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Grenada: Macro-Socio-Economic Assessment of the damages caused by Hurricane Ivan September 7,2004

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Executive Summary

The Process

This study to undertake a Macro-economic and Social Assessment of the effects of Hurricane Ivan on the performance of the Grenadian economy, in the short, medium and long term, was initiated as a result of a visit by the Director General of the Organization of Eastern Caribbean States, to the Prime Minister Dr. the Hon. Keith Mitchell, on 10 September - Day Three of the post event period.

It was clear from the scope and scale of the damages sustained, that while significant efforts needed to be deployed urgently to deal with the immediate emergency effects of the event, **critical** thinking also needed to be applied rather quickly, to the types of interventions **critical** to the process of rebuilding the economy. Tourism and agriculture – among the main drivers of the economy - had all suffered tremendous damages. Damages to infrastructure and other essential services at both the national and community levels were also significant.

Another type of initiative - one that would document, analyze and compute the indirect and direct effects of Ivan on the economy, allowing for an overall assessment of the damages and their impact on the economy, was also **critical**. Most important was the need to project the impact of these damages on overall macro economic performance in the short, medium and **long terms**, as the basis to guide discussion of rehabilitation and recovery requirements, establish guidelines for these efforts and identify a range of policy, programmatic and project interventions best suited to the long process of economic, social and environmental recovery. This is what this report seeks to do.

This type of comprehensive assessment of macro-economic impacts is based on a methodological approach formulated by UN-ECLAC and refined to suit the needs of Small Island Developing States by the Organization's regional Headquarters for the Caribbean. Reports of this type have formed the basis for targeted efforts, at recovery and rehabilitation, on the part of development partners in response to similar types of crisis in other Caribbean countries. What sets this particular event apart however, is the sheer intensity of the damages incurred, and their scope. It is this fact that has resulted in the blurring of the previously more rigid interpretation of the emergency response, and recovery and rehabilitation phases of natural disasters such as this, and has resulted in a reduction of the time between the event and the deployment of the assessment team.

The need for such an intervention and the facilitation of the same was discussed with the Prime Minister on 10 September, during the first visit of the OECS Director General, and immediately endorsed.

The Director General led the OECS Assessment Team; the Technical Coordinator of the Team was a member from the UN-ECLAC regional Headquarters for the Caribbean. The

ten person Team which was fielded comprised of five persons from the OECS Secretariat, two from the UN-ECLAC regional Headquarters for the Caribbean, one each from the Eastern Caribbean Central Bank and USAID, and one specialist consultant. The assessment took place in Grenada over the period 19 – 24 September. The report was presented to the Prime Minister and Cabinet colleagues on 24 September, and will form the basis for a meeting of Development Partners convened by the World Bank on behalf of the Government of Grenada on 4 October in Washington DC.

The Report

The report undertakes a sector by sector analysis of the impact of Hurricane Ivan; an assessment of overall damages is then computed. Sectors are grouped into four categories: Social, Productive, Infrastructural and Environment. The first includes the housing, health and education sectors. The second comprises agriculture, manufacturing, wholesale and retail, and tourism. The third includes electricity, water and sewerage, telecommunications, roads and drainage, coastal infrastructure, sea and airports. The environmental assessment includes, among other things, the impact of damages to watersheds on water quality and coastal resources; ecosystem and habitat damages, and implications for solid waste management - an important factor, given the tremendous amount of debris which must now be collected and dumped.

In each of the sectors, a distinction is made between direct and indirect damages. Direct damage refers to losses to assets and stocks at the time of the disaster. Indirect damage is defined as losses in flows (income and production flows following the occurrence of the disaster). Estimates of direct and indirect damages for the economy as a whole are then presented in summarized format. Their magnitude is evaluated in relation to macroeconomic aggregates. The overall computation of the damage also includes a detailed macroeconomic assessment of the situation prior to the disaster, the projected macroeconomic performance without the disaster, and estimated economic performance of the economy as a result of both the direct and indirect costs and effects associated with Hurricane Ivan.

The report concludes with a presentation of guidelines for a rehabilitation and reconstruction strategy and program. Of critical importance is the need to reduce vulnerability over time and increase resilience at both the community and national levels to events of this type. As a result reconstruction must be married with strategic policy interventions aimed at managing risks. A portfolio of projects aimed at facilitating reconstruction and recovery, is also included in this report.

The Effects

An event such as Hurricane Ivan serves to give stark reality to the inherent vulnerability of Small Island Developing States. Prior to hurricane Ivan, the economy was projected to

grow by 4.7 per cent in 2004 and at an average rate of 5.0 percent between 2005 and 2007. The growth was fuelled by developments in the agriculture and construction sectors and in the tourism industry for 2004. The fiscal operations of Central Government were estimated to result in a current account surplus of $17m or 1.3 per cent of GDP, with an overall balance (after grants) of $60m or 4.8 per cent of GDP. 0n the external account, the current account deficit was estimated to contract as a result of the projected slower growth in imports and the improved performance of the tourism industry.

