

Sustainability for Saint Croix, USVI

A Thesis Presented for The Bachelor of Science
in Sustainable Built Environments Degree

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May, 2014

Abstract

The study investigates how local-level efforts at sustainability have been implemented in developing countries and Caribbean islands. In order to protect resources and longevity of these regions, communities often adopt sustainable development initiatives with assistance of external support. The goal of this study is to evaluate initiatives taken by similar communities and organizations that have met the needs of ecosystems through sustainable action plans. The combined information gathered in this study will aid St. Croix, USVI in evaluating current practices as well as planning for future actions.

The purpose of this research is to develop a case study of local-level sustainable development initiatives for St. Croix, USVI in order to address the needs of community members and environment through evaluations and successful frameworks of similar island communities. Through information collected, an analysis that addresses issues related to improving community for healthier communities via an improved built environment design, will investigate possible forms and systems of successful urban populations. This thesis addresses some of the issues related to improving community design for better civiv health outcomes via an improved design and framework policy for the built environment. In order to explore this, the thesis seeks sustainable potentials in urban inner cities and island communities to develop an action plan and design for St. Croix. USVI.

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Chapter 1: Introduction

In the late nineteenth and early twentieth century, social reformers started to push for changes in environmental use and human habits because of their significant impacts on urban damages. Ebenezer Howard, one of the most influential writers of his time, understood this relationship and inspired generations of urban planners and designers to respond to the accompanying problems of the urban society through his works. As a response, new urban planners and designers called for plans that balanced the urban and rural environments in which populations were decentralized into new communities. While his ideas were applauded, new authors and visionaries saw the idea of his “garden city” as an extension of urban forms that included a much simpler, misinterpreted version; resulting in the development of “garden suburbs,” creating new development problems in the process (Howard, 1902).

The concept of sustainability, referring to the balance between urban and rural was inherent in many communities of the pre-modern era. However during the transformation of the modern society, the existing concept of sustainability was lost due to rationalized short-term vision that ultimately pursued comfort and convenience for oneself; without thought for much else. During the pre-modern era, cities of a million or more residents were unheard of. But, in the middle of the late nineteenth century, large numbers of people moved into crowded urban environments from the county side for economic reasons. In the height of the population boom, overcrowding led to rapid advances in technologies to accommodate the transition. For example, new technological advances such as the streetcar, railroad, road pavement, modern plumbing and electric lights helped move people from rural habitats and their traditional communities to large cities in hopes of finding better opportunities. Society’s rapid advances became an enemy, not only for the environment but also for human lifestyles.

For centuries, many people believed that optimal societies and communities were best evolved through each individual pursuing his or her own self interest but, this approach has led to serious deterioration in public and environmental health. Without question, this type of growth is gradually leading toward the destruction of all systems, including the ecosystem of the Earth. As such, the question becomes - in the context of our modern society, how can sustainability in communities be regained and promised to the future of generations?

Today 6 billion people share our planet. Some live in huge, wealthy, fast paced societies while 1.3 billion barely subsist on one dollar a day for their needs. Our planet is so diverse that most descriptions of our commonalities vary greatly. Options are branching off so quickly that it

seems almost impossible to make the right decisions. But for some, there are very few choices. Even so, we all share the same planet, making it essential that we make informed decisions. Community-based solutions can bridge gaps between the haves and the have nots and address current environmental damage. Holistic perspectives combined with quick action and cost effective solutions can help achieve these goals. Through sustainable community initiatives which recognize that people are living longer, preserving the environment through everyday decisions must continually be at the forefront of planning and development.

Unintentionally, modern built environments are discouraging social interactions and presenting unforeseen obstacles for our natural and social environment, which may be exacerbating the problems. Communities that adopt projects aimed at long-term management of natural resources for ecological health, economic gain and social equity can potentially reduce environmental limits that threaten progress. In a world where lives are increasingly subject to corporal changes controlled by distant determinants or progress, the uneven pace of improvement between groups results in social and economic inequalities; impairing the vision of promise to a holistic ecosystem. As greed, ego, cruelty, realism and shortsightedness are difficult to overcome, seeing challenges on a macro scale may help humans understand the need for a shift in lifestyle.

The question is whether we are ready to take collective action to make an effort for positive change. We must *“think globally [and] act locally”* (Patrick Geddes). Today’s global society is one in which all citizens of all nations are deeply connected. Networks among people of the world are stronger because of technology advances, communication, economics, trade and transportations. Although they provide an enhanced community, they also create unequal distributions of wealth and power; as well as over exploitation of resources. In response, it has been argued that in order for future generations of both human and non-human species to persist, current generations of humans must change the practices that have resulted in degradation of human and ecological system (WCED. 1987). As such, sustainable development is considered an approach to address the practices of current issues as it aims to secure a better future for current generation and those to come by changing how we use resources and reduce discrepancies related to wealth distribution and social equity.

Thus, sustainability is comprised of interdependent ecological, economic, and social factors (Agyeman & Angus, 2003; ICLEI, 2002a; James & Lahti, 2004; and Roseland, Cureton, & Wornell, 1998), all of which must receive equal consideration in the implementation of sustainable development initiatives. Because of reoccurring issues among different regions of

the world, initiatives have been introduced at regional or global levels by national and international institutions but have led toward a push for sustainability at local levels. This is because macro level initiatives are managed by people who derive direct livelihoods from their natural resources (Agrawal & Gibson, 2001).

For islands, sustainable development has focused largely on sectoral and macro-policy program shifts. Efforts in local-level sustainability in the Caribbean have been acknowledge, but have yet to be integrated in the everyday lives of the average citizen. Government institution, private sectors and civil societies should act fast when a communities source of livelihood relies on diminishing sources. As time proceeds and actions toward sustainability initiatives don't, the capacity to provide long-term sources is greatly diminished as well as its potential to maintain resource capacity for future generations. Therefore, local-level sustainable development in developing countries and the Caribbean must address the most basic needs (often related to natural resource management), in order to achieve a sustainable vision.

Sustainable approaches to livelihood can help ensure development policies and programs become more closely related to everyday lives of people in the Caribbean. The survival of small island developing states is firmly rooted in their human resources and cultural heritage; thus sustainable development programs must seek to improve the quality of life of peoples, including health, well-being and safety. As stated before, the potential is acknowledged, but the challenge for islands are to ensure that resources are used in a sustainable way that improves the overall wellbeing of the ecosystem.

The study investigates how local-level efforts at sustainability have been implemented in developing countries and Caribbean islands. By addressing issues related to improving community design for healthier communities, such as Portland, Oregon, Amsterdam, Netherlands; and Trinidad and Tobago, via an improved built environment, the goal of this study is to evaluate how initiatives taken by similar communities and organizations have met the needs of community members in addition to contributing to sustainable community actions. The combined information gathered in this study will aid St. Croix, USVI in evaluating current practices and deciding future actions.

Chapter 2: Literature Review

INTRODUCTION

The goal of this study is to address issues related to improving community design for healthier communities via an improved built environment design. As a literature review for this study, this chapter presents theoretical perspectives and previous research findings regarding visions of sustainable communities.

Early visionaries were concerned about the rapid growth of industrial cities; and in the late nineteenth century - large numbers of people lived in high dense urban environments just as they predicted. This distanced people from the natural world, creating further public health problems such as sanitation, overcrowding, and absent infrastructure. As the world continued to change early visionaries' predictions of deforestation and pollution, reached new heights.

Ebenzer Howard, an advocate of sustainability, inspired many generations of urban planners and designers. Howard and three other visionaries saw the extreme overcrowding of the industrial city and predicted that the main problems of these cities coincide with sanitation, service, pollution and public health. As a response, they found a balance between the city and the countryside in which decentralized populations were planned into new communities. Although Howard's early works like *Garden Cities* were congratulated, they missed the magnitude of the automobile age in the twentieth century. The widespread automobile use turned Howard's garden city idea into suburbia resulting in a new set of development problems (Howard, 1902).

Past planning for environmentalists focused on providing beautiful, aesthetic places to urban residents, contributing to the beginning frameworks for industrial city expansion - resulting in low density suburban sprawl. Suburbia led to a significant impact on the earth such that planners were provoked to find a new topic: the balance between city and nature. Researchers began to develop technologies to reduce factory pollutants and in the process, found that not only was the environment affected by sprawl but that residents were equally affected. The need for a more equitable society was inevitable and thus became a factor of sustainable development.

The third subject that contributed to sustainable development introduced the economic growth and the limitation of economies in finding balance between human and natural systems. The concept of sustainability sought to maximize environment, equity and economy without exploiting resources. Gifford Pinchot learned that to approach sustainability, managing ecosystem services was crucial. This is known as the conservational perspective. It emerged on

the vision of humans being a part of nature, taking responsibility of managing our own resources. The vision became a building block of many theories, Aldo Leopold's *The Land Ethic* in particular, discussing the importance of human responsibility. It emphasized the responsibility to care for healthy natural systems by being a part of a larger ecosystem, resulting as the base for sustainable community initiatives (Pinchot, 1905; Leopold, 1949).

More recently, our concern about global warming increased the search for sustainable development practices. Familiar documents like *Limits to Growth*, the *1987 Brundtland Commission*, the *1972 Rio Earth Summit* and the *2000 United Nations Millennium Development Goals*, are significant in stimulating sustainable development activity. As such, a conceptual framework for sustainable community development was created. These broad concepts of sustainable development and ecological, economic and social attributes of local sustainability initiatives in the Caribbean and developing countries generated guidelines for sustainable communities like St. Croix, USVI. Furthermore, the attributes comprising the conceptual framework are now being used to describe how communities advance toward sustainability.

“Sustainable development has become the watchword for international aid agencies, the jargon of development planners, the theme of conferences and learned papers, and the slogan of developmental and environmental activists. (Lele, 1998)”

Sustainability and sustainable development vary in definition because of their ambiguity. Most definitions attempt to combine development, environment and equity to describe the concept. The most commonly cited definition of sustainable development comes from the World Commission on Environment and Development (e.g. Agyeman & Angus, 2003; Hembd and Silberstein, 2004; Kates, Parris & Leiserowitz, 2005), which argued that sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (WCED, 1987). Acknowledging the decline in resource availability on a global scale with regards to future generations suggests that the term is criticized because of the wide range of interpretation (Roseland, Cureton, & Wornell, 1998; Bell & Morse, 1999; Kates, 2005; McCool & Moisey, 2001).

Open interpretations have led to confusion and manipulated definitions of the term suggesting unsustainable growth in which economic and political interests oust ecological and social well-being (Parris & Kates, 2003; Agyeman & Angus, 2003; Kelly, 2010). Opinionated definitions of sustainability and sustainable development are based on the degree of intensity of the country (Hembd and Silberstein, 2004; UN Documents, 1986). Under these circumstances,

some argue that developed and developing countries possess similar problems but the degree of intensity differs significantly thus obliging the same standard of definition without any exception (Berger, 2003; Rist, Zimmermann and Wiesmann 2004; Robinson, 2004; Wiesmann, 1998). In addition, the term's ambiguity has also led to various methods of measuring sustainability through varying indicators; specifically talking about 'what should be sustained' (Parris & Kates, 2003; National Research Council, 1999; Bell and Morse; 2008).

Nevertheless, the obscurity of what defines sustainability allows flexibility within context; allowing groups to adapt to development and strategies accordingly. (Kates, Clark, Corell, Hall, Jaeger, Lowe, McCarthy, Schellnhuber, Bolin, Dickson, Faucheux, Gallopin, Grüber, Huntley, Jäger, Jodha, Kaspersen, Mabogunje, Matson, Mooney, Moore III., O'Riordan, & Svedlin, 2001; Bolin, 2000; Haas, Levy, and Parson, 1992). Ancillary, the Brundtland Commission definition should be viewed as a philosophical guideline for sustainability rather than a checklist. The definition is meant to provide a broad understanding of global goals to sustain our future generations (American Planning Association, 2000; Edwards, 2005; James, & Lahti, 2004). As a result of broad judgment, the concept of sustainability has been broken down into categories that are significant in defining a level of intensity. Therefore it is important to understand the distinction between weak and strong sustainability. Weak sustainability is the idea that man-made capital is more important than natural capital; therefore it is possible to substitute natural capital for man-made capital (Neumayer, 2003). Whereas strong sustainability states that natural capital cannot be substituted. In other words, strong sustainability values all three elements, while weak sustainability views all three as substitutable.

Through selected literature, there is a common theme that underlines the interdependent elements that encompass sustainable development: ecological integrity, social equity and economic opportunity (Conesa-Sevilla, 2006; Costanza, d'Arge, de Groot, Farber, Grasso, Hannon, Limburg, Naeem, O'Neill, Paruelo, Raskin, Sutton, and van den Belt, 1997). Each element of the pyramid is made of multiple factors that guide sustainable project production. "Ecological integrity ensures that the structure, composition and function of the ecosystem are unimpaired by stresses from human activity; natural ecological processes are intact and self-sustaining, the ecosystem evolves naturally and its capacity for self-renewal is maintained; and the ecosystem's biodiversity is ensured" (BC Parks Legacy Panel, 1999). Social equity stresses that vital communities meet the needs of all of their citizens by providing fair access to livelihood, education and resources; full participation in political and cultural life; and self-determination in meeting needs. Lastly, the economic aspect of sustainability can be identified

through various strategies that make it possible to use available resources to their best advantage. The idea of economic sustainability is to promote the use of resources in a way that it is efficient and responsible to provide long-term benefit for people to sustain livelihood and meet basic needs (air, food, shelter, clothing, water etc.) of life. True sustainability encourages the responsible use of resources, such that projects or operations are not creating additional environmental concerns that upset the balance of the local ecology. The holistic view of these three elements are stressed in literature because researchers and theorists have found that environmental health and degradation are often correlated to economic and social disparities (Thrupp,1993; Rocky Mountain Institute, 2003; Chambers,1992; Scherr, 1997).

Although there is existing frameworks for sustainability, there is open discussion on how to achieve it. Appropriate governance to manage sustainable development initiatives is key to achieving sustainability. Thus most initiatives have been discussed on a larger scale carried out by national governments and large organizations. This is an elementary step in the process of sustainability; however, local resiliency will have a greater impact on the environment. It can be argued that large scale efforts often dismiss the local community rights by invalidating their autonomy to govern themselves towards sustainable goals (Armstrong and Stafford, 2004). Furthermore, some researchers have found that natural resources are managed more effectively by smaller communities that are most familiar with their direct service rather than government agencies and private investors (Agrawal & Gibson, 1999).

The United Nations (UN), a large-scale decision maker, supports local sustainable development. The Brundtland Commission report and the UN Conference on Environment and Development in 1992 have helped promote sustainability over the 20th century by recognizing the demands of the Earth (WCED, 1987). The conference, also known as the 'Rio Summit,' resulted in the development of a policy for global sustainable development known as Agenda 21. Developed to increase participation at the local level to achieve goals in preparation for implementing long term, Agenda 21 emphasizes the necessity of local involvement in sustainability through strategic plans that address priority development concerns. The strategies in this document stress that local involvement, starting with local authorities, is important for any type of sustainable integration:

“Because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objectives. Local authorities construct, operate, and maintain economic, social, and environmental infrastructure, oversee planning processes, establish local

environmental policies and regulations, and assist in implementing national and subnational environmental policies. As the level of governance closest to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development” (Chapter 28, UNCED, 1992). It is clear that Agenda 21 supports local sustainability, but we should still be conscious that the agenda also emphasizes collaboration and support between international, national, regional, local governments and NGO’s for further advances in sustainable development (UNCED, 1992).

Collectively, sustainability is a process. The ultimate goal is to acquire an equitable society that doesn't abuse the Earth's capacity to support human and non-human life. Working toward sustainable goals requires recognition of all government levels. The thesis is concerned with efforts at a local level in the process of achieving sustainable goals.

EFFORTS TOWARD SUSTAINABILITY AT THE COMMUNITY LEVEL

A sustainable community is one that is economically, environmentally and socially healthy and resilient. It meets challenges through integrated solutions rather than fragmented approaches that meet one of the goals in the sustainable pyramid at the expense of others. The international Council on a Local Environment (ICLEI) defines a sustainable community as ‘a community that maintains the integrity of its natural resources over the long term, promotes a prosperous economy, and hosts a vibrant, equitable society’ (ICELI, 2002). A sustainable community should manage its human, natural and financial resources to meet current needs while ensuring that adequate resources are equitably available for future generations. Community development is an important part of global sustainability such that local level initiatives seek: A better quality of life for the whole community without compromising the wellbeing of other communities, healthy ecosystems, effective governance supported by citizen participation; and economic security. There have been a number of initiatives at the local level that have been implemented and support sustainability in a number of ways.

Consequently, in many cases of community attempts toward resiliency, communities have learned valuable lessons from their experiences. At their expense, some communities have settled for the use of frameworks like The Natural Step (James & Lahti, 2004), SEED (Taylor-Ide & Taylor, 2002); whereas others joined national and global networks Sustainable Communities Network (Concern, 2002) and the Global Ecovillage Movement (Trainer, 2000) that provide guidelines for communities to follow in reaching sustainable goals.

Larger institutions such as the UN support sustainable communities as a solution to global sustainability. The UN's local Agenda 21 specifically calls for each community to formulate its own Local Agenda 21:

"Each local authority should enter into a dialogue with its citizens, local organizations, and private enterprises and adopt 'a local Agenda 21.' Through consultation and consensus-building, local authorities would learn from citizens and from local, civic, community, business and industrial organizations and acquire the information needed for formulating the best strategies." (Agenda 21, Chapter 28, sec 1,3.)

For instance, the UN and partner, the Earth Institute, have launched pilot initiatives for sustainable communities like the Millennium Villages Project. 'The Millennium Villages Project is a bottom up approach to lifting developing country villages out of the poverty trap that affects more than a billion people worldwide. The UN and the Earth Institute chose twelve impoverished communities in sub-Saharan Africa to explore how external funding and logistical and technical support can help pull small, rural communities out of the poverty trap. Although the tactic may sound reasonable researchers are quick to criticize the local agenda as well as Millennium Villages Project in such that it can be categorized as unsustainable (Rich, 2007). Some argue that he attempts may be unsustainable globally thus categorizing remaining projects as useful future references. In fact, there are a number of fundamental steps a municipality can take to initiate a sustainable community program. It is true that efforts at sustainability have spread across the globe and are prominent in both developed and developing countries, often leading in successful attempts towards sustainability.

ATTRIBUTES OF LOCAL SUSTAINABLE DEVELOPMENT INITIATIVES IN DEVELOPING COUNTRIES, ISLANDS AND THE CARIBBEAN.

There is a wide base of literature regarding local sustainability efforts in developing countries in regards to resource management, poverty, conservation, ecotourism and community (Agrawal & Redford, 2006). In examining the application of sustainable development in small Caribbean states, there is an understandable and unavoidable tension between the demands of employment, improved wages and living conditions and the environmental sustainability of economic policies implemented to achieve these demands (Pantin, 1994). In the Caribbean even those who are sensitive to environmental issues have not yet found solutions to the inherent problems of economic survival, the difficulty in assessing the environmental impact on natural resources of socioeconomic activities and the ability to prevent or mitigate environmental disasters. A sustainable approach to development is paramount

importance in island states (Pantin, 1994; Barker and McGregor, 1995). The literature reveals that many Caribbean islands are more concerned with projects that depend on maintaining the balance between resource use and human needs due to its relatively small size. According to Pantin, most island economies are dependent on their natural environment, have fragile ecosystems, suffer from natural hazards and represent a variety of sociopolitical and ecological systems that are ideal locations which to pioneer research on sustainable development. As a result of direct communal dependency of natural resources as sources of subsistence and livelihood, environment degradation impedes their ability to meet their basic needs (MEA, 2005).

Deciding what constitutes as sustainability is an issue resulting in tons of literature dedicated to its measurement (Bell & Morse, 1999; and Pagdee, Kim & Daugherty, 2006). Measurement tools for sustainability at the local level are subject to change depending on the user, context and location may lead to inconsistencies (Bell & Morse, 1999; and Parris & Kates, 2003). For example, the ICLEI report developed a criteria for a community to be considered an *Agenda 21* for the UN Earth Summit in Johannesburg; resulting in 6,416 communities that met the criteria (ICLEI, 2002).

The criteria included eight categories that communities must commit to:

1. Must include a participatory process with local citizens
2. Must include a consensus on a vision for sustainable future
3. Must address economic, social, and ecological need together
4. Must establish a multi-stakeholder group to oversee process
5. Must prepare an action plan
6. Action plan must include concrete long-term targets
7. Must establish indicators to monitor progress
8. Must establish a monitoring and reporting framework (ICLEI, 2002)

While the ICLEI indicators were used to make an initial checklist to report to the UN at the Johannesburg Summit in 2002, the indicators were ambiguous and vague.

Developing a list of ecological, economic and social indicators may help the communities strengthen the overall project and may lead to a more comprehensive idea of what is happening (Bell and Morse, 1991). Data availability in St. Croix, U.S. Virgin Islands does not allow the development of numerical sustainability progress indicators. In regards to this limitation, the study uses indicators derived from literature on sustainability initiatives as a checklist for sustainability. Using the initial state of the community, this study researches how St. Croix meets

the needs of community members and provides initiatives for commitment to sustainability. The list of attributes may aid efforts towards sustainability by providing guidelines.

The next section highlights ecological, economic and social attributes of local sustainability development initiatives that have been important factors in the implementation and longevity of projects in islands and developing countries. The information in this section comes from research regarding sustainability indicators, natural resource management, ecotourism and sustainable communities.

Ecological factors

Humans are part of a large ecosystem that interacts with the environment, providing humans with what they need to survive. Latin America and the Caribbean possess a relevant portion of the world's forest in addition to the world's deforestation. Environmental degradation reduces people's ability to live healthy and prosperous lives as well as impedes the continuation of non-human species that share the planet with humans (MEA, 2005). How communities manage and develop their resources is a key factor in the success of sustainable development, especially for communities that rely heavily on their surrounding resources for direct livelihood. There are several aspects of resource management that are important elements to achieve ecological goals.

¥ *Biodiversity conservation*

Biodiversity is "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species and of ecosystems" (UNEP, 1992). It has allowed for the development of humans through exploitation of various species and the niches they play in ecosystems (MEA, 2005). For instance, some species and habitats are responsible for many medicines. The loss in biodiversity reduces the amount of natural capital available. Medicinal value of biodiversity is only one of the many characteristics biodiversity offers an ecosystem. Intrinsic and aesthetic value of biodiversity functions as the basis of life, economy, and spiritually for an ecosystem. Anthropogenic environmental degradation threatens the status of biodiversity, and the potential for further development from it (MEA, 2005).

The Caribbean Islands Hotspot comprises 30 nations and territories, each characterized by unique and wide-ranging biodiversity and culture. The islands support important freshwater habitats, including large lowland rivers, mountain rivers and streams, lakes, wetlands and underground karst networks. In addition to providing habitat for many important, unique and migratory animals and plants, these freshwater sites provide clean water, food and many

services to local communities. These services are especially important as the small islands of the insular Caribbean are surrounded by salt water, and rely greatly on limited, land-based freshwater from functional ecosystems (CEPF, 2010). Majority of people living on islands reside close to shorelines, coastal ecosystems, including mangroves, beaches, lagoons and cays that are essential for biodiversity and coastal buffers. Buffering coastal communities from the effects of storms provides a basis for recreational and tourism industries, as well as nursery habitat for commercial species (CEPF, 2010).

¥ *Sustainable use of resources*

Sustainable use of natural resources is a common theme in local sustainable development literature. Communities dependency on surrounding resources sometimes results in overexploitation of services. Overexploitation can lead to extinction thus resulting in a loss of species as well as economic or social benefits they once created. A common example of the sustainable (or unsustainable) use of natural resources in the literature discusses coastal communities' use of resources. Decades of overfishing, pollution, and habitat destruction have left marine and coastal ecosystems in decline. In some cases where sustainable harvesting has taken place, the threats to a species' existence and its benefits to humans have been abated. For example, a protection and conservation project in Hispaniola focuses on requirements needed to protect and maintain the ecological integrity of productive reef areas that are subject to significant fishing pressures. An ecosystem-based, integrated sustainable development approach will be used to counteract over-exploitation, habitat degradation, and pollution problems, with a focus on adaptive management of marine biodiversity (CEP, 2010). The project demonstrates long-term thinking used to preserve economically important species for the future (Castillo & Toledo, 2000). Sustainable extraction regulations also help to lessen the chance of exploitation by certain user groups over others (Smith, 2003).

