TOURISM IN BELIZE
VULNERABILITY AND CAPACITY ASSESSMENT

Submitted for Belize's Second National Communication to the United Nations Framework Convention on Climate Change

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1 Introduction

Tourism is an important industry in Belize for economic growth, tax revenues, and foreign exchange earnings. Nearly US$200 million in tourism expenditures in 2006 represented about 17% of GDP for Belize. However, as a tropical, coastal nation, Belize is highly vulnerable to variable climate and weather patterns as well as tropical cyclones. This vulnerability is particularly relevant for the tourism sector, given the small scale and nature-based character of tourism in Belize.

Vulnerability in this context can be understood as the degree of sensitivity to and inability to cope with the negative impacts of climate change (McCarthy *et al*., 2001; Bijlsma *et al*., 1996). Klein and Nicholls (1998) have suggested that vulnerability is multi-dimensional, with biogeophysical, economic, institutional, and socio-cultural elements. The vulnerability of a system to climate change is a function of its exposure to negative effects and its ability to cope with those effects (McCarthy *et al*., 2001). Sterr *et al*. (2003) suggest that biogeophysical effects must be first understood before the vulnerability of socio-economic sectors can be assessed. Vulnerability assessments enable policy makers to anticipate the consequences of climate change and prioritize adaptation measures in order to minimize exposure to risk (Sterr *et al*., 2003).

Belize is considered a small island developing state (SIDS) because of its low-lying coast, its coastal communities, and its open vulnerable economy (UNDESA, 2005; NAR, 2003). Small island states are considered "extremely vulnerable" to climate change and rising sea levels (IPCC, 1997). Like many SIDS, Belize is economically, socially, and physically vulnerable to climate change. As a small, open economy, Belize depends on imports for many basic goods, and relies heavily on tourism for foreign-exchange earnings to meet the demand for imported goods. The potential impacts of climate change pose a particular risk to poverty and hunger, which already hinder human development in Belize. Due to its small size, land resources are constrained. SIDS are often already at risk from other environmental hazards such as flooding, tropical storms, and deforestation; the effects of climate change are expected to exacerbate these risks and introduce new ones (Tompkins *et al*., 2005).

This study presents an assessment of the vulnerability of the tourism sector in Belize to the impacts of climate change. The vulnerability of tourism in Belize to climate change stems from three biogeophysical impacts. Rising sea levels pose risks for flooding, inundation, saltwater intrusion, and erosion, which threaten water supplies, infrastructure, and coastal areas. Warmer sea water threatens the coral reefs along the coast of Belize that comprise the longest barrier reef in the western hemisphere and attract thousands of tourists for snorkeling and scuba diving activities. Also, warmer sea surface temperatures are associated with increasing frequency and intensity of tropical cyclones or hurricanes, which threaten coastal settlements and

infrastructure. Based on present spending levels, 45% to 70% of the tourism sector is highly vulnerable to the effects of climate change.

2 Tourism in Belize

The tourism sector in Belize is young relative to the agricultural and forestry industries that contributed to the early economic growth of the country. Tourism in Belize was originally developed around small-scale, adventure or nature-based recreation activities, and the scale of the development of hotels, resorts, and other infrastructure reflected this ecotourism niche. Belize is endowed with abundant tourism resources, including the second-largest barrier reef system in the world, numerous limestone caves, and tropical rainforests. The barrier reef was one of the earliest attractions, and development of the islands of Ambergris Caye and Caye Caulker as well as the coastal village of Placencia provided accessibility for visitors interested in snorkeling, underwater diving, deep sea fishing, and other water-based recreation activities. Significant resort and hotel development in the town of San Pedro has made it the country's largest tourist destination, and more recently, a destination for foreign retirees and migrant expatriates.

Since the 1980s, tourism has expanded rapidly in the Cayo District; tropical rainforest walks, medicinal plant trails, Mayan archaeological sites, and limestone cave tours attract visitors to western Belize and the twin towns of San Ignacio and Santa Elena. National parks and protected areas such as Blue Hole National Park, Crooked Tree Wildlife Sanctuary, and Cockscomb Basin Wildlife Sanctuary attract wildlife enthusiasts and bird watchers. The small size of the country allows for tourists to visit both coastal/island and inland destinations within a small time frame, though only less than half of visitors reported that they visited inland attractions (BTB, 2004).

Average annual growth in overnight visitors was nearly 4.5% from 1999 to 2006, though growth has slowed since a peak of 10.6% in 2003 (BTB, 2007). Approximately 95% of overnight visitor arrivals were for leisure purposes. Belize is the primary destination for over 70% of visitors, as just 29% visit more than one country during their travels (BTB, 2004). More than half of overnight tourists (61.7%) come from the USA (see Table 1), and nearly all international air passenger service to Belize originates there. The second most important region of origin for tourists in Belize is Europe, which constitutes about 14% of visitors. The number and share of Mexican tourists has sharply declined overall in the last decade. Cruise ships have brought more than 500,000 day visitors per year since 2003. When data for overnight visitors are combined with that of cruise ship visitors, annual tourist visitation in Belize amounted to nearly one million in 2006 (BTB, 2007).

Tourism is the single largest contributor to GDP and the largest source of foreign exchange earnings for Belize. In 2006, tourist expenditures reached nearly BZ$400 million dollars, which equates to 16.8% of GDP (BTB, 2007) (see Table 2). The increase in the numbers of tour operators and registered guides has outpaced the growth in arrivals, but given the continued increase in tourist spending, this may be due to changes in the type of tourist and the preferred recreation activities. The popularity of cave tours in the Cayo district has flourished,

and because of the risks to personal safety and fragile artifacts, many of these sites require booked tours with certified tour operators.

