population in the USVI. Since West Indians constitute the majority of the population (i.e., 76%) and the majority of the local government, this factor is related to DOs’ ability to participate in the adaptive co-management of the social-ecological system (SES) of which they are part.
Representative quote:  *I can’t think of one West Indian working for a dive company; I can’t think of one West Indian dive master or captain in any dive operation on the island here.*

2. Business environment (-11)

This factor reflects DOs’ perceptions of doing business in the USVI and interacting with the local government in a business capacity. This factor is related to DOs’ ability to participate in the adaptive co-management of the SES because local business policies can influence social resilience.

Representative quote:  *You have to be able to laugh things off because so many things don’t make sense...they’re very much so behind on technology...they’re still using files and post-it notes on our business files, there’s no servers, backup servers, anything like that, so it’s hard.*

3. Local governments’ lack of marine protection (-20)

This factor represents DOs’ perception of the local governments’ creation and implementation of policies that protect the marine environment and the DOs’ role in the creation of those policies. It is related to DO’s ability to participate in adaptive co-management because the management of the marine environment can influence the resilience of the SES.

Representative quote:  *The local Department of Planning and Natural Resources, like everything else in the government, doesn’t have the money to really go out and do that much. Or, if they do, it turns out it’s a cousin that they would be arresting...just like the cops. So, [it] just never happens on the enforcement side.*
4. Locals’ attitude toward the environment and tourism (-22)

This factor represents DOs’ perception of how the West Indian population views the local environment and tourism. Unlike factor 1, it is not about DOs’ direct relationship with locals, but rather the general West Indian attitude. It is related to DOs’ ability to participate in adaptive co-management because the larger cultural attitude towards the SES influences system resilience.

Representative quote: *It’s like people on this island, most, think they’d be better off without all these tourists; it's a very parochial, narrow-minded view of life.*

5. Moorings (+5)

This factor represents a specific example of DOs’ participation in the adaptive co-management of the system. DOs and other stakeholders concerned with the marine environment worked for years to get permission to install and maintain mooring buoys at popular dive sites. Boaters are able to tie up to the mooring rather than dropping anchors on the ocean floor and potentially harming the benthic community.

Representative quote: *…we do make a concerted effort to dive in areas where there’s moorings, so we don’t have to drop an anchor and damage any coral or sand…the dive industry here has made a concerted effort to install moorings at most of our sites…therefore we’re helping protect the reef as well.*

6. Not promoted as a dive destination/ bad reputation (-15)

This factor represents DOs’ perceptions of the local tourism board’s lack of assistance in marketing the USVI as a dive destination (i.e., a place where tourists come specifically for the purpose of diving) and the reputation of the territory’s dive sites within the diving culture. It is
related to DOs’ ability to participate in the adaptive co-management of the system since attracting dive tourists influences the resilience of the social part of the SES.

Representative quote: *If an island is going to promote its diving, it really needs strong government support, [a] willingness to promote it in advertising, trade shows, dive magazines …Virgin Islands doesn’t do that, they’d rather make their money selling T-shirts and rum.*

7. Lack of federal involvement (-7)

This factor represents DOs’ perceptions of the US federal government’s involvement in the management of marine resources in the USVI. It is related to DOs’ ability to participate in the adaptive co-management of the system because federal involvement could potentially influence the resilience of the ecological portion of the SES.

Representative quote: *I think US Fish and Wildlife don’t want to step on the locals’ toes. So they tend to not really do anything here.*

**Part 2: The nature of the link between the ecosystem and the social system (Factors 8-11)**

8. Less marine life (-10)

This factor represents DOs’ perceptions of change in the marine environment and how this change impacts their business. It is related to the linkage between the ecosystem and the social system because healthy marine life is known to correspond positively with the social resilience of dive livelihoods.

Representative quote: *Many of the seasoned divers that have been to other Caribbean islands say, ‘well where are all the fish?’ That question comes up quite often…When I first*
started diving here you’d see big sharks on every dive; from a bull shark, to a hammerhead to a reef shark, not uncommon. [Now] you might see a nurse shark once in a while.

9. Inexperienced clientele (+5)

This factor represents DOs’ perceptions of their customers’ diving experience. It is associated with the linkage between the ecosystem and the social system because more experienced divers are more likely to notice environmental degradation. Inexperienced clientele can decrease the resilience of the SES.

Representative quote: Most of the people who dive in St. Thomas are vacation divers; a person that dives probably once a year... they don’t know a lot about the underwater environment...very few people say, ‘wow, the coral looks bad,’ or ‘is that all the fish you have here?’ because generally speaking, I hate to say this, but they don’t know any better.

10. Competitive diving conditions (+12)

This factor represents DOs’ perceptions of the marine environment in the USVI compared to the marine environment of other Caribbean islands in regards to its ability to draw dive tourists. This factor is associated with the link between the ecosystem and social system because it is the state of the ecosystem that is creating resilience in the social system.

Representative quote: …we’re going to do a ninety-five foot deep ship wreck, and then a seventy foot wall dive. Tomorrow we’re going to do a seventy-foot drift dive, and then a shallow decimated wreck...The variety of diving and the variety of sea life I always saw when I came here was better than any other place I went and it still is that way...The diversity.
11. Non-environmental aspects of diving (+5)

This factor represents DOs’ perceptions of aspects of diving that draw tourists other than the marine environment. This factor is associated with the link between the ecosystem and the social system because it implies that the link is not absolute in its influence on SES resilience.

Representative quote: *I don’t know if it will ever necessarily come to [the point where the environmental degradation is so bad that I won’t be able to have a dive shop]. The reason why is because in addition to marine life, scuba diving is also just a feeling of being underwater, the feeling of weightlessness, it is an experience in itself.*

**Part 3: Ability to adapt and self-organize (Factors 12-18)**

12. Institutional memory (+9)

This factor represents DOs who have been in the business for 20 years or longer. It is associated with the ability of the community to self-organize because long-term dive operators have overcome challenges in the past and can share their adaptive strategies with less experienced DOs.