With the passage of hurricane Ivan, economic activity is projected to decline by approximately -1.4 percent in 2004 (resulting in an overall impact of six percentage points of GDP growth) reflecting a contraction in tourism and the halt in production of traditional crops. In the following year, the economy is projected to remain stagnant as the tourism industry continues to be weak and agriculture feels the full impact of Ivan. Thereafter, economic growth is projected to average 4.0 per cent mainly on account of the strong growth in construction, and a halt in the decline of tourism and agriculture.

In 2004, following Ivan, the fiscal position of Central Government deteriorates from a surplus of $17m to a deficit of $54m or 4.5 per cent of GDP reflecting the fall off in revenue, particularly from taxes on international trade and transactions. The growth in capital expenditure, including the outlays for rehabilitation and reconstruction, is projected to widen the overall fiscal deficit (after grants) to approximately 12 per cent of GDP. The external account will experience a widening of the current account deficit due to the strong growth in imports and the contraction in earnings from tourism, despite the growth in current transfers. The capital and financial account will benefit from higher official capital grants and insurance inflows.

The Future

The assessment presented in this report should form the basis for the government and international community to identify and set national priorities in the recovery and rehabilitation phase. It should be utilized as a basis for introducing disaster preparedness, planning and mitigation into the development planning apparatus of the country and into the consciousness of the people of the country. The last major event of this type to affect Grenada was Hurricane Janet, in 1953. There are two generations of Grenadians who have therefore not experienced an event of this type, and the trauma to the national physic has been severe. The 2004 hurricane season so far has resulted in an unprecedented wave of destructive tropical storms and hurricanes, with half of the season still to follow.

The passage of Ivan, terrible as it has been, should also be viewed as an opportunity, through the process of rebuilding, to put systems in place to assist in reducing overall impacts of such an event when they do occur. The following are some of the recommendations and projects resulting from the discussion of macro economic and social effects:

- The process of rebuilding will be enormous. There is need for the development of a statutory or other body to coordinate and direct this process.
- Systems should be put in place to ensure the management of disasters in their fullest sense; from security planning and deployment, to coordinating, receiving and distributing aid, to coordinating the efforts aimed at utility recovery.
- Land use and urban planning, the review of building codes and standards, the regularization of informal settlements that have been flattened, should also be given priority. Technical assistance with respect to introducing hurricane safety provisions in the rebuilding process is an immediate need, as is assistance relative to retrofitting for this purpose.
- A major campaign of public awareness with respect to disaster preparedness is indicated as is a systematic approach to providing counseling to the thousands who are suffering post traumatic stress disorder.
- Of critical importance is the need to identify series of projects with the potential to generate income and foreign exchange, and provide employment quickly. The agro forestry sector, agriculture and fisheries, eco-tourism, are among some of the sectors with the potential to provide immediate benefits. The high levels of unemployment in all sectors and particularly among Grenadian youth must be dealt with, urgently.

What must be cautioned against, even in the face of the real need to clear debris and start the process of rebuilding as quickly as possible, is the need to ensure that rebuilding does not take place at a lower standard, thereby increasing the vulnerability of the country to future events, and that the remarkable gains in solid waster and environmental management in which this country has taken a leadership role are not lost in the bid to find appropriate sites for the mountains of debris which must be cleared. Most importantly, in all of this, is the trauma and dislocation endured by the people of Grenada. The effects of post trauma stress disorder must also be dealt with, as speedily as possible.

Limitations of the Report

This report was undertaken over a four day period, twelve days after Hurricane Ivan swept through the island. The level of effort represented here is in keeping with both the amount of time available to the OECS led Assessment Team, and the conditions operating in the country at the time of Mission.

Although one of the Team members did visit Carriacou with her national counterpart, the data presented in this report, in the main covers only the island of Grenada which was the worst hit of the tri-island State.

The primary objective of the Mission was to undertake a critical assessment of the impact of damages, both direct and indirect, as well as their secondary causes and effects, on the macro-economic performance of the country in the short, and medium term. The assessment does not provide, for example, a quantitative analysis of the impacts on those in the informal sector and their linkages to the formal sector; neither has the report been able to quantify the damage caused to environmental assets. Benchmark numbers with respect to those operating in the informal sector are not available, and as a result, their linkages, while described, have not been quantified. It is important however to understand that they exist.

Similarly, the methodological approach utilized to compute macro effects does not permit for a comprehensive analysis of effects in an all encompassing way. A report such as this should not replace the need to undertake detailed socio-economic assessments of social safety nets that will be required, for example, to provide shelter and livelihoods for those whose losses are complete. In any event, such an analysis is not the objective of this report.

The report provides an overall extimate of the magnitude of the damage and states the reconstruction requirements. It quantifies the losses and projects macro performance soon after the event in an effort to ensure that the critical discussions required, relative to rebuilding the Grenadian economy, can start. It sets the basis for critical next step actions at both the international and national levels.

Preface

Hurricane Ivan, a category 3 system with sustained winds of 115mph, impacted Grenada and its dependencies on Tuesday, September 7th 2004, leaving a trail of damage. According to initial reports, eighty per cent (80%) of the country was reported to have been demolished with at least eighty- nine per cent (89%) of the housing stock being destroyed. In addition unconfirmed reports placed the number of persons dead at twenty-eight.