¥ *Environmental awareness and stewardship*

Environmental awareness and stewardship, or knowledge about ecological health and the will to preserve it, is an important way to engage community members in the management of natural resources and to create a connection to place (d'Entreves, 1992, quoted in Davidson, 2003). Ultimately, creating environmental awareness and stewardship may serve to reinforce the relationship between quality of life and participation in maintaining environmental health (Young, 1997).

¥ *Restoration and preservation of ecosystem function and services*

The earth's capacity to support human and non-human life are often correlated with environmental degradation as a result of both ultimate and immediate factors. Ultimate factors of environmental degradation like national policies, agriculture subsidies or globalization cannot be impaired, but proximate factors have potential to be modified and more readily addressed by local communities. Proximate factors include the physical processes that lead to degradation such as cutting trees, building roads or constructing too many wells in a given area (Padgee et al., 2006). By looking at immediate factors induced by human actions, sustainable action is a major consideration in the preservation and improvements of resources.

The protection of ecosystem function is an important aspect of sustainability projects because it keeps ecosystems that people rely on healthy (MEA, 2005). Changes in the ecosystem upset and alter natural biological flows of habitats. Without protecting ecosystems, services that are economically and socially beneficial to humans will no longer exist. Examples of ecosystem services include nutrient cycling, provision of food and water, climate regulation, aesthetics and recreation (MEA, 2005). Preserving these support systems by maintaining ecological function, preserving native biodiversity, and reducing degradation are key aspects of sustainability that should be recognized and considered by communities (Parris & Kates, 2003; and Roseland et al., 1996).

Economic factors

Economic health and prosperity is a defining component of sustainability. While economic prosperity is often credited with producing a high quality of life, it is often the combination of social, environmental and economic factors that create conditions that attract and retain residents and businesses. It is important for communities to act within the existence of economy and adjust to change while supporting local economic services.

¥ *Poverty reduction*

Apart from Haiti, the Caribbean islands are all middle- to high-income countries. However, there are high levels of economic inequity in some countries. Poor people in the Caribbean often depend directly on natural resources, but are frequently forced to use them unsustainably because of immediate survival needs. Consequently, poverty is considered a root cause of biodiversity, ecosystem loss and degradation on many islands. Poverty reduction is viewed as one of the most important aspects of sustainability projects in the developing world and is often the primary goal (Agrawal & Redford, 2006; Parris & Kates, 2003; and Smith et al., 2003). Components of poverty reduction goals are the sustained provision of basic needs such as food, water, air, shelter and clothing (Nagpal, 1995 ; Parris & Kates, 2003; and Smith et al.,

2003) and secure employment opportunities or livelihood options to ensure basic needs provision (Pagdee et al., 2006; Rocky Mountain Institute, 2003; and Smith et al., 2003).

¥ *Economic diversity*

Economic diversity is an important aspect of sustainability with regards to markets. A community that relies upon a single activity is subject to economic disaster. Maintaining a variety of economic activities buffers fluctuations in markets to reduce a community's vulnerability to economic failure. It is also an incentive to keep young people in a community rather than making them seek work elsewhere (Davidson, 2003).

¥ *Access to markets*

Market access to local, regional, national and international markets are significant aspects of sustainable economy. Local reliance emphasizes the participation of local market, supporting communities to establish boundaries between larger and local markets. Market access is correlated with infrastructure and transportation, indicating further importance of local markets in rural and developing communities in order to reduce shipping and travel for far regions. In addition, the use of resources to transport goods and services to larger markets is also an important economic factor for communities because it allows access to regional markets. Access to large markets is an advantage because local products are exposed to a wider demand base.

Social factors

The international agenda gave rise to discourses on nature, the environment and sustainable development. It includes compromised views concerning ways of acting out 'ideal' relationships with the environment. It includes ideas about social contracts and delineation of nature and environment. It is true that the idea of a social construction of nature is an important element in understanding sustainability. In order for local community groups to maintain efforts toward sustainability, several social factors by be recognized. These include: education, information sharing, capacity building, community ownership, government support, participation, development institutions, secure land, a community vision, action plan and distribution of projects.

¥ *Education, information sharing and building capacity*

Human development can be defined as a process of enlarging people's choices. The most critical ones are those that lead to a long and healthy life, to be educated and to have access to resources needed for a decent standard of living. The Millennium Development Goals

(MDGs) represent a global commitment to human development aimed at advancing the well-being of developing countries using a human rights approach by reducing extreme poverty, extending gender equality and advancing opportunities for health and education (ELAC, 2013). Providing education to community members in formal and informal settings are key elements of sustainability because it helps develop an understanding of why projects are important thus arranging a framework for communities to follow. A formal system of environmental education for sustainable development simply works to reproduce values, beliefs and stems in the wider populace. A formal system of environmental education for sustainable development is critical for sustainable development however, some argue that it educates people for unsustainability simultaneously (Sterling, 1996). In addition, informal education is critical to sustainability projects at a local level because it involves interactive and engaging community members as participants. It can take place in the form of forums, community meetings and education action to encourage education and knowledge of local strategies (Chambers, 1994). Furthermore successes stemmed from facilitated community meetings, accommodations of local databases from indigenous peoples yields pertinent information to sustainability, are often overlooked by projects facilitated by larger groups (James & Lahti, 2004).

To educate citizens about sustainability, internal and external information generated from various sources are necessary. Development projects occurring in local communities are not limited to internal sources thus expressing a positive support of external efforts that reinforce community actions. Clear communication between sources has a significant role in the participation of community members and groups. A study by Rist et al. (2007), for example, argues that management of natural resources is strongly affected by ways in which external and internal actors relate to each other. Information sharing between local groups, government, NGOs, research institutions can help communities learn new research from multiple fields and merge it with local or indigenous culture and knowledge (Castillo & Toledo, 2000; Redclift, 1993; Rist et al., 2007; Rocky Mountain Institute, 2003; Taylor-Ide & Taylor, 2002; and Thrupp, 1993). In addition to sharing actions between communities, it is important for local authorities to be involved in sharing information and provide access to information as well (Agyeman, 1996).

Capacity building is another key factor in maintaining sustainable development initiatives in local communities (Castillo & Toledo, 2000). Developing capacities in local communities allows communities to be agents of change by providing members with skills to carry out initiated projects (UNDP, 2008). Capacity building empowers community members, giving them confidence to undergo projects and sustain their work and resources. The adoption of

alternative techniques learned through capacity building exercises not only boosts local education and participation, but also redirects attentions to sustainable use of natural resources.

¥ *Community ownership*

Community ownership or collective self-determination is essential for building a healthier community. Collective ownership requires motility and organization involving both immediate and external factors. A community's commitment to change may be constrained if there is a disposition that the process does not belong to the members. If community members have a stake in a project, it makes the idea of sustainability concrete rather than an abstract concept derived by external actions overseen by large cohorts. Community ownership creates a relationship between members that ultimately promotes sustainable projects.

¥ *Support from multiple levels of government*

Although this thesis researches sustainable community development projects occurring at the local level, it is important to understand that local governments and groups are correlated with larger bodies of government on national and international levels (Agrawal & Gibson, 1999). Support from higher government is critical when implementing sustainable projects because they can act as a reference when supporting long-term commitments (Taylor and Taylor- Ide, 2002). Consequently, the lack of government support from higher levels of government may result in the undermining of project success. Emphasis of first level governance is crucial when projects are not managed by local government (ICLEI, 2002). Local governments are considered a tool for communicating with smaller islands. It is important for the government to participate in local projects so that communities are able to relay information and make connections to larger political structures, ensuring that demands of smaller communities are met at higher levels. As a precaution, it must be noted that local officials in attendance are to relay community initiatives without individual interests, otherwise it undermines the community as a whole (Davidson, 2003).

¥ *Participatory decision making process*

Sustainable projects that involve participatory of locals in the decision making process may have more long term success because they may assemble more support from the community rather than projects started by national governments (Armstrong & Stratford, 2004; Thrupp, 1993). A decision making process may inaugurate citizens to action. In some research, people found that democratic decision-making process methods have been successful in reaching sustainable goals; stressing the importance of including local communities in project

decisions. Local community involvement in decision making is significant because excluding communities yields poor resource management thus resulting in increased poverty rates and environmental degradation. Projects initiated prior to community involvement have failed, in part because of poorly introduced management methods that had little to no value for locals (Redclift, 1993). Local involvement increases relationships within a community in such that members have a valued place that they helped develop.

✧ *Development of local institutions*

The development of local institutions that govern behavior is viewed as one of the most important aspects of sustainable development at the local level (Agrawal & Gibson, 1999; Castillo & Toledo, 2000; Pagdee et al., 2006; and Pandey & Yadama, 1990; and Tucker, 2000). The creation of local institutions that are accepted by the community can help in the decision-making process, reduce vagrancy, and provide a transparent view of the process from both internal and external viewpoint (Castillo & Toledo, 2000; Tucker, 2000; and UNCED, 1992). A focus on local institutions helps unite members from distant groups that make up a community.

Institutions that are created through a participatory decision-making process are only helpful if they are developed, accepted, and enforced by the community as a whole. This is especially evident in community-based natural resource management projects (Pagdee et al., 2006), but also in the conduct that governs social and political interactions within groups (Agrawal & Gibson, 1999; and Berger, 2003). The impact external actors can have on local-level sustainability efforts is complicated and in many cases, may make or break any initiatives a local community attempts (ICLEI, 2002). Therefore, a focus on higher level institutions is important as well because weak insertions may reduce a projects sustainability. Regional or national attempts towards sustainability must take into account local institutions that govern behavior and adjust accordingly in order to reinforce sustainable goals.

✧ *Secure land tenure*

Secure land tenure in the form of legal or informal institutions that define ownership and use rights is also a critical aspect of sustainability projects at the local level (Castillo & Toledo, 2000). Successes in resource management are highly related to secure land tenure of local communities. In developing countries and much like islands, land tenure is an issue because areas formerly inhabited by local groups has changed such that land tenures are privatized or centrally managed. Often, marginalized groups have been relegated to less productive land (Thrupp, 1993) and local people resist involvement with the government in fear that their ownership or access to land would be changed. In order for communities to initiate and carry out

sustainable development projects on both private or common land, they must be reassured that the land will not be taken away from them.

✧ *Community vision, action plan and evaluation techniques*

Likewise with many projects, there must be a vision for the future of a community and plan to achieve it. Having a vision with an action plan consisting of goals, objective and benchmarks to achieve goals is a critical aspect of any project because it allows for measurements of success (ICLEI, 2002). This is significant in sustainable development projects because economic interests may be priorities over social and environmental ones. Action plans help reduce the likelihood of one branch superseding the others (Bell & Morse, 1999 and Kates 2005). Having a community vision and action plan gives the community a concrete checklist in working towards achieving sustainable goals. In this sense, evaluation is also a key factor in meeting project goals and working towards a vision and is often measured through the use of progress indicators (ICLEI, 2002; and Rocky Mountain Institute, 2003).

✧ *Equitable distribution of benefits*

A community's commitment to sustainability may only continue if benefits are equally distributed through the community (Pagdee et al., 2006). In some cases, one group may secure more economic gain from a project, leaving the poorest groups in the same financial situations they were in prior to project initiatives. When situations like these occur, projects are often forgotten about and diminished, resulting in lack of local participation. Contrary, equitable distributions of benefits to user may initiate more sustainable use of resources because all parties have an equal stake in protecting them (Pagdee et al., 2006 and Tucker, 2000). This is where development of institutions have a significant role in regulating behaviors toward resource use in a checks and balance system that ensures an equal distribution of benefits.

The differing contexts within which communities are found can make the transferability of sustainable development successes and failures implemented in one context difficult to achieve in other contexts (Agrawal & Redford, 2006). However, there are certain aspects that are commonly found in the literature and a focus on these attributes may be beneficial if adapted to the local context by local actors working with outside actors. This chapter identified factors important to sustainability that are important to consider in order to avoid over-emphasis one or a few elements (e.g., economic gains over social equity or ecological health). The attributes generated in this literature review may serve as a guide for communities for developing indicators for sustainability if they so choose.

AREAS OF CONCERN IN CARIBBEAN REGIONS THAT INDICATE POTENTIAL NEED FOR SUSTAINABLE ACTION

Internationally, it is becoming more accepted and evident that there is importance in recognizing equity amongst heritage of all states - size, geography, location, politics, tradition, environment and culture. Heritage represents to current and future generations who their ancestors were, what they did, what they knew, how they lived and what they valued. It is a historical framework that provides links between generations and their relationships with their ecosystems. Heritage has been described as the “fingerprint of generations” (Freedom Park), thus preservation and conservation of all aspects of heritage is an obligation that must be addressed in current and future plans for communities.

For Caribbean countries, many of which have emerged from the bonds of colonialism, heritage conservation and preservation assume significance in addition to preserving biodiversity. Geographical, environmental, socioeconomic and technological factors within specific communities separates targets in states but are not solely distinguishing factors of conserving isolated landscapes (Smith, 2007). The impact of history provides specific examples in understanding human relationships with landscape and natures interactions with landscape; resulting in determined and dedicated efforts for reviving and retrieving lost or damaged relationships. Likewise, the impact of manmade and natural disasters are concerns amongst Caribbean islands such that they have the ability to provide or destroy safe and secure communities regarding ecosystem functionality (Kaly et al; 2002; Lewsey et al, 2004; Lips et al, 2006; Lugo, 2008).

The main threats to the biodiversity of the Caribbean are habitat destruction and fragmentation due to agricultural, urban tourism and industrial/commercial development driven by increasing population and affluence; overexploitation of living resources; and predation and competition by invasive alien species. Climate change, pollution and sedimentation pose a threat, particularly to freshwater biodiversity, but are considered less important (McElroy, 1990; Margin et al, 2007). But, due to the relatively small size of most Caribbean islands, pollution from terrestrial sources tends to end up in neighboring coastal waters as a major threat to the marine environment in the Caribbean (CEP, 2003). Sedimentation and pollutants flowing downstream affect coastal water quality, smother corals, kill fish and reduce the touristic and recreational value of beaches in many countries.

Like other islands, Caribbean habitats are vulnerable to impacts of invasive species because of the generally small populations of indigenous species, evolutionary effects of isolation (such as loss of defensive behaviors) and the release of introduced species from

natural enemies (Kairo et al. 2003). The most damaging invasive species are typically goats, feral cats, pigs and rats and now the lionfish. They are responsible for more than half of all animal extinctions on islands globally (Island Conservation analysis of IUCN data); spread by its political, social and economic dependency upon imports (especially fresh food and live plants and animals), degree of exposure to extreme weather events and the freelance of pathways and routes. Many species are either deliberately or accidentally introduced, causing ongoing devastation. For many other invasive species like marine species, the potential for introduction has increased through globalization and international trade, tourism and transport links.

At the national level, most countries in the region have identified invasive aliens as one of the major threats to their biodiversity and the need for control activities. The Bahamas, for instance, established a National Invasive Species Strategy in 2003 and the Jamaica National Biodiversity Strategy Action Plan outlines 45 specific goals relating to invasive aliens, with the preparation of an invasive alien species management strategy listed as a key priority. However, quantitative data on Caribbean invasive species are still considered inadequate (Kairo et al. 2003) and limits the ability to design effective responses. However, low awareness levels from the public to policymakers does not help the outcome of threats posed by invasive species and their environmental and economic impacts.

The large impact on biodiversity impairment stems from the rapid increase in populations growth. Population growth demands on landscape yields extensive development; much of which has occurred without adequate planning (Day, 2009; ELAC, 2007; Fitzpatrick et al, 2007;). This has led to the destruction and degradation of large natural habitats resulting in coastal landscape transformations. Cited in a collection of works, impacts include pollution from sewage related to residential and tourism developments as well as contamination from industrial sites; clearance of natural coastal vegetation for construction, damage to coastal wetlands and mangroves for marinas and ports; sand and beach erosion; and increased consumption of water from surface and ground water sources leading to salt infusion and changes in ecosystem function - resulting in limited water availability.

The uncontrolled growth of tourism among Caribbean islands with regards to the widespread construction of hotels, marinas and associated developments along beach fronts and marine coasts is now a concern for small islands. Development on natural landscapes often mean the removal of natural vegetation for lawns and ornamental fixtures for golf courses, filling in of mangrove habitats for aesthetic marina developments for the construction of new infrastructure that gives access to coastal areas that was once only accessible by foot. Overall

figures for the area of natural habitats lost tourism development and have resulted in vast numbers of destroyed mangroves and other habitats like those found in the British Virgin Islands (BVIHCG, 2007).

Tourism is dependent on coastal and marine areas because tourism infrastructures are concentrated on activities on the coast, causing major environmental problems for habitats. The tourism sectors is expected to grow in the region (WTTC, 2004), which will require further land for construction and resources. For instance, the government of the Bahamas' current economic project is to put a major resort on each of the major outer islands without concern for the untouched habitats of the islands. In response, community-based nature and heritage tourism are being developed in several countries including Dominica, Jamaica and St. Lucia for significant economic value that does not invest in hazardous facilities. In cases like the Bahamas' there is evidence that points towards a disconnect between government policy, action and environment.

Even legally protected areas have not been immune to tourism development pressures, especially when international investment is involved. In recent years a lot of Caribbean government authorities have disregarded previous protection policies so that they could advance in tourism development. Furthermore, some infrastructure projects such as road construction are often linked in major tourist developments and can have positive effects on biodiversity. For example, the proposed "cross-country" road in St. Vincent is planned to cut through the proposed first reserves that make up the Central Mountain Range Corridor to provide access from a new airport to major tourist sites; while simultaneously supporting populations of four globally threatened species by embracing the watersheds that provide all of St. Vincent's freshwater (Colonarie Forest Reserve; Cumberland Forest Reserve; Dalaway Forest Reserve; Kingstown Forest Reserve; La Soufrière National Park; Mount Pleasant Forest Reserve; Richmond Forest Reserve key biodiversity areas). Subsequently, many tourist sites are operating beyond their capacity. Large numbers of tourists during high season for instance recently overtax public services, reduce local food stocks and water supplies and generate vast amounts of wastes that must be accommodated by local facilities that simply do not have the infrastructure or capacity to manage waste.

In addition, increased development among coastal zones for the pleasure of visitors is defiant in the holistic approach to protect local communities. The Caribbean is one of the most hurricane prone regions of the world and is susceptible to extremely hazardous conditions. Damage to hurricane-hit natural environments can be severe and enormous. For example, in

1988 Hurricane Gilbert (one of the most powerful ever recorded) hit Jamaica causing widespread damage, with 43 percent of trees in the John Crow mountains in the east of the island either toppled or with crowns broken (Varty 1991, Bellingham et al. 1992). Heavy rainfalls and strong winds associated with hurricane and tropical storms, especially in places that have already been exposed to hazards, cause landslips on steep hillsides; resulting in flooding or further damage. Hurricanes destroy important lowland and coastal habitats in addition to everything else that gets in their way. For instance, the storm surge from Hurricane Ivan in 2004, flooded and destroyed the central mangrove area in the Cayman Islands, resulting in standing salt water that eventually destroyed the majority of new mangrove revitalization. Similarly, red mangroves in Guadeloupe lost a large portion of their surface area to Hurricane Hugo (Imbert 2002); while Haiti experienced the ultimate loss of forests and environment because of its low resilience.

To a certain extent, Caribbean ecosystems have adapted to these extreme conditions and have been a driving force for evolutionary change. Moreover, these natural phenomena should not be considered when thinking about outraged impacts and increased risk of extinction. Many species however, depend on the gaps and landslides created by hurricane for regeneration, which is reflected in the growth characteristics of trees (Lugo, 2008); but population sizes and fragmentation from human activities should not be the leading cause of these features. Human induced projects have instead reduced the resiliency of remaining biodiversity and have threatened the existence of those now at risk; potentially losing all food sources and habitat from storms (Wiley & Wunderle, 1993).

The increase in population, spread of agriculture and urban tourism developments means that there are fewer undisturbed natural areas outside or protected areas. Studies have showed that even within protected areas, the increased number in visitors in areas has led to the degradation of vegetation and disturbance of natural functions due exceeding carrying capacities. In lieu of production, fire is a major cause of human-induced disturbance in the Caribbean. It is commonly used to clear land for agriculture and settlements, prepare sugar-cane fields for cutting, to "clean" undergrowth in forests and to encourage new growth in grassland and lightly wooded areas in the dry season for pasturage (FAO 2006b). This poses a problem because much of the Caribbean vegetation such as in Jamaica, Puerto Rico and the Lesser Antilles) is not fire-adapted and is adversely affected by fire. But in some cases species in Cuba and Hispaniola, have evolved with fire and are fire-dependant for their continued existence in their current life stages. Consequently, fire is not only a threat in the region, but a

critically important natural process in some systems and an important land management tool with potential to be managed to minimize its negative or maximize its positive aspects (Myers et al. 2004a, b).

A large area of concern among many islands is the large-scale clearance of land used for agriculture. As stated in previous sections of this paper, sugarcane plantations at lower elevations found continuously through out history was the leading cause for widespread of deforestations through the region. Although large parcels of land were burned for agriculture use, citizens used all material that could potentially come from the land like timber for building and fuel, for the sugar factories. This led to erosion, loss of some permanent streams and a decline in land fertility (McElroy, et al 1990). Some of the smaller islands, including Antigua, Barbados, the Bahamas, Bonaire, St. Kitts and Nevis, and the U.S. Virgin Islands, lost large amounts all of their native forest at or have been completely altered by agricultural developments. Regrowth of natural landscapes has been an area of concern after the abolition of slavery. People dispersed into surrounding areas of the plantations and developed their own small plots; leading to further degradation of forests and wetlands.

These parameters must be given their due weight when pursuing sustainable action.

Chapter 3: St. Croix, USVI Case Study

CASE STUDY OVERVIEW

The landscape of St. Croix provides rigid frameworks for symbiotic systems to protect the island and support diverse habitats and ecosystems. Through time, different inhabitants of St. Croix have been heavily influenced by various environmental features, transforming culture, tradition and architecture. In addition to their association with culture and tradition transformations, environmental assets simultaneously serve as habitats to both aquatic and terrestrial species. The history of the Virgin Islands continually suggests that St. Croix, St. Thomas and St. John are continual significant attractions for settlement. Specifically on St. Croix, rich terrestrial and historical landmarks like Salt River (also known as Columbus Landing), steadily attracts new inhabitants to its location. Its historical context narrates the importance of the natural estuary such that it once supplied inhabitants with fresh water and food; thus creating ideal conditions for settlement. Frequent settlements and changed ownerships throughout time, from the Taino peoples to European colonists, transformed connections to other landscapes as well. While Salt River is now an established tourist

attraction, it has retained its intrinsic value as a well-developed mangrove continuing much like it did when the Taino's settled there. Today, St. Croix in particular exists as a community that is bound to global issues related to resource management, economic sustainability, automobile dependency and environmental degradation. Without further question, protecting natural habitats are essential steps in progressing towards healthier and sustainable communities. The issues related to resource management, economic sustainability, and environmental degradation are approached through rediscovering historical elements, regenerating essential factors that heal the landscape; and reconnecting elements with potentials to reintroduce inhabitants, visitors and tourists on the island to achieve an overall balanced and stable holistic system.

St. Croix, the largest of the U.S. Virgin islands is just over 82 square miles and is located in the Caribbean Sea. St. Thomas and St. John are the other two major islands grouped more closely together in proximity of Water Island, the smallest and most undeveloped island. The Virgin Islands are an unincorporated territory of the United States since 1917, after multiple ownerships of seven different nations. St. Croix has a population of approximately 50,000. The name "St. Croix" comes from the word "Santa Cruz," given to the island by Christopher Columbus after his first encounter. There are two cities on St. Croix, Christiansted and Frederiksted. Christiansted and Frederiksted are located on opposite sides of the island landmarked by similar forts prominent to Danish architecture; hence St. Croix's nickname "Twin City." The highest point, Mt. Eagle, marks the center of the island distinguishing East (Christiansted) and West (Frederiksted).