Representative quote: *I think we were opening up a satellite [store] at a hotel when [Hurricane] Hugo hit...We found our tanks in the water and just kind of piecemealed things together. Our first job really doing anything was raising boats...Once the FEMA people got here they wanted to go diving on their days off, so we were right back in business.*

13. Possession of industry niche (+13)

This factor represents DOs’ ability to remain competitive within the USVI dive industry by specializing in a certain type of diving or a certain clientele. It is associated with the ability to
adapt and self-organize because it demonstrates DOs’ ability to arrange their social system in a resilient way.

Representative quote: *The wreck dives that are on the South side of the island, that’s a whole different type of diving… I can’t compete with those kinds of dives, but that’s not my market... When people tell me what type of diving they’re looking for, if I can’t really offer it without lying to them, then I’ll send them to another dive shop, because they’ll come back.*

14. Spatial range (+9)

This factor refers to DOs’ ability to access desirable dive sites. Because of the timetable that DOs work on, a fast boat is required for a large spatial range. This factor is associated with DOs’ ability to adapt and self-organize because it is a specific adaptive strategy to overcoming localized degradation of the marine environment. See appendix B for the maps of dive operators’ spatial ranges.

Representative quote: *I’m in an enviable position, I have a boat that has the ability to be able to handle this volume of an area and run two charters a day, not all boats on this island are as fast as mine.*

15. Diversified product (+12)

This factor represents DOs’ ability to earn income in ways other than diving. Other activities include running a retail store, renting dive gear, repairing dive gear, running charter sailboat tours, maintaining the mooring buoys, and doing snorkel tours. It is associated with the ability to adapt and self-organize because it represents an adaptive strategy that increases resilience to going out of business. If one income source fails the other might fill the gap.
Representative quote:  *I’m different because I know where the money is; it’s not in diving. It’s in snorkeling... The snorkelers outnumber the divers a hundred to one. So I do presentations at the hotels and I ask how many certified divers there are. Yesterday in a room, there was not one. Twice I asked rooms of thirty people, they were all snorkelers!*

16. View of future (+3)

This factor represents DOs’ perception of the resilience of their livelihood over time. It is one of the most mixed factors, with some DOs expressing positive views and other expressing negative views. Because it is so mixed, I present two representative examples. The factor is associated with the ability to adapt and self-organize because a positive view of the future can enhance adaptive ability and resilience.

Representatives quote (positive view): *I’m eternally optimistic. Unless something major happens, this environment will kind of continue.*

Representative quote (negative view): *It costs so much to be here, we can’t price [our products] like [non-US dive destinations] and survive. We’re done, the way I see it.*

17. Relationship with other dive operators (+12)

This factor represents DOs’ perception of their social connectedness with other DOs in the territory. It is associated with ability to adapt and self-organize because high levels of social connectedness are known to enhance resilience in stressful times.

Representative quote: *We had [a professional association] a long time ago. This occurred when PADI was no longer insuring dive shops in the Virgin Islands. So we banded*
together, went to the lieutenant governors’ office, who is the guy in charge of insurance, and they put pressure on PADI to do it. So we got it together...I think that was a great idea.

18. Actively promote industry/environmental education (+5)

This factor represents DOs’ ability to enhance their own resilience through either promoting diving themselves or teaching divers about protecting the marine environment. These two acts enhance social and ecological resilience respectively. This factor is associated with DOs’ ability to adapt and self-organize because it is an activity they do to enhance resilience.

Representative quote: You can’t have millions of people come down here and not have a negative impact on the environment. Especially when people aren’t educated and they don’t know what to touch and what not to touch, so people are always touching things, always. But I tell them not to. When they come to my diving and snorkeling trips I tell them, ‘touch nothing.’

Part 4: Influence of cross-scale drivers of change (Factors 19-24)

19. Economic downturn/tourist frugality (-17)

This factor represents DOs’ perceptions of how the global economic downturn has affected their business. It also represents a perception of increased tourist frugality linked to online discount vacation packages. This factor is an example of a cross-scale driver of change.

Representative quote: I don’t see the business that we had five years ago. My business is off like forty percent from when the recession started. Last year it was off fifty percent. So, I’m on an up-cline, but I don’t know how long that is going to last...Nobody wants to spend any money.
20. Competition with Cuba and other destinations (-11)

This factor represents DOs’ anxiety about Cuba opening to American tourists. It also represents the frustration that DOs have about trying to compete with other Caribbean tourism destinations that do not require the same high level of insurance coverage to run dive businesses. This factor is associated with cross-scale drivers of change because it represents a social resilience influence from the regional scale.

Representative quote: *If someone can jump on a flight for ninety bucks and fly ninety miles from Miami to Cuba, what’s going to make them pay an additional hundred and seventy dollars to fly to the US Virgin Islands?...Not a thing...And the diving there is supposed to be phenomenal. It would be a huge game-changer to have that island re-open to tourism.*

21. Lionfish (-15)

This factor represents DOs’ perceptions of the lionfish invasion. The lionfish is an invasive species from the Indian and Pacific Oceans that began appearing in northern Caribbean about five years ago. It was first sighted off the coast of Florida and has been expanding in a southeast direction, devastating coral reefs along the way. It began appeared in the USVI about in early June 2010. It represented a cross-scale driver of change from the larger scale.

Representative quote: *Lionfish can completely decimate a reef in a matter of months. The lionfish is a bulimic fish that will eat as long as there is food available. The typical Indo-Pacific lionfish grows to about eleven inches, yet we’ve caught lionfish over on St. Croix bigger than that already, and up in the Bahamas, they’ve got them over twenty two inches long.*

22. Climate Change (-7)
This factor represented DOs’ perception of climate change as an influence on their livelihood resilience. There is an established connection between climate change and negative impacts on coral reef health and an established connection between coral reef health and satisfaction of dive tourists. This factor is associated with cross-scale drivers of change because it is a resilience influence from the global scale.

Representative quote: *I honestly have to say that I’m not educated in [the area of climate change]. I read just like everybody else does and I’m not sure I believe everything I read…The winds this year were totally different. This has been a very strange weather year. Other than that, I don’t see a direct correlation underwater at this point and time with global warming.*

23. Lack of young diver/lack of interest (-2)

This factor represents DOs’ observations that there are less people getting into the sport. It is associated with cross-scale drivers of change because it is a potentially negative resilience influence from the larger scale.

