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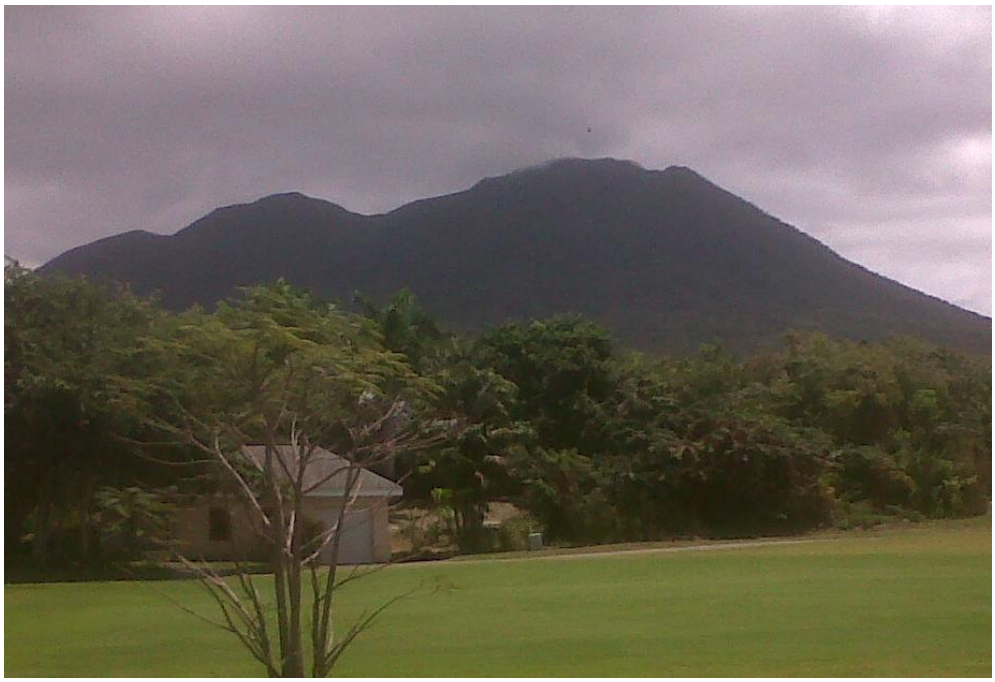
Protecting and enhancing the livelihoods, environments and economies of the Caribbean Basin

CARIBSAVE Climate Change Risk Profile for Nevis



Summary Document

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THE CARIBSAVE CLIMATE CHANGE RISK ATLAS (CCCRA)

A practical evidence-based approach to building resilience and capacity to address the challenges of climate change in the Caribbean

Climate change is a serious and substantial threat to the economies of Caribbean nations, the livelihoods of communities and the environments and infrastructure across the region. The CARIBSAVE Climate Change Risk Atlas (CCCRA) Phase I, funded by the UK Department for International Development (DFID/UKaid) and the Australian Agency for International Development (AusAID), was conducted from 2009 – 2011 and successfully used evidence-based, inter-sectoral approaches to examine climate change risks, vulnerabilities and adaptive capacities; and develop pragmatic response strategies to reduce vulnerability and enhance resilience in 15 countries across the Caribbean (*Anguilla, Antigua & Barbuda, The Bahamas, Barbados, Belize, Dominica, The Dominican Republic, Grenada, Jamaica, Nevis, Saint Lucia, St. Kitts, St. Vincent & the Grenadines, Suriname and the Turks & Caicos Islands*).

The CCCRA provides robust and meaningful new work in the key sectors and focal areas of: Community Livelihoods, Gender, Poverty and Development; Agriculture and Food security; Energy; Water Quality and Availability; Sea Level Rise and Storm Surge Impacts on Coastal Infrastructure and Settlements; Comprehensive Disaster Management; Human Health; and Marine and Terrestrial Biodiversity and Fisheries. This work was conducted through the lens of the tourism sector; the most significant socio-economic sector to the livelihoods, national economies and environments of the Caribbean and its people.

SELECTED POLICY POINTS

- Regional Climate Models, downscaled to national level in the Risk Atlas, have provided projections for Caribbean SIDS and coastal states with enough confidence to support decision-making for immediate adaptive action.
- Planned adaptation must be an absolute priority. New science and observations should be incorporated into existing sustainable development efforts.
- Economic investment and livelihoods, particularly those related to tourism, in the coastal zone of Caribbean countries are at risk from sea level rise and storm surge impacts. These risks can encourage innovative alternatives to the way of doing business and mainstreaming of disaster risk reduction across many areas of policy and practice.
- Climate change adaptation will come at a cost but the financial and human costs of inaction will be much greater.
- Tourism is the main economic driver in the Caribbean. Primary and secondary climate change impacts on this sector must both be considered seriously. Climate change is affecting related sectors such as health, agriculture, biodiversity and water resources that in turn impact on tourism resources and revenue in ways that are comparable to direct impacts on tourism alone.
- Continued learning is a necessary part of adaptation and building resilience and capacity. There are many areas in which action can and must be taken immediately.
- Learning from past experiences and applying new knowledge is essential in order to avoid maladaptation and further losses.

OVERVIEW OF CLIMATE CHANGE ISSUES IN NEVIS

Nevis is already experiencing some of the effects of climate variability and change through damages from severe weather systems and other extreme events, as well as more subtle changes in temperatures and rainfall patterns.

Detailed climate modelling projections for Nevis predict:

- an increase in average atmospheric temperature;
- reduced average annual rainfall;
- increased Sea Surface Temperatures (SST); and
- the potential for an increase in the intensity of tropical storms.

And the extent of such changes is expected to be worse than what is being experienced now.

To capture local experiences and observations; and to determine the risks to coastal properties and infrastructure, selected sites were extensively assessed. Primary data were collected and analysed to:

1. assess the vulnerability of the livelihoods of community residents in the **Jessups and Cotton Ground** areas to climate change; and
2. project sea level rise and storm surge impacts on **Lover's Bay, Jessups, Oualie and Pinney's Beach**.

The sites were selected by national stakeholders and represent areas of the country which are important to the tourism sector and the economy as a whole, and are already experiencing adverse impacts from climate-related events.

Vulnerable community livelihoods

- Tourism, farming and fishing are the main livelihood activities in the Jessups and Cotton Ground.
- Improper waste disposal, overfishing and development activities have been attributed to an increase in the severity of flooding (in some instances), depletion of fish stocks and the decline in coral reef health.
- Observations in the community include: sea level rise, increasing sea surface temperatures, an increase in ambient temperature, depletion of marine and terrestrial biodiversity and more frequent heavy rain events.

Vulnerable coastlines

- Even under a 0.5 m SLR, over 40% of the highly valued beach resource at Jessups, Oualie and Pinney's Beach would be inundated.
- Sea turtle nesting sites are also at risk to SLR and erosion, with 79% affected by a 50 m erosion scenario.
- Local tourism operators perceive that beaches along with the prevailing climate are the island's main tourism attractions.
- Projected rebuild costs for tourist resorts damaged and inundated by SLR amount to over US $936 million in 2050.

Climate change effects are evident in the decline of some coastal tourism resources, but also in the socioeconomic sectors which support tourism, such as agriculture, water resources, health and biodiversity.

CLIMATE CHANGE PROJECTIONS FOR NEVIS

The projections of *temperature, precipitation, sea surface temperatures;* and *tropical storms and hurricanes* for Nevis are indicated in Box 1 and have been used in making expert judgements on the impacts on various socio-economic sectors and natural systems, and their further implications for the tourism industry.

Stakeholders consulted in the CCCRA have shared their experiences and understanding about climate-related events, and this was generally consistent with observational data.

Box 1: Climate Modelling Projections for Nevis

Temperature: Regional Climate Model (RCM) projections indicate an increase ranging from 2.4˚C to 3.2˚C in mean annual temperatures by the 2080s, in the higher emissions scenario.