St. Croix can be described as a dry tropic, particularly along the Northeast side, where trade winds run along the length of the island carrying rain clouds with them. The south side of the island is a significant asset of St. Croix that attracts settlers lies just north of the island. Buck Island, a national park reserve, is a smaller island only accessible by boat. Buck Island and Point Udall, the most eastern part of the United States, have a major role in environmental and marine preservation. In lieu, efforts toward conservation and preservation for habitats are areas of concern for the Department of Natural Resources that must adopt policies in order for ecosystem protection. Discussion and actions related to protection programs and revival plans to sustain the environment are challenged in the context of economy.

Agriculture in the way of sugarcane production was once the main source of income for the Virgin Islands until tourism increased revenue. This revenue source was replaced by oil refining and tourism beginning in the 1960's. Frederiksted, located on the west side, is the

center for the cruise ship tourism factr; while Christiansted, located on the east side, is a mixed use area for government and private businesses and tourists related activities. Up until two years ago, labor was divided equally with one-third being employed by the government, one third by small private businesses and one third by Hovensa, one of the world's largest refineries. However, the income distribution was weighed heavily in favor of Hovensa as its salary scale superseded that of the other two entities. In addition to Hovensa's significant impact on gross domestic income, the Cruzan Rum distillery and now the Diageo distillery has had a significant role in economic gain and success. The rum distilleries use local and imported sugarcane crop to make some of the most renowned rum in the world. The distilleries not only employ a significant number of residents, but do provide a tax rebate and also advocate local production and economy. The processes of oil refining and rum production boost St. Croix's local economy, but also significantly impact social and environmental health. Both industries use excess resources and pollute the surrounding environment and even create traffic issues due to their centralized locations. Without a bus or other reliable commuter transportation method, 15 passenger taxis and personal vehicles remain the dominant forms of transportation. It is estimated that the island has 80% of personal vehicle ownership. For a small island, travel is not quick in certain areas due to poor planning in the industrial area.

Changes in lifestyle, resource use and management must be addressed in regards to social, ecological and economic concerns inflicting St. Croix. Much like the impact of a hurricane, when the oil refinery, Hovensa, shut down its plant in 2012 the island's unemployment skyrocketed (16.8%) and the already high cost of resources increased significantly. St. Croix literally went into a downward spiral that is still being felt today - overall population is down, energy costs are the highest in the nation (.5246 kwh), the housing market has collapsed and over 200 private business have closed Given the economic downturn, residents are seeking environments that offer great potential for sustainable initiatives in order to both subside and to prosper. Had St. Croix put into place a viable plan for sustainability, it would not have been as severely impacted by this one external event. A race toward sustainability in pursuit of a comfortable lifestyle is now taking place. There is now a concerted effort to diversify fuel options with wind, sun and gas options and even king grass. There is a town revitalization plan that was recently voted on. There is a well- developed program to protect the nesting leatherback turtles and programs to prevent over-fishing. There are grassroots efforts toward preserving culture and heritage and customs. Clearly missing are long term plans for commercial and residential development to avoid the "have and have-not"

syndrome. St. Croix has the opportunity to function as a sustainable environment that doesn't lose its culture, beauty, traditions or identity. St. Croix remains a place of history and culture that emanates through its landscape and buildings (Danish architecture), emphasizing important turning points of the island's ancestry through identifiable landmarks, such as Columbus Landing. There is a sense of belonging that locals extend to visitors, which appears to stem from colonization. Terrestrial landscapes and beach fronts are not abused with resorts or privileged private developments, thus preserving a sense of intimacy with the landscape and nature. Respect for natural beauty of the island is prominent and there is a sense of local pride that shows in those born on the island and long timers. A shift in paradigm that balances growth with alternative techniques, natural beauty, history, tradition and culture with respect to economic gain and environmental conditions is key in a sustainable community plan.

HISTORY

One of St. Croix most intriguing features is its history. Represented by seven flags, Spain, Great Britain, the Netherlands, France, the Knights of Malta, Denmark and now the United States, St. Croix is the definition of a diverse community. There are distinct landmarks from each ownership. However, history of St. Croix begins before the first western encounter by Christopher Columbus in 1493. Spanning a period of 5000 years, historians believe that the Meso-american groups were the first to leave their mark on the land. Likewise, St. Croix's ancestors are believed to descend from South America decided by evidence of similar styled artifacts and techniques associated with the Northeastern region of South America.

Ancient societies revolved around a class system which was physically represented by ancient village styles such that the center of the settlement was the most sacred followed by a concentric form of housing that demonstrated class hierarchy; the closer one was to the center determined societal roles and one's significance in the village. The Tainos, St. Croix's indigenous people, were wiped out by aggressive warriors, known as the Caribs; until 1493 when Europeans first settled on the island. Post Columbus, a new chapter started for the island, in which conquest dictated leadership.

As noted above, ownership changed frequently for two reasons – the slave trade and the sugarcane industry. With the sugarcane crop in full demand, slaves were imported as free labor and the islands exported both raw and produced materials from sugarcane in the way of sugar and rum. Popular in both Europe and America, the demand for product increased significantly thus creating a sustained economy. The economy used wind to turn sugar mills and shelter was built facing the east and with 18 inch walls to take advantage of the Tradewinds

against the heat and to sustain hurricanes and other bad weather. After a massive fireburn by the revolting slaves in 1848, slavery was abolished and the right to education was given to all inhabitants of St. Croix. By 1917, the United States purchased the islands from Denmark for military strategic reasons. The island's economy then followed on an agricultural path. During this time and for the next 60 years, the islands grew as agriculture, tourism and industry took hold. However in 1989 Hurricane Hugo destroyed St. Croix, devastating the majority of natural and man-made environments, leaving remnants of the past sprinkled around the island. Rediscovering history and retelling it through design and program are a key elements in successful, positive installments to better the community plan.

CONTEXT

Contextual events throughout history are significant resources in understanding societal roles and their connections to landscape. Interactions between humans and nature are important in a comprehensive plan, just as relationships between authority and locals are important in decisions for long-term plans (Kelly, 2010). The U.S. connection to St. Croix is culturally and economically weak. The distance of St. Croix from major contents and neighbors has kept traditions and culture alive on the island. Rediscovering the roles of nations and cities nearby can help guide a promising future for the well being of St. Croix. However, future concerns cannot be addressed until relationships between governance at higher levels are reconnected with local authorities. Reconnecting with higher bodies of governance and its surrounding environment emphasizes economic connections and cultural ones too, in regards to supporting local endowments (Portney, 2007; Bae and Feiock, 2013). In the case of St. Croix, this would entail making sure that local policies regarding sustainability are applicable and in scope with federal policies on sustainability in order to obtain funding and to be legally compliant.

Rediscovering connections relates back to history, the current culture and the struggle of expression and power. St. Croix offers one of the most ecological diverse habitats in the Caribbean, supported by powerful topographies that lead to multiple levels of natural systems, views and perspectives as well as reliable access to sun and wind. Preserving natural and cultural heritage is a concern that can be addressed through community initiatives and decision-making processes at the local level with support from the national government. Federal programs and laws that help fund and support historical and ecological preservation are essential to such a small locale in deciding which projects gets priority. This poses a viable question - Is there a way to combine history and preservation? The role of policy will determine

issues between locals and land equity, but programs that celebrate local tradition and support economies for landscapes will ultimately pose conditions that encourage diversity and agriculture in pursuit of a sustainable community.

CULTURE

Culture can be defined as the attitudes and behaviors or tastes in art and manner of the given society at a particular time and place. As a dynamic element, culture evolves through time with societal changes (UNESCO). St. Croix has had 5000 years of history contributing to its diverse population. Some inhabitants associate themselves with our past ancestors like the Tainos or Africans, while others represent nations from the Lessor Antilles, Denmark, Puerto Rico, the Dominican Republic, Haiti, Jamaica, the Philippines, and the Americas. Those who consider themselves locals are identified with the term Crucian. Traditions such as St. Croix's Half Ironman, and the Crucian Christmas Festival, are examples of events/organizations that have lead to established connections between heritage and nature through local tourism. These initiatives are factors of a strong sustainable community. Dependency on natural resources and Earth's services for life and health, including medicinal practices – a strong component of St. Croix culture, is a driving force for a change in use and management of the island's resources.

NATURE

Nature is a valuable asset of St. Croix that cannot be ignored. There are several protected areas in St. Croix such as Buck Island Reef National Monument; Green Cay National Wildlife Refuge; East End Marine Park, Nugent Park; and Salt River Bay National Historic Park and Ecological Preserve. Both terrestrial and aquatic landscapes are places of importance. Seas, bays and coral reefs have significant roles in holistic systems. St. Croix's landscape has been stressed after years of intense farming and burning for agriculture use; leaving behind arid landscapes filled and some invasive plants. Additionally, development has also stressed St. Croix's other valuable and necessary resource, water, Besides, land (which is finite on an island, fresh water is a limited commodity. Parts of watersheds have been disturbed by development such that land grading has altered natural water paths causing more environmental and social externalities. Even planting King Grass as an alternative fuel source (considered a positive move toward sustainability) is now a threat to the water table. Population growth, business growth and changing weather cycles all negatively affect this resource.

It is known, that the river that once flowed down Blue Mountain through Salt River has been long dried up as a result of development and faming. It's rainforest, which once provided

natural services to the native peoples such that plants were used for foods, medicines, dyes, poisons and infrastructure for comfortable lifestyles is now a skeleton of what it once was. Even so, the land is resilient and healing itself in parts of St. Croix as humans take more interest in preserving the land. Ecotourism is developing as a viable industry so that St. Croix can be remembered and shared.

Over the span of St. Croix's recorded existence, vegetation on the island has changed but still continues to protect and house thousands of species. One of the most important plants of St. Croix's biological system are mangroves. Mangroves protect shoreline and serve as the first line of defense during storms. Also, mangroves naturally filter water that runs off the island and into the bay, protecting corals and providing a nursery for fish. Salt River, for example, embodies the single largest mangrove system remaining in the Virgin Islands. After Hurricane Hugo, mangroves suffered a serious loss in number, but through community efforts, a large percentage of mangroves were replanted in service of giving back to the environment.

While land can regenerate and heal itself, local initiatives such as the Creque Dam Farm, which has made great strides in harvesting landscape, resulting in a reciprocation of service program that promotes a continuous holistic cycle. The process of giving and taking from the land is not a new strategy, but it is one that has not been used on St. Croix since it moved away from sugarcane plantations. Examples such as replenishing the mangroves and establishing farm to table initiatives are positive relationships the local communities are aiming towards for sustainability. As the residents continue to rely on the land to plant organically or rejuvenate the interest in native plants as medicinal sources or preserve the natural beauty of the locale for future generations, a natural educational process takes hold allowing communities to use their resources to their best advantage.

CONCERNS

There are three primary issues of concern that exist on St. Croix. Restoration of abused landscapes and natural resources, rebuilt relationships between locals and nature; and representation of history, culture and tradition are dimensions of understanding the requirements of sustainable integration.

First, landscapes are currently exposed to invasive species bearing few native plants and trees, negatively affecting the eco-cycle and water resources. Development further disturbs natural processes and functions, negatively affecting water and traffic flows. Further, as alternate energy sources, such as solar and wind energy, are implemented, the landscape can be further abused by too many windmills or solar panels creating noise pollution and destroying

the natural beauty of the landscape. Coastal landscapes that guard corals and fish nurseries are under attack by natural and human occurrences and should be protected and monitored with an emphasis on public education. For plans to be successful, the landscape must be understood first in relation to native species and cultural flora that used to flourish prior to settlement and industry (Coenen, 2009). For this to be true, a strategy that heals the land in a sustainable matter must be addressed. Reconnecting with nature will serve as a foundation to connect the past as well as initiate a framework for a balanced, stable ecosystem

Educating locals, visitors and tourists about nature's significance for a holistic system preserves its use for future generations. Both aquatic and terrestrial landscapes are essential to a healthy community. Education policies and management regulations must also be enforced to break down strong dichotomies between locals and nature. But, in order to transform relationships between people and nature, relationships between locals and governance must be amended. Trust and concern over rights and land between locals and government place a heavy burden on local economies (Roseland et al, 1998). Agreements and understanding between both parties is crucial in decision-making processes. On St. Croix, there is a heated discussion over land use particularly on the coast line as some residents seek optimal views and industries seek access to shipping lanes, while others seek preservation of the natural landscape. A balance has to be reached between the stakeholders to ensure sustainability. Thus, organizing spaces for communal activity will help achieve an equilibrium in emotions and desires between natives and nature. In hopes of success, tourists, visitors and locals should feel reconnected to nature and history. Lastly, integration of new research, material and technology must be initiated without overruling previous techniques in order to achieve a strong, stable healthy, functional, efficient community. Construction and material choice should follow models of sustainability, economically, socially and environmentally; so that frameworks can be provided with visions to protect, educate and rebuild the community. In addition, communication is crucial in successful outcomes

Third, preservation of history, culture and tradition should be safeguarded so that identity is not lost. For instance, there is a current move to re-establish the "fish market" . It was and is a gathering place to exchange news, buy local produce and otherwise interact with each other. This idea is historically and culturally important, while at the same time fills the current need for "farm to table" demands and other cottage business growth. With multiple layers of culture and society hidden beneath the earth and standing as monuments, appreciation of cultures and history is important to consider when thinking about relationships and connections. For St. Croix

this preservation is essential to its tourism industry. Including community input in the governmental decisions concerning the ecotourism and heritage tourism industry for instance, require education, management and maintenance through policy on local levels. Taking into consideration existing rules and regulations while simultaneously including historical and cultural value from a design perspective and educational outlook, the towns of Christiansted and Frederiksted can be refurbished and rebuilt for local and visitor enjoyment and enrichment. In this manner, stations such as the “fish market’ would be preserved and not replaced by a tourist shop.

While, it is understood that the landscape is constantly changing and communicating messages to its inhabitants, as protectors of Earth and the ecosystem, humans cannot ignore natural callings. These messages function as an important resource in implementing strategies for positive outcomes.

Chapter 4: Methodology

The goal of this study is to evaluate sustainable community initiatives in a developing country and the Caribbean to determine how these initiatives have met the needs of community members and how they have contributed to the development of a sustainable community. The objectives of this goal are categorized by literature reviews, project history and assessment of actions. This research develops a master plan and design highlighting St. Croix’s attributes, while suggesting improvements for the community’s overall well –being through sustainable integration on the built environment.

GENERAL METHODOLOGICAL APPROACH

In order to meet the objective of this study, methods based upon case study research, qualitative analysis and rapid resources assessment was used.

Case studies

Case studies as a form of research used primarily in the social sciences are selected when the study proposes “how” or “why” questions about the topic at hand, the researcher has little control over events, and the study is investigating contemporary phenomenon in the context of events in the real world (Eisenhardt, 1989, Yin, 1984). They are performed for various purposes. When applied as a research method, case studies are generally carried out to generate findings of relevance beyond the individual case (Fidel, 1982). The application of this method is to develop a comprehensive model describing patterns of behavior. By providing a

description of procedures and analysis applied, researchers may develop a sharper awareness of both the problem and its contributors (Yin, 1984).

The questions posed in this descriptive study meet the criteria for case study research. This study investigates *how* local-level sustainable development initiatives have been implemented by developing communities and island communities; *how* they are or are not meeting the immediate and long term needs of community members; and *how* initiatives have contributed to the development of a sustainable community. Lastly, this study investigates the approaches taken by communities and assesses how the approaches affect humans and the surrounding environment, with implications for future management of human and natural systems.

In order to develop a case study of the community, the researcher used several sources of evidence. Case study research, such as other forms of research, requires a number of sources to compile data, thus contributing to the validity of a study (Yin, 2003). Published and unpublished documents were collected before and during the researcher's time in the community. These documents are used to describe actions taken toward sustainability prior to research, in order to provide background information and support information collected with other research methods. The second source of evidence used by the researcher was a structured interview with community members, community leaders, government officials and other various members in the community. The third source of evidence used was direct observational data, which was collected during the time spent in St. Croix, USVI. The interview transcripts and observation data are found in Appendices of this thesis.

Interviews (Appendix 1)

The researcher conducted interviews with a variety of respondents from the community: students, young adults, adults, lawyers, doctors etc. These interviews took place during the semester long research project for the researcher's senior thesis between the months of January and April of 2014. The researcher conducted these interviews with the help of social media like Facebook to generate a large database of local opinions. The interview questions were the same for each participant in order to maintain constancy throughout the process. Each interview who posted or emailed the researcher gave the permission to use information gathered in the overall study. At the beginning of the interview the researcher provided an explanation for the reason of the interview and why individuals were being asked to participate.

In conducting interviews for community members, the researcher used techniques of convenience, snowball and purposeful sampling. Convenience sampling is interviewing people

because they are available at the time (Auerbach & Silverstein, 2003). Snowball sampling is a technique in which an interviewee passes on the survey to another person who is available at the time or was involved in the topic of discussion (Auerbach & Silverstein, 2003; and Patton, 2002). Purposeful sampling is selecting interviewees because they have a specific set of characteristics that pertain to the subject (Patton, 2002). To get a better understanding of the population sample of the community, interviewees were based upon their age (15+), what high school they attended and their relationship with St. Croix, USVI.

ANALYSIS OF QUALITATIVE DATA

This research is a qualitative study aimed at describing and analyzing shifts towards sustainable developments in local communities. Qualitative studies are hypothesis-generated, which “involves analyzing and interpreting texts and interviews in order to discover meaningful patterns descriptive of a particular phenomenon” (Auerbach & Silverstein, 2003). This research generates hypothesis for the case study of St. Croix based off of the successes and outcomes of sustainable initiatives and developments that exist in locations similar to Caribbean island. The researcher uses an open-coding technique to analyze the information gathered in the study.

Open-coding is a process used to systematically categorize, build relationships and explain transformations through the collection of raw data (Auerbach & Silverstein, 2003; Strauss & Corbin, 1998; and Taylor, & Bogdan, 1998). The process of this type of research involved a series of steps that include: formation of propositions, categorization of propositions and lastly the development of themes.

Triangulation is an important tool in qualitative research. It refers to the combination of multiple methods, materials, observers or perspectives in a single study. It is used to obtain a deeper understanding of the study to avoid the likelihood of misinterpretation (Yin, 1994).

Chapter 5: Restoring Abused Landscapes

CONCERN NO. 1

Environmental sustainability is a critical component of global economic and social well-being. While environmental problems have intensified globally with the majority of issues stemming from problems in nature, most ecosystems managed under national policies call for support and protection. Natural services provide a number of positive externalities that need to be protected and managed efficiently at local levels, as well as supported by national governance, in decisions that impact the future of the Earth.

Trinidad and Tobago, one of the leading countries in sustainable development in the Caribbean, has constituted a framework that resolves and strengthens environmental sustainability for the success in saving natural resources. Strategies to achieve environmental sustainability have been predominately associated with development and implementation of policies such as: the Climate Change Policy, a framework for Development of a Renewable Energy Policy, and the Protected Areas and Eco-Tourism Policy. Using Trinidad and Tobago's sustainable development framework as a guide, this chapter will explain and possibly resolve some of the shared problems that most Caribbean Islands, including St. Croix, face today. Through this type of research, efforts are made to provide island-specific strategies and recommendations for restoring landscapes.

Caribbean Islands are one of the world's greatest centers of biodiversity characterized by unique, wide-ranging wildlife and culture. Geography, climate and the expanse of the Caribbean have resulted in a diverse range of habitat and ecosystems that support high levels of species richness. Important freshwater habitats like rivers, streams, lakes and wetlands are supported by substantial levels of biodiversity, similarly to their roles in habitat functionality. In the context of saltwater surrounded landmasses like St. Croix, freshwater sites are rare; thus the importance of biodiversity preservation in local communities.

Ecosystem services are essential to human existence but ironically, terrestrial biodiversity has been impacted by humans since the arrival of the Amerindians in the Caribbean; followed by increased negative impacts associated with increasing populations and economic demands. Main threats to biodiversity in the Caribbean include habitat destruction and fragmentation due to agriculture, urban tourism and industrial/commercial development instigated by increased population, overexploitation of resources; and invasive species. Ecosystem fragmentation, driven by human activities and invasive species, has a measurable impact on various socioeconomic activities, including threats to indigenous species and landscapes because of disrupted natural cycles of many systems and habitats.

Restoring abused landscapes is a primary concern for St. Croix, USVI. Several reports pertaining to environmental vulnerability and hazards have influenced approaches for improved practices. Under sustainable development guidelines, there have been ten problem areas that are identified as environmental issues and challenges for St. Croix; which include: climate change and sea level rise, natural and man-made hazards, management of waste, management of coastal, marine, freshwater, land, energy, tourism and biodiversity resources;

and transportation. These challenges demand attention and feasible approaches that involve local, regional and international support.

CLIMATE CHANGE AND SEA LEVEL RISE

The issue of climate change and global warming has been identified as a global problem since 1979. It is the main environmental concern among all environmental issues. During the 20th century, the Caribbean region experienced on average a mean relative sea-level rise of 1mm year (IPCC, WGII, 2007). Indications such as these require swift action to mitigate possible hazards associated with climate change. The Caribbean islands, for instance, are vulnerable to events such as hurricanes, floods and droughts; natural events that have been taking place for centuries. However, these events are likely to be more frequent and severe as climate changes.

The inevitability of climate change calls for urgent action plans for appropriate protection. A recent study of forests in the USVI and Puerto Rico for example, found that climate is the main influence on forest species composition during deforestation recovery; while all other factors are secondary to the influence of climate (Brandeis et al 2009). The predicted intensity of climate change over time, will have serious effects on the Virgin Islands' terrestrial, aquatic and coastal systems. A summary of these effects were presented in the report "Climate Change in the Caribbean and the Challenge of Adaptation" by the United Nations Environmental Program (UNEP 2008):

- *Deteriorating coastal conditions, e.g. through beach erosion and coral bleaching, are expected to adversely affect local resources, like fisheries, and reduce their value as tourist destinations.*
- *Floods, storm surge, erosion and other coastal hazards, exacerbated by sea-level rise threaten vital infrastructure, settlements and facilities that support the livelihood of island communities.*
- *Reduction in freshwater resources by mid-century, to the point where demand cannot be met during low rainfall periods.*
- *Increased invasion by non-native species as a result of higher temperatures, particularly on middle and high-latitude islands.*
- *Economic losses from reduced agricultural yields. For example, shortening of the growing season, drought.*

- *Loss of mangrove forests and coral reefs due to sea level rise.*
- *Bleaching and acidification of the ocean.*
- *Damage to terrestrial forest caused by extreme events.*
- *Reduction in the size of freshwater lenses and of general water resource availability due to decreased rainfall and saltwater intrusion.*
- *Inundation of coastal settlements and arable land on the coast.*
- *Reduction in tourism due to increased frequency and severity of extreme weather.*

Impacts caused by severe weather have caused substantial damage in the Caribbean. Heavy rainfalls associated with natural hazards only seem to result in further land damage. St. Croix for example, has had a difficult time reviving the community after Hurricane Hugo in 1989. As hurricanes in the Caribbean are predicted to increase in intensity and frequency under climate change scenarios, policies to mitigate and adapt to phenomena need to be addressed.

Trinidad and Tobago's Working for Sustainable Development, includes a framework that addresses the consequences of increased temperatures. Greenhouse gas inventories recorded during the period of 1990-2060 indicate that the energy sector, transportation and industrial sectors account for the majority of carbon dioxide emission in Trinidad and Tobago. Similarly, these sectors associated with the community of St. Croix and the rest of the Virgin Islands indicate the similar results. In lieu, one of the primary ways in which Trinidad and Tobago is seeking to reduce their emissions is through the development of Compressed Natural Gas as an alternate fuel for vehicles. In the research conducted by the government of Trinidad and Tobago, they have found that "the use of CNG can reduce Green House Gas (GHGs) emissions by as much as 15 to 20 percent of GHGs produced by liquid fuels, gasoline and diesel. CNG has been proven to be a cleaner, cheaper, safer and greener fuel and as such, a suitable alternative fuel to use in Trinidad and Tobago."

There are also initiatives that shift towards renewable energy sources such as solar, wind and wave to complement supply from existing and natural sources through the adaptation of Energy Efficiency measures and practices; which may be more suitable for the smaller population of St. Croix. In the case of Trinidad and Tobago, their government has recognized the seriousness of the impacts of global warming and greenhouse gases on the island, and its surrounding territory. Therefore in addition to adopting Energy Efficiency measures and Compressed Natural Gas initiatives, the island has also adopted a National Climate Change Policy (2010), that is projected to increase the use of new and innovative technologies that

lower the levels of emissions; encourage the use of clean and renewable energy technology that promotes the adoption of more energy efficient practices.