Representative quote: *There are just not enough younger divers coming in. It’s not a cool sport. It takes a lot of gear and it takes a lot of training. You can go snow skiing with a lot less training than scuba diving. Surfing or kayaking, I can name a lot of things that take a lot less formal training to do than scuba diving does…It’s a tough sell sometimes.*

24. Presence of cruise ships (+2)

This factor represents DOs’ perception of the influence of cruise ships on their livelihood resilience. DOs are split on this factor. The representative quote that I have chosen represents
their split perceptions. This factor is associated with cross-scale drivers of change because it is an example of a larger scale resilience influence.

Representative quote: *With the cruise ships that come in, we’re always going to have divers here. I don’t know if that’s a good thing or not, because they’re probably contributing to some of the degradation of the reefs ‘cause they’re usually not the best divers.*

**Part 5: Health of the ecosystem (Factors 25-30)**

25. Development related pollution (-10)

This factor represents DOs’ perception of the negative impacts of development related pollution on the resilience of their livelihoods. Such pollution is caused by minimally planned, lightly regulated infrastructure development. It includes sediment runoff that smothers corals, toxic runoff that poisons marine life, and untreated sewage dumping. This factor is associated with the health of the ecosystem because it is influencing it.

Representative quote: *The other problem we have is just the amount of sewage spill and the [runoff] …if you just follow the rain into the guts and what goes in there, all the coolant that’s on the ground, the oils that are on the streets, the by-pass they’re doing up here, it’s just horrific and it’s just damaging our reefs.*

26. Hurricanes (-1)

This factor represents DOs’ perceptions of the impact of hurricanes on the marine environment and on their livelihood resilience. It is associated with health of the ecosystem because it influences it.
Representative quote: *You have to understand that there are a lot of corals that actually propagate themselves [during hurricanes]. A hurricane is a naturally occurring event that helps to encourage the growth of some of the coral in the Caribbean, because a lot of the hard corals need to be broken off and moved to plant and propagate a new colony.*

27. Coral Bleaching (-7)

This factor represents DOs’ perceptions of coral bleaching on the health of the marine environment and on their livelihoods. Coral bleaching is associated with prolonged elevated water temperature. It is a phenomenon where the animal part of the coral expels its symbiotic algae, causing the remaining structure to appear white. This factor is associated with the health of the ecosystem because it affects it.

Representative quote: *[During the coral bleaching event of 2005] it was pure white. We did a dive one day, and people came up singing Christmas songs, like ‘I’m Dreaming of a White Christmas.’ You just had the white, white corals, and it was really weird. It didn’t last that long though. I was surprised how the color started to come back.*

28. Fisherman’s impact and algae (-15)

This factor represents DOs’ perceptions on the impact of fishermen on the health of the marine environment. Fishermen were accused of both overfishing and of damaging reefs with their nets. This factor is related to the health of the ecosystem because it influences it.

Representative quote: *The algae eating fish aren’t here anymore...They’ve been fished out. Parrotfish are a cultural staple here...parrots fish is a huge local fish that has a lot of*
demand. Fishermen are bringing in pounds and pounds, and there’s nobody that’s really finding a way out, or getting that stopped, or slowed down, or just getting the demand changed.

29. Diver Impact (-13)

This factor represents DOs’ perceptions of the impact of dive tourists on the marine environment. Divers have been implicated by existing research as having a significant negative impact on the environment. This factor is associated with the health of the ecosystem because it can influence it.

Representative quote: [Diver impact is] substantial. We take a lot of divers out here, not only us, but a lot of other dive shops over the years. You see corals clipped off by fins; a lot of it’s that kind of stuff. In here it’s shallow. Snorkelers, if they can stand on it, they will. So a lot of that stuff’s already been damaged over the years. But, it’s fairly resilient.

30. Bounce-back of marine life (+8)

This factor represents DOs’ perceptions of the bounce-back-ability of the animals and plants that comprise the ecosystem. This factor is associated with the health of the ecosystem because the ability of the system’s components to bounce-back can influence its overall resilience.

Representative quote: The health of the reefs in our field of service is extremely healthy, and they seem to be propagating and growing. The elk horn coral that was out there that got damaged the most by bleaching actually came back, much, much healthier. It used to be like just one mighty grandpa standing out there and now it’s just everywhere and it’s so healthy.
Total Resilience Score (TRS) of Each Part of the Social-Ecological System

The TRS of each part of the system was calculated by summing the total significance scores of all factors that comprise each part (Table 2 and Figure 10). This analysis reveals that the resilience of the system is most positively influenced by the dive operators’ ability to adapt and self-organize (Total Resilience Score = +63) and most negatively influenced by the dive operators’ relationship with local people (Total Resilience Score = -9).

Table 2: Total Resilience Score and component resilience scores for each factor for each part of the social-ecological system.