Precipitation: General Circulation Model (GCM) projections of rainfall span both overall increases and decreases, ranging from -41 to +10 mm per month by 2080 under the higher emissions scenario. Most projections tend toward decreases. The RCM projections, driven by HadCM3 boundary conditions, indicate large decrease in annual rainfall (-22%) when compared to simulations based on ECHAM4 (-7%).

Sea Surface Temperatures (SST): GCM projections indicate increases in SST throughout the year. Projected increases range from +0.7˚C and +2.8˚C by the 2080s across all three emissions scenarios.

Tropical Storms and Hurricanes: North Atlantic hurricanes and tropical storms appear to have increased in intensity over the last 30 years. Observed and projected increases in SSTs indicate potential for continuing increases in hurricane activity and model projections indicate that this may occur through increases in intensity of events but not necessarily through increases in frequency of storms.

SEA LEVEL RISE AND STORM SURGE IMPACTS ON COASTAL INFRASTRUCTURE AND SETTLEMENTS

The majority of infrastructure and settlements in small islands, like Nevis, are located on or near the coast, including government, health, commercial and transportation facilities. This high density of development (particularly related to tourism) increases the risk of degradation of coastal and marine biodiversity thereby reducing its resilience to climate change impacts including SLR and storm surge.

Figure 1: Erosion at Lover's Beach (Nevis)

The CARIBSAVE Partnership coordinated a field research team with members from the University of Waterloo (Canada) and the staff from the Department of Development Control and Planning Authority to complete detailed coastal profile surveying of Lover's Bay, Jessups, Oualie and Pinney's Beach.

Even under a 0.5 m SLR, over 40% of the highly valued beach resource at Jessups, Oualie and Pinney's Beach would be inundated. With a 1 m SLR, all study

sites would be more than 50% inundated (Table 1). The response of tourists to such a diminished beach area remains an important question for future research; however local tourism operators perceive that these beach areas along with the prevailing climate are the island's main tourism attractions.

Table 1: Beach Area losses at Four Resorts Nevis

	Lover's Bay		Jessups		Oualie		Pinney's Beach	
SLR Scenario	Beach Area Lost To SLR (m^2)	Beach Area Lost To SLR (%)	Beach Area Lost To SLR (m^2)	Beach Area Lost To SLR (%)	Beach Area Lost To SLR (m^2)	Beach Area Lost To SLR (%)	Beach Area Lost To SLR (m^2)	Beach Area Lost To SLR (%)
0.5m	5471	37%	3823	54%	4482	66%	8914	41%
1.0m	2718	55%	1339	72%	1570	89%	2744	53%
2.0m	3485	78%	1978	100%	731	100%	9416	96%
3.0m	3249	100%	-	-	-	-	899	100%

Indeed if erosion is damaging tourism infrastructure, it means the beach will have essentially disappeared. With projected 100 m erosion, 82% of the resorts in Nevis would be at risk. Such impacts would transform coastal tourism in Nevis, with implications for property values, insurance costs, destination competitiveness, marketing and wider issues of local employment and economic well-being of thousands of employees. Sea turtle nesting sites, a tourist attraction, are also at risk to SLR and erosion, with 79% affected by a 50 m erosion scenario. Transportation infrastructure, also of key importance to tourism, is at risk. Ports are threatened, with 50% of port lands across the two islands (St. Kitts and Nevis) projected to be inundated with a 1 m SLR.

St. Kitts and Nevis is highly dependent on international tourism and will be particularly affected with annual costs as a direct result of SLR. St. Kitts and Nevis will incur annual losses between US $30 million in 2050 to over US $101 million in 2080 (based on a mid range scenario). Capital costs are also high, with rebuild costs for tourist resorts damaged and inundated by SLR amounting to over US $936 million in 2050 up to US $2.2 billion in 2080. Infrastructure critical to the tourism sector will also be impacted by SLR resulting in capital costs to rebuild airport estimated to be between US $44 million by 2050 to US $132 million by 2080. Capital costs to rebuild ports are estimated to be between $15 million in 2050, to $44 million by 2080[i].

COMMUNITY LIVELIHOODS, GENDER, POVERTY AND DEVELOPMENT

More than 50 residents and workers from the Jessups and Cotton Ground communities [1](in the parish of St. Thomas) participated in CARIBSAVE's vulnerability assessment which included a vulnerability mapping exercise (See Figure 3), focus groups and household surveys which were developed according to a sustainable livelihoods framework. This provided an understanding of: how the main tourism related activities, including fishing, vending and other micro and medium-sized commercial activities located along the coast and have been affected by climate related events; the community's adaptive capacity and the complex factors that influence their livelihood choices; and the differences in the vulnerability of men and women.

Figure 2: Beach area with small jetty used by pleasure craft and fishers

Some of Nevis' main tourism attractions are based in St. Thomas, including the Four Seasons Resort Nevis, golf courses, eco-trails, hiking, numerous beaches and some historical sites. The St. Kitts and Nevis Taiwan Agriculture Project is also based in St. Thomas and some fishers land their catches along the shoreline. The importance of tourism, agriculture and fisheries is quite high and these sectors and those who depend on them for their livelihoods, are very vulnerable to climate change impacts.

Community Characteristics and Experiences

Tourism in Nevis depends heavily on healthy coastal and marine resources, which include beaches, a clear and shallow nearshore and vibrant coral reefs for a variety of recreational activities. Farmers (including back-yard subsistence farmers) depend on fertile soil conditions and predictable wet and dry seasons in order to have higher outputs. Fisheries-based livelihoods, similar to tourism, thrive where there is an abundance of marine life and healthy coral habitats.

However, the integrity of these resources in Nevis is threatened by a changing climate and changes have already been observed. Some of the more evident changes include more frequent hydro-meteorological events (storms, heavy rains), SLR, sea surface temperature rise, an increase in ambient temperature and depletion of marine and terrestrial biodiversity. Changes in seasons have also been observed, although no specific patterns were identified. Aside from the impacts of climate change, some notable changes in the environment have been attributed to human actions. These actions may even exacerbate climate change impacts, but in the very least, they affect the livelihoods and well being of residents. Improper waste disposal, overfishing and development activities have been cited as issues of concern and are attributed to an increase in the severity of flooding (in some instances), depletion of fish stocks and the decline in coral reef health, respectively.

Hurricanes are the greatest concern for community residents as they cause the most physical damage. The main tourism employer on the island, the Four Seasons Hotel, had been closed on two occasions since its

[1] In this report these areas are collectively referred to as "The community".

establishment in 1991 as a result of storm events. The location of the resort makes it very prone to impacts from flooding and inundation from sea swells and storm surge. These closures, which lasted months at a time, resulted in temporary unemployment and loss of income for many locals who work at the resort and a significant loss of revenue at the national level.

Hurricane Omar in 2008 had the greatest impact, resulting in the closure of the property for two years between October 2008 and December 2010 to allow for extensive repairs and refurbishment. Not only those directly employed by the resort were affected, but also all of those persons employed in related industries (e.g. scuba diving, craft making, tour guides etc.). Fortunately, some staff members worked at other hotels in St. Kitts during the period of closure and subsequently returned to the Four Seasons Hotel after its reopening. Others went into self-employment in catering, roadside barbeque stalls and vending in the capital, Charlestown, which was relatively uncommon before. With the loss of income during the closure of the Four Seasons resort, workers were unable to pay loans and mortgages during this period and this led to the reclamation of vehicles, land and houses which were acquired on hired purchase through local banks. What is unclear is if projected climate change was given due consideration in the rebuild.