Pursuant to discussions on the 10th of September 2004, between the Prime Minister of Grenada and the Director General of the OECS, the OECS Secretariat fielded a multi-disciplinary team to assist the Government of Grenada undertake a macro-socio-economic assessment of the damage caused by Hurricane Ivan. This Inter-Agency Team was made up of four persons from the OECS Secretariat, two persons from UNECLAC, and one person from ECCB. In addition, two consultants supplemented the Team. The OECS Team worked with local counterparts who had been assembled for coverage of each of the main sectors. Funding for the assessment was provided by USAID and UNDP. This assessment, which was undertaken from the 19th to the 24th of September 2004, complements the compilation of damage and needs assessments prepared by numerous other agencies.

The assessment presented in this Report includes estimates of direct and indirect damage to the economy as a whole: their magnitude was evaluated in relation to macroeconomic aggregates. The overall assessment of the damage also includes a detailed macro-economic assessment of the situation prior to the disaster, the expected situation without the disaster, and the estimated performance of the economy with the passage of the hurricane. The information presented is based on data that was available and on evidence collected through field visits and interviews.

The assessment employed was in accordance with the methodology that has been developed by UNECLAC[1] and the OECS[2]. The focus of this methodology is on the valuation of the damage on the society, eocnomy and environment of the affected country so that appropriate mitigation strategies can be formulated during the reconstruction phase. The recommendations for the reconstruction phase take into account an assessment of the worst affected social, economic, infrastructure and environmental sectors.

It is estimated that the magnitude of the loss exceeds the country's ability to address reconstruction needs on its own, particularly if the aim is also to reduce the impact of similar events in the future. International cooperation is therefore considered essential.

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[1] See, ECLAC/IDNDR (1999), *Manual for Estimating the Socio-Economic Effects of Natural Disasters.*
ECLAC (2003) *Handbook foe Estimating the Socio-Economic and Environmental Effects of Disasters*.LC/MEX/G.5.LC/L.1874
ECLAC (2004) *Disaster Assessment Training Manual for SIDS.* LC/CAR/L.12.

[2] See, OECS (2004), post Disaster Rapid Environmental Assessment – Manual with Guidelines.

Consequently, outputs of the assessment include guidelines for a rehabilitation and reconstruction programme, and a tentative list of project outlines. Questions of improved land use planning, watershed and coastal management, early warning, emergency response, and structural preparedness for evacuation and sheltering potentially affected populations, are seen as important considerations for the reconstruction process. Additionally, the reconstruction strategy should pay special attention and priority on including sustainability and increased governance criteria in making social and productive investments, and on allocating resources to the reinforcement and retrofitting of vulnerable infrastructure, basic lifelines and services.

The Grenadian society and government now face the opportunity of undertaking the reconstruction with renewed values and criteria, and on embarking on institutional, policy, legal and structural reforms that will strengthen the country's resilience to economic, social and ecological vulnerability.

I. Background

1. The Mission

The OECS Mission was deployed on September 19th 2004. Mr. Timothy Antoine, Permanent Secretary in the Ministry of Finance was appointed as the focal point responsible for coordinating all logistical and technical support to the Mission Team. The Members of the Mission are identified below:

Dr. Len Ishmael	OECS, Director General
Dr. Estaban Perez	ECLAC, Regional Headquarters for the Caribbean (Technical Team Leader) Macro-Economist
Ms. Asha Kambon	ECLAC, Regional Headquarters for the Caribbean Social Scientist
Ms. Rosalyn Hazelle	OECS, Social Scientist
Dr. Vasantha Chase	OECS, Environmental Specialist
Mr. Francis Burnette	OECS, Public Health Specialist
Mr. George Alcee	OECS, Agricultural Specialist
Ms. Laurel Bain	ECCB, Macro-economist
Mr. Anthony Payne	USAID, Civil Engineer
Dr. David Smith	Smith Warner International, Coastal Engineer

Local counterparts provided continuous support to this effort. The full list of these colleagues is contained in Annex 1 of this Report.

2. Description of the Phenomenon and its Effects

The State of Grenada, which includes the islands of Carriacou and Petit Martinique, is located in the Caribbean Sea between latitudes 11°59´ and 12°20´ North and longitudes 61°36´ and 61°48´ West. Grenada is the largest and main island, being 18 km (11 miles) wide, 34 km (21 miles) long, and with a coastline of about 121 km (75 miles). It has an area of 312 km^2 (121 sq. miles) (Figure 1).

Figure 1 Map of Grenada

On Monday 6th September 2004, at 11:00AM, as Tropical Storm Ivan approached the Windward Islands from the Atlantic Ocean (Figure 2), tropical storm warnings for Grenada were upgraded to Hurricane warnings. As Hurricane Ivan came closer to Grenada, however, winds remained relatively light, less than 10 mph. At 1:00PM on the 7th, the eye of the storm was approximately 35 miles to the ESE of Grenada. Winds measured at the airport were gusting to 40 mph, while the maximum sustained wind speeds recorded by the National Hurricane Centre were of the order of 120 mph.