<table>
<thead>
<tr>
<th>TRS of Each Part of the System</th>
<th>Factors that Comprise Each Part of the System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to participate in the adaptive co-management of the system</td>
<td>Relationship with local people (-9)</td>
</tr>
<tr>
<td></td>
<td>Business environment (-11)</td>
</tr>
<tr>
<td></td>
<td>Local governments’ lack of marine protection (-20)</td>
</tr>
<tr>
<td></td>
<td>Locals’ attitude towards environment and tourism (-22)</td>
</tr>
<tr>
<td></td>
<td>Moorings (+5)</td>
</tr>
<tr>
<td></td>
<td>Not promoted as a dive destination/ bad reputation (-15)</td>
</tr>
<tr>
<td></td>
<td>Lack of federal involvement (-7)</td>
</tr>
<tr>
<td>TRS = -79</td>
<td></td>
</tr>
<tr>
<td>The nature of the link between the ecosystem and the social system</td>
<td>Less marine life (-10)</td>
</tr>
<tr>
<td></td>
<td>Inexperienced clientele (+5)</td>
</tr>
<tr>
<td></td>
<td>Competitive diving conditions (+12)</td>
</tr>
<tr>
<td></td>
<td>Non-environmental aspects of diving (+5)</td>
</tr>
<tr>
<td>TRS = +12</td>
<td></td>
</tr>
<tr>
<td>Ability to adapt and self-organize</td>
<td>Institutional memory (20+ years in business) (+9)</td>
</tr>
<tr>
<td></td>
<td>Possession of industry niche (+13)</td>
</tr>
<tr>
<td></td>
<td>Spatial range (+9)</td>
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<tr>
<td></td>
<td>Diversified product (+12)</td>
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<tr>
<td></td>
<td>View of future (+3)</td>
</tr>
<tr>
<td></td>
<td>Relationship with other dive operators (+12)</td>
</tr>
<tr>
<td></td>
<td>Actively promote industry/ environmental education (+5)</td>
</tr>
<tr>
<td>TRS = +63</td>
<td></td>
</tr>
<tr>
<td>Influence of cross-scale drivers of change</td>
<td>Economic downturn/tourist frugality (-17)</td>
</tr>
<tr>
<td></td>
<td>Competition w/ Cuba and other destinations (-11)</td>
</tr>
<tr>
<td></td>
<td>Lionfish (-15)</td>
</tr>
<tr>
<td></td>
<td>Climate change (-7)</td>
</tr>
<tr>
<td></td>
<td>Lack of young divers/lack of interest (-2)</td>
</tr>
<tr>
<td></td>
<td>Presence of cruise ships (+2)</td>
</tr>
<tr>
<td>TRS = -50</td>
<td></td>
</tr>
<tr>
<td>Health of the ecosystem</td>
<td>Development related pollution (-10)</td>
</tr>
<tr>
<td></td>
<td>Hurricanes (-1)</td>
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<tr>
<td></td>
<td>Coral bleaching (-7)</td>
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<td>Bounce-back of marine life (+8)</td>
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<tr>
<td>TRS = -51</td>
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</table>
Figure 10: Total Resilience Score for each part of the social-ecological system and for the overall system

operators’ lack of ability to participate in the adaptive co-management of the system (Total Resilience Score = -79). The Total Resilience Score for the overall social-ecological system is -105, implying that the resilience the diver operator livelihood is eroding at a relatively quick rate.
Summary

The findings presented in this chapter show that USVI diver operators identify 30 factors that influence their livelihood resilience. A positive or negative value and significance value between 0 (no significance) and 3 (high significance) was calculated for each factor. A positive value implies that the factor increases resilience and a negative value implies that the factor decreases resilience. I categorized the 30 resilience-influencing factors into the five categories of the five-part resilience framework. Totaling the significance values for all the factors that comprise each part of the social-ecological system reveals that two parts of the system contribute resilience while three parts erode resilience. It is also revealed that the overall resilience of the system is on the decline.
CHAPTER 5

Discussion

Introduction

In this chapter I explain how the findings help answer the research questions: (1) what specific factors do dive operators perceive as influencing their resilience and to what extent does each factor increase or decrease resilience? (2) How do the resilience-influencing factors fit into the five-part resilience framework? (3) How can this case study of dive operator resilience offer suggestions for sustainable tourism research to more adequately address climate change and other environmental and social impacts of local human activities? I discuss the findings in regards to each of these three questions.

Factors that Influence the Social-Ecological Resilience of USVI Dive Operators

Dive operators (DOs) in the USVI experience a specific set of challenges to the sustainability of their businesses. The 30 resilience-influencing factors help elucidate not only these challenges but also areas where DOs and other stakeholder groups can increase the resilience of their social-ecological system. Five distinct themes emerged from the interview data.

One of the most prominent themes is the lack of integration between dive operators and the West Indian culture. This theme is represented by multiple factors. For example, no business owner I talked to employed even a single West Indian person. Multiple dive operators said that West Indian people do not swim, possess poor work ethics, and are simply uninterested in the marine environment. The DOs said that the local politicians, who are primarily West Indian, are generally corrupt, racist, and have little concern for the wellbeing of dive tourism in
the territory. Doing business in the USVI was generally perceived as difficult due to the high cost and indignant attitudes of local government employees.

One notable exception to this theme was the fifth dive operator I interviewed. He and his wife had employed a West Indian person in the past, had worked with the local government to teach local youth how to dive, and perceived the business environment as unusual but very workable. This single data point suggests that DOs need to proactively integrate with their larger political/cultural environment to enhance the resilience of the businesses. The local government would give better support to diving if more local people were divers. No other research has studied the sustainability of dive tourism in relation to its larger political/cultural context.

A second theme is that in the USVI the condition of the marine environment and the satisfaction of dive tourists may not be as closely linked as previous research indicates. DOs explained that the average dive tourist in the USVI is too inexperienced to recognize the degraded condition of the marine environment. Many of the tourists come from cruise ships and resorts and simply view diving as something to do once they are in the territory. This observation corresponds with the observation that the USVI is not promoted as a dive destination, meaning that people do not generally travel there for the explicit purpose of diving.

Additionally, multiple dive operators pointed out elements of diving that draw customers that are not necessarily linked to a healthy marine environment. For example, wreck diving is an important part of the dive business but does not directly depend on the health of the marine ecosystem. DOs also said that diving is an experience in itself. This means that people enjoy feeling weightless and breathing underwater regardless of the marine life they encounter. This finding bodes well for the resilience of DOs in the USVI. If the health of the marine
environment continues to decline, DOs can still draw inexperienced divers with the non-
environmental elements of diving.

A third theme is the cohesion and cooperation of DOs with other DOs. Generally speaking, DOs get along with one another. DOs reported sharing resources like tanks, compressors, dive sites, customers, and employees. Each DO possesses a particular industry niche that allows him to stay in business while limiting his direct competition with other DOs. Part of this niche mentality is the different spatial ranges in which DOs operate.

Related to this theme, I found a fairly even mix of tenure among dive operators. Three of the interviewees have been in business in the territory for over 20 years. Three had been in business for between 5 and 20 years, and three had been in business for less than 5 years. This mix of tenure indicates a good balance of experience and novice enthusiasm. I also learned that some DOs are active in promoting diving in the territory and active in educating their clients about the marine environment. The DOs were even mounting their own grassroots response to the lionfish invasion, prompted by the local government’s lack of response. Previous research on dive tourism has not examined the ways that DOs interact with one another and the role that interaction plays in the sustainability of the industry.