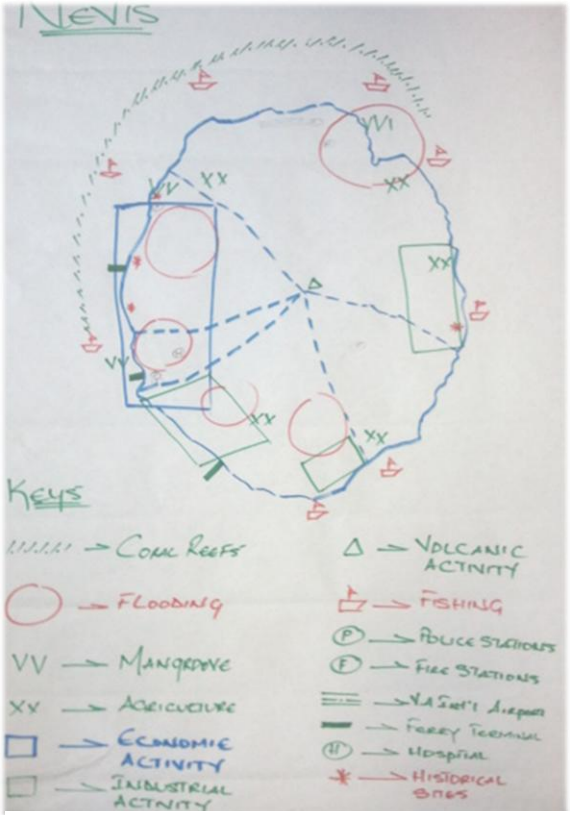

Figure 3: Hand-drawn Community Map showing areas of vulnerability to hazards around Nevis

The Nelson Spring area in St. Thomas is prone to flooding when storms or heavy rains occur. Apart from this, there is little concern for the physical impacts of flooding, landslides and other climate related events on the community. Weather events have more serious consequences for *livelihood activities,* especially tourism and residents working in tourism are highly vulnerable to weather impacts. During hurricanes, churches are used as shelters, but need significant improvements if they are to meet the standard required for effective hurricane shelters, as the structures may pose hazards in themselves.

The health of the coral eco-systems around the area is declining and this is blamed primarily on mining and quarry activities on the eastern side of the island. This in turn is associated in part to the decline of fisheries on the island. Overfishing is also seen to be a major problem in fisheries (both marine and freshwater fish), but while some community residents acknowledge the decline in fisheries, most attempts to get fishers to conserve and practice more sustainable fishing methods have been futile.

Climate change poses a specifically dire threat for social and economic groups which are inherently vulnerable; including women, children, the poor, the elderly, the disabled and persons working in volatile, climate sensitive sectors. Efforts by the Government of St. Kitts and Nevis have seen a reduction in poverty within the last decade, however close to half of the local population (in Nevis) was collectively rated as poor, or considered vulnerable to falling into poverty. Such persons, many of whom are involved in volatile sectors include large numbers of unskilled or low-skilled women. This is an important consideration in developing a suitable adaptation intervention for this community, bearing in mind that many households are headed by women and are therefore responsible for an entire family.

In further consideration of the community's capacity to respond to climate change events, their access to and dependence on a suite of 'livelihood assets' was examined. Ownership of houses, land and communication and entertainment assets is fairly high amongst both men and women and would tend to suggest that most community residents can afford a comfortable lifestyle. Housing structures are strong and sanitation conveniences are present in most cases. Provisions for personal and household protection are in place by some residents, but a high number of households are without home insurance because of a distrust of insurance companies based on previous experiences when trying to claim for losses after storm events. There is little indication of any adaptation or mitigation strategies by residents to protect themselves, their households and their livelihoods against impacts of extreme weather. This is of great concern as it has implications for household and overall community vulnerability to present day and future climate change impacts. Slight gender differences arose out of the household survey, but few highlight any significant disadvantages for men or women in relation to each other.

In the face of climate change and the threat that it poses to Caribbean societies and economies, the comprehensive integration of poverty, gender and livelihood issues into climate change impact and vulnerability assessment and planning processes is essential to developing appropriate adaptation strategies. Recommendations put forward to address vulnerability and adaptive capacity concerns range from infrastructural assessments and development, networking and collaboration, training and education activities and policy reform to incorporate gender and poverty lenses. These are only some of the activities that can be implemented in the short and long term and will require efforts at all levels and across sectors to build the resilience of communities like Cotton Ground and Jessups to the impacts of climate change.

AGRICULTURE AND FOOD SECURITY

The close of the sugarcane industry in St. Kitts and Nevis in 2005 signalled a significant change in the agricultural landscape of the country, which depended on this crop for its prosperity for a period of 350 years. However, the Government's intensive diversification programme has resulted in increased production of non-traditional crops, livestock, fruits and vegetables. Climate projections under both the CSIRO and HadCM2 models indicate potentially devastating impacts on the prospects for cultivation of these agricultural products and in both islands salinisation of coastal aquifers will negatively affect availability of water for agriculture. Some of these impacts are already being realised according to the National Annual Agricultural Review (2010), which reports that the harsh and long dry spells experienced by farmers in St. Kitts and Nevis is making production more difficult. Vegetable production during 2009 was adversely affected by heavy and consistent rainfall in the last quarter of the year. This occurrence considerably reduced the amount of land preparation services that could have been carried out during that time and consequently reduced crop planting days for farmers.

A significant contributory factor to vulnerability in the agriculture sector is land degradation as a result of the over use of lands for mono crop sugar cane agriculture; clearing of lands for residential and tourism development; farming on high elevations above the 1000 ft contour; and squatting or unregulated settlements. Competing demands on the island's land resources for agriculture, tourism, housing, services and facilities in conjunction with unenforced legislation and fragmented policies has exacerbated the situation.

In addition to the physical aspects of vulnerability, agriculture in Nevis is affected by scarcity of farm labour. This is generally attributed to the low wages paid for farm work and the consequent lack of interest.

Climate changes concerns for agriculture are presently dealt with at the farm level and there is the need for more public discussion supporting policies and an institutional framework to strengthen adaptive capacity of local farmers to mitigate against the negative impacts. The Government of St. Kitts and Nevis' Adaptation Strategy in Response to The New EU Sugar Regime 2006 – 2013 outlines a clear action plan to address agricultural diversification, food safety, security and nutrition. This framework is intended to strengthen policy and planning activities in the agriculture sector, expand public and private sector linkages and improve coordination and implementation. However, there needs to be an actual policy on climate change mitigation and adaptation for agriculture which would focus on prioritising and addressing the problems caused by climate change impacts as identified by local farmers.

Research on information needs of stakeholders in the agricultural and rural sector of St. Kitts and Nevis[ii] showed that there were specific knowledge gaps in agricultural technology. For instance, agro-processors lacked technical capacity to make value added products from local fruits and medicinal plants. Farmers also asked for support in the areas of integrated pest management, post harvest technology, grading systems, greenhouse technologies, hydroponics and water resource management. So this is clearly where several interventions can be made to address capacity gaps and knowledge about climate change.

Given the existing initiatives in Nevis, there are opportunities for developing projects that specifically deal with agriculture and climate change. A multi-location project involving farmers' cooperatives and the Government owned Capisterre Farm can be used to model the impact of climate change on production and help to develop new, adapted varieties of selected crops that respond to a changing climate. Similarly, the Taiwanese Agricultural Mission in St. Kitts and Nevis conducts research on various food crops and exposes local farmers to the current technologies and the emerging tools in agriculture. Capacity should therefore be built to include aspects on climate change.

ENERGY AND TOURISM

St. Kitts and Nevis belong to the region's low emitters at 2.6 t CO_2 per capita as compared with the global annual average of 4.3 t CO_2 per capita. However, more recent estimates suggest considerably higher emissions of 3.8 t CO_2 per capita. In the case of tourism in St. Kitts and Nevis, results indicate that cruise tourism is the most important sub-sector, accounting for 40% of emissions. This is followed by aviation (24%) and accommodation (15%). If compared to national emissions of 196,000 t CO_2, the tourism sector would account for about 88%. A detailed energy assessment of the tourism sector is needed, however, to confirm these figures, which in part are based on estimates with considerable uncertainties and assumptions. There is also uncertainty how emissions are divided between St. Kitts and Nevis, although approximately 20% of fuel imports are for Nevis and a comparison based on arrival numbers would suggest that about 20% of tourism related energy use and associated emissions fall on the island.

The Nevis Electricity Company (NEVLEC) is the wholly owned subsidiary of the Nevis Island Administration that generates, transmits, distributes and sells electrical energy in Nevis. The power plant is located at Prospect Industrial Site with a total installed capacity of 13.4 MW.

Table 2 presents the production and consumption data for NEVLEC over the past decade.