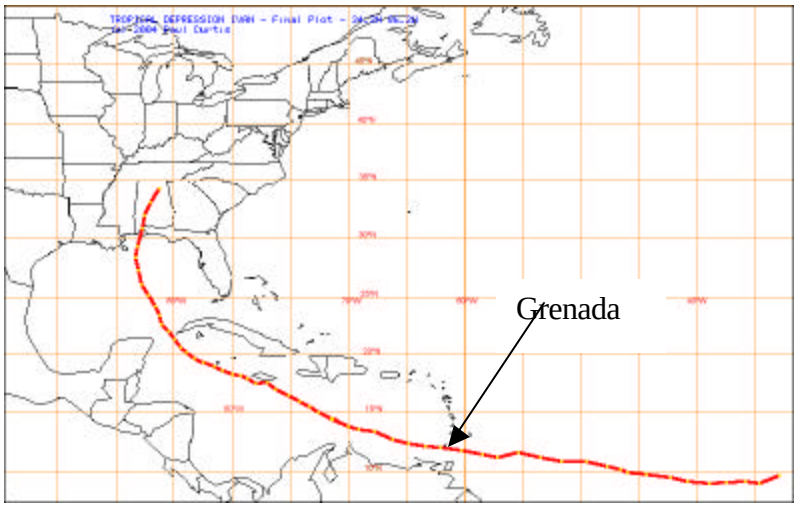

Figure 2 Track of Hurricane Ivan

Conditions in Grenada depreciated rapidly after this, with measured central pressures dropping from 998 mb at 1:00PM down to 955 mb at 4:30PM. Concurrently, wind speeds increased to over 120 mph at the Point Salines Airport, with gusts of over 145 mph occurring between 4:05PM and

4:10PM. By midnight of the 7th, recorded atmospheric pressures had risen to 1000 mb, and winds had dropped to between 40 and 60 mph. Over the following day, wind speeds slowly decreased and atmospheric pressures climbed to 1010 mb.

A satellite image of Hurricane Ivan is presented in Figure 3. This image was taken as the eye of the hurricane was almost directly over Grenada.

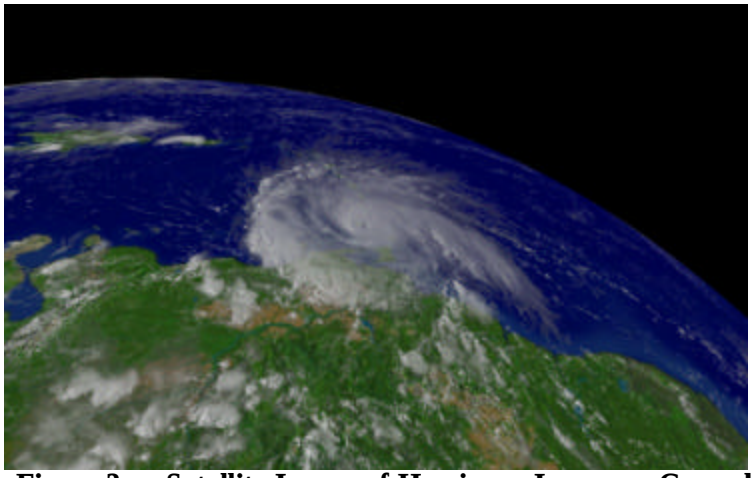

Figure 3 Satellite Image of Hurricane Ivan over Grenada

Damage caused by the storm was extensive, with the worst observed being in the parishes of St. George's, St. David's, St. John's and St. Andrew's. Significant damage to the housing stock was recorded, in the form of wooden houses being totally destroyed, roofing being blown off houses (both concrete and wood), and with concrete walls being knocked down. In addition, electrical poles were downed in many areas of the country, thereby affecting power distribution and telecommunications. Reservoirs and intake structures were adversely affected (fallen trees, silt and general debris). In addition, distribution lines were damaged. This resulted in island-wide disruption of water supply services.

Photo 1 Damaged Housing in St. Georges

As a result of electric poles coming down, telecommunications island-wide were disrupted. This also extended to the cellular network, where antennae were moved out of alignment.

Damage to housing infrastructure was also accompanied by widespread deforestation throughout the island (Photo 2). Anecdotal reports indicate that during the hurricane's passage over Grenada, several small but powerful whirlwinds were noted. These had the effect of exacerbating significantly, the damage that occurred.

Photo 2Downed Trees in the Central Areas of the Island

Hurricane advisory data taken from the National Hurricane Center (NHC) database, gave information on central pressures during the storm's approach to Grenada. Using this data, along with observed forward speed and maximum wind data, a very preliminary estimate was done of the waves that would have been generated by Hurricane Ivan. This procedure[3] gave waves in deep water approximately 14m in height, with directions to the NW. Once the hurricane passed west of Grenada, wave directions would have shifted to the north. Even though these large waves were generated offshore, they would have been reduced as they traveled inshore, as a result of the large offshore bank that trends in a NE-SW direction off the south and east coasts of Grenada. These banks would have resulted in a significant amount of wave energy loss occurring before the arrival of the storm waves onshore, therefore reducing the amount of damage caused by this phenomenon. This was evidenced by the fact that only limited areas were seriously affected by wave action.

To put the intensity of hurricane generated waves into perspective, the estimated wave heights from Hurricane Ivan can be compared with a wave analysis carried out recently for Grenada[4]. That analysis also involved the use of parametric wave models to derive a data series of wave heights from hurricanes (HURWave). The NOAA database of hurricane records, which dates back to 1900, was used. All hurricanes passing within a 400 km radius of Grenada were selected from the larger database, and wave heights in deep water (greater than 150m deep) computed for those selected occurrences. A statistical analysis was carried out on the data series of wave heights. The following plot (**Figure**4) shows the fit of the distribution used to the data series of wave heights.