Table 1: Arrivals of overnight visitors by nation of origin, 1999-2006

Nationality	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
USA	92,695	104,717	106,292	104,603	127,288	137,376	145,977	151,510
Europe	24,746	27,674	29,115	29,115	33,530	32,770	33,466	34,373
Canada	8,430	9,205	9,492	9,185	9,831	11,925	13,580	15,553
Belizeans living abroad	14,545	14,106	12,999	11,896	7,799	7,698	7,705	8,365
Guatemala	12,162	17,313	15,652	21,184	17,632	15,949	13,907	13,616
Mexico	8,258	8,688	7,739	8,413	6,312	6,851	5,893	5,855
Other	19,959	14,062	14,045	15,126	18,182	18,272	16,045	18,037
TOTAL	180,795	195,766	195,955	199,521	220,574	230,832	236,573	247,309
Annual Change	2.7%	8.3%	0.1%	1.8%	10.6%	4.7%	2.5%	4.5%

Source: BTB, 2007

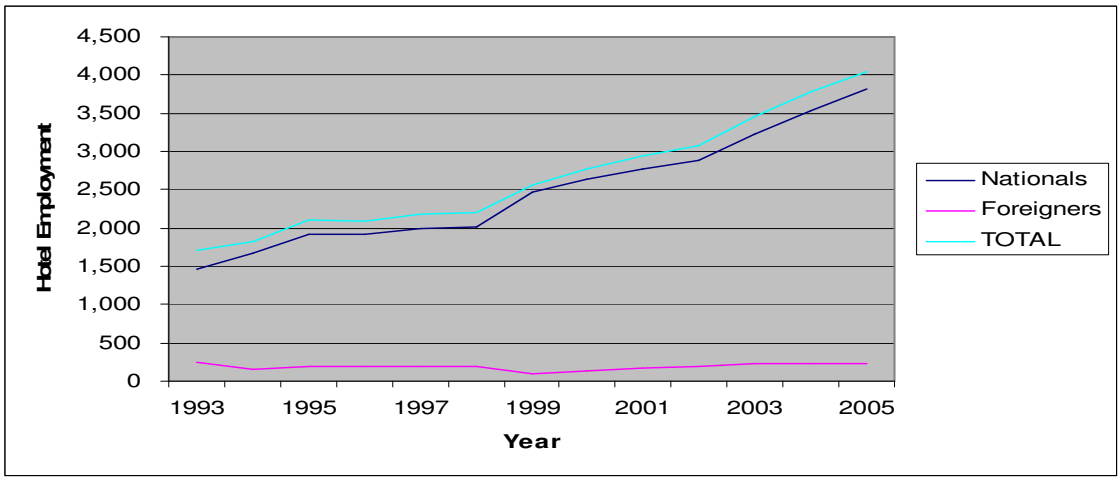
Table 2: Economic impact of tourism in Belize, 1999-2006

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Tourist expenditures (BZ$ millions)	222.9	240.4	241.0	265.6	311.4	345.3	349.4	398.8
Tourist expenditures (% of GDP)	15.2	14.5	13.9	14.3	15.9	16.7	15.8	16.8

Source: BTB, 2007

The economic impact of tourism in Belize is most readily evidenced by its contribution to employment of Belizean citizens. Hotel employment of Belizean nationals alone has more than doubled in the last decade (see Figure 1).

Figure 1: Hotel employment in Belize, 1993-2005.



Source: BTB, 2007

As of 2006, there are 561 hotels and 5,789 rooms in Belize (BTB, 2007), which illustrates the small-scale nature of tourism in Belize (average property size is 10.3 rooms). Hotels in Belize employ 4,347 persons; restaurants employ another 4,531. There are nearly 200 tour operators and 1,145 registered tour guides (BTB, 2007).

Natural resources are important attractions for Belize tourism. The barrier reef, cayes, national parks, and wildlife sanctuaries appeal to many visitors seeking tropical experiences in nature that are not readily available in their countries of origin. Visits to selected protected areas for 1998-2006 are provided below in Table 3. High levels of visitation to the Hol Chan Marine Reserve reflect its proximity to the popular destinations of Ambergris Caye and Caye Caulker.

Table 3: Visits to selected protected areas, 1998-2006

Protected Area	1998	1999	2000	2001	2002	2003	2004	2005	2006
Guanacaste National Park	2,567	2,788	1,184	1,452	2,445	2,288	2,306	n/a	1,564
Crooked Tree Wildlife Sanctuary	1,483	1,619	947	1,116	1,440	1,299	2,359	n/a	2,180
Cockscomb Basin Wildlife Sanctuary	4,078	3,603	5,189	6,085	6,343	10,062	9,194	n/a	4,163
Blue Hole National Park (Inland)	7,098	6,162	10,080	8,853	8,485	7,880	10,448	n/a	8,818
Half Moon Caye National Monument	7,310	7,940	12,317	10,071	10,207	7,141	9,803	n/a	9,502
Hol Chan Marine Reserve	40,048	37,059	36,887	38,687	55,701	74,375	87,136	73,619	54,625
TOTAL	64,582	61,170	68,604	68,265	86,623	105,048	123,250	n/a	82,858

Source: BTB, 2007

Ambergris Caye and Caye Caulker are the most popular destinations, followed by the Cayo District and the coastal village of Placencia (BTB, 2004). Snorkeling, diving, and island tours are the most popular activities, followed by archaeological site visits and jungle tours.

The Government of Belize and the tourism industry recognize the need to protect the quality of its natural resources and maintain a pristine environment in order to sustain the tourism industry. The projected impacts of climate change have acute implications for tourism and the natural resources on which it depends. As such, this issue warrants thorough and comprehensive consideration by all stakeholders.

3 Climate Change and Tourism

Climate change is the general term associated with a range of demonstrable changes in global and regional climatic conditions, including temperature, sea levels, precipitation, and extreme weather events such as droughts, flooding, and storms (IPCC, 2001a). The effects of climate change are associated with higher concentrations of anthropogenic greenhouse gases in the atmosphere. A natural greenhouse effect keeps the Earth's surface temperature warm, however, an amplified greenhouse effect where anthropogenically-caused increases in atmospheric concentration of energy-trapping gases is causing rapid global warming (a rise of the Earth's surface temperature).

Two options exist to deal with climate change: adaptation (concentrating on changing factors that make one susceptible to climate change) and mitigation (attempting to alter factors that cause climate change). Developing nations and impoverished people are more vulnerable to climate change and will be disproportionately affected, in large part due to their lack of resources.

The symptoms of climate change include rising global mean temperatures, rising sea levels (as polar and alpine ice melts), and rising sea surface temperatures, which are associated with an increase in the frequency and intensity of tropical cyclones. Several geophysical impacts have been linked with the forces of climate change, including a loss of coastal land, coral reef mortality (or coral bleaching), ocean acidification, changes in the productivity of agriculture and forestry, risks to human health, and risks to physical infrastructure.

Several studies have considered the potential impacts of climate change on recreation and tourism. Mendelsohn and Markowski (1999) identified three ways in which climate is expected to affect recreation. First, changes in the lengths of seasons will affect the availability of particular recreation activities. Second, changes in climate may affect the overall comfort and enjoyment of outdoor recreation. Finally, climate change may impact the ecological systems of an area, ultimately affecting the quality of the recreation experience.