Table 2: Electricity generating statistics, Nevis 2001-2009

Years	Electricity Production	Unit Consumption	Wind Production

	(kWh)	(kWh)	(kWh)
2001	36,529,470	29,369,300*	
2002	44,441,970	36,306,750	
2003	46,472,420	37,376,190	
2004	47,668,050	38,021,830	
2005	52,020,160	42,169,360*	
2006	54,346,510	44,030,680	
2007	55,303,180	44,607,790	
2008	55,779,790	44,520,950	
2009	50,995,700	39,756,300	
2010	50,851,480	41,251,750	1,237,250

*These values were forecast/estimated because not all data was collected for those particular years.

(Source: Cartwright Farrell, NEVLEC, personal communication, May 11, 2011)

Oil consumption in St. Kitts and Nevis has increased from 449 bbl per day in 1990 to 1300 bbl per day in 2008 and further growth is projected to 2015. De Cuba (2006) presents the projected peak demand for Nevis, which indicates considerable growth in the period 2005 - 2015, Figure 4.

In addition to the diesel plant, the WindWatt Wind Farm on Maddens Estate in south-eastern Nevis (2.2 MW capacity) was opened in summer 2010 and was the first wind power project in the OECS. The eight turbines have been providing 1.1 MW, with an allowance to go to a maximum of 1.6 MW of power. Work is ongoing for the development of a 10 MW geothermal power plant, with additional discussions regarding expansion by another 30 MW to supply St. Kitts by underwater cable.

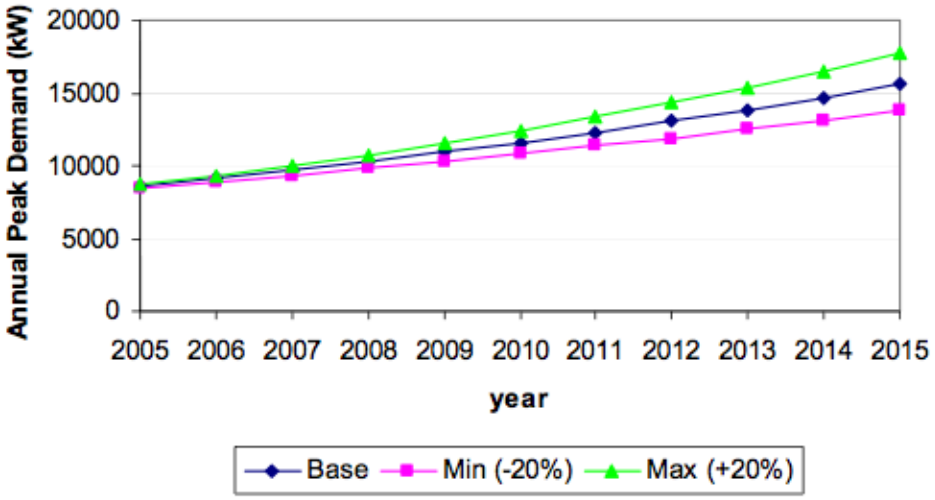

Figure 4: Projections of the annual peak demand for Nevis 2005-2015

(Source: De Cuba, 2006)

St. Kitts and Nevis have, in the form of the draft National Energy Policy and the draft National Energy Action Plan, two of the most advanced documents in the region to address energy use and to strategically re-structure the energy sector towards renewable energy sources (wind power and geothermal). The documents propose that the islands focus on regional integration, diversification and increased energy supply and security, with a view to participating in the Clean Development Mechanism, thereby reducing emissions and cost of energy. The optimal combination of power supplies for Nevis will achieve a contribution of 30 - 35% of capacity from renewable sources[iii]. Table 3 presents the options that are being considered for future renewable energy development over the short, medium and long term.

Table 3: Possible future wind, solar and geothermal power

		St. Kitts		Nevis		Regional	
		Wind	Solar	Wind	Geothermal	Renewable	Fossil fuel
Short term (1-3 years)	Installed Capacity (MW)	5.4		2.2	10		
	Average capacity (MW)	2.7		0.9	9		
	Sum additional average capacity (MW)				12.6		
	Timing	2012		2010	2011		
Medium term (3-10 years)	Installed Capacity (MW)		5		35		
	Average capacity (MW)		2		33		
	Sum additional average capacity (MW)				35		
	Timing		2013		2015		
Long term (10-20 years)	Installed Capacity (MW)				20	30	
	Average capacity (MW)				18	28	
	Sum additional average capacity (MW)				46		
	Timing				2020	2020	

(Source: MOPWUEH, 2011a)

Rising prices for fossil fuels and emerging climate policy will make the tourism sector in Nevis increasingly vulnerable. High and rising energy costs should self-evidently lead to interest in more efficient operations, but this does not appear to be the case in tourism generally. Rising oil prices will affect tourism in particular since aviation has limited options for using alternative fuels and increases in fuel costs will inevitably be passed on to the passengers. The International Energy Agency (IEA, 2010) anticipates that even under its New Policies Scenario, which favours energy efficiency and renewable energies, energy demand will be 36% higher in 2035 than in 2008, with fossil fuels continuing to dominate demand. At the same time there is reason to believe that 'peak oil', i.e. the maximum capacity to produce oil, may be passed in the near future.

Overall, current frameworks to mitigate GHG emissions from aviation do not seem to represent a substantial threat to tourism development[iv,v,vi], but new regulatory regimes and market based instruments to reduce emissions in line with global policy objectives would cause changes in the global tourism system that could affect in particular SIDS. To anticipate these changes and to prepare the vulnerable tourism economies in the Caribbean to these changes should thus be a key management goal for tourism stakeholders.

St. Kitts and Nevis is planning considerable action that could make the twin island federation a leader in renewable energy development in the region but the direct impacts of climate change on energy generation, distribution and transmission infrastructure must be considered. This has implications for existing traditional (fossil fuel based) energy systems as well as proposed renewable energy initiatives that are being implemented. It is therefore recommended that the sustainability of the chosen technologies given the projected climate changes is carefully assessed. An increase in the intensity (and possibly frequency) of severe low pressure systems, such as hurricanes, has the potential to affect both traditional and renewable energy production and distribution infrastructure, including generating plants, transmission lines and pipelines. The energy based infrastructure in Nevis is therefore vulnerable to impacts from tropical storms and hurricanes during any given year. Some of the more vulnerable components of the energy system include transmission lines, poles and other relatively light, above ground infrastructure, which can suffer significant damage from high winds. Modern wind turbines stop rotating when wind speed exceeds approximately 55 mph to protect the equipment and the structures are typically designed to

withstand winds in excess of 150 mph. The turbines installed in Nevis are designed to be winched down in the event of an approaching hurricane. Power generating stations and other major infrastructure located on the coastline are also highly vulnerable to damage from flooding and inundation resulting from SLR and storm induced surges. Temperature increases have been shown to reduce the efficiency of energy generation at thermal power plants and reduced precipitation may affect water availability for non-contact cooling of power generators. Alternative energy sources, while they are environmentally more sustainable, also face challenges from physical climate change impacts and these must be considered in energy sector planning.

Tourism's share in energy use and emissions is considerable and likely to grow in the future, leading to growing vulnerabilities in a business-as-usual scenario. At the same time, the sector holds great potential for energy reductions and should thus be one of the focus points of policy considerations to de-carbonise island economies. In St. Kitts and Nevis the National Energy Plan addresses the tourism sector, focusing on energy efficiency through technology and renewable alternatives, recycling, capacity building and a potential levy for high energy uses.

The vision of the Federation of St. Kitts and Nevis is "to become an island nation with a sustainable energy sector where reliable, renewable, clean and affordable energy services are provided to all its citizens"[vii]. Although the current Policy and Plan do not specifically refer to the sustainability of the sector under climate change it does make it clear that the aim is to develop sustainable energy solutions. Installation of wind turbines that can be winched down in the event of an approaching storm indicates that the type of assessments that have been considered and are further required in other areas to assess the sustainability of the sector.