NATURAL AND MAN-MADE HAZARDS

Growing human populations, spread of agriculture, and urban and tourism developments increases a habitat's vulnerability. Resorts, condominiums and marinas and their related marine recreation activities, have damaged mangrove habitats, coral reefs and seagrass beds; exposing ecosystems for further damage. Population growth demands on landscape yields extensive development, much of which has occurred without adequate planning. This has led to the destruction and degradation of large natural habitats resulting in coastal landscape transformations. Impacts include: pollution from residential and tourism developments as well as contamination from industrial sites; clearance of natural coastal vegetation for construction, damaged coastal wetlands and mangroves for marinas; sand and beach erosion; and increased consumption of water from surface and ground water sources leading to salt infusions and altered ecosystem function - resulting in limited water availability.

According to Island Resources Foundation (2010, p. 69), "The Virgin Islands are among the most vulnerable societies in the world (Crowards, 1999), with major risks including hurricanes, drought, earthquake, tsunami and manmade disasters." Like all other Caribbean islands, the biggest natural hazard to the Virgin Islands are hurricanes. The Virgin Islands are situated in Hurricane Alley which makes them susceptible to the impact of these storms. Many species however, depend on the gaps and landslides created by natural disasters for regeneration, which is reflected in the growth characteristics of trees (Lugo, 2008); but population sizes and fragmentation from human activities should not be the leading cause of these features. Human induced projects have instead reduced the resiliency of remaining biodiversity and have threatened the existence of those now at risk; potentially losing all food sources and habitat from storms (Wiley & Wunderle, 1993). For instance, land clearing and other agricultural practice of the colonial plantation system during St. Croix slave period has changed the landscape forever; introducing exotic, alien species that have had major impacts on wildlife and habitats, more frequent natural disturbances that threaten the islands ecosystem as well as land use effects resulting in chronic landscape damage.

In addition to St. Croix's vulnerability to natural hazards due to location, it is also susceptible to anthropogenic hazards. The territory's economy is hinged on the extraction and processing of oil and gas. The hazards associated with the operation of the oil industry are numerous. For instance, environmental hazards such as fires or soil can destroy watersheds

and marine ecosystems. There is a list of similar hazards such as chemical contamination and air pollution that are better categorized in other sections; that have negative impacts on sustainable development if they're not efficiently and effectively managed. In 2005, the FAO developed a Caribbean Fire Management Cooperation Strategy (FAO 2005) that aims to strengthen Caribbean fire management networking by encouraging closer collaboration among countries with similar ecological conditions.

Locally, The US Virgin Islands currently uses a developing program for emergency management (VITEMA) that aims to prepare territorial organizations to respond, recover from, and mitigate hazards (VITEMA, 2011). In recent years, VITEMA has focused its efforts on planning and training for hurricanes and other coastal storms, but the fact remains that the territory is also prone to other natural and man-made disasters (VITEMA, 2011). Steps have also been taken to address hazards of these types through mitigation and preparedness strategies such as:

- *Conduct assessments of the structural integrity of one of the islands primary shelters and to correct deficiencies so as to allow it to better withstand earthquakes and hurricanes and allow for the identification of the most disaster-resilient facilities which also serve multi-hazard purposes;*
- *To sustain partnerships between the private sector and the public through use of a small grant program which provides incentives for groups and communities to identify those areas of greatest risk and minimize damage by addressing mitigation strategies of greater priority (short-term and long-term mitigation measures which address preparedness needs have resulted due to partnerships between the government, homeowner associations, local businesses, and community organizations) and;*
- *To provide disaster mitigation education and awareness to the public has an island-wide educational campaign has been enacted to develop a family disaster resource manual, a school-based curriculum to educate on family disaster planning, and the development of a best practice resource guide for construction builders. (V.I. Business Staff, 2011).*

In addition to integrated emergency plans, the region has also launched a multi-hazard alert system to notify the public of storms (Cooper, 2010). The alert system will have storm alert notifications forwarded directly to resident cell phones, pagers, faxes, and e-mail addresses (Cooper, 2010). Lastly, the ultimate goal of VITEMA is to prepare the community for all types of

disasters. The problem, however with these initiatives is that they have not been facilitated because further assistance is need for the disaster plan to exist and take action.

Trinidad and Tobago, similar to St. Croix, has historically sustained losses to life and fragmented landscapes caused by such hazards; that are sometimes associated with health issues and increased incidences of poverty. “Negative impacts on individuals, households and communities reduce the nations ability to maintain sustainable socioeconomic growth and stability” (Kaly, 2002). Trinidad and Tobago’s approach to disaster management is continually evolving from existing approaches of disaster preparedness and response as suggested in VITEMA. There are differences in the systematic approaches of each plan. Trinidad and Tobago’s Comprehensive Disaster Management Policy Framework suggests multi-step ‘checklists’ for planning and preparing programs for disasters. “The strategic goals of Trinidad and Tobago’s Comprehensive Disaster Management Policy Framework (CDMPF) include:

- *More effective integration of disaster risk considerations into sustainable development policies, planning and programming at all levels, with special emphasis on disaster prevention, mitigation and preparedness;*
- *Develop and strengthen institutions, mechanisms and capacities at all levels, in particular at the community level, which can systematically contribute to building resilience to hazards;*
- *Systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response and recovery programmes in the reconstruction of affected communities (George Robinson, 2010).”*

Disaster management policies and plans will further educate locals on the significance of hazards in regards to socio-economic factors. Facilitating hazard response programs requires efforts from all levels of society so that disaster agencies and various stakeholders can develop mitigation initiatives that are effective and efficient in planning, preparation, response and recovery.

SOLID WASTE MANAGEMENT

Mentioned in the previous section, rapid rates of urbanization and migration from rural to urban areas have resulted in increased demands for natural resources (particularly water and energy) and land for building; leading to problems associated with waste management and sanitation. Demographic changes and increasing population density in sensitive areas such as coastal zones have led to severe environmental degradation and the potential for conflict over limited resources. Increased populations densities are generally related to a rise in gross domestic production, thus yielding a higher income for the working middle class. Frequency in

trade contributes to invasive risks that have demonstrated increased pressures on land for housing and urban development; and environmental services that demand energy and freshwater.

St. Croix has struggled in waste management for many years, with continued hazards associated with wildlife. “Demands by the FAA to the Port Authority to address the wildlife issue went unaddressed by the territory for decade, eventually leading to FAA fund withholdings and crippled capital improvements at the airport” (VIWMA). In handling waste, Waste Management Authority was created by the government in 2004 and was effective immediately by 2005. It is noted that by working with local residents and local businesses, the department created the first facility in the territory that met their initial goal. Prior to the facility construction, there was a number of dumped materials on roadsides and the base of the landfill. Although the landfill was a major tool in managing waste; climate and potential hazardous weather added difficulties to the process of waste suppression, causing air pollutants, fire hazards and land degradation as well as disturbing airplane schedules.

Across the board, landfilling is the preferred method of waste disposal. It however, competes for limited space, therefore minimizing the waste capacity for a landfill. Described in programs associated with Trinidad and Tobago, efforts to reduce waste are minimal. “In Trinidad, the SMWCOL established a waste recovery system and market for recyclable materials.” This establishment was meant to reduce the amount of waste entering the landfill while contributing to the conservation of resources; in addition to more job opportunities and income generation. But, in both the cases of St. Croix and Trinidad, the recycling industry remains untouched and vacant because citizens do not place value on preferred disposal practices. This is compounded by the fact that the economies of scale are not reached to make it a viable economic concern. Thus it is left to the consciousness of the individual.

In Trinidad and Tobago, initiatives have been geared toward institutional strengthening, aimed at giving power to environmental agencies to support quick action in order to enforce existing standards - including a direct approach on littering. To compliment these regulations, penalties will be increased in the near future under the Litter Act to protect the environment from harmful effects of citizens and corporations in their waste disposals.

The lack of citizen interest in waste management has led to international initiatives that suggest an alternative that uses the biogas as an energy source. “Biogas is the gas that is produced by the breakdown of organic matter in the absence of oxygen. It is comprised primarily of methane, carbon dioxide and small amounts of hydrogen sulphide” (Parsram, 2007).

In some developed countries, the use of biogas already exists and is used to power large farming operations and landfills. But in achieving this sustainable technique, educational efforts and sustained efforts toward budgets shall be addressed in sustainable development frameworks.

COASTAL AND MARINE SOURCES

Small developing islands are defined by their historic, cultural and economic links to oceans and seas. They are heavily dependent on their marine resources, particularly for sustainable livelihoods of coastal communities. St. Croix landscapes are exposed to resilient invasive species bearing few native plants and trees in addition to damaged coral reef nurseries and coastal landscapes that provide many natural services. “Like other islands, Caribbean habitats are vulnerable to impacts of invasive species because of the vernally small populations of indigents species, evolutionary effects of isolation and the release of introduced species from natural enemies” (Kairo et al. 2003). The spread of invasive species is considered one of the greatest threats to biodiversity, leading toward further problems associated with socio-economic advances.

The demand for space by a fast growing population resulted in extensive loss and degradation of natural ecosystems in the USVI where sprawling residential communities and commercial centers have replaced or fragmented much of the native forests (Platenberg et al, 2005). Resorts, condominiums and marinas have been added to coastal wetlands where marine recreation activities have damaged mangrove habitats, coral reefs and seagrass beds; contributing to continuous increases in pollution that ultimately contaminates wetlands and marine environments. In the expansion and colonization throughout the centuries, forests on the island were cleared and terraced for sugarcane production. This and other crops such as cotton, tobacco and indigo were grown using intense labor systems that ultimately eroded the land in 1948 when slavery was abolished. Those left were soon destroyed in lieu of natural disasters.

Island populations declined and cultivated land began to revert to natural vegetation. Hillsides were cleared for agriculture, resulting in the loss of native species, spread of non-native species such as tan tan; and increased soil erosion. With sudden desertification, strategies and natural methods to mitigate run off were abandoned, leaving previous infrastructure to act as buffers to block the dispersal of plants animals and other organisms. But in reality, the inconsistencies of paved and unpaved roads resulted in a source of sediment runoff that severely impacts marine environments.

Land-use effects are an area of concern, but with and increased stress on economy and tourism, there have been increases in coral reef and reef organism degradation. Visitation to the islands has increased substantially and have contributed to the disturbance or killing of fragile habitats. Swimmers, snorkelers, and divers can hurt underwater communities by stepping on them; and kicking and picking up marine life. In addition to these direct human inflictions, the carelessness of boat grounding and anchors unknowingly contributes to the significant damage in marine habitats. Boat groundings and anchors break corals and tear up seagrass beds, which destroys food sources for wildlife like sea turtles. For instance, in 1998 a single anchor drop from a cruise ship destroyed more than 3,200 square feet of reef in Bonaire. As a result, monitoring at this site has revealed no significant recovery of hard coral since the incident.

Like St. Croix and other Caribbean Islands, Trinidad and Tobago depends on the marine ecosystem primarily as a source of food. Differentials between The U.S. Virgin Islands and Trinidad and Tobago suggest that The U.S. Virgin Islands have more support from authorities in importing food sources while Trinidad and Tobago are mostly independent; and rely on their ecosystems to provide the majority of their everyday needs. In Trinidad for example, there are several major fishing communities that imply further issues for their economy such as problems associated with overfishing. Similarly to St. Croix, Trinidad relies greatly on the services of their mangrove ecosystems for ecotourism, and habitat protection to avoid issues like overfishing.

In comparison to initiatives taken by the US Virgin Islands in protecting coastal resources, Trinidad lacks regulation policies within watershed areas, exhibiting a higher level of susceptibility and vulnerability to hazards. The failure to properly regulate the release of pollutants generated from land activists have had significant impacts on marine ecosystems, therefore easing pressures on wild fisheries and natural stock will contribute to global consumption through aqua culture commercial fishing. Trinidad and St. Croix have both used the option of monitored marine-culture for environmentally sustainable and economically feasible production systems. "Although these programs comply to consumer demands and relive pressures on marine food sources, there are still concerns with the overall status of coastal ecosystems" (Cesar et al, 2000). Therefore in tandem with these types of initiatives, integrated coastal zone management and development policies have been initiated to address coastal development in order to minimize the impact of marine and land-based pollution."

Through zoning techniques, preserved areas and recreation areas are designed to reduce damage to resources and threats to environmental quality. Specifically, Buccoo Reef in Tobago, has suffered from the improper use of anchors; causing major reef damages. In

Tobago, where marine tourism activities are concentrated, an initiative undertaken by the Department of Marine Resources and Fisheries have counteracted the problem through the installation of moorings used as tour operators and guidelines (Environmental Management Authority, 2004). Though Trinidad and Tobago has made some progress in protecting coastal and marine resources, research suggests that they adopt the blue economy approach (Appendix 2).

FRESHWATER RESOURCES

While the USVI is rich in biodiversity, water demands create deficits. Historically, rain water harvesting has been a principle source of potable water for residents due to nonexistent supplies of surface water. Desalination satisfies most water needs in public water distribution systems, but concerns for potable water and wastewater disposal continue for the island. With increased urban and residential developments, imposing intense land-use effects, efforts in preserving native flora through propositions of native plant species have supported the conservation of St. Croix's freshwater resources. Research supporting local plant nurseries and native plant growth for personal landscaping have led to the understanding of the relationship between nature and local economy. Programs that promote using native, ornamental plants within their native range have recently become successful in several states and a similar approach in the US Virgin Islands is strongly advocated by the US Forest Service (Overton, et al., 2006).

Discharge from industries, improper disposal of wastes, nonfunctional waste treatment plants and the disposal of solid waste are troubling in the means of surface sources and human health. Potable water emanates from surface sources, freshwater resource management and mitigation for improve water quality is essential to life. Land-use changes, which are the results of forest fires, burn agriculture techniques, land demand for development, and inappropriate land use practices have all had negative impacts on water resources. Issues related to water quality in many nations including Jamaica and Trinidad, yields discussion of management to attain sustainable economic development with positive impacts on human health and ecosystem well-being.

Trinidad and Tobago has a greater population than the U.S.. Virgin Islands, therefore they have been exposed to more hazards caused by development, land-use practices and eco-tourism related issues. The quantity of public water supply thus becomes a significant area of water resource management. As a response, their government has adopted water resource functions through a series of several acts such as: Water and Sewage Act (1965); Waterworks

and Water Conservation Act (1994)' and The Environmental Management Act (1995). The formation and approval of these approaches acted as a major step for the country's water sector.

Subsequently, other initiatives have been taken to address freshwater resources that are more detailed and achievable in smaller steps (more likely aimed for communities like St. Croix) that include:

- *Provision of commercial service facilities for agriculture and wastewater treatment fascinates and institutions. Permits issues will be used to regulate levels of pollutants being discharge into water bodies*
- *Implementation of Water Pollution Rules (2007) which reduces volume and concentration of pollutants discharged into watercourses; resulting in improved water quality.*
- *Development of water quality monitoring programs that ensure the protection of water quality in rivers, seas, swamps and beaches.*
- *Increase education and awareness to sensitize the public on water related issues (scarcity, health etc)*
- *Establish affordable potable water to the public through installation of improved infrastructure*
- *Develop/ constitute additional desalination plants that upgrade water treatment and lower cost*
- *Upgrade wastewater management systems and sewage systems (Government of Trinidad and Tobago, 2012).*

While many of these initiatives are still in developing stages, both quantity and quality of freshwater have been rapidly depleted through overuse and pollutions. Selected literatures advise a shift toward initiatives and lifestyles that encourage less dependency on freshwater sources and more responsible stewardship of freshwater resources at all levels. Responsibility to reduce freshwater demand has a large role in the accomplishment of sustainability. Water reuse can be encouraged and is most realistic for water demands associated with irrigation and agricultural purposes.

LAND RESOURCES

Many issues and challenges facing the USVI are similar to those of other Caribbean islands and nations. There is an increasing demand for developing "vacant" land, as need for

economic growth and creation of jobs increases (USVI, 2006). Development in the forms of hotels, golf courses, condominiums and other human-induced infrastructures puts stress on remaining land resources. Loss of landscapes to development and its induced threats on other habitats like watersheds are critical problems for small islands. The natural topography have natural systems that work simultaneously in keeping ecosystem balances. For example, natural slopes provide areas for water infiltration and help prevent soil erosion. Development on steep slopes leads to soil erosion, resulting in damaged watershed and off shores coral reefs; leading to further damages for local fisheries and tourism (Beller et al., 1990).

Fragmentation is recognized as a threat because it degrades the quality of land by creating more edge habitat. Constantly changing edge habitats and different climate conditions like corridors and developments, make edge habitats hazardous for local species. These areas are highly susceptible to many invasive plants and animals. Thus, roads and population growth contribute greatly to vulnerability through fragmentation of forest and forest types, with higher potential for increased hazards (Daley, 2009, Meddens et al., 2008, Riitters et al., 2004). Changes in land-use have been inadequately measure for so long that poor planning decisions have been made as a result. Initiatives that have been made have suggested distancing roads from forest areas as well as limiting the use of land for extensive agriculture. Through threat analyses performed under the FIA (Brandeis and Oswalt, 2007), recent threats were represented in areas that are centered on existing developed infrastructure. Industrialized areas of the island that are categorized as threatening existing developments are power plants that discharge pollutants; affecting wetlands and coastal areas.

“Of its total land area of 512,800 hectares, Trinidad and Tobago has an estimated total arable land area of 75,000 hectares with an additional 47,000 hectares under permanent crops, while 11,000 hectares are under permanent pasture. Wetlands are said to occupy about 23,500 hectares, and forests 248,000 hectares of which 77 per cent is State-owned” (Government of Trinidad and Tobago, 2012). Maintaining and magnifying economic and environmental values of land resources in terms of food production, food security, biodiversity and sustainable agriculture development have critical importance to the island. Most aspects of management are dependent on the planning and use of its land sources. The combination of competing demands and a lack of comprehensive land use planning have led to overuse and degradation of land masses. “The country’s physical planning is governed by the Town and Country Planning Act (Chapter 35:01). In keeping with the requirements of that legislation, the first National Physical Development Plan (NPDP) was prepared in the early 1980s and became statutory in 1984 with

a 20-year lifespan, providing a broad policy framework within which more detailed regional and local area plans were to be prepared to guide development on the ground” (Government of Trinidad and Tobago, 2012).

The Planning and Facilitation of Development Bill is part of a project that will ultimately result in the creation of plan that constitutes detailed risks of all areas with priorities that mark attention that delineates the need of spatial planning frameworks. In addition, it will assist in correcting the disconnect between socio-economic and physical planning detentions that will allegedly result in altering the delegation of powers. All in all, strong regulations of specific areas with improvements in protection and mitigation are in favor for improvements in revenue and conservation if and only if substantial contributions from citizens and government are made. The importance of clear and consistent regulation play a significant role in steps toward sustainability. Briefly discussed in previous sections of this chapter, continuous land degradation caused by human activities has increased the island’s vulnerability to invasive species; which have significant impacts on ecosystem functions. Non-native plant species compete with native species for sunlight, nutrients and water; and in most cases are extremely aggressive through the process. A lot of research has been conducted on invasive species, resulting in biological threats stemming from land-use effects and poor management.

ENERGY RESOURCES

Islands are extremely dependent on fossil fuels, and because of their geographic isolation they tend to have very high electricity costs. On the other hand, islands typically have abundant renewable resources - wind (examples in Barbados), hydro (examples in Dominica, Dominican Republic and St. Vincent); and solar energy are seen as potential alternative sources of energy. Installations of these types of energy farms do not involve extensive habitat destruction in comparison to importing fossil fuels. Like many island communities, the USVI is almost 100% dependent on imported oil for electricity and transportation, leaving the territory vulnerable to fluctuations that have serious impacts on economy and the population. Through projects like EDIN, an international partnership focused on addressing the unique energy challenges islands face, clean energy initiatives are the focus to help the territory reduce is dependency on fossil fuels.

“EDIN-USVI is a long term investment in a more secure, sustainable energy future. It represents a sustained collaborative effort to:

- *Minimize the territory’s dependence on fossil fuels*
- *Enhance energy affordability and reliability*

- *Reduce environmental threats associated with global warming*
- *Build a thriving clean energy sector that generates local green jobs*
- *Preserve the natural resources that are the lifeblood of the islands*
- *Lead the way toward a clean energy future for the USVI and the Caribbean” (EDIN-USVI, 2011).*

EDIN-USVI aims to lead the transition toward a clean energy economy and advance in goals toward reducing energy consumption and cost. In hope for high success rates, wiring collaboratives in specific groups have been adopted as an integrated deployment strategy that incorporates the broad range of energy efficiency measures and renewable technologies in the comprehensive plan. The implementation phase of the plan is ongoing, and a great deal of work needs to be done. But, the most important and hardest step towards sustainability ,building public and international support, has already happened.

Looking at Trinidad and Tobago, the country has been dependent on oil for a long time. “Oil and natural gas have sustained economic and infrastructural development of Trinidad and Tobago consistently, from 1908 when commercial production was established until present” (Government of Trinidad and Tobago, 2012). Trinidad and Tobago, however, is unique in the sense that they foster their own oil reserves and production. But, because they have had the luxury of sustaining themselves and providing oil for other countries, the indefinite dependency on oil has resulted in substantial depletion in some of their reserves. In reality, this will result in pressures in economic decline due to production rates and availability. Mainstream use of oil and gas has had serious impacts on their environment. Heavy dependence on combustion of these resources for oil extraction has had an enormous impact on land, waterways, air and human health.

By gathering data and analyzing it through the breakdown of where most resources were used, “the Ministry of Energy and Energy Affairs has developed a Draft Renewable Energy Policy for Trinidad and Tobago, exploring alternative forms of energy for use in Trinidad and Tobago. This in turn would impact on:

- 1) *the carbon dioxide output from the burning of the fossil fuel which would be significantly reduced*
- 2) *the amount of oil and natural gas used in the production of energy locally, in the form of electricity, which would also be minimized, hence conserving the current oil and gas reserves; and*

3) the exploration, extraction, refining and exportation of oil and natural gas by greatly diminishing in particular, atmospheric, land and water discharge, dust emissions and interruption of the flora, fauna and other biological cycles” (Renewable Energy Committee, 2007).

This framework for renewable energy, “Framework for Development of a Renewable Energy Policy for Trinidad and Tobago,” proposed in January 2011, focuses on three sources of renewable energy to supplement the use of natural gas internally as a country. The three forms of renewables being looked at for future development include solar energy, wind energy and biogas from combustion of refuse from the landfills (Government of Trinidad and Tobago, 2012)

Energy transformations involve a shift in how the entire community thinks about the use of energy. Each milestone they reach is an opportunity to showcase the technical viability of clean energy technologies, thus influencing change on global scales. Trinidad and Tobago has taken major steps in shifting energy production and use, however means of measurement are not quite clear in production and the demand for construction may potentially affect environmental and economic sectors of the community. The energy balance shall be reviewed to determine current assessments of applications through efforts that promote collaboration between local and regional partners facilitated by the United States Department of Energy.

TOURISM RESOURCES

As one of the most tourism-dependent areas of the country, it is crucial to ensure preservation of valuable natural and cultural resources that determine future successes. While the Virgin Islands have their own Department of Environmental Protection, it is still overseen by the Environmental Protection Policy - being held to the same standards as all of 50 states and territories. In the USVI however, there aren't many unique protection laws that ensure the preservation of natural and cultural resources. Sustainable tourism is key for socioeconomic transformation such that boosting economic diversification and competitiveness; and balancing environmental social and human development can enhance local communities and preserve natural and cultural assets.

Being one of the most desired destinations to visit, it is important to preserve natural amenities that host popular activities like snorkeling and scuba diving, in order to increase economies and prolong traditions. One of the greatest concerns across the region is the widespread construction of hotels and marinas, especially along coastlines that typically create critical problems for wildlife and associated habitats. Many tourists sites are operating beyond

their carrying capacity; and with increased construction and inadequate planning policies, an influx of tourists frequently overtax public services, reduce local food stocks and water supplies and generate large amounts of waste that may not be accommodated by local facilities. As a result, other environmental and social problems associated with these degrading factors often lead to increased, external issues that affect social and economic sustainability.