[3] Young, I.R. 1988. "Parametric Hurricane Wave Prediction Model"
[4] Smith Warner International Ltd. 2004. "Marine Component of EIA for Prickly Bay, Grenada"

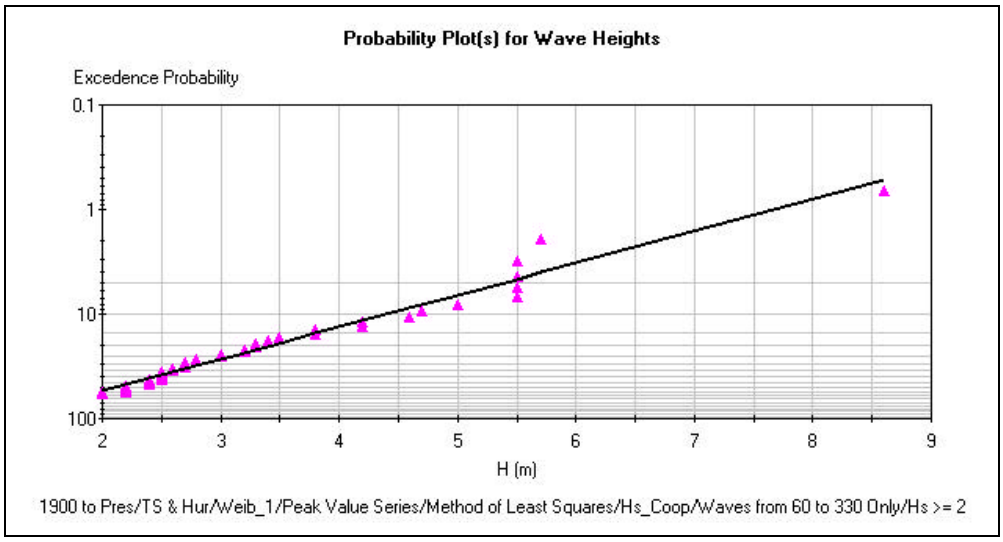

Figure 4 Hurricane Wave Extremal Analysis

Coming out of this analysis, a number of return period events were identified. The results of this hurricane analysis are shown below in Table 1. The probability that a particular wave height would be exceeded within the next 50 years, is also shown in the table below.

Weibull Distribution, k =	1.0		
Correlation Coefficient =	0.971		
Return Period (years)	**Significant Wave Height H_s (m)**	**Wave Period, T_p (s)**	**Exceedance Probability (%) for 50 yrs**
2	1.74	4.68	100.0
5	3.04	6.65	100.0
10	4.02	7.93	99.5
20	5.01	9.10	92.3
25	5.32	9.46	87.0
50	6.30	10.53	63.6
100	7.29	11.53	39.5

Table 1 Results of Statistical Hurricane Analysis

The comparison of the estimate of wave heights, generated under Hurricane Ivan, with those previously obtained for the larger database, indicates that Ivan may have been a more than 100 year event.

Three areas in particular suffered damage form storm surge and wave action. These were the areas of Soubise to Marquis, Rive Antoine and Waltham. At Soubise for example, local eyewitness accounts indicate that the storm surge and wave run-up was in excess of +3.0m above Mean Sea Level. The result of this was that the sea pushed all of the houses along that strip of roadway from the seaward side of the road over to the landward side. Residents subsequently relocated their homes back to their original places after the storm.

Photo 3 Damage to Soubise Area (Note boat washed onto landward side of road)

Rainfall measured at the Point Salines International Airport (PSIA) indicated a total amount of 256.0 mm between the hours of 11:00AM and 5:00PM. This translates to an average rainfall rate of 42.7 mm/hour during that six-hour period. To put this into context, the following data is presented summarizing rainfall patterns for Grenada.

1. Rain is distributed into a rainy season from June to December – which receives about 77 percent of the annual rainfall – and a dry season from January to May.
2. Grenada experiences wide variations in annual precipitation at different locations, with, for example, the Grand Etang Forest receiving an average annual rainfall of about 3,880 mm (153 in).
3. Rainfall intensities are often greater than 50 mm/hr, and intensities up to 132 mm/hr have been reported (CCA, 1991).
4. Average annual rainfall recorded at the Point Salines International Airport (PSIA) for the period 1986-2003 was 1,125.6 mm (44 in), with monthly variations shown in **Figure** following.

The comparison of rainfall received during the hurricane, with seasonal rates, indicates that relatively little rainfall fell during this event. This was very beneficial, as had there been heavy rains, combined with the deforestation that occurred, significant landslides and further loss of life would almost certainly have occurred.