A fourth theme is the significant impacts of larger scale changes on the local diving industry. The global economic downturn was perceived by DOs as one of the most significant challenges to their sustainability. Nearly every DO commented on how his business had dropped off recently. Concurrent with this observation was the observation that tourists had become more frugal. DOs reported that this was due to not only the economic downturn but also increased presence of online vacation planning tools. DOs reported an increased deal-seeking trend among their customers that was difficult for them to live up to while still making a profit.
Compounding the economic difficulties described above, DOs commented frequently about an inability to compete with other Caribbean destinations that have a lower cost of doing business. The cost of liability insurance in the US was mentioned repeatedly as a competitive disadvantage, as was the high price of vacationing in the USVI. Adding to this theme, DOs reported great concern about the potential opening of Cuba to US tourists.

As far as larger scale environmental changes, DOs were very concerned about the invasion of the lionfish. This invasion had begun recently in the USVI and was in the forefront of DOs’ minds during many of the interviews. All of the DOs had been asked to participate in the grassroots lionfish response program and were involved to some extent. DOs reported horror stories from the lionfish invasion in the Bahamas but were also trying to muster creative responses like marketing lionfish hunting trips to customers.

Interestingly, DOs did not perceive climate change as a significant threat to their livelihoods. Interviewees only talked about climate change if asked about it. There were a few DOs who recognized the full potential of climate change to negatively impact the health of the marine environment but an equal amount of DOs who were not sure that climate change was really happening. DOs perceive more immediate problems to deal with than climate change, like declining business and lionfish. Overall, the larger scale changes negatively impact the resilience of dive operators. A potential beneficial direction for future research on dive tourism would be to focus on ways that DOs can use their strong community cohesion to protect themselves against resilience-eroding cross-scale drivers of change.

A fifth theme that emerged from the interview data is that DOs have mixed perceptions of the health of the marine environment. The DOs with over 20 years of experience reported a major decline in the abundance of marine life. One DO said that the underwater environment
was “not even close” to what it was like in 1981 when he arrived in the territory. The novice dive operators, however, reported significant amounts of marine life, including rare fish and corals. Overall the DOs expressed a sense that while the marine environment was declining in health it was still plenty good for diving and competitive with other Caribbean locations. Perceptions of ecosystem health were spatially specific. DOs could easily distinguish between underwater environments that had experienced serious decline and areas that were relatively pristine. Thus, DOs’ perceptions of marine environment health were influenced by length of time in the territory and by a tendency to think of the environment as a marketable commodity.

DOs were fairly consistent in their observations about drivers of environmental degradation. Natural drivers of environmental change like hurricanes and coral bleaching were not perceived as significant sources of negative impacts. DOs reported that the marine environment always bounced back quickly after these natural events. Commonly cited causes of environmental degradation were fishermen, development runoff, sewage dumping, and diver impact.

Nearly every DO reported that dive tourists caused a substantial negative impact on the marine environment. The most frequently reported negative impacts of divers are stomping coral to death, touching sensitive life forms, and using a variety of unnatural products to lure fish into view (e.g., dog food and canned cheese spread). However, most DOs suggested that it was tourists diving with other DOs who caused the negative impact on the marine environment.

The DOs who contract with the cruise ships and deal in high volumes of customers were specifically fingered as the perpetrators of environmental damage. DOs reported that the high volume model of dive tourism leads to poorly prepared divers, poorly regulated divers, and divers who are more likely to bump into things underwater because there is less room to
maneuver. DOs also reported that the damage inflicted by divers on the marine environment was site specific. There were only a few dive sites that the high volume DOs used, thereby isolating the damage. The DOs that I interviewed simply avoided the high volume dive cites.

The relationship between cruise ships and diver impact helps explain the mixed perception of cruise ships’ influence on resilience. For the DOs who gain substantial portions of their clientele from cruise ships, cruise ships enhance resilience. For DOs who do not gain clientele from cruise ships, cruise ships detract from resilience by reducing the number of viable dive sites. The findings from this fifth theme indicate that future research on sustainable dive tourism would benefit from studying DOs’ perceptions of environmental change. This line of research could help coordinate DOs’ perceptions of the environment with the perceptions of regulatory agencies.

The Five-part Resilience Framework

The first part of the five-part resilience framework is the ability of the community being studied to participate in the adaptive co-management of the social-ecological system of which they are part (see Figure 6 for a graphic representation of the social-ecological system and how the five-part resilience framework maps onto it). Part one consisted of seven of the specific factors identified by dive operators. Out of those seven factors, only one received a positive resilience score. The positive factor in this part of the system was DOs installation, maintenance, and use of mooring buoys. Besides this one act of co-management, DOs expressed little ability to participate in the political and social cultures of the USVI. Significant factors that erode resilience in this part of the system include the local governments' lack of marine protection
(which had a weighted resilience score of -20) and the locals’ attitude towards the environment and tourism (which had a score of -22).

The summed significance weightings for each factor in this part of the system – the Total Resilience Score (TRS) – were -79. Participation in adaptive co-management of their own social-ecological system is the largest negative score for any part of the system and therefore the greatest detractor of system resilience. In the next section I will discuss the implications of this finding for the larger field of sustainable tourism.

The second part of the five-part resilience framework is the link between the ecosystem and the social system. This part of the framework consisted of four of the 30 factors identified by DOs. Of those four factors, only one received a negative resilience score. This factor was the observation of less marine life (-10), which some dive tourists notice and express dissatisfaction with. The other three factors that link the ecosystem with the social system all positively influence resilience. These three factors are the inexperience of the clientele (+5), the non-environmental aspects of diving (+5), and the relatively competitive diving conditions offered in the USVI (+12). This part of the system received a TRS of +12, indicating that it contributes to system resilience to a relatively small extent.

I must make a caveat to this finding. The fact that the health of the marine environment is not the only thing drawing dive tourists in the USVI enhances resilience in the short run but may erode resilience in the long run. This finding is therefore dependent on the time scale of interest. This kind of system dynamic is called a lock-in trap. DOs have adjusted their behavior to cater to inexperienced dive tourists who are not as concerned about the marine environment as experienced dive tourists. The inexperienced dive tourist model is also reinforced by the presence of cruise ships and resorts that supply a seemingly endless supply of inexperienced
divers. The system has become locked-in on a model of dive tourism that does not place a high value on a healthy marine environment. The problem for resilience is that the health of the marine environment will likely continue to decline until it crosses a threshold beyond which even the inexperienced divers will stop coming. DOs must find a way to escape this lock-in trap.