Trinidad and Tobago has many tourism products that have potential to ensure sustainable socioeconomic transformations. Sun and sea tourism attractions will always be important assets to the tourism product. Trinidad and Tobago have supported opportunities to develop eco-tourism by harmonizing natural capital with economic development. “The development of both traditional and relatively new tourism products are guided by the National Tourism Policy of Trinidad and Tobago (2010). The policy recognizes the differences between the product offerings of each island and therefore, its efforts are geared towards building on and optimizing this diversity so that the islands’ tourism products are complemented” (Government of Trinidad and Tobago, 2012). For example, the country is recognized for its cultural diversity (known for having one of the best carnivals in the region), thriving businesses and idealistic island-environments; capturing both leisure and excited aspects of tourist attraction.

In their tourism sector, policies incorporate environmental consideration to ensure that there is a balanced system. Below are some of the following considerations being addressed:

- *Develop a management and monitoring system that is required to ensure sustainable development of the sector*
- *Continuously monitor sensitive areas prone to high vulnerability*
- *Require to ensure that environmental impact assessments are conducted for all tourism-related projects*
- *Evaluate and consider the impacts of proposed projects on all sectors of community*
- *Incorporate management agencies to develop a country-wide strategy*
- *Identify optimal allocations of land for tourism development*
- *Work towards developing regulations that will protect ecological factors*
- *Encourage and promote the use of sustainable practices and strategies in all processes of tourism projects*
- *Develop initiatives fostering a more environmental aware population; with the goal of reducing carbon footprints for the local travel and tourism industry*

To address these concerns, The Draft Eco-Tourism Policy (2010) has been credited as a protection area management strategy that involves community based programs linked to ecotourism, capacity building, education and increased public awareness. Programs like nature camps, nature walks, wildlife viewing and river cruises, adventure sports; fishing and other common tourist activities that include nature and education of natural areas will lead toward local sustainability.

Through development of a variety of products linked to ecotourism, heritage and the country's cultural diversity, the country has not only sustained their economy but also revitalized their landscape; such that it has resulted in regrowth and positive food production of natural vegetation.

BIODIVERSITY AND PROTECTED AREAS

Biodiversity is the root of all living organisms including the genetic make up of animal and plant species as well as terrestrial, aquatic and marine ecosystems that they are a part of. It makes up the structure and predicts the function of ecosystems and habitats that support essential living resources that provide citizens basic needs of food, shelter, medicine, oxygen and clean water. Priority on conservation and protection are catered to economy and taxonomy resulting in unequal distribution of attention with regards to concerns for protection. St. Croix for example is more rural with extensive agriculture, while St. John enjoys the protection of the US National Park Service covering roughly two-thirds of its area because the island attracts more tourists. Mentioned in Chapter 3 of this study, the Virgin Islands have been important for human colonization and settlement throughout history.

The demand for space by a fast growing population resulted in extensive loss and degradation of natural ecosystem in the USVI, where sprawling residential communities and commercial centers have been replaced or fragmented much of the native forests (Platenberg et al, 2005). Resorts, condominiums and marinas have been added to coastal wetlands where marine recreation activities have damaged mangrove habitats, coral reefs and seagrass beds. Human development has led to a continuous increase in pollution that ultimately contaminates wetlands and marine environments in addition to the introduction of exotic, alien species that have had major impacts on wildlife and habitats.

“On an international scale, human activities have raised the rate of extinction to 1,000 times its usual rate. In Trinidad and Tobago, expansion in industrial activities, mineral and lumber extraction, housing provision and road network expansion are just some of the major

activities that have resulted in significant deterioration of the natural environment” (Government of Trinidad and Tobago, 2012).

Agriculture, fishing, recreation, tourism and culture have specific importance to all sectors in both Trinidad and St. Croix. However, the increase in resource consumption and population have led to rapid loss of biodiversity and contribute to the depleting capacity of earth's natural systems to provide natural goods and services that communities depend on. For places found in the Caribbean region, high biological diversity within a small geographic area implies that relatively small losses in natural areas can have rather large impacts on ecosystems. In Trinidad and Tobago's continued efforts towards sustainability, they found that biodiversity can be protected through the establishment of protected areas; such that they act as management tools for protecting, conserving and managing natural and built heritage, critical to sustainable development. In the case of Trinidad and Tobago, “Trends indicate that the present rate of exploitation of Trinidad and Tobago's natural biodiversity is detrimental for sustainable development. For instance, the national current hunting rates have resulted in a serious decline of the game animal population, while fishing and forestry data also show that these resources are in decline. In addition, development pressures and increasing pollution are imposing an additional burden on ecosystems and their ability to provide their services” (Government of Trinidad and Tobago, 2012).

Action is being taken to protect biodiversity in Trinidad and Tobago. The first step has been to accurately catalogue the species diversity of the country, which has been done through collaborative works between the University of the West Indies in Trinidad and the Oxford University of the United Kingdom. Progress in preservation has been done through these initiatives:

- *Adoption of the Protected Areas Policy (2011);*
- *Preparation of a Draft National Biosafety Network for Trinidad and Tobago;*
- *Declaration of the Buccoo Reef as an Environmentally Sensitive Area;*
- *The EMA has recently undertaken efforts to conserve the country's local biodiversity by conducting an assessment of the status of the biodiversity resources, compiling existing national biodiversity in Trinidad and Tobago and undertaking a gap analysis of the biodiversity information. The aim of this was the synchronisation of national biodiversity information to produce guidelines and protocols for the integration of biodiversity conservation issues into national plans, programmes and policies (Government of Trinidad and Tobago, 2012).*

Although these actions are making progress in protecting biodiversity through protected areas, emphasis needs to be placed now on the protection, strengthening and enforcement of policies and regulations through local and national approaches in actions and strategies.

TRANSPORTATION

Like many island communities, the USVI is almost one hundred percent dependent on imported oil for electricity and transportation, leaving the territory vulnerable to global oil price fluctuation that can have devastating economic effects. Increased carbon emissions have direct correlation to rising sea levels, intense hurricane and widespread losses of coral reefs, with additional effects on the social environment. The burning of fossil fuel to generate energy for transportation, electricity and other residential, commercial and industrial processes result in large amounts of greenhouse gas emissions; therefore there is an obligation to reduce emissions. Given the vulnerability of small islands, the US Virgin Islands in particular has a responsibility to act.

The extensive and concentrated number of restaurants, hotels and cruise ships found in island tourist destinations produce significant quantities of waste. Waste generated by development and transportation processes are usually disposed improperly, contributing to public hazards and environmental degradation. Based on successes of alternative energy programs, the Virgin Islands have joined efforts in developing a curriculum that promotes the use of alternative fuels and environmentally friendly transportation strategies.

“Trinidad and Tobago has approximately 630,000 vehicles in the country and increases are projected at approximately 30,000 annually. GHG from the transportation sector alone have increased by 278 per cent over the period 1990 to 2006”(Government of Trinidad and Tobago, 2012). In comparison to other countries in the region, Trinidad and Tobago has the highest motorization levels relative to its population, identifying transportation infrastructures and urban spatial planning to be unparalleled to the rate of demand; ultimately resulting in severe congestion, pollution and prolonged in the context of travel time. As a small developing country that faces extreme issues of poverty and human development, Trinidad and Tobago’s efforts to minimize severe condition can be questioned. However, during times of rapid development and heightened global stressors, the country has committed to “green” visions in their transportation sector.

“Trinidad and Tobago has prescribed several remedial measures. Specifically, the MTPF 2011- 2014 outlines a strategy for the “Greening” of the Priority Bus Route, which is the major

East-West road network artery utilized by public (buses) and private (maxi taxis) mass transportation. The Priority Bus Route is in the process of being converted into a “Green” route which envisions:

- *all vehicles using the route being powered by either low carbon emission fuels (CNG), have zero emissions (electric power) or a combination of electric power and fossil fuel (hybrid power), and;*
- *(all street and traffic lights along the Route being converted to ones that are solar powered)”(Government of Trinidad and Tobago, 2011-2014).*

New technologies tested in places that have resources that generate biofuels, like Trinidad, can provide the local transportation sector with alternatives in a carbon cycle that eventually lead toward consumption alternatives. Initiatives like these however, are short term economic savers still produce greenhouse gases. Although emissions are more environmentally sensitive, safer and cleaner actions are accommodated in working toward a sustainable future.

Despite new fuel technologies, Trinidad and Tobago has continued to enhance infrastructure developments associated with personal vehicles, congestion, travel times and alternative transit methods. “The Government recognizes the need for a more efficient public transport and simultaneously improving public perception for its use. Consequently, the transportation sector in Trinidad and Tobago has recently been improved to increase the availability and accessibility of public transport to the population; attracting more of the population towards the utilization of public transportation” (MTPF 2011- 2014), thus reducing carbon emissions.

Chapter 6: Rebuilding Relationships Between Locals and Nature

CONCERN NO. 2

Sustainable development integrates the dynamics of social, economic and environmental concerns of the community. As we know, change in any one of these three pillars will have an impact on the other two pillars of sustainability. For social concerns, sustainable development is an approach to improving the quality of life, and we also acknowledge that human well-being is linked to economic and environmental well-being. Human well-being cannot be sustained without healthy relationships with the environment which promotes sustained economy. Social connections to economy, such as work quality, housing conditions, and income are essential connections. . Understanding and accepting the relationships between the three

pillars of sustainable development can guide social actions toward a more consistent sustainable community.

Mending the relationship between humans and the environment can be a starting point for the development of the physical forms in a community. But a community is more than just a physical form. It is composed of people as well as the places where they live and carry out their traditional practices, culture and historical heritage. This poses the question of social sustainability versus environmental sustainability. A socially sustainability community promotes a society that is equal, and does not exclude the promise of a decent life for current and future generations. Rebuilding relationships between society and nature is important in preserving nature, traditions and culture so that communities are affected by positive economic, social and environmental outcomes. By discussing the six themes that highlight the basic features of social sustainability: quality of life, equity and social justice, inclusion and access, poverty eradication, future focuses and participatory processes, improved approaches to social well-being can support proactive approaches in sustainable development for healthy communities. Additionally, family structures, including members' status, their associated roles, functions and interpersonal relationships, also have an important impact on most social conditions which can affect economic fortunes, political decision-making and sustainable futures.

QUALITY OF LIFE

The concept of social sustainability is about more than just providing for our social wellbeing. It is about sustaining a high level of social wellbeing in the long term and ensuring stability and value of life. Coastal living, however, is a unique challenge to individuals and communities. When a community's culture and economy are closely intertwined with coastal and marine ecosystems, a decline in the condition of this ecosystem can mean trouble in both sectors. For example, tropical storms and hurricanes cause direct issues related to public safety in addition to a dramatic change in habitat. Disturbed habitats can subsequently form short or long-term health consequences for local ecosystems, particularly where human disturbance has reduced the capacity for resilience (Greening et al. 2006; Conner et al. 1989). As a result of some of these large-scale impact events, the culture, economy and landscape of communities have potentials to transform, due in part to changes to historic connectivity between communities and ecosystems.

The quality of life is also impacted by direct human activities. Human-induced events along coastlines such as development, water/air pollution resulting in harmed habitats and dismantled ecosystems can reduce the health and productivity of ecosystems, making life more

difficult for residents of coastal communities (Arata et al. 2000; Fall et al. 2001; Picou et al. 1992). Human-induced events can threaten the short term health of people (Diaz 2011; Meo et al. 2009; Suarez et al. 2005); such that addressing basic needs like adequate food, water and shelter, have become alarming concerns in context of sustaining life. One of the most commonly used measurements of the quality of life within a country is its Human Development Index (HDI). The HDI combines life expectancy, educational attainment and income into an index that describes public growth; emphasizing that people and their capabilities should be the ultimate consideration for assessing the development of a country. Trinidad and Tobago, had a relatively high HDI in 2011, placing the country at 62 of 187 countries, particularly discussing the rapid increase of life expectancy at birth and mean years of schooling. As a result, in the years 1980 and 2011, Trinidad and Tobago not only increased the quality of life, but also their net income per capita by 62 percent. Compared to St. Croix, the dependence of imported goods increases the cost of living, and reduces life expectancy as well as life quality. The authors of the Millennium Ecosystem Assessment (2005) argued that “basic material for a good life” must be considered when assessing the status of human well-being. There are essentially three categories of measures of basic needs: food security, water security and housing security.

Trinidad and Tobago’s high human development index is the result of their Government’s commitment to poverty eradication, education and health. These categories are identified as high areas of concern, reflected in Trinidad and Tobago’s high expense on social sectors such as education, health, housing and social services. “Roughly 30% is allocated to the social services sector compared to the 9% and 8% provided for economic services and public services” (Government of Trinidad and Tobago, 2012). The government recognizes citizens’ health and wellness as a critical component to development, therefore focuses on creating an efficient and modern health care system that regulates, monitors and improves the quality of health care. Health, both physical and mental, contributes tremendously to an individual’s well-being. The economic and social cost of impaired health can be significant for both the individual and the society in which they live (Mariotto et al. 2011; Heidenreich et al. 2011; Soni 2009). For this reason, the improvement of human health is a common policy goal. In St. Croix, there are 28 health concerns and disparities in the USVI. The leading health concerns in the USVI centered on issues of access to quality health services for 1) heart disease and stroke, 2) cancer, 3) diabetes, and 4) HIV infection. It is no surprise that health concerns are predominately associated with concerns about limited resources and high costs, such as the Medicare gap, high cost of insurance and co-pay, large number of uninsured residents, and the

overall cost of services. Trinidad and Tobago share similar concerns for their population, thus The Social Sector Investment Programme adopted in 2012, is one of several programs that will enable Trinidad and Tobago to develop a modern high quality health care system that benefits current and future generations. There are initiatives that include upgrading hospitals and health facilities, further training for doctors and nurses are additional initiatives for improving the quality of life that are more common in sustainable frameworks.

For people to gain necessary achievement of personal, cultural and social goals, some degree of learning is required. Through an education system or program, people gain knowledge and learn the practices and skills required for successful performance of daily social and economic activities (Doyal and Gough, 1991). Basic knowledge and skill sets, such as reading (i.e., literacy), are necessary to achieve requisite degrees of autonomy in modern society (Doyal and Gough 1991). In fact, research indicates that well-being typically increases with each increment of educational advancement (Keyes 1998); generally correlated with higher income levels of both individuals and population, reducing stress and enhancing an individual's value of life. At the population level, higher educational attainment has been associated with "better labor market outcomes including higher earnings, lower poverty and lower unemployment" (USDOC 2011:17). Education is a challenge for the Virgin Islands and to be to be competitive in the knowledge-based economy, it requires a highly skilled labor force and a solid educational infrastructure to train future generations of knowledge workers. Educational attainment in the U.S. Virgin Islands is far below U.S. national averages, with nearly 40 percent of the adult population having less than a high school diploma. In Trinidad, policies that ensure accessibility to quality education for every child is strongly enforced. Currently, priority attention is given to the development of new, modern subject areas that are better aligned to current and future labor market needs, and methods of learning that are more specifically focused. The integration of modern learning technologies in school systems will play a significant role in creating a more relevant and productive workforce to expedite and sustain the economy. In addition to adequate support for basic education and skills development, a knowledge-based economy requires continual upgrading of skills. One way to promote continual upgrading is through 'customized training,' which involves the private sector, educational institutes and community organizations (Torjman 1999b).

On the international level, the U.N. Housing Rights Programme monitors a variety of measures related to housing security, such as available housing stock, tenure, presence of plumbing, age of housing structures, and cost or affordability (Tsenkova and French 2011). In

the Virgin Islands, a number of factors combine to create significant challenges to affordable housing. Due to the geography and size of the islands, the supply of buildable land is limited and the cost of construction materials and labor is relatively high due to limited supply. The main problem for St. Croix is the production cost associated with public housing. High material costs affect both rental and home ownerships, resulting in even higher insurance costs. The limited income of the Virgin Islands residents restricts affordability, thus creating further social challenges. Similar to St. Croix, Trinidad and Tobago face the same types of challenges such that there is an insufficient supply of suitable housing that meets current and future needs, as well as the issue of affordability; which is directly linked to the imbalance between supply and demand of the population. Through the cooperation of various small private groups, focusing on the poor, low and middle income groups of the population has resulted in the following strategies:

- *Review existing financial arrangements such as the provision of grants, subsidies and mortgages to further alleviate the issues of affordability and accessibility;*
- *Transform squatter settlements through upgrade and regularization, into planned, sustainable communities to reduce the plight of squatters in accordance with the Squatter Regularization Act No. 25 of 1998; and*
- *Review existing legislation and adopt public awareness initiatives in order to contain further squatting (Government of Trinidad and Tobago, 2012).*

Another important part of well-being is safety. Safety can mean both safety of person and safety of property from actions or events that cause damage, harm or impede one's access to needed resources (MEA 2005). Crime can compromise well-being both at the individual and the community level. At the individual level, persons who become victims of crime may suffer physically, emotionally or financially (McCollister et al. 2010). High crime rates can also take a toll on community level well-being by increasing the cost of the criminal justice process (e.g., prosecution and corrections) (McCollister et al. 2010). Research indicates that life expectancy is higher in areas with lower crime rates (Poudyal et al. 2009); also indicating that high crime rates may erode social connectedness in a community. Safety of person and property are frequently threatened by natural elements impeding access to social services and security. In the Virgin Islands, as in the rest of the nation, the criminal justice system is in dire need of re-creation. In order to address the cause of crime, healthier economic systems that can provide well-paying jobs and economic stability for all who need, are important in the context of

poverty and economic insecurities. Economic insecurities can lead to domestic violence and child abuse, which in turn, reflects violent behavior in youths. In Island communities, the rate of criminal activity is often highly concentrated on issues pertaining to local themes like affordable housing, gang affiliations and money discrepancies. In both St. Croix and Trinidad, where the cost of living is expensive, drug and gang affiliated crime has become more frequent, further destabilizing the economy. In 2012, the Caribbean Human Development report emphasized the need for government action in addressing citizens' security concerns. In Trinidad and Tobago, a noteworthy initiative in the Government's fight against crime is the Citizen Security Program. It is a community based crime preventions program that seeks to reduce crime and violence by addressing risk factors like: rearms use, unsafe neighborhoods and violent behavior. The components of the program include: strengthening National Security by improving plans and management prevention projects; strengthening police series to increase public confidence and comfortability by higher standards of performance and training; and creating community-based prevention measures (Government of Trinidad and Tobago, 2012). Overall, improving the quality of life of citizens through the creation of a safer and healthier environment in which citizens can live valued lives without external disturbances is important in social sustainability. Developments and programs that reduce hazards pertaining to international and local crime can have positive impacts on local economy such that there are more opportunities geared toward self-sufficiency and poverty eradication.

EQUITY AND SOCIAL JUSTICE

Social equity is a broad topic that includes both individual and corporate responsibility. Common in the longstanding discussion of social equity, are the ideas of people's "wellbeing," "quality of life" and "respect," - remembering the people and communities behind the products and services we use. Equity recognizes that the quality of life can vary significantly across certain areas of the populations. Relative to fairness, equity refers primarily to unjust inequalities among people. Inequalities are especially unjust when particular groups (gender, race, birthplace, sex, etc.), are disadvantaged. The term is the most common requirement for social sustainability since inequity and social hierarchy are related to instability and conflict. In the case of St. Croix, unequal social standards contribute to high crime activity because people do not have sufficient wages to live. Insufficient wages reflects negatively on youth education, crime, health and actions. Youth crime statistics can be lowered by early intervention and quality care at the start of a child's life, which can be impacted by education, income, housing,

community, accessibility and affordability. The importance of social equity shall be considered in future decisions in order to protect culture and heritage; and reduce factors that cause economic and social impairments.

While earnings are lower in the territory, costs are significantly higher. As an outlying territory, Virgin Islands families must purchase more expensive goods, energy and other necessary items. Those increasing financial pressures have placed many families in the territory in a financial crisis. According to the 2000 U.S. Census, 35 percent of families with children live below the federal poverty threshold in the territory, and 41 percent of families with children under the age of 5 are in poverty. Current trends in poverty suggest that progress is made with poverty reduction. Expenditure by federal government has been linked to economic growth and can be vital to ameliorating financial stresses due to disparities at the county level (Liu and Hsu 2008; Warner 1999). Local governments have unequal capacity to generate revenue, depending on location and the wellbeing of residents. Economic security of households in a county influences economic security at a community level (Osberg and Sharpe 2002). For instance, if within a county there are large numbers of households with high incomes and large numbers of children in poverty this may be indicative of issues with income distribution, possibly related to ineffectual social welfare programs.

INCLUSION AND ACCESSIBILITY

Equity stems from notions of public inclusion and access. Social exclusion refers to the way poverty, deprivation and related social problems alienate people both physically (through inequitable access to transport, jobs or public services) and socially from the benefits and opportunities afforded by social and economic participation. Moving towards social sustainability requires an increase in the level of access to resources, services and opportunities for all subgroups of a population. By addressing levels of access to all aspects of life, from employment, housing, living conditions, services and facilities to opportunities for public participation; and cultural and political structures, one can move toward social sustainability. St. Croix is in a unique situation because on the surface, the access and inclusion to these factors appear equal, when in fact, the economic factors clearly show that St. Croix suffers from public exclusion and insufficient accessibility to public resources. It is a situation where a select few control the majority of resources. Where decentralized decision-making affects the quality of life of local communities, access to social services becomes an important factor of quality of life because the support of the government supplying services can vary. Access to basic social services and healthcare are required for citizens to reach fully appreciate the value of life. Thus,

many well-being assessments have included a type of indicator related to the accessibility of social and health support services. For those people who cannot reliably secure resources for adequate levels of well-being, access to social services can help them sustain or even recover from adversity.

“Creating conditions for participation and equity or greater inclusiveness and equity in Trinidad and Tobago’s socio-economic development is one of the fundamental principles underlying the Government’s economic and social transformation strategy articulated in the MTPF 2011-2014” (Government of Trinidad and Tobago, 2012). Increasing the availability of work programs and creating social safety programs that target excluded populations is a proactive initiative promoted by Trinidad. The Poverty Reduction Program for example, is intended to provide persons living in poverty with an opportunity to undertake business venture or skill training under the support of the Government. Through this approach, it is expected that vulnerable citizens will have the opportunity to become self-sufficient and empowered to live sustainable lives through small businesses and learned skills. By providing populations with opportunities that normally wouldn't be granted work opportunities allows people to live healthier, longer lives with overall higher living conditions. St. Croix lacks basic infrastructure with the necessary amenities and opportunities for investment in order to create sustainable communities.

Providing new economic opportunities will create employment in surrounding communities, providing opportunities for improving the quality of life, promoting self-development and shaping a brighter future for generations. “Management systems (inclusive of policy, regulations, compliance, environmental protection), would ensure human security and be the hallmark of excellence as citizen safety and security are pursued in tandem with sustainable development. The OSH system will comply with world standards with respect to health and safety issues such as NEBOSH Health and Safety System of the UK and the OSHA system of the US. for Trinidad” (Government of Trinidad and Tobago, 2012).

POVERTY ERADICATION

St. Croix’s poverty rate is higher than the national average. The island also has the highest cost of living in the nation. Increased personal earnings and income both contribute to positive outcomes of successful economic development. Higher incomes mean greater individual wealth and prosperity, which result in higher spending on demands and services. In 2006, the estimated per capita income of island residents was just below \$20,000, slightly higher than half the U.S. average. The problem of low income is further compounded by the

relatively higher costs of living of on the Virgin Islands. This gap has steadily widened as real (inflation-adjusted) incomes in the Virgin Islands have declined slightly over the past 15 years (U.S. Census Bureau, 2000). The average income of the island is low because of high unemployment, lack of opportunity and low living wage standards. Looking at the graph provided by the US Census Bureau, it is evident that the income distribution of the Virgin Islands is highly skewed; suggesting that more than 25 percent of all households live on less than \$10,000 per year.

In addition, poverty data demonstrates a much more dramatic portrait of the economic reality of the Virgin Islands. Roughly 32 percent of Virgin Islands residents were living below the poverty level in 1999, up slightly from 27 percent as reported in the 1990 Census. Far more Virgin Islands residents are living in poverty, regardless of age. Almost half the children age five or younger are living in poverty in the Virgin Islands—two- and-a-half times the U.S. national rate. More than three times as many elderly persons (65+) live in poverty in the Virgin Islands than do in the United States overall. The greatest concentrations of poverty are in the interior of St. Croix Island and in the coastal areas near Frederiksted and Christiansted, where the majority of the population is associated with low standards of living, increased crime, lack of transportation and access to opportunities and services.