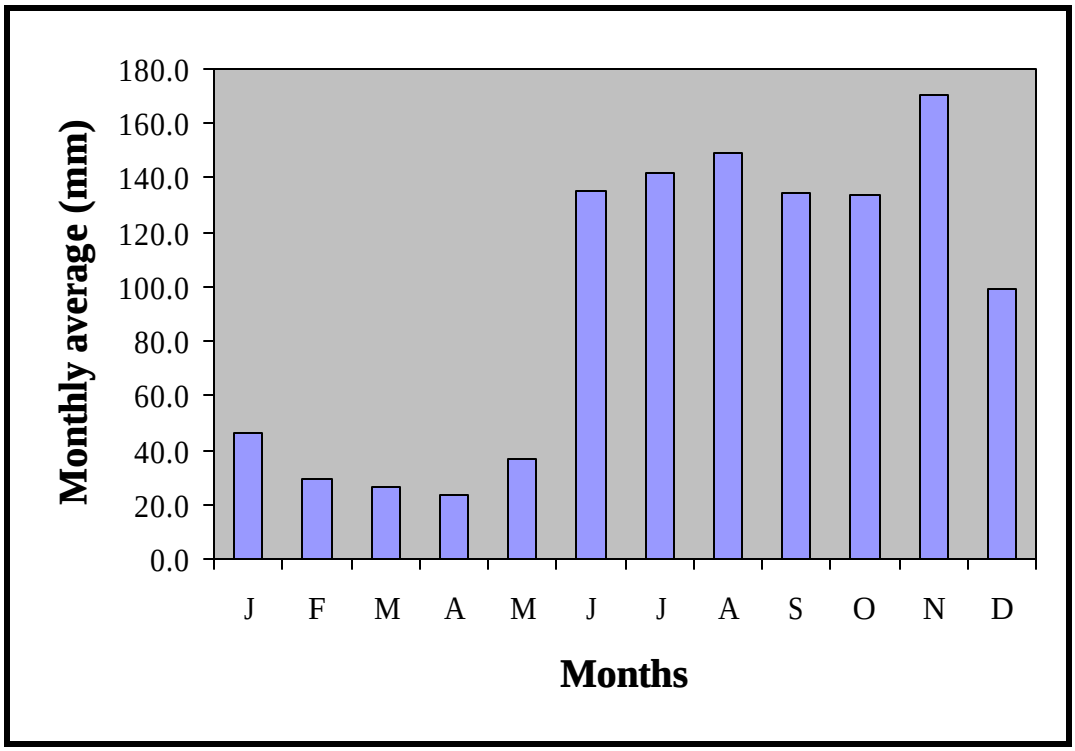

Figure 5 Monthly Average Rainfall – PSIA (1986-2003)

Finally, it should be noted that although Grenada is considered to be located just south of the hurricane belt, Hurricane Ivan has confirmed that the country is vulnerable to tropical storms, hurricanes and storm surges during the hurricane season, which runs from June to November. The last hurricane to directly hit Grenada, Hurricane Janet, in 1955, resulted in extensive damage and the loss of over 100 lives. More recently, in 1999, storm surges and high waves (no wind or rain) caused by Hurricane Lenny in the northern Caribbean resulted in severe infrastructural damage to Grenada's west coast. Hurricane Ivan, even though coming 49 years after Janet, reinforces the need for all Caribbean countries to be adequately prepared for hurricane attack.

3. Affected Population

3.1 Description of Affected Population

Grenada is comprised of seven parishes, which include the island of Carriacou and Petit Martinique; together they have a population of 102,632 persons[5]. Of the six parishes on the island of Grenada, which were impacted by hurricane Ivan, four: St. George, St. David, St. Andrew and St. John, were most severely affected.

The four affected parishes consist of a total population of some 81,883 persons or 80% of the total population. In the other three parishes St. Mark, St. Patrick and Carriacou, on average, some 20% of the persons in those parishes were severely affected. Table 2

[5] Government of Grenada Population and Housing Census 2001

details the affected population by Parish. Worst hit were persons in St. George, St. Andrew and St. David.

Parish	Total population [b]	Population		Population Affected
		Male	Female	
St. George's	37,057	17893	19164	35575 [a]
St. John's	8591	4314	4277	7732 [c]
St. Mark's	3994	1965	2029	799 [d]
St. Patrick	10,674	5256	5418	2135 [d]
St. Andrew's	24,749	12311	12438	23,759 [a]
St. David's	11,486	5770	5716	10337 [a]
Carriacou	6081	2972	3109	1216 [d]
Totals	102,632	50481	52151	81,553

Table 2.Grenada: Estimated Affected Population due to Hurricane Ivan[6]

Hurricane Ivan took the lives of twenty-eight persons, of which 30 % were due to trauma to the head and chest, attributed directly to the hurricane. The majority or 69 % of the victims were males, and 70 % of all deceased were over 60 years old. Consistent with the destructive path of the hurricane, 50% of deaths occurred in St. Georges, followed by 25 % in St. David's. Seven persons died indirectly as a consequence of the hurricane. Within two weeks after the passage of Hurricane Ivan, the accident and emergency departments of the two largest hospitals reported that 680 persons had been treated for various injuries. Cases of gastro enteritis in children were beginning to surface as the shortage of potable water became acute. In response, the Ministry of Health had begun the distribution of rehydration kits.

A Poverty Assessment Study conducted in 1999 indicated that some 32% of the population of Grenada were living in poverty. Of those who were defined as poor, 32% could be found in the parish of St. George's, 27% in St. Andrew's, 10% in St John's and 10% in St. David's. Table 3 below presents the data for poverty estimates by parish in Grenada. The poor who lived in the most affected parishes by hurricane Ivan, accounted for approximately 75% of the all those persons who were poor across the nation. The annual expenditure of the poor was estimated to be less than EC$3,262.00 which was considered to be the cost of meeting minimal food and other basic requirements. Approximately 13% of all individuals in the country were found to be extremely poor or indigent.