It is advisable for all destinations in the Caribbean to initiate discussions on new tourism management models to reduce energy use and emissions, with a focus on market structure and average length of stay. The rationale is that some markets are economically more beneficial, while consuming considerable less energy and causing lower emissions. The analysis of markets based on a combined assessment of their economics and energy intensity should thus be a key priority. Furthermore, average length of stay is declining throughout the region and to maintain a stable number of bednights tourist volumes would have to continuously grow in the future. This would make islands more vulnerable to energy prices and climate policy. Marketing efforts to increase average length of stay should thus be considered and evidence from a case study in Barbados suggests that this is indeed feasible and at the same time there is scope to increase spending.

Policy frameworks need the active engagement of stakeholders in tourism planning with regard to energy use and emissions. Policy goals must be communicated and monitored to ensure that stakeholders engage in the required changes in their operations. Consequently, measures ranging from regulation to market based instruments to incentives will have to be implemented.

As a strategy to achieve low-energy, low-emission societies in the Caribbean islands, eight specific measures are recommended, some of which are already captured in the draft National Energy Policy and Plan. These include i) measures to improve knowledge and awareness of energy consumption, emissions of greenhouse gases and climate change among stakeholders; ii) energy audits to better understand where energy is used and where emissions occur; iii) the definition of action plans to avoid energy use, increase efficiencies and develop renewable energies; iv) the translation of carbon management, technological innovation and policy in co-ordinated management strategies; v) the pricing of energy through taxes and emissions trading to convey clear, long-term market signals; vi) regulation of carbon intense activities in

combination with vii) incentives for low-carbon technology and consumption; and viii) the documentation of progress and its communication to stakeholders and society.

WATER QUALITY AND AVAILABILITY

Groundwater is the main source of water in Nevis where there are 14 active wells[viii]. However, compared to larger St. Kitts, water is less available on Nevis due to rainfall patterns as a result of the lower elevations of its central mountains, absence of significant springs and prominence of a layer of silica pan covered with a layer of clayey soils that inhibits the prolific water infiltration. Approximately 91% of piped-borne water is obtained from ground water sources and 9% from surface springs. According to the Water Services Department, water resources are considered sufficient to meet current water demands on the island, despite the fact that the average annual rainfall is 1170 mm which is lower than St. Kitts and lower than other islands in the Caribbean.

Figure 5: A rainwater storage tank as is used by many householders in Nevis

Adequate supply may be due to the fact that, unlike many other Caribbean countries, the island has become greatly adapted to rainwater harvesting. According to a study on rainwater harvesting in selected Caribbean countries, 80 – 90% of the residents and businesses in Nevis can capture water, whereas for St. Kitts only 5% of the island can accomplish the same[ix]. The water storage capacity of Nevis is approximately 3 million gallons of water/day.

In both St. Kitts and Nevis, 96.8% of the population has access to potable water and 86% of households have water for seven days of the week. The data did not provide a breakdown of the type of toilet facilities by island, but for the entire federation 7% and 1% of the population utilises pit latrines and ventilated pit latrines respectively. Only 5.8% of toilets are linked to a sewer system and 1.1% of the population indicated they do not have access to any type of toilet facility[x]. The Nevis Water Department has approximately 7,500 customers all of which are metered, however water rates are either flat or metered. The cost of water is higher in Nevis than St. Kitts and this may encourage independent water storage.

This sector is vulnerable to climate change in a number of ways. Hurricane activity can impact on water infrastructure and SLR can contaminate coastal aquifers with saline water. There have also been reports of heavy metal contaminants in ground water resources[viii]. The majority of population utilises septic tanks and this therefore causes the concern that heavy rainfall leading to flooding can introduce bacteriological contaminants into the aquifers. However, flooding in Nevis is less of a concern than other Caribbean islands because only 4% of Nevis has <2 ° slope. Nonetheless, turbidity issues are exacerbated by unregulated building and road construction on steep slopes which increases erosion. Conversely during dry spells and drought conditions, ground water recharge rates decrease affecting the available water resources. This is particularly important to Nevis as it depends on groundwater resources even more than St. Kitts.

When droughts occur in Nevis, they generally last for between 2 to 3 months. The Nevis Water Department usually issues public notices for consumers to conserve water and depending on the severity, water rationing may be carried out. It is estimated that if there is a 10 to 20% decline in annual precipitation ground water recharge rates would be affected, as Mr Morris of the Nevis Water Services Department summarises "If we would have more frequent droughts, our surplus would be at risk and our storage would suffer". The agriculture sector is most affected during drought conditions.

As in St. Kitts, the Watercourses and Waterworks Ordinance 1956 is the main legislation that governs management of water resources in Nevis, however it is outdated and does not make reference to, or have any provisions for groundwater resources. There is no legislation that directly addresses water conservation but there are a number of other pieces of legislation that have some role in water resources management in the island. One of these is the National Conservation and Environmental Act 1987 which includes the responsibility for forestry. As a consequence, measures to ensure healthy forests and their conservation are included in this act which also serves a secondary function of water protection. A new Water Resources Management Act is being drafted.

The Nevis Water Department (NWD) is responsible for production, distribution and water quality in Nevis and is currently working with the Caribbean Development Bank on a project entitled the Nevis Water Supply Enhancement Project as well as the Nevis Water Distribution Master Plan for the execution of the activities under the project. One component of the project will make provisions for NWD to become a Statutory Body.

In response to climate change, efforts should be made to protect water infrastructure to reduce vulnerability during major storms and hurricanes. In particular, (i) where lacking, water storage should be encouraged through incentives and every new building should have its own stored water infrastructure; (ii) the viability of additional storage should be assessed, allowing improved access to potable water in different communities; and (iii) losses in water distribution should be reduced through pipe replacement.

COMPREHENSIVE NATURAL DISASTER MANAGEMENT

Nevis faces an array of natural hazards that have a great potential to cause significant loss of life and seriously affect livelihoods, including flooding, volcanic eruption and tropical storms. The vulnerability of communities in Nevis is, however, manageable if actions are taken at the household, community and national level to prepare and mitigate the impacts.

Nevis' location on the Atlantic Hurricane Belt means that heavy rainfall and high winds associated with low pressure systems, including hurricanes, impact the island with some regularity. While Hurricane Omar (2008) did not pass directly over the island, it caused serious damage to a major establishment on the island, the Four Seasons Resort as described in an earlier section of this document. Renovations to this facility were estimated at EC $120 million[xi].

Storm surges associated with hurricanes and tropical storms exacerbate the erosion process on the coast. As a result, cumulative erosion impacts pose a significant threat to coastal eco-systems and structures (e.g. tourism developments) and extreme events will worsen those impacts. The high dependence and proven vulnerability of tourism in Nevis calls for local disaster management authorities to work with relevant tourism stakeholders to develop and implement tourism sector disaster plans, with a focus on vulnerability reduction and hazard mitigation in the tourism industry.

Flooding is also a major concern and the greatest risk of flooding comes during times of heavy rainfall when mountain streams can quickly become raging torrents as they flow down slope into settlements. Soil stability is threatened by clearing of vegetation, which increases the risk of landslides and reduces infiltration capacity, thus exacerbating flooding. Earthquakes and volcanoes can also occur in Nevis, which can further compound vulnerability and undermine efforts to build resilience to climate events.