The relationship between climate change and tourism can be understood in two ways (Viner and Amelung, 2003). First, the natural environment on which much of tourism is based is affected by climate change, which implies that tourism must adapt to these changes. Second, tourism contributes to the causes of climate change through the uses of fossil fuels and the resulting emissions of greenhouse gases. Nature-based tourism is resource-dependent, and as such, may be particularly vulnerable to climate change. For example, Loomis and Crespi (1999) studied the economic effects of climate change on specific recreation activities. The authors predicted a decline in economic benefits from forest-based recreation due to expected losses in forest cover; significant losses to downhill and cross-country skiing were offset by gains to reservoir, beach, golf, and stream recreation. Anticipated effects of climate change on tourism depend heavily on the relationship between climate and specific recreation activities—a longer summer season in alpine national parks was found to have a positive effect on tourism (Richardson and Loomis, 2004); by contrast, warmer temperatures and reduced snowfall were found to have negative effects on winter recreation activities (Scott *et al*., 2003). Optimal air temperature for water based activities ranges from 15-35 degrees Celsius, while optimal water temperatures are between 10 and 20 degrees for water skiing and sailing, less than 18 for fishing, and between 15 and 20 for swimming and sunbathing (Hall and Higham, 2005). Warmer temperatures would make these activities uncomfortable.

The IPCC (1997) has identified a range of anticipated effects of climate change that threaten the long-term sustainability of tourism in coastal areas and tropical islands. These effects include the loss of beaches to erosion and inundation, increased salinity of freshwater aquifers, added stress to coastal ecosystems, damage to infrastructure from tropical storms, and an overall loss of environmental amenities.

Smith (1990) concluded that summer precipitation in the UK influenced the number of people traveling to the Mediterranean. Giles and Perry's (1998) work indicated that a pleasant summer in the UK in 1995 led to a decrease in outbound tourism and demand for packaged vacations to the Mediterranean. Perry (2006) studied the impact of climate on tourists to the Mediterranean region in the summer of 2003 and found that the region could become less attractive to tourists in the future, both for health (due to skin cancer, food-related diseases, and possible vector-borne diseases) and comfort (heat) reasons. Repeated heat waves may lead to bad publicity, which would negatively affect tourism demand. Increased temperatures may cause peak tourism seasons to shift. He concluded that tourist expectations for air-conditioned facilities would strain energy resources and that destinations that offer only beach options will be impacted the most. Changes in the amount and severity of extreme weather events (*e.g.*, heat waves, droughts) will most likely be more important than the gradual average temperature rise.

Mather *et al*. (2005) studied the tourism flow from North America to the Caribbean, and concluded that global warming may reduce the appeal of tropical destinations because of heat, beach erosion, decline in reef quality, and increased health risks. In the year 2000, approximately eight million North Americans traveled to the Caribbean and each arrival generated expenditure of approximately US$1,000. If climate change causes even half a percentage point decline in the growth rate (using 2.5 and 2% as an example) by the year 2050, the region will have lost between eight and thirteen tourist arrivals equaling between eight and thirteen billion US dollars of generated expenditure. Amelung *et al*. (2007) combined climate change scenarios with the Tourism Climatic Index in the study of global tourism flows and found that ideal tourism conditions are likely to shift poleward; their analysis found that by the 2050s, climate conditions for Central America and the Caribbean were generally "unfavorable" and that very few locations in the region would offer even a single month in which conditions were likely to be "comfortable" for general tourist activity.

Uyarra *et al*. (2005) studied the preferences of tourists for environmental features and found that tourists in Bonaire prioritized marine wildlife diversity and abundance while tourists in Barbados prioritized beach characteristics. The study found that more than 80% of tourists would be unwilling to return for the same price in the event of coral bleaching (from warmer sea waters) and reduced beach area (from rising sea levels). They concluded that the impacts of climate change may affect the tourism economies of countries where preferred environmental features were impaired.

In a study regarding the implications of climate change on tourism in Oceania, it was found that small island states will not only be impacted first, but also hardest (Craig-Smith and Ruhanen, 2005; IPCC, 2001a). Tourism in this region, like the Caribbean, is reliant on a pleasant climate and environmental quality. The authors cite the World Tourism Organization's main concerns of coral bleaching, erosion or submersion of coastal areas from rising sea levels, and a higher incidence of storms.

4 Method

The concept of vulnerability has been associated with several related terms, including risk, hazard, and exposure (Patwardhan *et al*., 2003; Shukla *et al*., 2003; IPCC, 2001b). The

IPCC (2001b) describes vulnerability as the degree to which as system is susceptible to or unable to cope with the adverse effects of climate change including climate variability and extremes. McCarthy *et al*., (2001) defined vulnerability as the residual impacts of climate change after implementation of adaptation measures. Therefore, vulnerability can be generally understood to be a function of climate-related hazards, socio-economic exposure, and adaptive capacity. Patwardhan *et al*. (2003) describe vulnerability as systemic, and they suggest that the focus of adaptive capacity should be to reduce exposure, according to the following framework:

Risk = Hazard (climate) x Vulnerability (exposure)

The IPCC (1997) recommends a fully-integrated approach to assessing vulnerability to climate change, where biogeophysical attributes (e.g., land area) are integrated with economic, social, and cultural characteristics, including non-market goods and services. Pulwarty (2006) recommends an integrated approach to vulnerability and capacity assessment that is based on input from a country advisory panel as to the vulnerability of a particular sector. The Pulwarty approach suggests the development of a conceptual model that is relevant to the sector and the country.