The Affordable Care Act that is recently being developed for the territory identifies the importance of territory inclusion during national decisions, paying close attention to the disparity in poverty levels and the cost of living in the territories. In lieu, the application of local inclusion will impact efforts to expand health coverage to territorial residents; thus suggesting an increased quality of life that has limited social impacts. This program, along with similar programs identified in Trinidad and Tobago's framework, represents a wide range of social programs that are aimed to support the unemployed and the poor. The programs are concerned with children, single mothers, elderly and low-income households. In addition, other programs address skills and opportunities for entrepreneurship for temporary work programs. These types of initiatives are steps in the right direction to restructure public outlooks and security. Beyond this however, the emphasis is on increasing economic inclusion and participation by helping people to raise themselves out of poverty through education, training, skills building, and the development of labor intensive sectors and community driven sectors. Based on data income, these initiatives have decreased Trinidad and Tobago's poverty rate by over 5 percent in 2011.

FUTURE FOCUS

It is understood that the ability of future generation to live healthy and fulfilling lives is not undermined by the decisions and actions undertaken by the current generation in pursuit of their own wants and needs. Environmental justice requires special attention to low-income and disadvantaged communities which are disproportionately at risk and traditionally likely to receive fewer benefits from natural resources and development efforts; but can learn to be self sufficient through education of cultural factors that have had successful economies and the sustained populations' standard of living during the past. The greatest challenge facing historic preservation as a learning tool in the U.S. Virgin Islands is the challenge of linking preservation goals to individuals who are not fully committed to transformations. The most direct route to achieving preservation goals is to begin telling all sides of the story; to showcase the true identity of those individuals who built historic towns, as promoted by the National Trust for Historic Preservation's program "This Place Matters." It is noted that the most endangered "species" of structures in the U.S. Virgin Islands are the small wooden vernacular residences that make up a large portion of the historic towns. Residences tell a rarely chronicled history of the African descendants that were freed and consequently built these distinct and exquisitely crafted structures. In essence, these buildings are representative of the transference of wealth from one generation of African descendants to another, many of which are still presently owned by local families. Small investment of typically \$25,000 to \$35,000 per structure, these distinctive "mortise and tenon", hand-hewn residences could be restored and would have a great impact on the overall streetscapes of historic towns (Lunn & Co, 2011).

Concerning the history the relations are more important than buildings. To the minds of the younger generation of the USVI, the ruined buildings reflect the ruined relations, so rebuilding should reflect rebuilt relations. To preserve the built environment could be a burden and a restriction to a development desired by the younger generation (Lunn & Co, 2011), but revitalizing/restoring historic landmarks and buildings creates a new economic market that pertains to an expansion of tourism; without further damage to landscapes from "new" developments. Educating younger generations about their culture through infrastructure leads to an awareness of their own importance in a community, as well as natural assets that support successful economies and environmental regrowth provided by past generations. Initiatives that enhance historic preservation like installments of environmentally friendly infrastructure and techniques will promote future generation sustainability without losing cultural identity. This section, therefore, emphasizes intergenerational equity to provide heritage for future

generations. In Trinidad, “the Heritage Stabilization Fund (HSF) is to use savings and investment income derived from excess petroleum revenues to provide a heritage for future generations of Trinidad and Tobago” (Government of Trinidad and Tobago, 2012). The introduction of advanced technology, specifically of this country, in addition to the creation of new, high-value jobs in new creative industries (for example, entertainment, information technology, light manufacturing, and agro-industries), is likely to benefit current and future generations through the provision of sustainable livelihoods.

In addition to factors related to sustainable economy in pursuit of a social sustainability, environmental conservation plays a significant role to guarding the welfare of future generations, especially considering vulnerability and current poverty rates. Poor and vulnerable areas tend to be affected by environmental impacts such as degradation due to more severe stress and few management tools. “The Government of Trinidad and Tobago ultimately recognizes the importance of balancing social and economic transformation with environmental conservation, and hence has taken concrete steps to embrace ‘green’ policy planning in order to guarantee environmental security and a good quality of life for future generations. A good recent and tangible example of this is the construction of a board walk at Williams Bay Chaguaramas with recyclable materials as part of a totally green initiative” (Government of Trinidad and Tobago, 2012).

PARTICIPATION

Since the 1970's great emphasis is placed on public participation in the environmental decision making process in the USA. Researchers have found that among low income groups, participation in social aid and pleasure organizations resulted in collective resources that helped compensate for the lack of individual resources during disaster recovery (Weil 2010). Chandra and colleagues (2011) describe social connectedness as effective for the exchange of resources, social cohesion, response and recovery. From an environmental perspective, societies with high social capital transform environmental utilization into well-being more efficiently (Knight and Rosa 2010) thus capitalizing on the availability of ecosystem services. Social connection includes participation in democracy, opportunity for community participation and investment in communities. In the context of well-being social connectedness is often applied at a personal level that focus on individual inclusion through a system of networks. Group participation, however, is key in island communities.

Participation in organizations can have a positive effect on the development of social institutions, such as law, politics or education, by serving as a space for open dialogue and civic socialization (Fung 2003). Political participation has been included in quality of life assessments as a component of community development (Mitchell 2000). By limiting social isolation and improving public participation and social interaction, in time, positive social behaviors will instigate investments in communities thus ensuring greater social connectedness with the environment. By improving equity within a community through investments in collective resources, the length of residence in a community due to place attachment will increase social, natural and economic capital. Greater place attachment or sense of place is positively associated with strong social networks in the community, increased participation in community organizations and a greater sense of community identity (Putnam 2000; Williams et al. 2008) all of which support well-being (Keyes 1998).

In order to increase social connections to the greater environment, good governance and public awareness must be addressed. Higher authority must support mechanisms that increase citizens' understanding of the holistic system such that public involvement is prominent in the social and economic transformations pertaining to the betterment of life for locals. "In Trinidad, the Government and various civil society organizations are committed to promoting greater access to information that enables and empowers citizens to influence and make inputs that are consistent with the national sustainable development agenda. The MTPF 2011-2014 further outlines several new institutional arrangements that will permit greater collaboration amongst social partners- government, business, labor and civil society- in the State's decision-making process. For example, the establishment of an interconnected triad, namely the Civil Society Board (CSB)⁸, the Stakeholder Advisory Councils (SAC) and the Economic Development Board (EDB), will facilitate the development of a Social Compact, with all stakeholders cultivating an understanding of the important role that each party plays in the country's socio-economic transformation as well as an appreciation of the potential benefits of greater collaboration" (Government of Trinidad and Tobago, 2012).

There are ten modern tactics geared toward the current populations that have been used in order to increase public participation in local communities, listed in Appendix. Although the global concerns of sustainability have emphasized environmental and economic difficulties, social concerns of sustainability is increasingly equally important. This being the case of Trinidad and Tobago, the Government has given strict policies and programs that attend to developments beings made around social concerns. "Altogether Trinidad and Tobago's

steadfast pursuit of sustainable development is due primarily to the Government's belief that its people are the country's greatest assets and their welfare, its greatest priority" (Government of Trinidad and Tobago, 2012).

Chapter 7: Representation of History, Culture and Tradition

CONCERN NO. 3

There is an increasing recognition that overall goals of environmental conservation and economic development are not always negatively related. In some cases the relationship between environment and economy can reinforce methods to approach development conflicts. An environmentally sustainable economy encourages economic growth through methods that are both environmentally sound and socially responsible. Through careful planning, it actually provides the resources necessary to support the community. Providing sufficient wages and capital for community development, a sustainable economy generates the capital necessary for growth that supports the current needs of the community without overlooking the direct impact on social justice and well-being. A stable economy is also closely tied to the renewable use of environmental resources. Because the economy of a community strongly influences all other aspects of sustainability, its economic vitality is considered a major factor in creating a sustainable community.

The Virgin Islands' economic volatility is due largely to its historic dependency on a few key industries, oil refining and tourism. While there are other viable economic concerns, such as construction and retail entities, they too are also related to tourism and oil refining. For example, the sale of retail goods to visitors or the construction of new resorts and vacation homes are attributable to tourism. With the closure of the Hovensa oil refinery on St. Croix, the manufacturing sector of St. Croix's economy virtually collapsed. As such, St. Croix is searching for a sustainable economic development plan which is in tandem with its tourism product as a ecotourism, heritage tourism and green tourism destination.. By contrast, in Trinidad and Tobago, sustainable development remains closely related to oil and gas roles "Ultimately, Trinidad and Tobago's hydrocarbon resources, in particular, its natural gas, have enabled it to become the most industrialized Caribbean nation with a relatively high standard of living for its citizens. Its traditional sectors of agriculture and manufacturing have declined and progress has been slow in the development of other industries that can contribute to sustained growth" (Government of Trinidad and Tobago, 2012).

Because the Virgin Islands are almost one hundred percent dependent on imported oil for electricity, the closure of the Hovensa plant resulted in a resurgence in alternative energy sources, such as wind and solar, which are more environmentally friendly, more in keeping with the tourism product .. These efforts have been supported with government tax incentives and reinforced through education. The goal is a better quality of life for humans with cleaner air and water through the integration and preservation of ecosystem services and existing unique assets. Those assets in the Caribbean are wind, sea and sun. Education, awareness, and frameworks that address energy, partition, economy, and well-being are important factors in pushing for change in local communities. “The Government of Trinidad and Tobago also remains fervent in its efforts to invest in human capital development to inculcate a culture of innovation and entrepreneurship, transitioning from exploiting non-renewable fossil fuel to harnessing the natural creative genius of its people. This is supported by the reorientation of primary education, the transformation of the secondary school curriculum and the expansion of tertiary education” (Government of Trinidad and Tobago, 2012). Moving away from total dependence on natural resources will reduce vulnerability to externalities, facilitating the creation of a sustainable economy. Strengthening competitiveness and standards to raise productivity and increase the country's attractiveness to visitors will further encourage economic growth thus resulting in increased job opportunities.

ACTION ON NEW STRATEGIC SECTORS

Creative Industry

Stories that reiterate natural and cultural resources are told or interpreted in framework themes. Themes provide the connections that people can use to understand the importance of an area and its resources. Themes are the core content of a program that develop cohesive ideas that link tangible and intangible resources with cultural connection to natural resources; thus giving more meaning and value to a community in which individuals are part of. Successful programs help residents and visitors understand the region's overall contributions linked to national heritage. Some of these elements include natural and cultural resources, important events and decisions; and the role of specific places, people, beliefs and traditions. Specifically, St. Croix's protected heritage area is derived from understanding the island's contributions to national heritage through public involvement processes. Intangible values associated with people, places, tradition, customs and beliefs, determine the type of development and industry suitable for a multicultural society.

Trinidad and Tobago has a diverse mix of culture derived from its colonial past. The islands are known to have one of the best Carnivals in the region, in lieu of outstanding visual and performing arts, publishing, design and promotion of music and festivals; which all have grown over the decades and have become main attractions in a growing creative industry. “An industry based on creativity and cultural power has the capacity to foster innovation and entrepreneurial activities, preserving and strengthening while simultaneously promoting local cultural attributes, indigenous skills and talents of the citizens of Trinidad and Tobago” (Government of Trinidad and Tobago, 2012). Straying away from Trinidad’s successful economy in the oil industry, tourism is their second source of income. Like Trinidad, the Virgin Islands’ present economy is based on tourism, manufacturing and related service industries. The culture of the Virgin Islands is also a mix. Thus, for most Virgin Islanders ‘culture’ means ‘native’ culture, although many of the characteristics are shared by other immigrant groups as well. The main cultural markers that should be capitalized to increase local economy are language, dress, foods, music, entertainment, historical landmarks and various behavioral traditions. To this end, St. Croix recognized its strong Danish ties and developed strategies to specifically attract a market for Danish tourist. It’s success has stabilized the island’s tourist trade through the economic downturn of the United States. Of interest to the Danes are interests such as the architecture, graveyard sites and tracing their family tree/name.

Taking advantage of natural creativity demonstrated through traditional behaviors and local common practices provides a diverse, malleable starting point in the economic sector and has potential in developing unique cultural products and services to generate export earnings; thus increasing domestic income. Again, St. Croix has a small but sustainable jeweler’s cottage industry showcasing what is known as the “Cruzan bracelet”, which has become a telltale piece of jewelry that a person has visited the islands. Acknowledging the necessary shift in export earnings, Trinidad and Tobago’s Government will develop and strengthen their economic sector to build an industry that will generate sustainable livelihoods through cultural capital. Creative capital focuses on investments and management approaches that promote quality and organization in lieu of enhancing entrepreneurial and commercial possibilities to strengthen export economy and income. In the case of St. Croix, forgotten practices of the past like native handcrafts including basketry, pottery and furniture making, stress the importance of connection of historic and tradition culture of the islands. Native culture points out viable alternative economic strategies for the Caribbean. In the case of creative economy, successful

developments of cultural industries can ultimately sustain a part of current economies through visitor sales with minimal risk to the environment. One sector that St. Croix has continually managed to develop has been its rum industry. The island remains a major distributor albeit not from harvesting sugar cane, but through tax incentives long tied to exporting rum. In comparison to manufacturing industries, creative industries derive from human imagination and cultural exchange in order to build capacity and thus hosting innovations that are upstanding.

Environmental Services

Many Caribbean islands have had long histories of human-environment interactions. Ties between the local residents and the marine environment are particularly notable. For many years, Virgin Islanders have been dependent on the sea for its resources, but over time the level of dependence has changed. Although much food is now imported, it holds true today that many Virgin Islands still flock to local fish markets for fish, companionship and ideas. As generations change, these heritage and culture exchanges are at risk for being lost to new technologies, practices and community interests. Thus it is critical to appreciate the significance of marine/coastal resources and habitats in addition to the role economy plays in the balance of both environmental services and cultural identity. In this regard, St. Croix's Agricultural Fair has become a major local and tourist event, drawing tens of thousands of people to the island for instruction on anything from raising farm animals to installing solar panels. Another human-environment interaction that is notable is the reliance on "bush" medicine among the local population. This is a growing field with the potential for export as the world's population seeks more natural products. For instance, the moringa plant or the "tree of life" plant currently grows freely in the islands. Connecting people and the environment to the health of the economy by the possible production and export of moringa creates a sustainable economy.

• *Renewable Energy*

Given the economic impacts of high and fluctuating energy prices, a number of islands in the Caribbean have started to promote energy efficiency by using native energy resources. Various energy efficient and renewable energy incentives highlight the immediate need for specific policies related to energy methods. Policy development between local governments and federal agencies for tax incentives and planned development is a significant strategy to reducing fossil fuel reliance and developing clean energy installments. Locally produce energy systems provide independence from fossil fuels and imported fossil fuels; security from global

markets; and promote environmental health due to reduced pollution and emissions. The development of clean energy can also lead toward the creation of more jobs, and local involvement when considering construction and installation. Renewable energy initiatives will not only have a greater impact on environmental conditions, but also enhances human well-being. Implementing alternative energy lowers the cost of living, increases social awareness and job opportunities; as well as introducing the concept of self-sufficiency among local communities.

The US Virgin Islands unemployment rate was roughly 10 percent (U.S. Census Bureau, 2010), and has been increasing significantly since the economic downturn of 2008 and the closure of the Hovensa refinery. The recent closing of the Hovensa refinery in St. Croix, devastated the local economy, leaving roughly two-thousand people unemployed. As previously mentioned, the Virgin Islands' economic volatility is due largely to its historic dependency on tourism and oil refinery - similar to Trinidad and Tobago. "Other renewable energy sources can be harnessed to make similar economic gains while promoting the preservation of the environment; such as diverting waste into productive uses, for example energy and fuels, can supplement the use of fossil fuels in Trinidad and Tobago, and therefore, is of potentially great economic and environmental benefit" (Government of Trinidad and Tobago, 2012). To go forth with these innovations, fiscal incentives have been introduced in Trinidad and Tobago's sustainability framework to encourage the expansion of renewable technologies such as solar, wind and waste to energy, thus enhancing the value of the country and the value of holistic community systems. While this is true, renewable technologies such as solar cannot just be expanded without taking into consideration the effect their placement may have on the natural outward and inward beauty (i.e. not obstructing views), noise pollution or additional costs to the impoverished due to reduced demand from the existing power system.

- *Eco-tourism*

"Eco-tourism provides many opportunities for creating environmentally sustainable livelihoods at the community level while preserving the country's sensitive ecosystems" (Government of Trinidad and Tobago, 2012). Caribbean destinations are diverse with respect to area, population, income, government and geography; indicating that certain important shared characteristics such as colonial legacy is undoubtedly dependent upon activities like agriculture and tourism. Because of the regions location to mainlands and their high resource attainments, the Caribbean is highly associated with beach resorts and cruise ship activity; such that social

tourism, business tourism, environmental tourism and culture and historical tourism are considered a holistic response for future endowments.

Proper management of eco-tourism products and searches will recognize the uniqueness of a community's environmental and cultural heritage and will balance socio-economic gains with environmental concerns. The USVI is one of the world's favorite destinations, thus travel and tourism is a fast growing industry in the territory. The increasing economic importance of tourism has captured the attention of many countries, but global growth of tourism, especially in the USVI, poses a significant threat to culture and biological diversity. Ecotourism, thus, is an important tool in sustainable development strategies. It is entrusted with conserving natural areas, educating visitors about sustainability and sharing the island with local people. Ecotourism markets demonstrate the revitalized relationship between human and wilderness in pristine areas; however proper planning and management are critical to development or it will threaten the biological diversity in which it depends upon. Ecological accommodation in the Virgin Islands is dedicated to protecting the beauty of the territory's natural environment while allowing visitors to enjoy the territory's unique features. By integrating historical awareness in environmental activities for visitors and investors, efforts to reverse the effects of compounding damage to the United States Virgin Islands are substantial.

"In this light, the Government has identified a range of eco-tourism initiatives to facilitate private sector engagement. In addition, specific thrusts in product development, strategic marketing, and events development and management have been identified for action. These include development of Chaguaramas, the development of nature trails, nature spots and reserves, protection of wetlands and identification of ecologically sensitive areas and issues in the development of land use policy" (Government of Trinidad and Tobago, 2012).

REVITALIZING CULTURAL AND TRADITIONAL CONNECTIONS

Agriculture and Fisheries

The majority of small islands cannot sustain themselves through agriculture. The lack of infrastructure for supplying water and labor capacity is a common challenge that is faced when addressing local agriculture economies. Traditionally, community improvement efforts have been based on social and cultural activities, but now new efforts of using natural resources of rural communities to promote development. Since the 1960's agriculture has been a lost practice among many Virgin Islanders. When the last of the sugar-cane factories shut down, major industrial corporations like Hovensa were brought in, completing the island's shift from an agrarian environment to a tourism and industry based economy. Many believe that reviving

agriculture production in the territory would benefit the Virgin Island's local economy, create cottage industry for self employment, revitalize the historical knowledge of medicinal plants and reduce the dependence on outside food sources. However, environmental vulnerability is a major area of concern in reviving agriculture practices, especially since the impact of natural hazards, such as hurricanes, can have a devastating effect on infrastructure, accessibility and crop product in the territory.

Initiatives concerning agriculture and fisheries are focused on expanding and improving productivity in traditional agriculture as well as diversifying the cultivation of food crops for both local consumption and export. "Strategies to improve agricultural practices through the use of environmentally sound methods are also of priority for Government in order to strengthen the sustainable development thrust" (Government of Trinidad and Tobago, 2012). Just as agriculture was one a large market in the economic history of the Virgin Islands, the marine environment is crucial to the economy as well. Commercial and sport fishing have a significant role in local economy, however, extensive fishing has led to degradation of marine environments due to the effects of overfishing and destructive fishing practices. Management and maintenance strategies are vital in achieving sustainable use of resources by recreational and commercial fishing, tourism, boaters, residents and visitors.

The government of Trinidad and Tobago recognizes that marine ecosystems are a vital component in sustaining a healthy economy within a local community, stressing strategies and management tools for protecting natural fish stock and engaging local fishing traditions in proposed initiatives. "Moreover, aquaculture practices will now supplement the existing fisheries sector with intentions to earn additional revenues from the exporting of aquaculture products. Major legislation to address conservation in the management of ocean fish stock in the waters of Trinidad and Tobago is now before the Legislative Review Committee" (Government of Trinidad and Tobago, 2012).

Tourism

Promoting cultural diversity of the Caribbean region facilitates exchanges in language learning and cultural cohesiveness and enhances relationships and strengthens regional integration. Carnival, one of the most unifying events and cultural celebrations, finds its social, political and historical expression and origin through dance, music, costumes, lyrics and performance. Carnival is recognized not only as a social event that brings the community together, but also an important economic activity. The tourism industry indicates a direct

relationship between carnival and increased visitors, thus increased revenue. Carnival's visitor arrivals have grown by 60 percent since the late 1990s and continue to grow annually. This industry generates significant economic activity associated with local economy such as entertainment, media, hospitality and retail, in lieu of contributing to a viable and sustainable global economic industry that is supported by talent, skill and knowledge specific to the Caribbean.

Tourism is a valued sector of a working community. It is a driving force to preserve and strengthen cultural identity, while making positive impacts on social and economy development. In addition, culture is an important factor of a destination uniqueness and appeal, thus increasing global competition as well as changes in migration and consumer patterns that impact tourism's supply and demand. Therefore, there is a need to strengthen the relationship between tourism and culture, by emphasizing development based on cultural products and activities while promoting cultural aspects through tourism activities. The strength and appeal of cultural events and festivals is an essential component of tourism, especially in this region. Not only does it bring more visitors to the destination, increasing gross domestic income, but it also engages travelers and locals in cultural traditions that reminds society of heritage importance.

Like many Caribbean islands, Trinidad and Tobago, has traditionally depended on both its environmental resources (sun, sand and sea) and Carnival to develop a wider range of tourism products and services. "Over the last decade, eco-tourism has been promoted as an avenue for economic gains while maintaining harmony with the environment. In addition, Tobago has the potential for sports and heritage tourism, while Trinidad has been growing in the niche markets of business and cultural tourism" (Government of Trinidad and Tobago, 2012). The tourism industry offers a variety of opportunities for diversification, new businesses with consideration for responsible environmental practice and ecological sensitivity.

BALANCING THE ECONOMY AND THE ENVIRONMENT

The American way of life is prominent in many islands across the Caribbean region. The region's traditional ways, as well as self-reliant methods of fishing, boat building, farming and even hunting are slowly receding. When islanders need something, they have it imported. Like the rest of the world, the Virgin Islands have been exposed to the recent global recession, negatively affecting the island's tourism economy. However, a recession forces the populace to re-explore the "old ways", such as a return to gardening (although now done in garden boxes), saving water (using a water buffalo to catch rainwater), or raising chickens (a source of fresh eggs). These activities are not done place of the tourism product, but in conjunction with it –

creating its own market with products such as “farm to table” restaurants or food trucks with organically produced meals. Government has finally realized that promoting tourism and protecting the natural environment creates another aspect of the tourism trade. A realistic approach to balancing growth and the environment can prevent, overdevelopment, a primary concern for the Virgin Islands.

Like the Virgin Islands, Trinidad and Tobago’s long-term dependency on their oil industry have resulted in environmental degradation. Thus, in order to achieve sustainable economic development, mending relationships between the economy and the environment is significant. One method is through valuing the country’s ecosystem. “Assigning a monetary value to ecosystem goods and services will ensure that the returns from natural resource extraction will be wisely reinvested into the environment. This system of “natural green accounting” allows for a mutual relationship between the environment and the economy. The ProEcoServ Programme, a new initiative of the Government of Trinidad and Tobago in collaboration with the University of the West Indies, integrates ecosystem assessment, scenario development, and economic valuation of ecosystem services into national sustainable development planning” (Government of Trinidad and Tobago, 2012). With support from UNEP, conservation and preservation of Trinidad and Tobago’s ecosystem will ensure the sustainable and optimal use of the country’s limited renewable and non-renewable resources in hopes of achieving economic and environmental goals. In the Virgin Islands where items such as land and fresh water are limited resources, optimal use of the renewable or non-renewable cannot be left to chance.

Regulatory initiatives that are sought out through substantial planning are strategies that develop a culture of innovation and opportunity that will eventually integrate cultural and environmental diversities; leading toward increased values and access to markets seeking unique products and services. New strategies “used in further developing the economy will simultaneously lend to environmental preservation, thereby creating a “green economy” which is conducive to macro-economic stability and sustainable growth. The idea also is to foster and facilitate economic inclusion and community participation with shared benefits and to put people at the centre of the development process” (Government of Trinidad and Tobago, 2012). Again, because the islands are stand alone entities, proper regulatory initiatives are essential for optimal use of renewable or non-renewable resources because the populace cannot simply pick up and move to the next state.