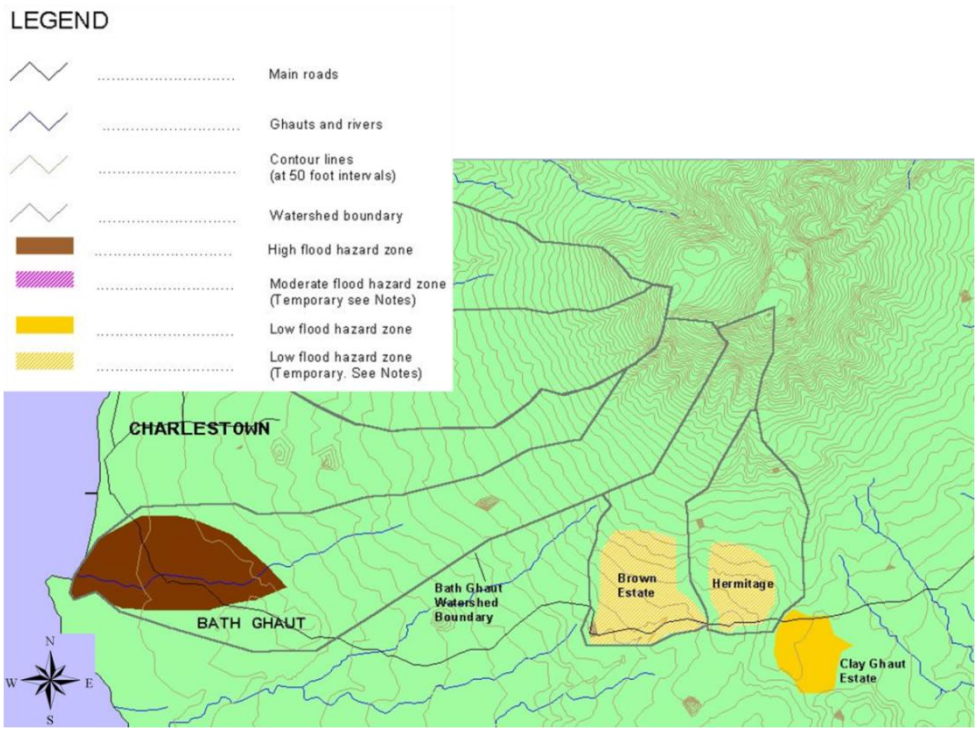

Figure 6: Nevis flood risk map

(Source: Cooper, 2001)

There is much strength in the Nevis disaster management system as both St. Kitts and Nevis have made progress in the achievement of their Hyogo Framework for Action (HFA) goals for disaster risk reduction (DRR). Disaster management in St. Kitts and Nevis is led by the National Emergency Management Agency (NEMA), within the Ministry of National Security, although Nevis has its own agency, the Nevis Disaster Management Department (NDMD). The separation of disaster management responsibility between the two islands has its benefits in terms of improving local actions and communication, but poses a challenge to funding allocation and for standardised action in disaster risk reduction within the Federation.

Nevis' disaster management policy and legislation come from the National Disaster Management Act for St. Kitts and Nevis (1998). Reviews of hazard and vulnerability were undertaken in 2001 following Hurricane Georges and public health facilities were again assessed in 2009. However, there is need for an up to date national vulnerability and risk assessment to inform development activities with respect to DRR.

Related policies also have implications for vulnerability reduction:

- Land use development, building practices and natural hazards are intricately related.
- Planning legislation was first enacted for St. Kitts and Nevis in 2000 with assistance from the Organisation of Eastern Caribbean States Environmental and Sustainable Development Unit (OECS-ESDU); this was the first attempt in addressing the need for uniform planning standards across both islands.

- In 2006, the National Physical Development Plan was approved and includes a comprehensive land use guide. This is a positive first step toward risk reduction; however, progress continues to be limited by financial constraints and technical resources.

Reduction of vulnerability at the smallest level is imperative in efforts to minimise overall hazard implications. Participatory and innovative community education and capacity building designed to reach all levels of Nevisian society are essential for enabling individuals to manage their own risk levels and also build resilience to natural hazard events. In particular, technological tools and equipment have valuable benefits to disaster and emergency management and the NDMD is capitalising on this area. The NDMD website offers valuable information to the public and national curriculum also includes hazard information in secondary and tertiary level classes. The mass media are also actively involved in dissemination of warnings and the high-risk communities receive timely and understandable warnings for predictable events (e.g. hurricanes).

HUMAN HEALTH

Health is an important issue in the tourism industry because tourists are susceptible to acquiring diseases as well as potential carriers of diseases. The effects of climate related phenomena on public health can be direct or indirect. The former includes weather related mortality and morbidity arising from natural disasters (e.g. hurricanes) and high temperatures (e.g. 'hot' days/nights). Indirect impacts are more extensive, including vector borne diseases such as dengue fever and malaria.

St. Kitts and Nevis' Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) highlighted the following communicable diseases and their relationship to health as follows, "*weather and climate influenced health care problems continue to constitute major sources of morbidity including gastrointestinal diseases, dengue and influenza*"[xii]. A recent study highlighted that heat stress was considered the most important issue related to climate change and climate variability to residents of St. Kitts and Nevis.

In addition, mortality and morbidity rates due to injuries sustained during natural disasters are important considerations when assessing the vulnerability of a country to climate change. Displacement of persons and loss of shelter bear health implications related to water and food as well as psychological effects.

Even though Nevis is one of the drier islands of the Caribbean region, experiencing annual rainfall that of approximately 890 – 1000mm per year, concern exists for vector-borne diseases including dengue fever and malaria due to its tropical climate. Periods of dry spells and drought conditions can also contribute to the spread of air and food borne conditions linked to inadequate water supply and poor sanitation, including gastroenteritis, the intensification of scabies shigellosis, salmonella, legionella and cholera; and the increase in incidence of asthma, influenza, respiratory diseases and Acute Respiratory Infections (ARI) due to increases in particulate air pollutants and a changing air composition. Figure 7 demonstrates that in St. Kitts and Nevis ARI cases are more prevalent during the rainy season. Conversely, in Figure 7Figure 8 gastroenteritis morbidity cases are more prevalent during the dry season. This suggests that interventions could be made with regard to household and individual practices.

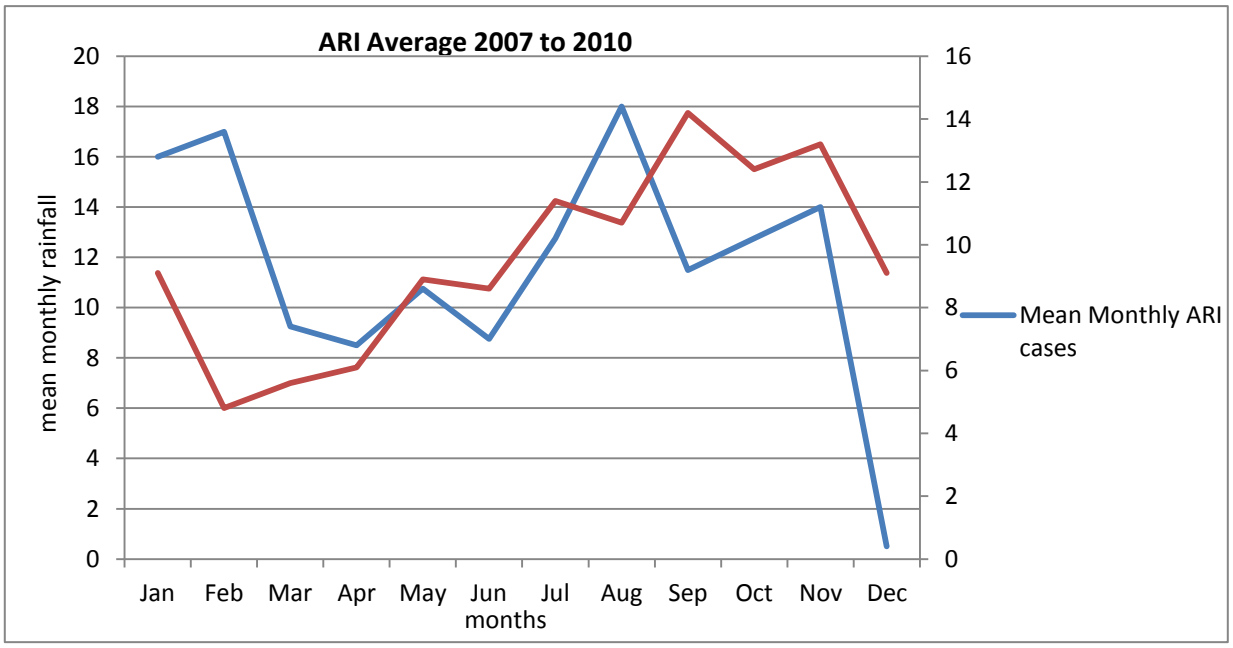

Figure 7: Mean Monthly Acute Respiratory Infections (ARI) morbidity cases against Rainfall in St. Kitts and Nevis
(Source: by author, data provided by Ministry of Health, 2011)