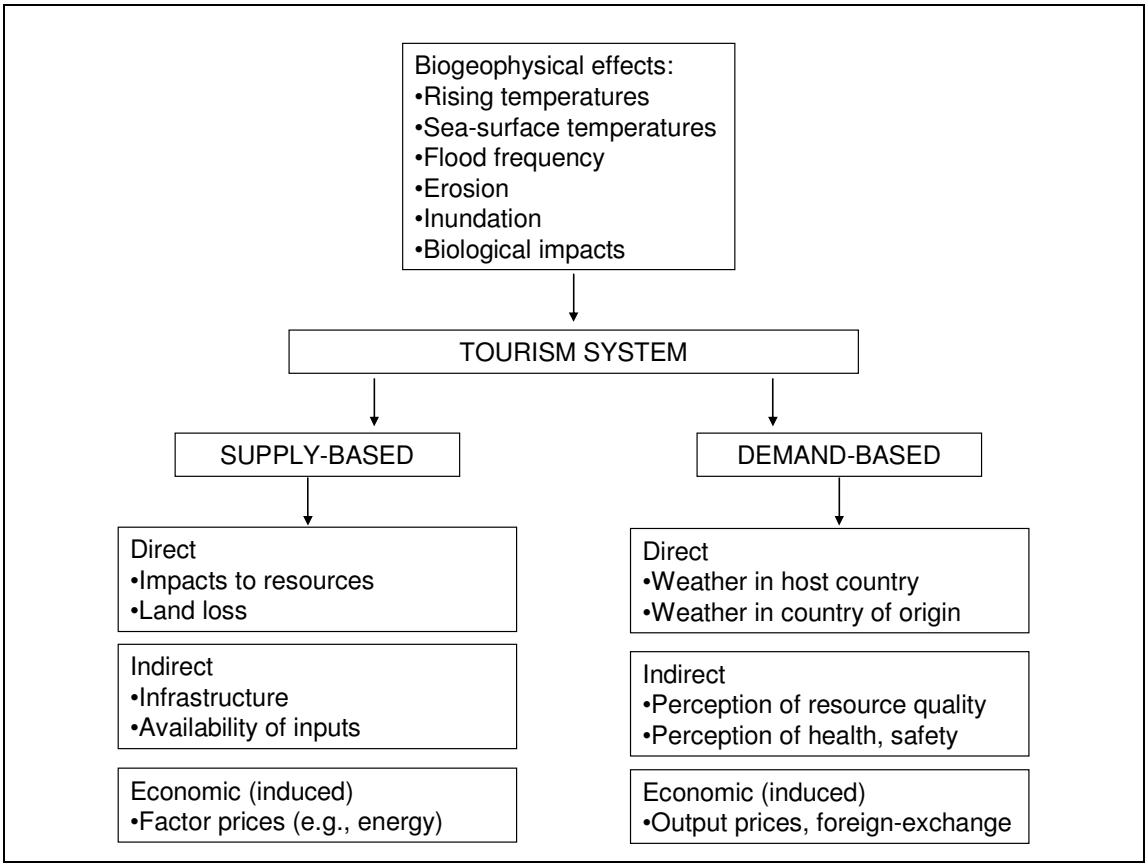
Sterr *et al*. (2003) indicated that vulnerability assessments of socio-economic sectors depend on an understanding of the extent to which biogeophysical effects will occur in the study area. They highlight flood frequency, erosion, inundation, and biological effects as the direct biogeophysical impacts of climate change on the tourism sector.

The method of analysis for this assessment is based on a conceptual framework for tourism vulnerability as well as a survey of tourism businesses in two locations in Belize (Ambergris Caye and Cayo District). The conceptual framework presented in Figure 2 is based on an economic approach to vulnerability assessment and considers tourism as an economic system. In this framework, sources of vulnerability to climate are either supply- or demand-based. Climate influences the tourism sector either in the *production* (supply) of tourism services (through the quality and availability of infrastructure, resources, or materials) or in the *consumption* (demand) of tourism services (through tourist perceptions of weather, resources, amenities, or costs). Sources of vulnerability can be evaluated based on the degree of risk or exposure, and the adaptive capacity of the sector. Where applicable, vulnerability responses are categorized as related to either mitigation or adaptation strategies. Impacts are categorized as direct, indirect, or induced, depending on whether the effects are a physical function of climate change or a socio-economic function the tourism system.

The vulnerability of the supply (or production) of tourism services may be directly affected by impacts to tourism resources and land loss. The vulnerability of resources includes impacts to ecosystems, coral reefs, beaches, forests, and wildlife. The vulnerability of land loss is associated with sea-level rise and relates to the risks of flooding, inundation, and erosion, which has significant implications for islands and coastal areas. Indirect sources of supply-based vulnerability include impacts to infrastructure, including transportation systems (*e.g.*, port, airport, and highways), telecommunications, and tourism-related business (*e.g.*, hotels, restaurants, and tour operators). Natural and manufactured attractions and the availability of inputs (*e.g.*, water, accommodations, food, beverages, and labor) may also be vulnerable.

Induced or economic sources of vulnerability relate to the potential effects on factor prices such as labor, supplies, or energy. Dependence on imports may increase the supply-based vulnerabilities.

Figure 2: Conceptual framework for tourism vulnerability assessment



The vulnerability of the demand for tourism services may be directly affected by weather in the host country as well as the country of origin. Warming temperatures and changes in precipitation in the host country may affect visitor preferences and the overall comfort and enjoyment of activities. Warmer temperatures in the country of origin may reduce demand for trips to tropical countries. Indirect sources of demand-based vulnerability include tourist perceptions of the quality of natural resources and attractions (*e.g.*, coral reefs, beaches, wildlife, and other natural resources) as well as perceptions about health and safety conditions (*e.g.*, risk of vector-borne diseases, tropical cyclones). Induced or economic vulnerability of the demand for tourism relates to the associated effects on tax revenues, prices of tourism services, and the foreign exchange fluctuations. Demand may also be influenced by rising costs of transportation, attractions, accommodations, and food, particularly if mitigation measures include emissions charges.

A survey of hotels, guesthouses, restaurants, bars, and tour operators in two locations in Belize was conducted in June 2006. Interviews with business owners and managers included questions about the vulnerability of their business, economic impacts of past climate-related

events, knowledge of climate change, and appropriate adaptive measures. There were 132 respondents to the survey; 96 were located in Ambergris Caye and 36 were located in the Cayo District.

5 Results

The vulnerability of the tourism sector in Belize to the impacts of climate change is assessed using the conceptual framework presented in Figure 1 along with the results of the survey of tourism-related businesses. Vulnerability is discussed in terms of supply- and demand-based risks.

Supply-based vulnerability

The supply-based vulnerability of tourism in Belize is a function of the sector's exposure to climate hazards as well as its capacity for adaptation. The supply or production of tourism services is directly vulnerable to the effects of climate change in terms of risks to natural resources and attractions and the availability of inputs.

The vulnerability of coral reefs is among the most significant threats to the tourism sector in Belize, as reef-based activities attract more than 80 per cent of tourists who visit Belize. Healthy reefs provide numerous economic benefits, generating income from both tourism and fishing and protecting the shoreline. As early as 1990, tourism based on reefs and beaches contributed almost US$90 billion per year to the economy of the Caribbean region (Reaser *et al*., 2000). Coral bleaching has been associated with increasing sea surface temperatures. Buchheim (1998) concluded that a conservative temperature increase of 1-2 degrees Celsius would cause regions between 20-30 degrees North to experience "sustained warming that falls within the lethal limits of most reef-building coral species". The Belize Barrier Reef lies near the lower latitude of this range, along with much of the Caribbean Sea, where extensive bleaching events occurred in the mid-1980s during anomalous increases in sea temperatures (Buchheim, 1998). The IPCC (1997) notes that the reefs of the Caribbean Sea already live near their thresholds of temperature tolerance. The first recorded bleaching event in Belize occurred in 1995, and was followed shortly thereafter by a mass bleaching event in 1998, with the bleaching of some individual colonies by more than 90 per cent (WRI, 2005). Coral reefs have also been significantly affected by tropical cyclones in 1998, 2000, and 2001, which reduced coral cover at numerous locations along the barrier reef. Coral reefs are also threatened by dredging, over-fishing, gill netting, trawling, and physical damages from recreation.