Many DOs expressed a desire for an alternative to this lock-in trap. They would like to see the USVI get away from the mass tourism model that brings the inexperienced divers and transform into a dive destination model. In the dive destination model the link between the ecosystem and the social system is strengthened and preserving the health of the marine environment becomes an economic priority. Attracting fewer better divers who are willing to pay larger sums for an excellent diving experience could mean the same amount of income with less environmental impact. This alternative model would provide greater resilience for DO livelihoods in the long run. Transforming the system to this alternative model should be a direction for future research in the USVI.

The third part of the system is the ability of DOs to adapt and self-organize. Unlike part one of the system, which is the ability to participate in adaptive co-management, this part of the system consists of actions the DOs take without the support of the local political and social cultures. It can be thought of as intra-community adaptation. This part of the system consisted of seven of the factors identified by DOs. Every one of the seven factors received a positive resilience score. The highest scored factors in this part of the system are the possession of an industry niche (+13) and relationship with other dive operators (+12). The TRS for this part of the system is +63. This is the largest positive score of any of the five parts, indicating that the ability of the DOs to adapt and self-organize is their greatest source of resilience. In the next
section I discuss the significance of this finding for the larger field of sustainable tourism research.

I am not claiming that there are no elements of the DO community that could negatively influence resilience. For example, DOs lack of a professional organization at this time could have been a factor that was categorized into this part of the system and would have received a negative resilience score. However, this factor was never reported by the DOs and therefore cannot be counted in the analysis. These research findings are intended to present the ways in which DOs perceive their own livelihood resilience. The factors I present are the factors that dive operators perceive as being important.

The fourth part of the system is the influence of cross-scale drivers of change. This part of the system consisted of six of the factors identified by DOs. Of the six factors, only one (presence of cruise ships) received a nearly neutral score of +2 due to most DOs feeling that cruise ships were a positive influence, but some DOs feeling that cruise ships negatively impact resilience. Of the five factors that received negative scores, three were substantial: the economic downturn (-17), competition with other destinations (-11), and the lionfish invasion (-15). The TRS for this part of the system is -50, indicating that the resilience of dive operators is severely eroded by the presence of cross-scale drivers of change. Climate change only received a score of -7, suggesting that DOs do not perceive it as a major threat to their livelihoods.

This part of the system provides a good example of the resilience principles of complexity and unpredictability in social-ecological systems. No DOs in the USVI had predicted the economic downturn or the lionfish invasions, but they still require specific adaptive responses. The presence of these types of surprises highlights the need to manage the system for resilience, even if it means sacrificing maximum gain in the short term. There are no guarantees
that resilience management techniques will work, however, as some external influences such as lionfish might still be capable of severely altering even the most resilient marine ecosystem.

The fifth part of the system is the health of the marine environment. This instance is similar to the third part, which is the ability of DOs to adapt and self-organize, but in this case pertains to the ecosystem portion rather than the social system portion of the socio-ecological system. The fifth part of the system consists of six factors identified by the DOs. Five of these six factors received negative resilience scores. The TRS for the fifth part of the system is -51, indicating that the health of the ecosystem, or lack thereof, is significantly eroding the resilience of dive operators. The one positive factor in this part of the system is the ability of marine life to bounce back after being disturbed, on which many of the DOs commented.

However, the ability of marine life to bounce back is challenged by the other five factors in this part of the system. The human-related impacts received the largest negative scores: development pollution (-10), fishermen’s impact (-15), and diver impact (-13). Fisherman impact represents competition from a different economic sector for the same resources that DOs depend on. Diver impact, however, represents erosion of resilience from within the social-ecological system thereby creating a positive feedback loop. As dive tourists negatively impact the marine environment at a given dive site (e.g., trample the coral to death), DOs have to find new dive sites. Over time, the new dive sites experience the same environmental degradation, forcing DOs to find even more dive sites. In this sense, the initial environmental impact leads to more and more environmental impacts. The condition of the overall system slowly moves towards a threshold. If this threshold is crossed, even inexperienced tourists might stop coming because the environment is in such poor condition. This positive feedback loop is part of the
lock-in trap that I identified before. Stakeholders in the system need to seek methods for breaking this loop and escaping the trap.

By applying the five-part resilience framework to the social-ecological system defined by dive operators in the USVI, I have shown that the ability of the community to adapt and self-organize provides the greatest source of resilience to the system. I have also shown that the inability of the community to participate in the adaptive co-management of the system produces the greatest erosion of system resilience. The system is in a lock-in trap driven by a positive feedback loop and multiple cross-scale drivers of change. The system will eventually collapse if local stakeholders do not transform the system to a more resilient model. The substantial negative Total Resilience Score of the overall system (-105) also suggests the movement of the system towards collapse. Facilitating a transformation to a more resilient system is an important area for future applied research in the USVI, but is beyond the scope of this thesis. I will now shift attention to discussing the significance of the finding for the larger field of sustainable tourism research.

**Significance for Sustainable Tourism Research**

The findings from this research offer new ideas for sustainable tourism research. Sustainable tourism research has reached an impasse because of its inability to adequately respond to the challenges of climate change and other local environmental and social impacts of human activity. What then can a resilience framework offer to transcend this impasse?

On the topic of climate change, the findings indicate that dive operators do not perceive climate change as significantly eroding their livelihood resilience. Climate change received a resilience score of only -7, which was much less significant than several other cross-scale drivers
of change. This finding demonstrates that the UN World Tourism Organization (UNWTO) and local agents who are involved in tourism “on the ground” perceive the importance of climate change much differently. The UNWTO has declared that the tourism industry must adapt to climate change and mitigate carbon emissions at once. In contrast, the findings of this research indicate that tourism operators themselves do not share this goal.

Considering the finding that the ability of DOs to adapt and self-organize is their greatest source of resilience, I suggest that future sustainable tourism research focuses on tourism operators’ perceptions of climate change. If climate change is going to be adequately addressed in the tourism sector, it will be through the will and self-organizing ability of the operators themselves. The UNWTO needs to know why local tourism operators are not currently concerned about climate change to the same extent that the international organization is. One reason for this gap in the tourism industry might be that tourism operators, especially the small-scale type represented by DOs, have more immediate problems to deal with. DOs are adapting to and self-organizing around problems like the lionfish invasion.