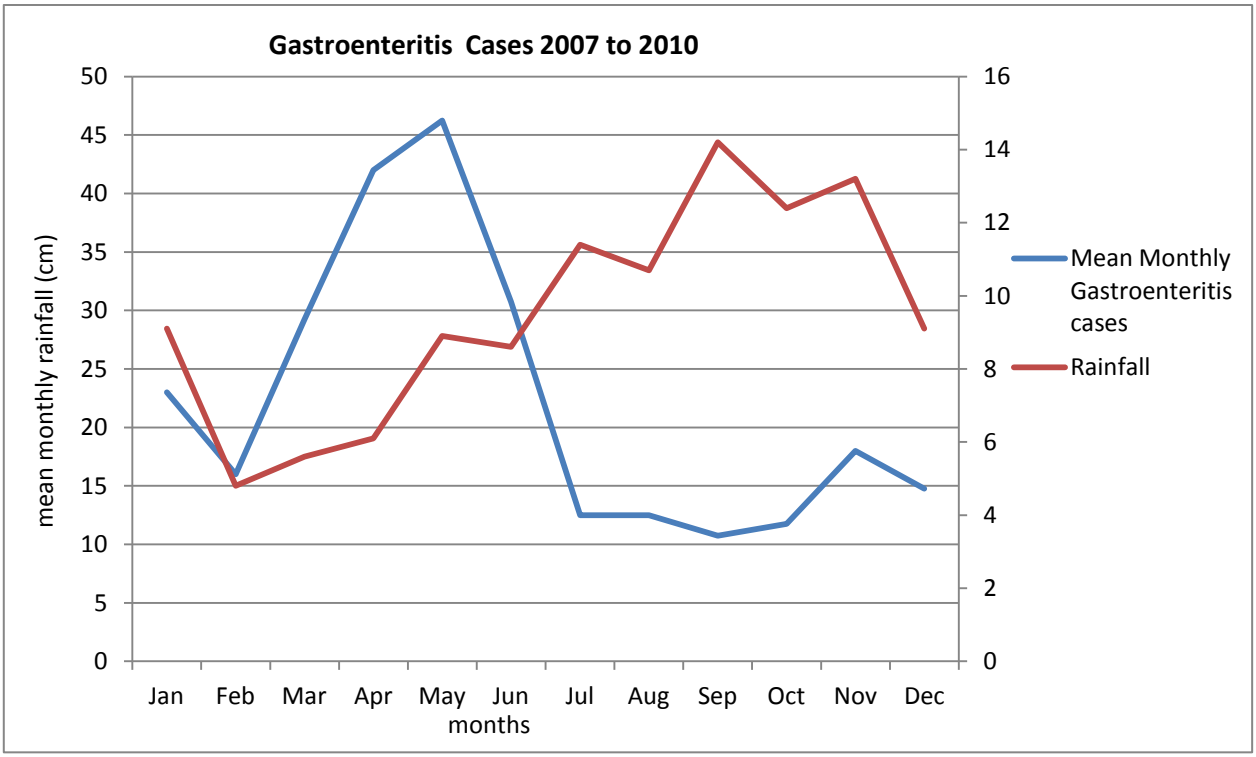

Figure 8: Mean Monthly Gastroenteritis morbidity cases against Mean Monthly Rainfall in St. Kitts and Nevis
(Source: by author, data provided by Ministry of Health, 2011)

However, further research should be conducted to link the epidemiology of diseases in Nevis with climate data, including studies to determine correlations link climate change, tourism and health to fully understand the extent of health risks.

Nevis does not have a significant agricultural sector owing to its size, geography and rainfall patterns and therefore has to import substantial amounts of food. Extreme climate conditions can compromise both

local and external sources of food. Increased precipitation may also result in increased incidence of pests as well as flooding and contamination from sewage especially from pit latrines. This can impact the health of the population, especially in poor and marginalised communities. Aside from the diseases mentioned previously, malnutrition may become a serious concern. Food production and fisheries stock are considered an integral part of the Agricultural Sector so a reduction in fish stocks can also contribute to malnutrition due to a decrease in the protein content in the diet.

The Government of St. Kitts and Nevis places significant emphasis on health, exemplified by their increasing public expenditure on health despite current economic challenges - in an effort to ensure health care can be accessed by all citizens. Policies and related funding strategies geared towards poverty reduction (such as the soon to be developed Poverty Reduction Strategy) are key factors in climate change because of the linkages between disease transmission, environment and living conditions, which by extension affects the ability of communities and Nevis on the whole to adapt.

Nevis has its own Ministry of Health, under the Ministry of Health, Social Services, Community Development, Culture and Gender Affairs. Within the ministry two departments oversee these responsibilities; these are the Public Health Department and the Department of Environment. Other important institutions include the Health Promotion Unit which was inaugurated in 2000, the Solid Waste Management Authority in St. Kitts and the Social Assistance Department which indirectly form the base for institutions to respond to the impacts of climate change.

In the Caribbean region, the priorities regarding climate change and health are more closely centred on communicable diseases such as vector borne diseases and gastrointestinal diseases. Therefore climate change policies should focus on these areas to arrest any increases in the incidence of these diseases due to climatological occurrences.

MARINE AND TERRESTRIAL BIODIVERSITY AND FISHERIES

The Caribbean Region is one of the world's biodiversity hotspots and is at great risk of losing its remaining natural resources thus increasing its vulnerability to climate change. Maintaining and preserving the biodiversity and ecological products and services of Caribbean SIDS is of paramount importance for the sustainability of livelihoods that depend on them. In particular, in recent years the tourism sector has become a major part of the local economy, with a high dependence on natural resources.

Forests have always played an important role in well being and livelihoods of Nevisians and to the country's economy, providing several ecological services and supporting small eco-tourism initiatives (e.g. guided hikes which are conducted along the Nevis Peak and several rainforest trails, such as Jessups and Butler's Source). Such services are significant to the support of the country's fledgling tourism industry by contributing to visitor comfort, physical safety and enjoyment. However, forests continue to face threats from human activity as lowlands are intensely used for development or farming.

Climate change related variations in average daily temperature, seasonal precipitation and extreme weather events will exacerbate the effects of existing human stressors on forest eco-systems. Decreases in precipitation and increased average daily temperatures could result in a loss of rainforest zones and an associated increase in the tropical dry forest zones. The implications are a loss of habitat for endemic species and a loss of revenue for the eco-tourism sector.

The major beaches in Nevis are on the west and north coasts and are important recreational spots for tourists and residents. Despite the importance of beaches and coral reefs to tourism and fisheries, poor

land use management, sand mining and other human activities have degraded these key natural assets. Beach sediment along with the vegetation found growing on beaches act as buffers protecting coastlines and coastal infrastructure from wind and wave erosion. Beaches are also important to biodiversity conservation through the provision of habitat and nesting grounds for a diversity of species such as shorebirds, marine turtles and molluscs.

Corals are habitat, feeding and nursery grounds for juvenile fish, molluscs, crustaceans and marine reptiles that support commercial and recreational fisheries, as well as marine based tourism activities such as snorkelling and diving. There is currently only one dive operator in Nevis at the Oualie Beach Resort; however the popularity of this activity is increasing thus maintaining healthy reefs will become ever more important to the tourism industry. Coral reefs also provide shoreline protection and are also a significant source of beach sand. This supply of sand is critically important for the continued existence of beaches, which themselves also contribute to shoreline protection by helping to reduce the destructive force of high energy waves.

Beach profile monitoring has revealed that although beaches in Nevis have shown signs of recovery after extreme weather events, they have not yet returned to pre-hurricane conditions. Climate change is very likely to exacerbate current trends of beach and reef loss, because of coral bleaching events, more intense storms and SLR.