The supply or production of tourism services is also affected by climate in terms of risks to infrastructure (from tropical cyclones and flooding) and the loss of coastal land (from rising sea levels). Low-lying islands such as the offshore cayes and atolls of Belize are especially vulnerable to rising sea levels associated with climate change because the land area rarely exceeds 3-4 meters above sea level (IPCC, 1997). Small-island developing states (SIDS), as Belize is characterized, are highly susceptible to the impacts of sea level rise, which could possibly be the most "catastrophic" danger they face (Schmidt, 2005). The vulnerability of coastal areas is exacerbated where mangroves have been removed for development. This threat

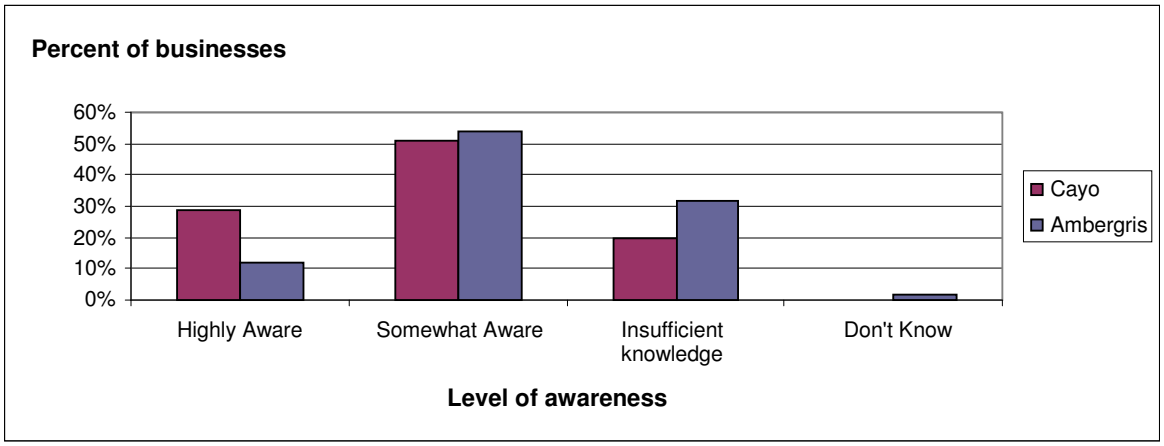
has been identified as highest along the barrier reef, near Belize City, and near Placencia in southern Belize (WRI, 2005).

More than forty documented hurricanes and tropical storms have passed over Belize in the 20th century. Of the seven hurricanes designated as Category 3 or higher, six have occurred since 1950. Since most tourism development has occurred on off-shore cayes and in coastal areas, the sector faces significant exposure to the risks of increasing storm frequency and intensity. Tropical cyclones are considered to be among the two major geophysical causes of loss of life and property (Anthes, 1982). A statement by climate experts called upon leaders of government and industry worldwide to respond with immediate and sustained action to evaluate building practices, land use, insurance, and disaster relief policies that have served to exacerbate vulnerability to hurricanes (Emanuel *et al*., 2006). This same concern poses serious threats for Belize; the survey of tourism businesses for this study found that more than a quarter of respondents on Ambergris Caye (25.3%) and nearly half of respondents in the Cayo District (45.7%) lack insurance protection against natural disasters.

Inland tourism may be less vulnerable to the impacts of climate change than coastal tourism, yet inland destinations still face risks of damage from hurricanes and tropical storms, river flooding, and losses in biodiversity.

The results of the survey of tourism-related businesses indicate that 54% of respondents from Ambergris Caye and 51% of respondents from Cayo are "highly" or "somewhat" aware of climate change (see Figure 3). Nearly one third of respondents from Ambergris Caye rated their knowledge of climate change as "insufficient;" given the inherent vulnerability of this island and its coastal businesses, these results have significant implications for public education and outreach.

Figure 3: Awareness of climate change



Respondents were asked to rate their perception of Belize to the impacts of climate change. Most respondents recognize the country's overall vulnerability; nearly 86% perceive Belize as "extremely" or "somewhat" vulnerable (see Figure 4).

Figure 4: Perceived vulnerability of Belize to climate change

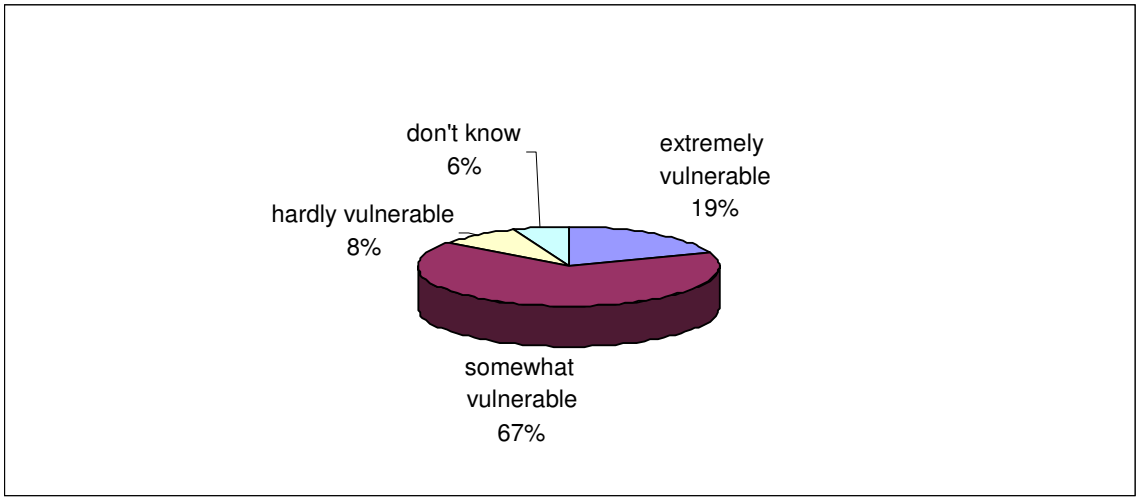
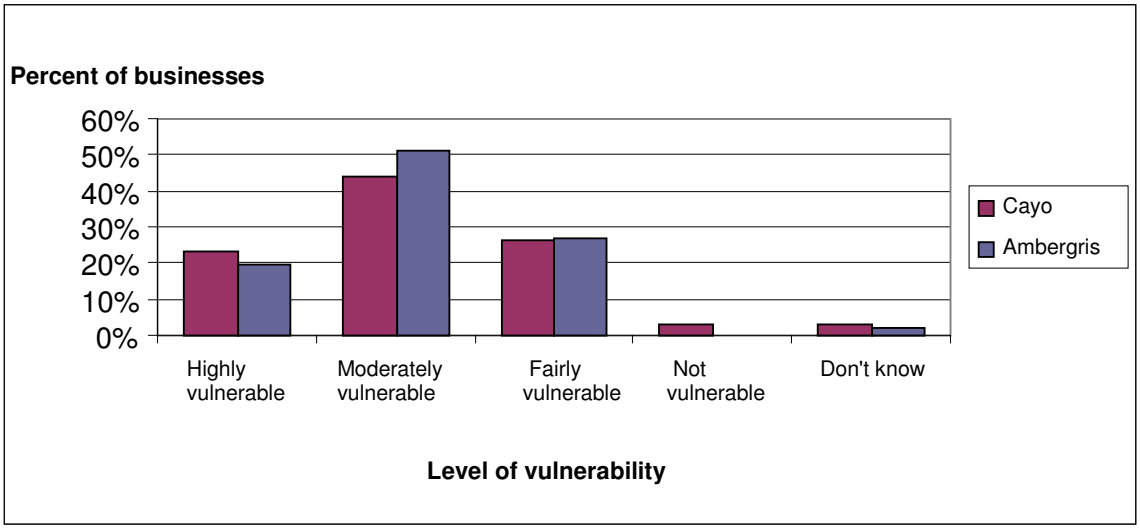