Disasters associated with natural events are fundamentally an issue of development and there are close links between poverty, low-income populations, and communities being disproportionately affected by natural hazards. The effect of the disaster on the parishes with the significant proportions of the poor exacerbated an already difficult situation.

[6] Source:[b] Population Census 2001; [a] as estimated by 96% of those living in the hardest hit parishes; [c] as estimated by 90% of those affected parishes that were also hard hit; [d] as estimated by 20% of those living in parishes which were not as severely affected

This became evident, in the aftermath of the hurricane, when bands of persons who had lost their homes, took to the streets and looted.

Parish	Total population [b]	% of population	As a % of the poor population [a]
St. George's	37,057	36.1	31.7
St. John's	8591	8.4	10.0
St. Mark's	3994	3.9	4.8
St. Patrick	10,674	10.4	14.0
St. Andrew's	24,749	24.1	26.6
St. David's	11,486	11.1	9.8
Carriacou	6081	6.0	3.1
Totals	102,632	100	100

Table 3 Poverty Estimates by Parish – Grenada[7]

St. George's has suffered the fate of modern-day towns and cities, which became magnets for persons from the country-side seeking employment and livelihoods. These persons are part of the continuous internal migration streams which flow from the country side to town. They often find themselves cut off from family ties, living in precarious circumstances and in overcrowded squatter communities. In Grenada, many such persons work mainly in the informal sector[8] providing support services -such as meals to workers in the manufacturing sector at the estate in Frequente. To the tourist sector on the south coast of St. Georges's, informal sector workers provide hand crafted beads, craft produced from forestry products, and hair braiding services. Many women, as well, in this sector are involved in the trafficking of fruits and ground vegetables. The Poverty Assessment Report concluded that the informal sector has been important to the growth of Grenada. In the parish of St. Georges, they can be found living in the Grand Anse Valley, and in St. Andrew's in Soubise, both of which suffered immense destruction from the hurricane.

In the wake of Ivan, many persons found themselves without shelter, food, belongings or a social network to provide immediate support. It was reported that 18,000 persons were without homes and required relocation to approximately 160 formal and informal shelters.[9] Unfortunately many locations designated as shelters had their roofs torn off by hurricane Ivan forcing persons to seek alternate places of refuge. However, two weeks after the event, the numbers residing in shelters had been reduced to approximately 5,700 persons, or approximately 7% of the affected population, distributed in just over 140 shelters. The details of known formal and informal shelters are presented in table 3. Reports indicated that in some instances, as many as five families could be found crowded into single-family dwellings, which still had roofs or partial roofs, following the

[7] Source: [a] Grenada Poverty Assessment Report 1999; [b]Population Census 2001

[8] Government sources indicate that the informal sector may contain some 30% of the working age population (15-49) with a female participation rate that may be higher than that of the male rate.

[9] A peculiar situation arose following hurricane Ivan, where in some cases, designated shelters were destroyed by the hurricane, and in other cases, where persons were either without access to or knowledge of the location of the designated shelters, they moved into unoccupied buildings that appeard to be able to withstand the hurricane winds. In those situations the living conditions were precarious.

hurricane. In one instance, where some 540 persons took refuge in an informal shelter, they were found to be without basic sanitation facilities. Immediate installation of portable toilets occurred to avoid a serious health crisis.

Number of Shelters	Persons in Official Shelters	Persons in Unofficial Shelters	Total Number of persons in Shelters
10(official) 27(unofficial)	124	949	1073
20(official) 38(unofficial)	774	1803	2577
2(official) 6(unofficial)	O	149	149
8(official) 4(unofficial)	145	49	194
4(official) 22(unofficial)	341	1277	1618
3(official)	101	-	101
144	1485	4227	5712

Table 4 Summary of persons in shelters by Parish[10]

Fallen trees, landslides and debris (galvanize sheetings, boards, parts of household furnishings) strewn on the roads and broken poles and downed telephone lines resulted in the isolation of a number of communities. This hampered the distribution of food and other relief supplies. Almost the entire population was without access to potable water in the immediate aftermath of hurricane Ivan. After two weeks, water was gradually being restored. In the parish of St. George's, access to water had been increased from 30% to 75%.[11] The entire population was without access to electricity, immediately after the event, barring the few who had personal generators. Electricity has been restored to a small section of the country through the assistance of local and regional crews provided by CARICOM member states through CARILEC. After two weeks, approximately 50% of those persons with usual access to telecommunications services were without. Services to sections of St. Georges have been restored.

3.2. Vulnerability of Women and Children

Male headed households account for some 52% of the households in Grenada and females 48%, but among the poor the situation is reversed, female headship accounts for 52% of the households. The living conditions and capacities of the head of household is important as it affects issues of intergenerational poverty , the life chances of children and the other dependents, such as the youth and elderly who live in the household. The difficult situation of poor female headed households in the aftermath of hurricane Ivan was evident in the larger numbers of females in shelters than males and the larger number of children than adults. In one shelter in Bollieau, two women had between them some 22 children, which supports the findings of the poverty assessment regarding the extremely large size of poor families. UNDAC reported that the food distribution situation was slow and tedious, not often reaching the people who needed it most.