Focusing solely on immediate problems and ignoring the long term, slower drivers of change, however, can severely reduce the resilience of social-ecological systems. Slow drivers, like climate change, can push systems towards thresholds in a nearly unperceivable manner. The system can collapse once those thresholds are crossed. The coral bleaching that some DOs observed is a good example. So far the coral has bounced back, but a small shift in sea temperatures may make it impossible for the system to bounce back next time.

If dive operators and other tourism operators understood the importance of managing their businesses for resilience, they might begin to take long-term drivers of change into account. This type of management could include both adapting to climate change and mitigating carbon
emissions, as the UNWTO desires. For sustainable tourism research to adequately deal with the challenge posed by climate change, researchers need to study the perceptions of tourism operators and work with them collaboratively to enhance resilience to long-term drivers of change. In this way, operators’ ability to adapt and self-organize can be put to the greatest use.

The greatest source of erosion to the resilience of DOs comes from their inability to participate in the adaptive co-management (ACM) of the system. This finding suggests new ideas for sustainable tourism research in regards to local environmental and social impacts of human tourism activities. The argument made against the sustainability of tourism is that large-scale tourism development negatively impacts the local environment and the less powerful portions of society. While this is a valid argument in many cases, this study demonstrates a different dynamic. It is the purveyors of tourism – the DOs – who are the less powerful portions of the larger system and are excluded from the larger social and cultural context of the USVI.

DOs have virtually no say in the local governments’ management of the marine environment or the creation of business policies. DOs feel that the local government does not care whether they succeed or fail. DOs also feel that the general attitude of the West Indian society is detrimental to the continuation of their livelihoods. The idea that tourism can negatively affect the local environment and culture may be true, but the local culture and its approach to environmental management can also negatively impact tourism, especially small-scale tourism.

The larger social and cultural context in which tourism systems are embedded must be examined for tourism to become more sustainable through a lessening of its impacts on local environments and communities. Even more important than the sociocultural context of the tourism, however, is a focus on the relationship between the tourism operators and the local political and social cultures. If the power in this relationship is too far on the side of the tourism
operators (as in conventional critiques) or too far on the side of the local political and social cultures (as in this study) system resilience can be compromised. The concept of ACM, which hails from resilience theory, offers a model for overcoming inequitable power dynamics by highlighting the specific benefits of power sharing. Sustainable tourism research needs to consider ACM more prominently in the future.

In the case of USVI DOs, co-management would mean that the local government, local fishermen, DOs, and other stakeholders work together to manage the marine environment. Considering the DOs strong criticism of local marine protection, a co-managed approach might result in a higher level of protection. The adaptive part of ACM means that any policy that is implemented is viewed as an experiment, or a trial. Monitoring is needed to see if the policy is working for the different stakeholder groups and re-negotiations are always possible. In this way management schemes remain flexible and adaptable to the uncertain behavior of the systems they are relating to. In the past ACM has been used as an argument for integrating local people into tourism systems. The findings show that ACM should also be used as an argument for integrating tourism operators into local systems.

Summary and conclusions

In this chapter I examined the implications of the research findings in order to answer the research questions. I explained the 30 factors that influence DO resilience in greater detail by illustrating how they relate to one another via five themes that emerged from the interviews. I showed how the 30 factors come together to comprise the five-parts of the resilience framework and how the resilience framework represents the five-parts of the social-ecological system under investigation. On the one hand, I demonstrated that the ability of DOs to adapt and self-organize
is the part of the system that contributes the greatest amount of resilience. On the other hand, the inability of DOs to participate in the adaptive co-management of the system is the part of the system that most erodes their resilience. I demonstrated that the system is in a lock-in trap driven by a positive feedback loop and cross-scale drivers of change. DOs should draw upon their ability to adapt and self-organize to escape this trap and avoid system collapse.

These findings are significant for the larger field of sustainable tourism studies for two reasons. First, understanding that the greatest source of resilience for tourism systems comes from the operators’ ability to adapt and self-organize suggests that the challenge of climate change should be addressed in this part of the system. Tourism operators themselves hold great potential for local adaption and mitigation of climate change. Sustainable tourism researchers need to engage operators more frequently and more collaboratively to make progress on this front.

Second, understanding that tourism operators can sometimes be negatively impacted by their local social/environmental context supplements the common critique that tourism has negative local environmental and social impacts. Adaptive co-management provides a model for moving towards more equitable and resilient social-ecological tourism systems. This approach to sustainable tourism studies has been underused.
CHAPTER 6

Conclusions

I have identified 30 factors that influence the resilience of dive operators in the US Virgin Islands to environmental and social changes that could potentially put them out of business. I have assigned each of the 30 factors to one of five parts of the social-ecological system that is represented by a five-part resilience framework. The part of the system that contributes the most resilience to the overall system is the ability of the dive operators to adapt and self-organize. The part of the system that erodes the most resilience from the overall system is the inability of the dive operators to participate in the adaptive co-management of the system. These findings suggest that the resilience of the dive operators in the USVI is significantly determined by social factors. Future research on dive tourism should focus on the human dimensions of the activity.

The nature of the link between the social and ecological portions of the system was found to increase the resilience of the overall system, but only weakly. This positive finding will remain true as long as the marine ecosystem does not deteriorate to such an extent that even novice divers stop coming. The influence of cross-scale drivers of change was shown to significantly erode the resilience of dive operators. The global economic downturn and the lionfish invasion were important factors in this part of the system. The health of the ecosystem was also shown to erode dive operator resilience. Diver impact, overfishing, and pollution were important factors in the declining health of the ecosystem part of the system.

The overall resilience of dive operators in the USVI is declining. Dive operators and other tourism operators in the territory must transform the tourism system to achieve longer-term sustainability. Their ability to adapt to the current system will only go so far. As some of the dive operators suggested moving away from the mass tourism model would be a good start.
Attracting fewer tourists who stay in the territory longer could generate economic activity competitive with the mass tourism model, but with less environmental and social impacts. In moving away from mass tourism, the USVI will need to develop its nature-based tourism and its heritage tourism. Nature-based tourism, like diving and kayaking, is more environmentally sustainable than the current model. Heritage tourism, like sugar plantation tours and history museums, is more socially sustainable than the current model.