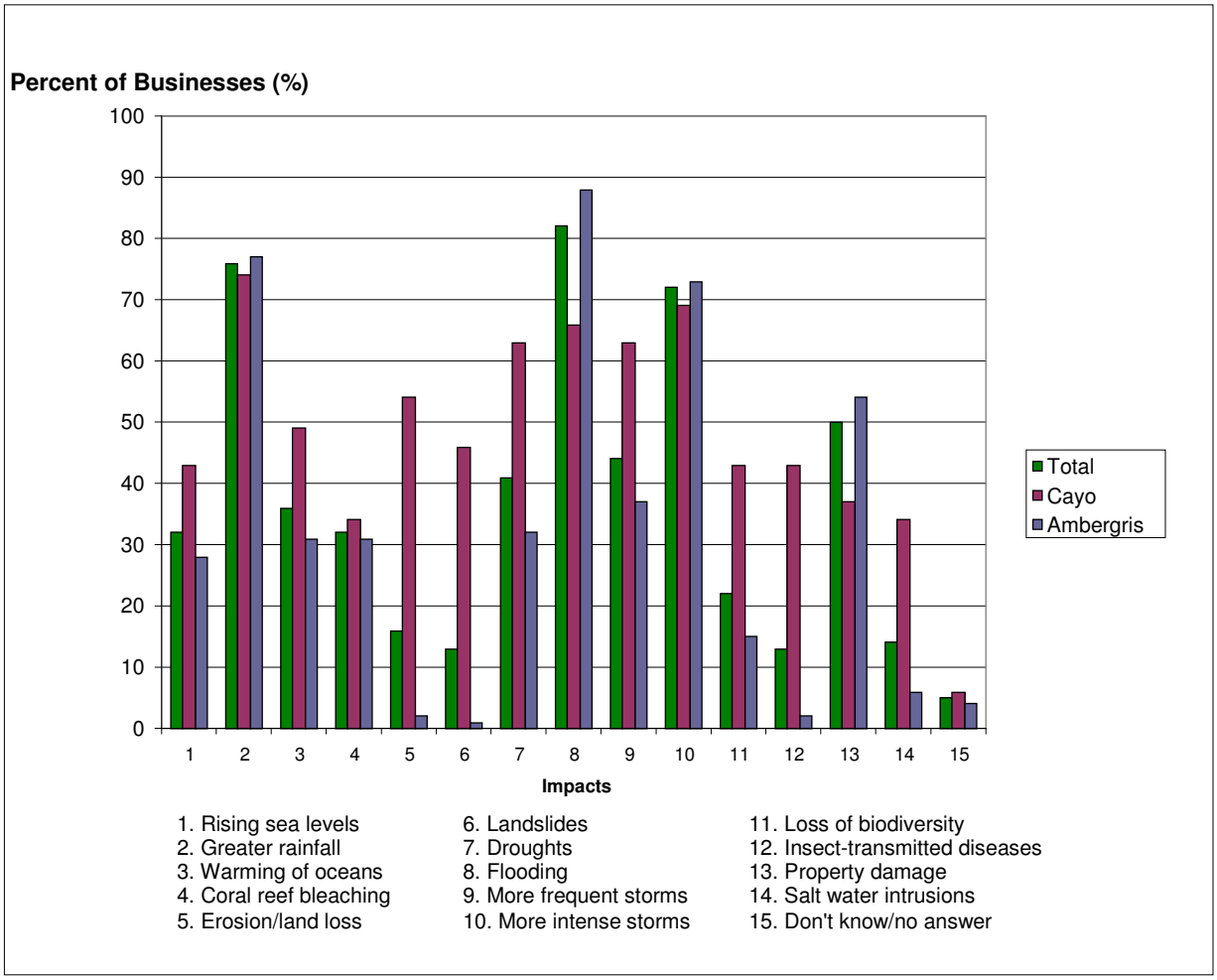
Figure 5 illustrates that 70% of respondents rated their own businesses as "highly" or "moderately" vulnerable, and the proportions for the two locations were comparable (71% and 68% for Ambergris Caye and Cayo, respectively).

Figure 5: Perceived level of vulnerability of businesses to climate change



When asked how specific impacts of climate change might impact their businesses, more than half of total respondents mentioned increased rainfall (76%), flooding (82%), and the intensity of tropical storms (72%) (see Figure 6). However, of particular concern are the low levels of response from businesses in Ambergris Caye to the effects of rising sea levels (28%), warming of oceans (31%), erosion and land loss (2%), loss of biodiversity (15%), and salt water intrusion (6%). These results demonstrate a lack of awareness of the effects of climate change and the associations with tourism resources and activities.