Chapter 8: Discussion - The Way Forward

This thesis has described the experiences of two small, rural communities that are making efforts to improve the lives of inhabitants and invest in sustainable actions that will help secure a better future for generations to come. In interviews conducted (listed in Appendix 1), with citizens of the Virgin Islands, they all expressed common concerns primarily associated with employment, education, infrastructure, crime and electricity; all of which affect their quality of life and which is further magnified by their finite environment. In addition, the interviewees agree that the problems are exacerbated by too much planning talk and too little action during this critical time. How did these social concerns get away from the stem from?

This study proposed that the Virgin Islands have had a difficult time in meeting basic needs for its inhabitants because there is a lack of public participation in decision making coupled with ineffective government actions which has resulted in the haphazard approach to sustainable environments for the islands. These troubling challenges included increased poverty, growing criminal activities, a crumbling infrastructure, limited access to health care and opportunity, poor education and a lack of jobs and opportunities. However, an understanding of the common purpose of a healthy community, locally and nationally, can create a shift in governance to pursue a common future.

It is time for the the Territory to achieve a balance its revenues and expenditures with a plan of action impacting the social, environmental and economic sectors of the community that is in line with the public's desires. If the Territory continues to react by spending money on short term fix-it projects, it will never get ahead of the curve. It's lack of planning will result in not meeting basic needs of the community and moving further away from a harmonized economy, society and environment. . Without these harmonized development decisions, sustainability cannot be achieved and a downward spiral begins. Furthermore, there must be fairness in managing competing requirements during the developmental process. In this context, both economic and social pillars are traditionally prioritized over the environmental pillar, compromising the territory's potential sustainable future.

Reviving the territory relies primarily on improving the tourism product. However, sustainability also requires diversification. The tourism product heavily taxes the environment,

so stopgaps to prevent environmental degradation are essential. Because the U.S. Virgin Islands economy is intrinsically linked to its ecological beauty, protection and capitalization of its natural must go hand in hand at all times. At the forefront should be a mandate that decisions must be made knowing that preserving ecosystems services determines the success of the community. Coastal communities, such as St. Croix, who , rely heavily on their ecosystem services both for their daily needs and long term growth, have to protect these systems from vulnerability to natural hazards, invasive species and human activities The potential of a successful sustainable community is achievable through a diverse environment..

Island communities often fact a high cost of living and a limited job market, especially if their main source of income is derived from an outside means, such as tourism.. A strong and effective government must balance growth without destroying the very systems that attract more tourists. Thus, adding low impact and environmentally conscious businesses to the islands' economies is essential. Such planning can keep social needs and concerns at the forefront without destroying the environmental and cultural heritage defines that defines the main source of income, the tourist product. In this manner, opportunities for growth continue which in turn positively impacts education and income.

St. Croix is crucially poised for redefining who and what it is now that the Hovensa plant has closed. Is it a general tourist destination or a cruise ship destination? Will it cater to European and Asian travelers who stay longer and are looking for a more historical and cultural experience? Will it revert to a manufacturing base instead given its skilled labor force? Will it become a tax haven? No matter the decision, a decision is necessary as no decision will result in social ills. A responsible balance now between growing businesses while still protecting the environment is a priority for the territory. Lowering energy costs, engaging in export opportunities through technology, redesigning tourism, and educating the upcoming generations and the current workforce are key elements to sustaining economic development and economic growth of the Virgin Islands no matter what direction is chosen. By revitalizing responsible resource use for alternative energy, the cost of living will decrease; making it more attractive to open businesses, which in turn will help more families out of poverty, thus increasing education successes among children and decreasing crime rates, all with an eye toward sustainable growth.

Educating the populace is is key to the success of a sustainable community. sustainability. Setting good examples of appropriate behaviors and educating children on their heritage and past practices reconnects generations to their environment, reinforcing value of

place so that future efforts to give back to the community and initiate a market for new jobs is continual. Since tourism is currently the main source of income, emphasis on social and environmental connection through alternative energy and agriculture technologies must be considered to diverge from importing goods and high costs of living - in order to seek a sustainable community with a thriving economy. By educating society about their home through managerial tools that reiterate the importance of its aesthetics and natural resource, the Virgin Islands can achieve this goal. In addition, introducing alternative energy efforts as well as revitalizing coastal and marine ecosystems through eco-tourism initiatives, the local community will reap benefits through savings by better health (reduced emissions, locally produce food sources, increased healthcare) while simultaneously contributing to the success of a profitable community. The future, however, depends on more than just educating the population. Initiatives to increase public participation, education and awareness need to be compatible with accessibility.

One reason for low education standards, high levels of unawareness and poverty is due to the fragmentation of urban and natural landscape. Sustainable development seeks to connect past practices and infrastructure to current and future needs through a healthy economy that does not disrupt natural cycles. Current access to healthcare, education, housing, opportunity and food sources are limited. Disconnection between necessary destinations is a problem in achieving a sustainable goal. By integrating appropriate infrastructure such as public transportation, alternative transportation (sidewalks, sidewalk connectivity, bike paths) and proximity to destinations such as the airport, housing complexes, food sources and business districts; will enhance community relationships and decrease environmental hazards, thus increasing identity and value of culture and perseverance. With stronger ties among community members, the importance of heritage and identity emulates the territory, emphasizing the significance of past tradition and culture in current economy strategies. These strategies are essential even on a small island like St. Croix as it is evident that Frederiksted is definitely "poorer" than Christiansted.

Sustainable development seeks to connect past practices and infrastructure to current and future needs through a healthy economy that does not disrupt natural cycles. In the case of the Virgin Islands' diverse background, heritage and tradition play an important role in the tourism sector. Implementing alternative modes of transportation that link significant landmarks on the island, have extremely high potentials in bringing more visitors who have regional, national or international ties to the territory. As such, preservation of these historic landmarks is

key and an emphasis on their value is essential. Therefore, even as economic growth starts to take place, it cannot do so at the expense of historic buildings even if that location may be ideal for new growth. As cultural tourism continues to be an overall success in the Virgin Islands, preservation of historic landmarks will have a far greater impact on the tourist economy, especially with the increase of international visitors..

As St. Croix and the rest of the Virgin Islands continue to make significant strides in their development to become self-sufficient, the islands need to strengthen their methods in sustainable development. In order to achieve this goal and ensure that all three pillars are recognized in the process, institutional strengthening, revision of legislative and regulatory frameworks, increased public education, public participation, attitudinal changes and diversification of the economy must be pursued. Strengthening of the institutional framework is the first critical element to address matters of sustainable development. This will ensure that policies and managerial methods in all three pillars pertain to effective use of limited resources ensuring that alternative energy and government funding are optimally used. Existing legislation and regulatory framework are also crucial in implementing sustainable development. A review of existing laws and policies and their enforcement where applicable is necessary for maximum impact. Additionally, existing laws and policies that are outdated and to guide new development process should be replaced with the formation of new laws and policies for further development as a high priority. In addition, it is also important to acknowledge any conflict between new and existing laws/policies that are obstacles to sustainable action. The policy and strategy implications of a coherent legislative framework must also be carefully thought through and performed in a timely manner.

“It is also essential that the government continues to engage key stakeholders in its decision-making process and to increase stakeholders’ awareness of their specific roles and responsibilities. A viable sustainable development strategy requires that all sectors of society work together towards a shared vision of socio-economic and environmental sustainability” (Government of Trinidad and Tobago, 2012). In lieu of achieving social cohesiveness, transforming values and attitudes of the population is important. Since there is a greater stress on cultural industries, ideas and concepts that are associated with development and expansion of these industries can also instigate debate, thus promoting changes in attitudes and behaviors that will slow economic transformations efforts as well as social development.

Social safety, however, is the ultimate target that must be designed and structured with clear strategies that ensure that wealth and equity is equally distributed. Diversifying economy in order to reduce dependency on finite resources is critical in achieving social security and sustainable development; such that it can potentially reduce poverty, and increase education and training systems, health systems and regional and community development; and housing and community creating through “green” initiatives. Transforming country stability to sustainability requires great emphasis among the three pillars. Managing natural resources and protecting the environment so that development can coexist does not only require new laws and legislation. It also requires the strengthening of existing ones, with focus on enforcing initiatives to promote green economy.

“Sustainable transformation however depends not only on government led initiatives. It requires the commitment of all sectors of society; private sector enterprises, public sector organizations and civil society organizations, especially those representing communities, in order to better determine the needs of the entire population and to identify and implement innovative and appropriate solutions. Sustainable practices require thoughtful considerations, entrepreneurial initiative and innovative solutions”(Government of Trinidad and Tobago, 2012). Ultimately, the goal is to establish local economies that are economically feasible, environmentally sounds and socially responsible. Although St. Croix has begun to move in the right direction towards sustainability in terms of economic diversification and renewed focus on modern concerns, more must be done to accomplish the overall sustainability of the territory,

Long term prosperity and continued economic progress for future generation involves innovation, creativity, entrepreneurship, social capital building, participation and education with an eye on feasible solutions for challenging problems. In this regard, preserving upcoming generations by providing appropriate behavioral examples, encouraging creativity and innovation through collaboration with citizens will lead a prosperous community. If successes can be achieved within guidelines of sustainable development, then positive outcomes of healthy communities are highly susceptible in the context of social, environmental and economic prosperity.

Chapter 9: Suggestions for Future Research

1. The development, implementation and evaluation of a sustainability education program for schools in the Virgin Islands

2. The development of measurable, quantifiable objectives for sustainability attributes that include a set of indicators for each attribute (e.g., sustainable use of natural resources → water quality → various water quality indicators) that can then be applied in a local setting and monitored over time.
3. The importance of community ownership in the longevity of development projects that have been implemented by an external actor.

STUDY LIMITATIONS

1. This study was not designed to measure sustainability quantitatively, but did offer qualitative observations about each community's level of sustainability.
2. Distance was an issue. The researcher was not present on the island during the time of research.
3. Some of the opinions and views expressed in these interviews may not reflect the big picture of the USVI's process to meet its goals.
4. Case study research is generally performed over a longer period of time than what was available for this project

Chapter 10: References

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Appendix 1: Interviews from St. Croix Community Members

Interviewee: 1

Title: Community member of St. Croix: USVI Nurse

Interviewer: Felicia Farrante

1. What are the biggest issues in the community? (select all that apply)
 - a. Water/food
 - b. Affordable housing
 - c. Transportation
 - d. Employment
 - e. Education
 - f. Infrastructure (material, public facilities, water harvest/irrigation)
 - g. Crime
 - h. Electricity

Employment , education infrastructure, crime, electricity

2. What has been done to address these issues?

Lots of talk from administration with little movement. Progress not fast enough for residents to feel hopeful

3. What is the current and long term needs for you and your family?

Affordable quality education at all levels. Affordable utilities and food

4. What are the needs of the overall community?

Reduction in crime, less corruption, reduce 'crab in the barrel syndrome'. Lift each other up.

5. What has been done to address these current long-term needs?

Every man for themselves thus slow progress

6. What would you like to see happen in the community for the future?

Influx of business, money, quality education and career opportunities so our children can come back home.

Interviewee: 2

Title: Community member of St. Croix: Student

Interviewer: Felicia Farrante

1. What are the biggest issues in the community? (select all that apply)
 - a. Water/food
 - b. Affordable housing
 - c. Transportation
 - d. Employment
 - e. Education
 - f. Infrastructure (material, public facilities, water harvest/irrigation)
 - g. Crime
 - h. Electricity

Education. Infrastructure. Food and water.

2. What has been done to address these issues?

Nothing has been followed through.

Politicians here (like in the states) are for the most part ego driven and misguided. Morale of the people here is down and so is the involvement and interest in politics, and that only makes it worse.

3. What is the current and long term needs for you and your family?

A reduction in crime would be nice. So would nice roads to drive on, and well lit ones. And obviously employment to make it appealing to live here.

4. What are the needs of the overall community?

A better education system. They shaft and short change students and teachers so much here it makes me angry. Better infrastructure as well - these roads are truly horrid.

5. What has been done to address these current long-term needs?

I see a few grass roots movements and slow, really really slow road repaving; but nothing substantial yet.

6. What would you like to see happen in the community for the future?

Our generation step up, and run things from a place of love and progress. but i'm just a hippie.

Interviewee: 3

Title: Community member of St. Croix

Interviewer: Felicia Farrante

1. What are the biggest issues in the community? (select all that apply)
 - a. Water/food
 - b. Affordable housing
 - c. Transportation
 - d. Employment
 - e. Education
 - f. Infrastructure (material, public facilities, water harvest/irrigation)
 - g. Crime
 - h. Electricity

Employment, education, infrastructure, crime, wapa

2. What has been done to address these issues?

Ah these lovely senators. There's so much talk and no action! Everyone has "plan" but no one puts it to work.

3. What is the current and long term needs for you and your family?

Jobs! Affordable living and safety. Cost of life is way to high! Yeah it takes more money to ship things here but still as a territory it shouldn't be this big of a difference..

4. What are the needs of the overall community?

Work together!! As an island we have a strong sense of culture but that's it, we don't support our own like we should..we are not one as a people. We fight each other before the "outsiders"

5. What has been done to address these current long-term needs?

Number 4..stop being so selfish with each other.

6. What would you like to see happen in the community for the future?

*Crime rate drops, people feel safe leaving their houses, people are willing to come back home, tourism flourishes again, jobs increase stress decrease.
Everybody blessed again*

Interviewee: 4

Title: Community member of St. Croix

Interviewer: Felicia Farrante

1. What are the biggest issues in the community? (select all that apply)

- a. Water/food
- b. Affordable housing
- c. Transportation
- d. Employment
- e. Education
- f. Infrastructure (material, public facilities, water harvest/irrigation)
- g. Crime
- h. Electricity

Affordable housing -- WAPA having a huge effect on this, Education, Crime, Electricity -- WAPA, Healthcare?

2. What has been done to address these issues?

Daniel explained the new WAPA set up better than I could and hopefully this will bring a lot of good change too the island. I've heard of other being frustrated that this change won't bring immediate savings but as they're pairing up with a new company and changing their system it seems understandable that the price of electricity won't immediately drop but again hopefully it'll bring better quality. As for the other issues there hasn't been much done. New cop cars don't lower the crime rate and neither do constant radio add about where you can find and fill out compliant/compliment slips. Education, much like healthcare, is trying but progress is slow. I know, especially with visiting doctors, our situation on island is frustrating. Obtaining certification to practice on island shouldn't be so ridiculous that nationally renowned doctors can't even offer their services.

3. What is the current and long term needs for you and your family?

With a dwindling economy it's hard for my parents to find a steady income that can finically support them living on island. This has become a huge issue after HESS shut down as many employees were dependent on the income and the provided housing.

4. What are the needs of the overall community?

We need to stop excusing things because "that's just St. Croix." Our island can be rich in it's culture and thrive economically if everyone would be willing to accept responsibilities and put for the effort.

5. What has been done to address these current long-term needs?

I know employers are trying, for both themselves and the island, but it's a hard time.

6. What would you like to see happen in the community for the future?

Honestly I think the biggest thing that needs to happen is that the people of STX and the USVI as a whole need to come together to work on these larger issues. It's not a matter of addressing them (we know WAPA sucks and the roads are crap) it's a matter of making a plan and executing it (and not like the Bypass which took 40 years of planning and construction). As I mentioned in #4 our community needs to take responsibility. There is no reason our crime should be so high or our healthcare so hopeless that if someone does suffer a huge injury they need to be flown to PR or FL. We are capable of being a sustaining and flourishing community but only if we are willing to help each other.

Interviewee: 5

Title: Community member of St. Croix

Interviewer: Felicia Farrante

1. What are the biggest issues in the community? (select all that apply)

- a. Water/food
- b. Affordable housing
- c. Transportation
- d. Employment
- e. Education
- f. Infrastructure (material, public facilities, water harvest/irrigation)
- g. Crime
- h. Electricity

Employment, Crime, Electricity, Roads

2. What has been done to address these issues?

Electricity - Wapa has finally come to it's senses and are going with a propane facility (more efficient). It will be looking over Krum Bay. Vitol is the company that is helping finance and put together this facility. They have fronted 55 percent of the estimated 91million dollar contract. Lower electric bills thank god.

Employment- Don't really know anything yet

Crime- Don't really know anything yet

3. What is the current and long term needs for you and your family?

What is the current and long term needs for you and your family?

Right now we are currently in North Carlina but still own our house in st.croix. So if I were to pick something I would say a solution to knock down crime. Since December 2013 it has risen almost 2%. So if I want to keep the house rented and not have people scared to live on st. croix, crime needs to drop. That's really the only thing I could think of. The only way to be able to keep my house.

4. What are the needs of the overall community?

They need to fix roads. They only fix the certain stretch that the half iron man runs. It's bull. More money needs to be towards roads and not new cop vehicles every like 3 years.

5. What has been done to address these current long-term needs?

Nothing about roads that I know of. Someone on island can answer that

6. What would you like to see happen in the community for the future?

For hope that the new facility at Krum Bay to open new jobs and drop electric prices. For community to get a little safer

Interviewee: 6

Title: Community member of St. Croix

Interviewer: Felicia Farrante

1. What are the biggest issues in the community? (select all that apply)

- a. Water/food
- b. Affordable housing
- c. Transportation
- d. Employment
- e. Education
- f. Infrastructure (material, public facilities, water harvest/irrigation)
- g. Crime
- h. Electricity

Employment, Education, Infrastructure, Crime, Electricity

2. What has been done to address these issues?

Not much can be done to improve employment because we have no businesses to hire anyone. Education is a problem because the kids don't want to learn. Infrastructure needs to improve and we need to obtain as many federal funds as possible. Police are trying to reach out to the community to get criminals off the streets.

3. What is the current and long term needs for you and your family?

Lower food prices, lower electricity rates, more job opportunities

4. What are the needs of the overall community?

Lower food prices, lower electricity rates, more job opportunities, crime reduction

5. What has been done to address these current long-term needs?

WAPA has partnered with companies to lower the oil consumption and rates should be lower within a year. Jobs are a problem because there aren't any industries to create jobs. Food is

expensive because supermarkets charge whatever they want. Crime is going to be a problem until more jobs are created.

6. What would you like to see happen in the community for the future?

I would love for my home to have thriving industries other than tourism. We have vast amounts of land that should be used to house factories or agricultural markets. We need to become innovative and creative in order to flourish.

Appendix 2: Initiatives Toward Sustainable Development - Trinidad and Tobago (Government of Trinidad and Tobago, 2012)

PILLAR 1: SUSTAINABLE ECONOMY

According to the MTPF 2011-2014, Government has embarked on the following strategies to ensure sustained macro-economic stability and growth with regard to its investment, growth and job creation objectives:

1. Diversification to restructure the productive base;
2. Promote new strategic sectors with the potential for contributing to growth, job creation and innovation namely, the Creative Industries, Environmental Services, Renewable Energy, Eco-tourism and Events and Conference Tourism, and Information and Communication Technology Services (ICTs);
3. Develop new growth centres across the country to ensure greater geographical distribution of wealth and to support industrial diversification
4. Promote innovation and entrepreneurship
5. Revitalise traditional sectors capable of achieving competitiveness and promote viable clusters capable of achieving sustainability;
6. Move up the value chain in energy
7. Develop a sustainable tourism industry.

PILLAR 2: SOCIAL SUSTAINABILITY

Social sustainability incorporates considerations related to justice, poverty, inequality and people's aspiration for a better life. In this report social sustainability is equated with a society that is just, equal, without social exclusion and holding the promise of a decent quality of life, or livelihood, for current and future generations. More specifically, the concept of socially sustainable development includes development that:

- meets basic needs for food, shelter, education, work, income and safe living and working conditions;
- is equitable, ensuring that the benefits of development are distributed fairly across society;
- enhances, or at least does not impair, the physical, mental and social well-being of the current and future populations;
- promotes education, creativity and the development of human potential for the whole population;

- preserves cultural and biological heritage, thus strengthening citizens' sense of connectedness to their national history and environment;
- promotes conviviality, with people living together harmoniously and in mutual support of each other; and
- is democratic, promoting citizen participation and involvement.

Quality of Life

Trinidad and Tobago has an inadequate system of health services accreditation which is a necessary tool for regulating, monitoring, and improving the quality of health care (Social Sector Investment Programme, 2012). This initiative is one of several that will enable Trinidad and Tobago to develop a modern responsive high quality health care system that will benefit both current and future generations. Other initiatives include the upgrade and expansion of hospitals and Enhanced Health Facilities such as the newly opened Scarborough hospital in Tobago, the Chronic Disease Risk Factor Screening Campaign, mobile clinics, the passage of the Tobacco Control Act 2009, upgraded and expanded training for doctors and nurses, international recruitment of medical practitioners to fill gaps, construction of a Children's hospital, a new emphasis on specialised training, and new public-private initiatives in health care delivery of specialist care.

In the MTPF 2011-2014, the Government of Trinidad and Tobago reiterated its commitment towards ensuring that every child has access to quality education. From Early Education to Tertiary level priority attention is being given to the development of new, modern subject areas that are better aligned to current and future labour market needs, and methods of learning that are technology focused. A very significant component of the reform effort is the integration of ICT throughout the school system. Government has already initiated the process through the eConnect and Learn (eCAL) Programme and the laptop for every child initiative. These education initiatives will play a pivotal role in creating a more relevant and productive workforce to expedite the emergence of a sustainable economy. Education up to University degree level is fully supported by the State and at higher levels fifty percent support is offered. The target for tertiary participation by 2015 is 60%.

A noteworthy initiative in Government's fight against crime is the Citizen Security Programme (CSP). This community-based crime prevention programme seeks to reduce crime and violence by addressing risk factors—such as firearms use, unsafe neighbourhoods and violent behaviour—in 22 'high-need' communities in Trinidad and Tobago. The components of this programme include: (a) institutional strengthening of the Ministry of National Security by improving its ability to plan, coordinate and manage violence and crime prevention projects; (b) institutional strengthening of the police service to increase public confidence by improving performance, training, management and supervision; and (c) coordination and implementation of community-based preventive measures. It is a strong reflection of government's determination to engender a culture of peace and lawfulness.

Equity and Social Justice

Data from the Central Statistical Office indicate that roughly 16.7% of population was below the poverty line in 2005, with the most recent Household Budgetary Survey in 2008/09 suggesting that poverty increased by approximately 2 per cent between 2005 and 2009. Moreover, the geographic distribution of poverty was highly unequal according to the Survey of Living Conditions in 2005, with the north-eastern, east and southwestern parts of the island of Trinidad lagging behind, in terms of the living conditions of the population. The recently completed Human Development ATLAS 20127 (based on 2009/10 statistical data), which disaggregates key aspects of human development by the 15 regional corporations, suggests

that regional inequalities persist. However, recent trends in poverty suggest that progress has been made with poverty reduction, with a figure of 14.7% for 2011. Though a modest progress, Trinidad and Tobago is headed in the right direction.

Inclusion and Access

The Poverty Reduction Programme (PRP) is one such initiative. The Micro Enterprise Grant is one of its components, and is intended to provide persons living in poverty as well as welfare recipients with a grant to undertake a micro business venture or skills training. The expected impact is that these vulnerable citizens will have a viable avenue for becoming self-sufficient and empowered to lead sustainable livelihoods via small businesses and through acquisition of skills. In terms of health, a number of initiatives are also in place to assist the vulnerable with their health care needs such as the Children's Life Fund, financial assistance to needy patients and the Adult Cardiac Surgery Programme. With regard to reducing regional disparities, the Government will provide regions lacking basic infrastructure with the necessary amenities and opportunities for investment in order to create an environment for sustainable communities.

Government is simultaneously implementing initiatives to ensure the development and protection of workers' rights through a Decent Work Policy and Programme of Action for Trinidad and Tobago (2011-2013) which aims to foster: the promotion of standards and fundamental principles and rights at work; the creation of employment; the enhancement of social protection and the strengthening of social dialogue. The Policy will provide opportunities for improving the quality of life, promoting self-development and shaping a brighter future for generations to come.