Dive operators’ greatest source of resilience is their ability to adapt and self-organize. They could draw upon this strength to form a professional organization that lobbies the local government to move away from mass tourism. If the local government began marketing the USVI as a dive destination then it would make economic sense for the government to protect the marine environment. This would be a step towards sustainability that would work for dive operators and the local government.

Dive operators could also draw on their ability to adapt and self-organize by deciding as a social group to further integrate with the local culture. The chasm between dive operators and West Indians is a significant source of resilience erosion. Teaching West Indians to dive would provide a social service to the larger community and, although unlikely, could also give dive operators a new client base. Local customers are less likely than tourists to vanish during economic downturns. Increasing the number of residents who care about the marine environment is also likely to increase the popular desire for marine protection. There are multiple creative ways for dive operators to enhance their own resilience and increase the overall sustainability of tourism in the territory. Future sustainable tourism research would benefit from moving in an operator-centered direction.
Sustainable tourism research must overcome its current impasse. The study findings offer suggestions for better addressing the challenge of climate change. Researchers need to begin studying local tourism operators’ perceptions of climate change because operators are much less concerned about climate change than the UN World Tourism Organization. Researchers could play an important role in finding ways to help tourism operators mitigate their greenhouse gas emissions. Dive operators could reduce the number of customers that currently travel long distances if they derived more of their customers from the local community; an increased local client base would reduce the greenhouse gas footprint of the industry because long distance travel is a major source of greenhouse gas emissions in the tourism sector. There are also significant mitigation benefits that could be achieved through dive operators’ adoption of more efficient engines on their dive boats. Significant mitigation could be achieved if these kinds of operator-centered mitigation strategies were implemented throughout the entire tourism industry.

Sustainable tourism research also needs to find new ways to think about the impacts of tourism on local environments and local communities. The concept of adaptive co-management (ACM) holds significant promise in this regard. In the USVI dive operators have very little ability to participate in the ACM of their system, which is the greatest source of resilience erosion to their system. Sustainable tourism researchers can start working to bridge the gap between different stakeholder groups including tourism operators and government institutions. For the most part, tourism researchers have not participated in this applied style of research. While understanding the local impacts of tourism is unquestionably important, it is more important to find solutions to local problems caused by tourism. Tourism is not going away and
therefore must be addressed in way that balances benefits and drawbacks among all the stakeholders.

This thesis shows some of the benefits that a resilience approach can offer to the study of sustainable tourism. Through the study of dive operators in the USVI I have shown that there are many factors that influence the resilience of dive operators. By thinking about these factors as parts of a larger social-ecological system I have shown which parts of the system contribute to resilience and which parts erode resilience. Understanding system resilience in this nuanced manner facilitates part-specific transformations that can enhance the resilience of the system as a whole.

By applying a resilience framework I also revealed the presence of a positive feedback loop and cross-scale drivers of change that are pushing the dive operator livelihood system into a lock-in trap. If the system is not transformed it will eventually cross a threshold and collapse. After collapse the system will cycle through the other phases of the adaptive cycle. Sustainable tourism research can overcome its current impasse by implementing theoretical concepts like feedback loops, traps, thresholds, and adaptive cycles. Resilience theory offers concepts that account for new understandings of system behavior. A resilience-based approach to tourism research appears to be a good option for facilitating sustainability in the sector.

The initial observations I had while working as a tour guide in the territory were accurate – the current approach to USVI tourism cannot go on forever. Through this research, I now know that sustainability is not something to be achieved but rather a continual process of reflection and adaptation. Resilience theory gives sustainable tourism researchers the tools they need to facilitate the process of sustainability.
REFERENCES


APPENDIX A

Interview Questions

Business Background
- How long has the business existed?
- How many employees does the business have?
- How many boats does the business use? How big are the boats? How old are the boats?
- What are the daily ranges of the boats?
- Where is the business located? (Use map)

Individual Background
- What is your job title and associated responsibilities?
- How did you come to work for this business?
- How long have you worked for this business?
- How long have you been SCUBA diving in the USVI?
- Have you worked for other dive businesses, and if so, which ones and for how long?

Business Operations
- How many dive sites does the business use?
- How do you choose which dive sites to use?
- Is there ever competition for the dive sites, and if so, with whom and how frequently?
- Where are the dive sites located? (Use map)
- How many dive trips does the business run in an average week?
- How many tourists are on an average dive trip?
- Does business fluctuate seasonally, and if so, how?
- How does the business advertise?
- Is the businesses contracted or affiliated with cruise ships, hotels, or other businesses?

Ecological Changes
- What changes have you observed in marine ecosystems throughout your diving career?
- What do you think the causes of these changes are?
- Do you think your livelihood as a dive operator is threatened by ecological changes?
- What do you think about current efforts to mitigate ecological changes?
- How have you responded to these changes?

Economic Changes
- What changes have you observed in the competition between dive businesses over your career?
- What do you think the causes of these changes are?
- Do you think your livelihood as a dive operator is threatened by economic changes?
- How have you responded to these changes?
Social Changes
- Do any “locals” work here? If so, how many? If not, why do you think that is?
- Do you feel pressure from tourists, NGOs, or the government to hire or to not hire locals?
- Do you think more locals should work in dive tourism? Why or why not?
- In your opinion what are some general advantages of hiring locals?
- In your opinion what are some general disadvantages of hiring locals?
- If you’ve hired locales in the please describe how it went for you?
- How have you responded to social changes?

Resilience and Adaptation
- How has your business dealt with changing ecological conditions?
- How has your business dealt with changing economic conditions?
- How has your business dealt with the social stratification of the region?
- What do you think future ecological changes are going to be?
- What do you think future economic changes are going to be?
- What do you think the future social conditions on the island will be?
- Does your business have plans to deal with future ecological changes, and if so, what are they?
- Does your business have plans to deal with future economic changes, and if so, what are they?
- Does your business have plans to integrate “locals” to a greater extent, and if so, what are they?
- How do bigger dive operators typically respond to these changes?
- How do smaller dive operators typically respond to these changes?
- How do you wish you would have been able to respond in ways that you were not able?
APPENDIX B: Dive Operators’ Spatial Range Maps