Figure 6: Perceived impacts of climate change on businesses



Availability of inputs represents another source of indirect vulnerability of climate change to the tourism sector in Belize. Much of the building materials, food, beverages, and energy supporting the sector are imported from overseas (primarily the USA and UK), and rising fuel costs have already forced increases to many products and services. Rising sea levels threaten the viability of coastal and island real estate, which has the potential to escalate housing costs and strain the supply of labor. A study by the UN Food and Agriculture Organization indicates that developing countries will experience an 11% decrease in the amount of cultivable rainfed land and an associated decline in cereal production due to climate change, and the most significant declines are anticipated for sub-tropical regions, including Central America (FAO, 2005). The FAO also includes the spread and emergence of diseases in livestock and plant pests among the impacts of climate change.

Demand-based vulnerability

The vulnerability of the demand for tourism depends on the tastes and preferences of tourists and the price elasticity of demand for tourism products and services. People will continue to travel, however the activities and destinations they choose will most likely change. Perry (2006) suggests that tourists are flexible in choice and decision making, but tour operators

and local tourism managers are less flexible. Since little is known about the preferences and priorities of tourists toward environmental features and the implications of climate change, an assessment of demand-based vulnerability of tourism in Belize would be enhanced by a contingent visitation analysis (Richardson, 2007). A visitor survey would be used to elicit responses from tourists about their visitation behavior contingent upon various climate scenarios and changes in environmental features.

Tourism demand in Belize may be directly affected by climate change in terms of changes in the weather of the host country and the country of origin. Maximum temperatures during the peak tourist season in Belize average about 30º Celsius (or 85º Fahrenheit), which is within the range of optimal air temperatures for water-based activities (Hall and Higham, 2005), but may be at the upper bound for comfort in the inland forested regions of the Cayo District, where the stagnant heat is not tempered by sea breezes.

Weather in country of origin may also affect the demand for tourism in Belize. More than 80% of overnight visitors to Belize come from the USA, Canada, and Europe (BTB, 2007), and there is concern that rising temperatures and milder winters in the home countries may reduce the appeal of Belize and other tropical destinations for leisure travel in favor of destinations closer to home. The findings of Amelung *et al*. (2007) suggest that climatically ideal tourism conditions are likely to shift poleward, which would negatively affect tropical destinations such as Belize.

Tourism demand in Belize may be indirectly affected by visitor perceptions of the quality of tourism resources as well as perceptions about risks to health and personal safety. The vulnerability of the tourism sector in Belize is underscored by its dependence on coastal resources. Reef-based activities attract the greatest level of participation among tourists in Belize, according to the Visitor Expenditure and Motivation Survey, administered by the Belize Tourism Board (2004). Snorkeling and diving attract 57.2 and 24.3 per cent of tourists, respectively, while river trips, caving, and birding attract 23.7, 19.6, and 12.9 per cent of tourists, respectively. In terms of sites, the cayes attract 70.3 per cent of tourists, while archaeological sites and national parks attracted only 37.4 and 29.5 per cent, respectively. These statistics suggest that the perceptions of reef quality may be an important factor in the assessment of the vulnerability of tourism demand to climate change. A study of tourist preferences for environmental features in the Caribbean found that roughly 80% of tourists in Bonaire would be unwilling to return in the event of coral bleaching from climate change; more than 80% in Barbados would be unwilling to return in the event of beach erosion from rising sea levels (Uyarra *et al*., 2005). These findings have negative implications for return visitors to the cayes (where reef-based activities are important) and Placencia (where beach features are important). The 2003 Visitor Expenditure and Motivation Survey (VEMS) found that approximately 18% of tourists in Belize had visited before (BTB, 2004); the Uyarra *et al*. (2005) findings suggest that return visitors to coastal destinations could be substantially reduced if environmental features are affected by climate change.

Incidence of tropical diseases such as malaria and dengue fever are relatively rare in Belize, but an increase in prevalence would be costly in terms of reduced demand from wary travelers. The geographical distribution of these vector-borne diseases, along with water-borne, heat-related, and food-borne diseases is expected to expand as a result of warming temperatures.

Risks of personal safety related to tropical storms are a potential factor for vulnerability, although the peak tourism season presently does not coincide with the hurricane season.

Overall, given the present distribution of tourism activities and expenditures in Belize (and assuming no adaptation measures), approximately 45% to 70% of the tourism sector is highly vulnerable to the effects of climate change. At current spending levels, this range corresponds to BZ$ 180 to BZ 280 million (or US$90 to $140 million), and is related to the proportion of tourism that is centered on the cayes, atolls, and coastal zones, and depends on the barrier reef and coastal resources for sustainability. The vulnerability is directly related to rising sea levels, increasing temperatures (and coral bleaching), and the increasing frequency and intensity of tropical storms. This estimate is based on secondary data and the results of other studies, and would be improved by additional research on the possible demand response to changes in environmental features.

6 Adaptive Capacity

Since tourism in Belize contributes a relatively small fraction of overall greenhouse gas emissions, a strategy to mitigate the impacts of climate change would only be marginally effective. Thus, the focus of the response from the tourism sector is on adaptation. From a national perspective, Belize has limited capacity to adapt to the exposure of its tourism sector to the impacts of climate change. The country is constrained by unsustainably high levels of public debt, which consumes increasingly greater portions of national income. Public debt now hovers around US$1 billion, which is roughly equivalent to GDP; debt service has nearly tripled since 1990 and currently represents over a quarter of GDP (UNDP, 2005). Belize has limited access to capital, and credit rating agencies have downgraded the country's debt to their lowest possible levels. The economy, which was historically based on preferential trade agreements with the UK, USA, and the European Union, faces significant uncertainty because of free trade policies and the erosion of trade pacts enforced by the World Trade Organization.