On previous occasions, the resulting storm surge from the passage of hurricanes (Hugo, 1989; Luis 1995 and Omar, 2010) caused severe erosion of the island's beaches. As much as 20 m of sand from Pinney's Beach in front of the Four Seasons Hotel was removed by wave action so that the water's edge was close to the restaurant. The resort also lost part of its pier and the pavilion and swimming pool were undermined (compare Figure 9 and Figure 10). Similarly the Sandpipers Restaurant of Pinney's Beach when completed in August 1995 was 37 m from the water's edge. After the passage of Hurricane Luis the beach was so severely eroded that the sea encroached on the property's restaurant. Hurricane Luis eroded the beach and the land behind the beach undermining the foundations of the restaurant and the swimming pool. The implementation of adequate setback provisions would have prevented much of this damage.

Figure 9: Pinney's Beach, August 1995, before Hurricane Luis.

Figure 10: Pinney's Beach, October, 1995.

(Source: Cambers, 1996)

The fisheries sub-sector is also an important component of the local economy and numerous Nevisians go out to sea daily. Coastal fisheries have declined sharply in recent years and fishers have attributed this decline to a degraded marine environment, unsustainable fishing practices and extreme weather events[xiii]. It is perceived that Kittitian fishermen are also fishing heavily for parrotfish (roughly estimated at 90% of catch) and this will have serious implications for coral reef health in Nevis as well as St. Kitts. Climate change is projected to affect fisheries by altering the distribution and movements of pelagic species, as well

as by reducing key nursery and breeding habitats (e.g. coral reefs, seagrass beds, mangroves). Landing sites for boats may also be lost with SLR and accelerated coastal erosion. The recent arrival of the invasive lionfish (first reported in November 2010) is potentially a major threat to the fisheries of St. Kitts and Nevis, as this rapidly expanding species is a voracious predator on small reef fish.

The Government of St. Kitts and Nevis has acknowledged the importance of its biological resources to the tourism product and to sustainable development and as such has already begun to take steps towards biodiversity conservation through the development of plans and policies. In order to be effective over the long term, adaptation strategies for biodiversity should take an eco-system based approach. This means that strategies must aim to:

1. enhance the quality of terrestrial and marine eco-systems;
2. strengthen the linkages between habitats;
3. increase the size and number of protected areas; and
4. improve their management with greater stakeholder involvement.

Strategies should also aim to strengthen the linkages between resource users and resource managers by building capacity through education/awareness and empowering these stakeholder groups to be environmental stewards. If the tourism sector, is to be sustainable, it must engage more actively in the conservation and management of protected areas. Planning and managing for resilient eco-systems and adapting to a dramatically changing climate must become a key priority for the Government of St. Kitts and Nevis.

The Government of St. Kitts and Nevis is a signatory to many Multilateral Environmental Agreements (MEAs) that have bearing on the country's biodiversity. The St. Kitts and Nevis National Environmental Management Strategy and Action Plan 2005 - 2009 (NEMS), was adopted in 2005 and is one of the main strategy documents informing the implementation of best practice approaches to guide environmental management over the long term. The National Physical Development Plan of 2006 earmarks special areas for environmental protection and the Integrated Strategic Development Plan for Nevis recognises several biodiversity related strengths and weaknesses in the island including a high potential for growth of resource-oriented economic activities but poor environmental management and development planning. The Nevis Resource Assessment and Zoning Plan 1990 is the land development policy for the island which restricts development in areas of special environmental and ecological interests.

A range of tools exist that may be utilised to assess the implications of climate change adaptation strategies from socio-economic and environmental perspectives. Environmental Impact Assessment (EIA) is one such tool for which the Development Control and Planning Act No. 14 of 2000, section 26(2) of 2006 makes provision. However, a lack of training and equipment for properly conducting EIAs are constraints to the effective use of this tool in Nevis. The National Biodiversity Strategy and Action Plan (NBSAP) for St. Kitts and Nevis includes a gap assessment of policy and legal structure that identifies a number of other areas that are weak, absent or conflicting. The assessment identifies a lack of appropriately implemented policies, lack of enforcement of legislation and the failure to incorporate environmental costs into action plans and national budget as shortcomings that have limited in the country's ability to live up to its obligations of eco-system conservation.

The Nevis Island Administration is responsible for environmental management in Nevis as well as development control and forward planning. This agency is assisted by The Department of Physical Planning, Natural Resources and Environment, the Ministry of Communication and Works, and Public Utilities and Posts in implementing the conventions on Climate Change, Biological Diversity and Desertification. The

Nevis Historical and Conservation Society is also active in projects related to biodiversity conservation. There are, however, constraints to effective management including inadequate monitoring, surveillance and law enforcement; lack of the ability to assess fish stocks and biodiversity; and overall, limited financial resources.

An additional concern with regards to fisheries management is that there are no legally declared Marine Protected Areas (MPA). But preliminary work done by The Nature Conservancy and the Marine Resource Governance in the Eastern Caribbean (MarGov) project will help to guide the Government's commitment under the Caribbean Challenge to protect 20% of its coastline by 2020. The Narrows, the area between St. Kitts and Nevis and encompassing the Booby Island Shoal, has been proposed as a marine protected area (MPA). Stakeholders should therefore be encouraged to collaborate in the creation of a strategy for:

- establishing an effective fish sanctuary management and enforcement system for coastal communities;
- for building the capacity of resource managers and users to be more resilient to climate change; and
- establishing a sustainable finance mechanism for supporting fish sanctuary management.

The strategy should increase the involvement of the tourism sector in supporting community-based MPAs, as well as provide opportunities for alternative livelihoods and technologies for public education. It is

Additionally, short films encouraging visitors to be more conscious of their impacts on the fragile eco-systems of the islands can be shown during in-bound international flights and on local TV networks. The films should focus on positive actions that visitors can take to minimise negative impacts on the environment, and engage local expertise as possible including actors, cameramen, technicians etc. Other stakeholders will include the various tourism organisations. By reducing anthropogenic stresses on the environment, eco-system health will improve and become better able to cope with climate change.

CONCLUSION

Nevis has a growing dependence on the tourism industry, supported by a diversity of natural assets which enable it to be successful and many local livelihoods are also very dependent on these resources. Coastal eco-systems and water resources in particular, are already facing serious pressures from increasing (and sometimes poorly planned) development and poor land management practices thereby decreasing the resilience of plant and animal species. The natural resource base is also affected by climate related events.

Nevis has a history of damages and losses from natural disasters that not only interrupt development progress at the national level, but also result in the investment of much time and resources into rebuilding homes and livelihoods after an impact. Since there is high confidence that climate change will result in more intense hurricanes and extreme events, posing even greater threats to eco-systems and the population, preparedness for disasters and climate change adaptation become common goals.

The CCCRA explored recent and future changes in climate in Nevis using a combination of observations and climate model projections. Despite the limitations that exist with regards to climate modelling and the attribution of present conditions to climate change, this information provides very useful indications of the changes in the characteristics of climate and impacts on socio-economic sectors. Consequently, decision makers should adopt a precautionary approach and ensure that measures are taken now to increase the resilience of economies, businesses and communities to climate related hazards.

It is clear that the Government of St. Kitts and Nevis is committed to adapting to climate change, as evidenced by some policy responses, current practices and planned actions; particularly the planned renewable energy initiatives. However, financial resource shortages along with limited technical capacities hinder successful adaptation efforts across most government ministries and other stakeholder groups. Additionally, resource users with little or incomplete awareness of their risks and alternative courses of action continue to degrade or over-extract from marine and terrestrial eco-systems in an effort to sustain themselves. Enforcement of laws to protect biodiversity remains a challenge, as does land use planning and regulation of settlements. Continued work in data collection, monitoring and evaluation of climate change adaptation policies, plans and activities will be key to successful development of a sustainable tourism industry in Nevis but also for development in the country as a whole.

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This document provides a synopsis of critical *sectoral* vulnerabilities and capacities and highlights challenges, opportunities and strategies for action. The complete, 250+ page, Climate Change Risk Profile for Nevis is also available from www.caribsave.org and provides detailed climate modelling for various climate parameters, sectoral assessments, and analyses using proven, scientific methodologies to inform pragmatic strategies specific to key sectors in Nevis.

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