The Government is also committed to the improvement of Health, Safety, Security and Environmental (HSSE) standards. The adoption of a preventative, proactive culture of HSSE, incorporating effective Occupational Safety and Health (OSH) management systems (inclusive of policy, regulations, compliance, environmental protection), would ensure human security and be the hallmark of excellence as citizen safety and security are pursued in tandem with sustainable development. The OSH system will comply with world standards with respect to health and safety issues such as NEBOSH Health and Safety System of the UK and the OSHA system of the US.

Participatory Practices

The MTPF 2011-2014 further outlines several new institutional arrangements that will permit greater collaboration amongst social partners- government, business, labour and civil society- in the State's decision-making process. For example, the establishment of an interconnected triad, namely the Civil Society Board (CSB)⁸, the Stakeholder Advisory Councils (SAC) and the Economic Development Board (EDB), will facilitate the development of a Social Compact, with all stakeholders cultivating an understanding of the important role that each party plays in the country's socio-economic transformation as well as an appreciation of the potential benefits of greater collaboration. The CSB, SAC and EDB are the current primary mechanisms for public involvement and consultation, and will be part of the national governance arrangements and Institutional Framework for Sustainable Development. Over the last six months consultations have been held with Civil Society organisations across fifteen (15) regions in the country on the Medium Term Policy Framework (MTPF) and with several communities on development plans for their area. The Business community has also been engaged on several issues of interest to them by the Economic Development Board and the Council for Competitiveness and Innovation. In a difficult climate of labour relations the labour movement has been engaged on an ongoing basis at the highest levels of Government.

Stronger and more effective public sector anti-corruption efforts are also important in moving toward greater transparency and accountability. In September 2010, the Government of Trinidad and Tobago reaffirmed Trinidad and Tobago's commitment to the Extractive Industries Transparency Initiative (EITI). The EITI is a global initiative which aims to foster transparency and accountability by companies involved in extractive (i.e. oil, gas and quarrying) industries by disclosing to the population the total payments made to government by these companies reconciled with the government's declared receipts. A Cabinet appointed Multi-stakeholder Steering Committee comprised of nineteen (19) members, eight (8) of which represent civil society organisations, has been charged with the responsibility for Trinidad and Tobago achieving EITI compliant country status by August 2013. The EITI implementation process involves the production of annual independently audited reports on the revenues earned from the extractive sector, the removal of legal and administrative barriers to revenue transparency and accountability and the building of the capacity of civil society to engage in a discourse on the manner in which revenue is managed and distributed nationally. The Government is also in the process of bringing an enlightened procurement bill before Parliament, which addresses not only transparency, accountability and value for money issues, but also green economy issues.

PILLAR 3: THE ENVIRONMENT

Climate Change and Sea Level Rise

As outlined in the MTPF 2011-2014, Trinidad and Tobago has adopted a National Climate Change Policy (2010), the implementation of which will increase the use of new and innovative technologies that can lower the levels of emission; encourage the use of clean energy technology and renewable energy and promote the adoption of more energy efficient practices. The stage is therefore now set for a strategy for mitigating climate change and taking the steps to adapt to it.

Progress

- Adoption of a national Climate Change Policy (2010);
- Increase in the use of renewable energy (solar);
- Increase energy efficiency in commercial and residential buildings;
- Enhanced natural carbon sinks (done through the conservation and protection of natural forest)
- Increase the use of cleaner technologies in all greenhouse gas emitting sectors; and
- Enhanced research and development in renewable resources, granting fiscal incentives to involve private sector investment in renewable energy sources, energy efficiency, alternative energy technologies, devices and programmes.
- The establishment of a Cabinet appointed Energy Service Company (ESCO) Certification Committee, whose mandate includes the development of regulations and standards for the conduct of energy audits to ensure adherence to minimum industry requirements in accordance with best international practices.
- Ministry of Works and Infrastructure is undertaking the Mayaro Coastal Studies Project which is intended to analyse and identify the causes of erosion along the eastern coastline and to develop solutions to arrest the rate of erosion.
- The Manzanilla Seawall Project is another initiative being undertaken by the Ministry of Works and Infrastructure. The main aim of this project is to preserve the coastline of the Manzanilla coastline

Constraints and Challenges

- Inadequate data relevant to climate change, particularly historical data;
- Deficit of programmes and institutional capacity to support research, development and acquisition of renewable energy technology;
- Need for establishment of incentives to promote the use of clean technologies, alternative fuels and recycling initiatives; this is now being addressed by policy and action;
- Institutional and technical capacity constraints in identifying possible impacts of climate change on human, biological and physical resources through the conduct of vulnerability assessments with specificity;
- Need for more educational programmes to enhance the public awareness on climate change and the need to sustain this to effect change of behaviour.

Natural and Anthropogenic Hazard

Trinidad and Tobago's approach to disaster management is presently evolving from the existing approach of disaster preparedness and response, to embrace prevention, mitigation, recovery and rehabilitation planning through a Comprehensive Disaster Management (CDM) approach. This is aligned with the international and regional paradigm shift in disaster management and is critical to sustainable development.

The strategic goals of Trinidad and Tobago's Comprehensive Disaster Management Policy Framework (CDMPF) include:

1. More effective integration of disaster risk considerations into sustainable development policies, planning and programming at all levels, with special emphasis on disaster prevention, mitigation and preparedness;
2. Develop and strengthen institutions, mechanisms and capacities at all levels, in particular at the community level, which can systematically contribute to building resilience to hazards;
3. Systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response and recovery programmes in the reconstruction of affected communities.

Progress

MITIGATION

The Ministry of Planning and the Economy has established a partnership with the Seismic Institute at the University of the West Indies to conduct a systematic Microzonation Study in phases over the next ten (10) years. Work on this project is proceeding and is reviewed annually.

The Office of Disaster Preparedness and Management (ODPM) is currently conducting preliminary vulnerability assessments of each municipality in Trinidad and Tobago. The Preliminary Vulnerability Assessment, Critical Facilities Map and Hazard Occurrences Map of Tunapuna/ Piarco Region and Arima Borough, Couva/ Tabaquite/ Talparo Region, Penal/ Debe Region and Sangre Grande Region have been completed. The Preliminary Vulnerability Assessments will feed into the comprehensive national risk and capacity assessments.

PLAN AND PREPARE

The ODPM continues to encourage and facilitate Business Continuity Management (BCM) to ensure that essential services, private business, and local sectors prevent critical service

interruptions before, during and after an event or be able to re-establish full functionality after an event.

A National Land Use Policy and a Physical Development Plan are being prepared and will be completed in September 2012. This is supported by fifteen (15) regional plans and five hundred and eight five (585) community plans which will result in rezoning, and better order, process and planning.

RESPONSE

The ODPM continues to ensure effective response in the aftermath of a disaster. As such, plans are regularly practised through national exercises. Past exercises mainly included simulating flooding, earthquakes and ODPM's response to these events. Some of ODPM's priority areas for action continue to be: 1) shelter identification and inspection; 2) retrofit of homes to meet acceptable standards; 3) train shelter management personnel; 4) enactment of laws and regulations for shelters; and 5) establish purpose built shelters.

RECOVERY

The ODPM has hosted and facilitated several training sessions in damage assessment in collaboration with the United States Agency for International Development/Office of Foreign Disaster Assistance (USAID/OFDA) and with UN Economic Commission for Latin American and the Caribbean (UNECLAC).

The ODPM continues to assist in recovery efforts after hazard events. This involves the restoration and improvement of facilities, livelihoods and living conditions of disaster-affected communities in efforts to reduce disaster risk factors.

In addition, several funds are available for the Government to tap into to assist in recovery and relief efforts. These include: the Caribbean Catastrophe Risk Insurance Facility (CCRIF); the UN Central Emergency Relief Fund; the Inter-American Emergency Aid Fund (FONDEM); the Caribbean Development Bank (CDB); the Emergency Grant, Emergency Response Loan and Rehabilitation Loan and the Heritage and Stabilisation Fund.

Constraints and Challenges

- The small size of Trinidad and Tobago renders the entire country highly vulnerable to direct and indirect impacts from local, regional and international natural and man-made disasters, affecting its efforts to achieve sustainable development;
- Population continues to demonstrate a high level of complacency in mitigating risks and preparing for natural events;
- Lack of knowledge by the general population of the country's disaster response mechanisms such as shelter location and emergency response bodies; and
- Need for greater efforts to develop synergies between the leading disaster agency (ODPM) and various stakeholders in mitigation initiatives, planning and preparing, response and recovery efforts to effectively and efficiently deliver the CDM policy.

Management of Waste

The Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL) is responsible for the management of the country public landfill sites. Municipal Borough and City Corporations are responsible for the collection of domestic wastes within their individual Municipality. The Tobago House of Assembly (THA) is responsible of waste collection and disposal on the island of Tobago.

Progress

In the Budget Statement for fiscal 2011, proper waste management practices have been duly considered particularly with respect to its role in safeguarding the environment. The Government has consistently reiterated its responsibility to the environment which it views as a national asset to be conserved, for the benefit of this generation as well as future generations. There are several proposed pieces of legislation currently engaging the attention of stakeholders such as:

- Draft Waste Management Rules, 2008,
- Draft Beverage Container Bill, 1999 (amended, 2011),
- Draft Waste Prevention and Recycling Policy, 2010,
- Draft Municipal Solid Waste Management Policy (2008), and
- The Code of Practice for Biomedical Waste Management in Trinidad and Tobago (2005)

Other international initiatives include:

- the signing of a project document with the UNDP to assess the capacity of the Global Environment Fund (GEF) to develop within two (2) years a National Implementation Plan for the Stockholm Convention;
- the signing of a Memorandum of Understanding (MoU) with the Province of Nova Scotia to assist the Government with the development and implementation of an integrated Solid Waste/Resource Management System; and
- the signing of a Framework Agreement with the Basel Convention Secretariat and enactment of enabling legislation for the establishment of the Caribbean Basel Regional Centre for Technology Transfer and Training.

An alternative that can be proposed is the use of biogas as a source of energy. Biogas refers to the gas that is produced by the breakdown of organic matter in the absence of oxygen. The biogas that is produced comprises primarily methane, carbon dioxide and small amounts of Hydrogen Sulphide. In developed countries biogas technology already exists, where it is used on an industrial scale to power large farming operations, landfills, and so on. The use of biogas as an alternative energy source has its advantages:

- It reduces the impact of greenhouse gases such as methane which is a significantly more powerful greenhouse gas than carbon dioxide, with greater potential for increasing global warming effects;
- A Renewable Resource: Since biofuel is the product of recently consolidated atmospheric carbon, it is also considered to be a highly renewable resource

Coastal and Marine Resources

In the National Food Production Action Plan 2012-2015, the goal of the aquaculture programme will be to increase production within the first year with incremental increases in production over the five year period. Also, an accelerated marketing and promotional campaign and centralized processing and cold storage facilities will ensure sustained supplies and expanded production of farm grown fish. Further key elements of the Action Plan for Aquaculture will include, inter alia:

- Encouraging and promoting the adoption of Global Aquaculture alliance Standards (GAAS);
- Development of a policy on water use for aquaculture;
- Development of Tech – Parks to support investment in the sector;

- Production of a National Policy on Aquaculture through review and update of the draft aquaculture policy;
- Development of a model farm to promote and test production systems;
- Facilitating the expansion of hatcheries and research in production of high – value feeds;
- and
- Resolve issues of regulatory approvals for aquaculture projects in collaboration with relevant stakeholders.

Consequently the Ministry of Food Production, Land and Marine Affairs has introduced a revised Agricultural Incentive Programme designed to provide support to the various agricultural sub-sectors which now specifically targets Aquaculture. In tandem with these initiatives, research in aquaculture to improve Trinidad and Tobago's local production efficiency is still ongoing. The Institute of Marine Affairs' (IMA) Fisheries and Aquaculture Research Programme (F&ARP) has introduced re-circulating aquaculture systems (RAS) to improve the efficiency and sustainability of aquaculture production systems. One project based on this system is a collaborative effort with the Seafood Industry Development Company (SIDC) for the development of an intensive production system for growing hybrid red tilapias. To date there is no successful large scale commercial aquaculture project for food fish in Trinidad and Tobago. This project would therefore serve to demonstrate the possibilities for successful commercial aquaculture and potentially initiate further developments in commercial aquaculture.

Additionally, the Environmentally Sensitive Areas Rules of 2001 are being reviewed to allow for further conservation efforts. The international conventions which govern coastal and marine resources are:

- The Convention for the Protection and Development of Marine Environment of the Wider Caribbean Region which entered into force in Trinidad and Tobago on October 11, 1986 (the CARTAGENA Convention).
- The Protocol concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Water Caribbean Region which entered into force in Trinidad and Tobago on January 18, 1990 (the SPAW Protocol).
- The Convention on Wetlands (the Ramsar Convention, Iran 1971) which entered into force in Trinidad and Tobago on April 21, 1993.
- The United Nations Framework Convention on Climate Change which entered into force in Trinidad and Tobago on September 22, 1994.
- The United Nations Convention on Biological Diversity which entered into force in Trinidad and Tobago on August 01, 1996.

Though Trinidad and Tobago has made some headway in protecting its coastal and marine resources, research and ideas have been suggested for SIDS to adopt the blue economy approach. A UNESCO report, 'Blueprint for Ocean and Coastal Sustainability'10(2011) suggests that there be a shift from the current green economy emphasis towards the blue, ocean oriented, end of the spectrum and argues that for SIDS a green economy must in fact be very blue. In this report, ten (10) proposals were highlighted for ocean and coastal sustainability:

1. Create a global blue carbon market as a means of creating direct economic gains through habitat protection;
2. Fill governance gaps in the high seas, by reinforcing the UN Convention on the Law of the Sea;
3. Support the development of green economies in (SIDS);
4. Promote research on ocean acidification - how to adapt to it and mitigate it
5. Increase institutional capacity for scientific monitoring of oceans and coastal areas;

6. Reform and reinforce regional ocean management organisations;
7. Promote responsible fisheries and aquaculture in a green economy;
8. Strengthen legal frameworks to address aquatic invasive species;
9. “Green” the nutrient economy to reduce ocean hypoxia and promote food security; and
10. Enhance coordination, coherence and effectiveness of the UN system on ocean issues

Freshwater Resources

Water Resource Management and Development are shared amongst several government ministries and agencies. The Legislation governing Water Resources functions in Trinidad and Tobago are spread over several Acts such as:

- Water and Sewerage Act (1965);
- Waterworks and Water Conservation Act (1944);
- The Environmental Management Act (1995);
- The Town and Country Planning Act (1960);
- The Freedom of Information Act (1996);
- Regulated Industries Commission Act (proposed);
- Fair Trading Act Green Paper (proposed);
- Local Government Act No. 26 (1977);
- Municipal Corporation Act No. 21 (1990); and
- The Planning and Facilitation of Development Bill due to be laid in Parliament in mid-2012

Progress

The formulation and subsequent approval of the National Integrated Water Resources Management Policy in 2005 constituted a major step in this country’s water sector reform since it has established a coherent, cohesive and sustainable institutional framework for Integrated Water Resources Management.

- Other initiatives undertaken in alignment with the national goal of the water sector were:
 - - Establishment of the EMA through the enactment of the Environmental Authority Act (2000 revised)
 - - Establishment of the Regulated Industries Commission through the Regulated Industries Act (1998)
 - - Adoption of a Water Resources Management Strategy (2000)
 - - Establishment of the Water Resources Management Unit within the Ministry of Public Utilities (2000)
- Some other initiatives undertaken to address freshwater resources issues include:
 - - Implementation of the Water Pollution Rules (2007) which is aimed at reducing both the volume and concentration of pollutants discharged into watercourses thereby improving the quality of water. A registration system has been established to create an inventory of
 - water polluters.
 - - Provision of commercial service facilities for farming and related agricultural enterprises
 - and institutions, and wastewater treatment facilities. Further to the registration system, Water Pollution Discharge Permits will be issued to regulate the level of pollutants being discharged into water bodies.
 - - Development of a Water Quality Index and a water quality monitoring programme to ensure that water quality in rivers, seas, swamps and beaches are protected.

- Conduct of an education and awareness campaign to sensitise the public on water related issues;
- Establishing a potable water supply to approximately 95 percent of the population through the installation of improved infrastructure;
- Development of major water sources including the construction of additional desalination plants, the construction of a National Water Transmission and Distribution Grid, completion of the Beetham Water Re-use project, implementation of an aggressive Demand Management Programme of Universal Metering, and the completion, refurbishment and upgrade of water treatment plants, booster stations and service reservoirs;
- Upgrade of the wastewater management systems and sewerage systems through the refurbishment of the Primary and Secondary Clarifiers at the San Fernando Wastewater Treatment Plant; Integration and Expansion of the Wastewater Systems in the City of San Fernando and environs and the design of treatment, collection and outfall systems for the South-West Tobago Environment and Wastewater Project;
- - Development of Quality of Service Standards and Codes of Practice which have been agreed to by the Regulated Industries Commission (RIC) and WASA;
- - Implementation of a Beetham Wastewater Reuse Project to provide a dedicated water supply to the Point Lisas Industrial Estate from non-traditional source waste water. This involves the use of the high quality effluent from the Beetham Wastewater Treatment Plant to be treated to a standard that will permit its use by industries in the Point Lisas Industrial Estate via a Submarine Pipeline in the Gulf of Paria. The project will comprise three components, namely, a water reuse treatment facility, a submarine transmission system and a localized water distribution network; and
- - Implementation of Sludge Management at Beetham Wastewater Treatment Plant to improve the quality of sludge being discharged from the Beetham Wastewater Treatment Plant.

Energy Resources

Initiatives with respect to sustainable use of energy resources include:

- Developing a programme for continuous sustained exploration, but also with the intent that downstream demand for natural gas is met. This would be done through a bidding process.
- Engaging in optimal development of the petroleum industry to ensure that gas is explored, drilled and utilised in an efficient and effective manner through the development of a National Energy Policy inclusive of a natural gas utilisation and pricing policy. This would ensure future development of the country's hydrocarbon resources and would take into consideration green initiatives, as identified in the National Energy Policy Green Paper, which would be finalised in 2012. Reducing the Carbon footprint that harmfully impacts Trinidad and Tobago and its coastal neighbours is also a key priority of the Government.
- Diversifying - alternative gas based industries would be established within the Energy sector. This would reduce the impacts on the environment as a result of exploration and drilling processes. In an attempt to curb the emission of greenhouse gases from industry related activities, the Government would integrate cleaner technologies into the existing industrial parks.
- Fiscal incentives to encourage the use of renewable energy were proposed in the National

Budget Statement for fiscal 2011 and 2012 such as the zero-rating for VAT purposes of solar water heating equipment with the relevant amendments having been made to the Income Tax act via the Finance Act 2011.

Tourism Resources

The Draft Eco-Tourism Policy (2010) currently under review by the Standing Committee on Tourism has been crafted to address these environmental concerns within the sub-sector. The Government, in partnership with stakeholders, endeavors to:

- Identify and promote potential eco-tourism sites;
- Develop ecologically sound eco-tourism infrastructure;
- Diversify the range of tourism activities available at sites;
- Develop and enforce standards and norms for eco-tourism activities;
- Secure the involvement of the local communities living in and dependent on peripheral and other areas for their livelihood;
- Develop natural areas into national parks with emphasis on conservation with government/community/NGO co-managed visitation;
- Increase awareness amongst the general public, local communities, foreign visitors and Government staff;
- Enunciate mechanisms for securing the partnership of private sector enterprises committed to the goals of ecotourism for development of infrastructure and services; and
- Sensitise communities and augment local community livelihood.

Projects Implemented:

Some of the current initiatives undertaken by the Tourism Development Company Ltd. (TDC) to develop and expand the local tourism industry include the Service, Training, Attitude, Respect (STAR) programme, School Awareness, the Maracas Beach Redesign and Restoration Project, the Small Tourism Enterprise Project (STEP), and the Trinidad and Tobago Tourism Industry Certification (TTTIC).

- The National Tourism Quality Service Improvement Programmes
- The Maracas Beach Redesign and Restoration Project
- A sustainable and ecologically sensitive strategy
- School Awareness
- Small Tourism Enterprise Project (STEP)
- The Trinidad and Tobago Tourism Industry Certification (TTTIC)
- Green Globe 21
- Tourism Development Incentives

Constraints and Challenges

A number of factors affect the sustainable development of the tourism industry and its potential to contribute more significantly to the economy. The major constraints and challenges include:

- Insufficient collaboration and communication among major stakeholders;
- Environmental degradation and socio-cultural impacts;
- Insufficient tourism education and training to increase human resource and entrepreneurial development;
- Inadequate local community involvement;
- Inadequate infrastructure;
- Inadequate air and sea access for intra-regional travel;
- Limited innovation in product development, marketing and promotion;

- Quality of tourist accommodation establishments;
- Poor adherence to international standards;
- Inadequate funding; the need for effective investment schemes and industry incentives;
- Insufficient land use plans and carrying capacity studies;
- The need to address safety, security as well as issues of disaster management, preparedness and communication;
- Insufficient research and measurement of industry results, standards and indicators;
- Increased social issues of crime, HIV, prostitution and the illegal drug trade which adversely affect the country's image.

Biodiversity and Protected Areas

One of the ways in which biodiversity can be protected is through the establishment of protected areas. Protected Areas (PAs) are important management tools for protecting, conserving and managing natural and built heritage; critical to sustainable national development. They vary in intensity of human use from no entry areas in the case of strict nature reserves, to sites that allow for multiple uses in different zones. They can be terrestrial, coastal, or marine or a combination of these.

Progress

- Adoption of the Protected Areas Policy (2011);
- Preparation of a Draft National Biosafety Network for Trinidad and Tobago;
- Declaration of the Buccoo Reef as an Environmentally Sensitive Area;
- The EMA has recently undertaken efforts to conserve the country's local biodiversity by conducting an assessment of the status of the biodiversity resources, compiling existing national biodiversity in Trinidad and Tobago and undertaking a gap analysis of the biodiversity information. The aim of this was the synchronisation of national biodiversity information to produce guidelines and protocols for the integration of biodiversity conservation issues into national plans, programmes and policies.

Constraints and Challenges

- To protect biodiversity, the National Wildlife Policy needs to be adopted;
- Financial and technical support;
- Inadequate trained personnel for all aspects of biodiversity management;
- Lack of collaboration among the multitude of agencies involved in biodiversity management;
- Need to formally establish a National Biodiversity Centre to provide applied science to support the work of the management agencies;
- Greater representation of NGOs and CBOs on the Forest and Protected Areas Authority Board is needed;
- The country's biodiversity, in particular, its marine resources, faces new threats in the form of marine alien invasive species which require legislative controls;
- Existing regulatory framework for the management of the nation's biodiversity is severely deficient, piecemeal at best, and responsive only to issues when they arise on the national agenda;
- No wildlife sanctuary or environmentally sensitive area is sufficient in size to support the range of the species which it seeks to protect;
- Sensitive Species Rules and the Sensitive Areas Rules under the Environmental Management Act are failing;
- Hunting is taking place in an ad hoc, unsustainable manner; and
- Slow decision-making process, especially in the context of approval of policies or plans and acquisition of resources for action.

Transport
Progress

Methods of producing fuels can include the formation of alcohols by fermentation of biomass in bioreactors containing microorganisms and the gasification of biomass in reactors to form syngas (carbon monoxide and hydrogen mixture), which can then be used to produce numerous hydrocarbon fuels such as diesel. The biomass used in these processes can potentially range from sugarcane to switch grass, algae, or biodegradable waste, with different raw materials providing better product yields dependent on production method.

Considering the contribution of the transportation sector to GHG emissions, the Government of Trinidad and Tobago has prescribed several remedial measures. Specifically, the MTPF 2011- 2014 outlines a strategy for the “Greening” of the Priority Bus Route, which is the major East-West road network artery utilized by public (buses) and private (maxi taxis) mass transportation. The Priority Bus Route is in the process of being converted into a “Green” route which envisions:

- (i) all vehicles using the route being powered by either low carbon emission fuels (CNG), have zero emissions (electric power) or a combination of electric power and fossil fuel (hybrid power), and;
- (ii) all street and traffic lights along the Route being converted to ones that are solar powered

Monitoring research and development in gasification and other processes used in the production of biofuels is critical to determine the applicability of this technology in Trinidad and Tobago in the future as the world shifts from peak oil through peak natural gas, toward consumption of alternatives.

1. Compressed Natural Gas (CNG)
2. Increased Public Transport Efficiency and Infrastructure