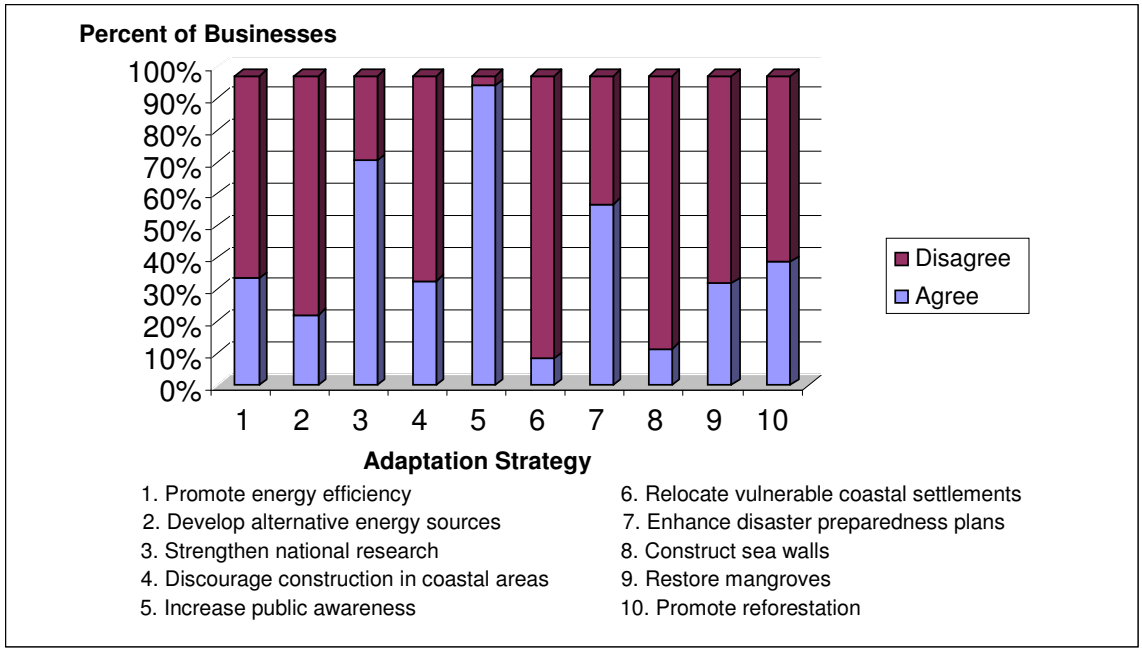
However, the tourism sector and the ministries that regulate natural resource and land uses possess significant capacity to devise adaptation measures through their planning, marketing, and policy making authority. Belize is rich with abundant natural resources, and tourism policies that focus on reducing the exposure of the tourism sector to the impacts of climate change would increase its adaptive capacity. Examples of adaptation strategies include the construction of sea wall defenses to stem coastal erosion, restoration of natural defenses (*e.g.*, mangrove swamps, vegetation, and land levels), beach nourishment, and greater attention toward disaster preparedness planning. Tourism marketing strategies could be modified to more significantly promote inland attractions, such as limestone caves, tropical rainforests, and Mayan archaeological sites, in an effort to further diversify the tourism portfolio. Coastal development should be planned with caution in light of the physical vulnerability of beaches, construction, and infrastructure. The feasibility of installing artificial reefs should be considered as part of a strategy to offset some of the potential losses stemming from the negative impacts to reef-based tourism and to divert some of the pressure of visitor impacts from existing Marine Protected Areas on the barrier reef. Also, the very unique Blue Hole Marine Park exists at such a depth that its attributes are likely to be more resilient to the effects of coral bleaching; although it is

intended for more experienced divers only, the marketing of its attraction could be viewed as an adaptation strategy to the vulnerability of shallow coral reef diving sites.

Most importantly, an emphasis on education and public awareness of the vulnerability to climate change, both in the public sector as well as among private businesses, is essential. While many business survey respondents indicated that they had considered the potential impacts of climate change in their business plans or strategies, most of those who had not cited a lack of expertise, knowledge, and technology as their reasons. Responses to many of the survey questions revealed the insufficient awareness and understanding of climate change and its potential impacts, which underscores the need for greater education and outreach.

Respondents to the survey of tourism businesses were asked about their perceptions of possible adaptation strategies for Belize. The strategies that were supported strongest were to strengthen national research (71%) and to increase public awareness (94%), suggesting that information-based adaptation strategies would be most effective. There was very little support for strategies such as the development of alternative energy sources (22%), relocation of vulnerable coastal settlements (8%), and the construction of sea walls for protection (11%). Responses are presented below in Figure 7.

Figure 7: Perceptions of possible adaptation strategies for Belize



The conceptual framework presented in Figure 1 can be a useful basis for identifying and prioritizing adaptation measures. For example, given the importance of reef-based activities for tourism in Belize and the vulnerability of reefs to the impacts of climate change, a coordinated preservation effort could be developed to focus on preventing boats from anchoring in reef areas, educating for sustainable fishing, reducing agricultural pollution, and reducing cruise-ship generated waste. The infrastructure supporting the tourism sector is vulnerable to rising sea levels and the increasing frequency and intensity of tropical storms, but this vulnerability may be

mitigated by an increasing investment in reinforcement, resilience, and relocation of physical structures. The construction of sea walls may provide added defense against the impacts of climate change. Increasing linkages with local agriculture may reduce the dependence on some imports. Additional research regarding tourist preferences and priorities for environmental features and recreation activities may reduce uncertainty and provide useful information for future planning and marketing of destinations in Belize. Projected impacts of climate change and associated adaptation measures are presented below in Table 4. These measures are suggestions for consideration and deliberation; other appropriate measures may be identified through stakeholder planning.

Table 4: Climate change impacts and adaptation

Impacts	**Adaptation measures**
Increasing temperatures/hot weather	Building design to increase airflow; trees for shade
Rising sea levels/erosion	Sea wall defenses; mangrove restoration; beach nourishment; trees for protection
Tropical storms and hurricanes	Storm-proof construction and reinforcement; trees for windbreaks
Coral bleaching	Marine protected areas; pollution control; coral regeneration
Droughts	Rainwater collection systems; water tanks
Water availability	Conservation; tourist education and awareness

7 Conclusions

Tourism in Belize generates roughly BZ$400 million (or US$200 million) in expenditures per year, directly representing about 17% of GDP and indirectly supporting numerous other sectors from inter-industry trade. Tourism-dependent nations—especially small island developing states such as Belize—are vulnerable to the effects of climate change. The conceptual framework presented in this assessment can be useful in assessing the economic vulnerability of the tourism sector to the effects of climate change such as rising sea levels, loss of coastal land, and warming sea temperatures. Furthermore, the framework can be useful in identifying and prioritizing adaptation measures. An assessment of economic vulnerability should consider the exposure of the tourism system to the hazards of climate change as well as the adaptive capacity of states and communities. Climate effects will vary based on behavioral responses; lower income countries have much less capital to invest in adaptation and mitigation measures, and this condition intensifies the existing risks.

The application of this conceptual framework to the tourism sector of Belize highlights several areas of supply- and demand-based economic vulnerability to climate change, including the risks to coastal land and infrastructure, exposure to resource damages such as coral bleaching, and an associated reduction in demand because of resource changes or risks to personal health and safety. A preliminary assessment of Belize's tourism sector suggests that it is highly vulnerable to the effects of climate change through both its exposure to climate impacts and its weak capacity for adaptation. Adaptation measures that reflect these specific sources of vulnerability should be considered in light of the country's limited capacity to moderate the harmful effects of climate change. Such measures include diversifying the portfolio of tourism

offerings to emphasize inland attractions, planning for coastal development with greater caution, and considering the feasibility of artificial reefs as underwater attractions to alleviate some of the existing pressures on Marine Protected Areas.

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