[10] Source: OECS on the basis of official information and consultations with Government officials
[11] CDERA Situation Report #8.

There were anecdotal reports of young women, seeking to procure transactional sex in order to secure needed supplies. Reports were also received of instances of gender based violence occurring in informal shelters.

Women are very often left with the responsibility for elderly relatives. Grenada has one of the highest total dependency ratios in the OECS region 94.8% and a relatively high elderly dependency ratio of 31.8%[12]. Persons over 65 years of age account for 16.3% of the population. It was not surprising therefore, that many of the deaths due to hurricane Ivan occurred among the aged, nor among elderly men, as there has been noticed a phenomenon in the OECS countries of the single headed male household living in somewhat lonely and precarious circumstances in old age. [13]

The employment situation is precarious in the best of times. The rate for male unemployment is 15% and 13% for females. Labour force participation rate of women is significantly lower in Grenada than other OECS countries. Approximately 68% of males and 38% of females participate in the labour force. This may not represent those working in the informal sector however, as many persons who eke out a living, to maintain themselves, through activities in that sector often do not consider themselves to be part of the labour force. The reported damage to day care centres, caused by hurricane Ivan which left some 480 children, in the parish of St. George's alone, without the care to which their parent or guardian have been accustomed, could make the participation in the labour force of women all the more precarious. This has become particularly clear, as the data on the parent of children of the day care centres, point to a significant proportion, 70%, of the parents being single female heads of households. With the expected negative fallout on the productive sectors of the economy, due to hurricane Ivan, larger numbers of women and men can be expected to seek their livelihoods in the informal sector. Provision of support services to female heads of households, in the form of day care for their children, will become necessary , not only to allow the mother time to secure a livelihood, but to ensure the safety and reduced vulnerability of the children who would have to be left without supervision and care in her absence.

3.3. Psycho Social Trauma

Eighty per cent[14] of persons alive today in Grenada would never have experienced a hurricane, as the last major event, Janet, occurred in 1955, some 49 years ago. Disasters affect people in different ways. However, the shock at the devastation caused by hurricane Ivan and the resulting psycho social trauma to the entire population although acknowledged, has not been able to receive the attention of the health system that it requires. The health services have been burdened treating with the physical needs of the population following the crisis and trying to ensure that no outbreaks of infectious diseases occur. It is therefore not surprising that evidence of trauma rehabilitation has not been strong. UNICEF had begun to provide support to the government in the

[12] Poverty Assessment Report, Grenada, 1999
[13] Social Audit of the Sugar Industry of St. Kitts and Nevis (2002)
[14] Grenada Population Census 2001 indicates that 80% of the population are aged 0-49

organization of community level peer counseling for children in shelters. Efforts were being made to secure the services of child psychologists and counselors, from off island, to support the needs of children and women.

4. Emergency Actions

4.1 Government Actions

Based on reports received originating from the Hurricane Centre in Miami, Grenada's Hurricane Tracking commenced as early as Saturday September 4, 2004. On Sunday September 5, the Government issued a Storm Watch. This was upgraded to a Hurricane Watch by 11:00 am on September 6. This action was taken as the centre of Hurricane Ivan was said to be located near the Island. The Government of Grenada took a decision to close all schools and governments offices to allow for citizens to prepare themselves for the Hurricane.

Government received information that suggested that if Ivan continued on its path it would have been likely to reach Grenada within 22 hours. In response, the National Emergency Relief Organization (NERO) called on citizens to take the storm warning seriously and to start their preparations. NERO continued to issue regular updates to citizens including information on basic supplies, the location of shelters and a call to listen to their radios for information. Persons living in low-lying areas, or areas prone to flooding were encouraged to evacuate, as well as those whose homes may have been vulnerable to high winds. At 5:00 pm the Hurricane Watch was upgraded to a Hurricane Warning.

The Prime Minister of Grenada, Dr. the Rt. Hon. Keith Mitchell, on September 7, called on all citizens to brace themselves for the worst eventualities. He advised persons to seek shelter at the venues announced by the Disaster Preparedness Office, and also urged persons not to become complacent.

Food was distributed to shelters starting on September 8, meats held in cold storage was also widely distributed. All seven parishes received food shipments on Saturday and Sunday following the passage of Ivan. There was also the distribution of water to shelters. Water bladders with a capacity of approximately 10,000 gallons were deployed within the first seventy-two hours after the storm.

The Public Health Department struggled to set up community water tanks. Water crews worked on restoring some water capacity in all areas, St. Patrick had 75% of its water restored by September 11, while St. Andrews had 50% of its water by the same date. However, water shortages were being addressed through bladders, tanks, water trucks and bottled water.

The Carriacou Disaster Preparedness Committee meanwhile had alerted chairpersons of the district committees to revisit vulnerable persons and prepare them for relocation; Shelters were opened; senior citizen's homes were prepared.

4.2 International Cooperation

On Wednesday at approximately 9:00 am the Eastern Caribbean Donor Group met at the CDERA Headquarters, to receive a preliminary damage report. The information emanating from that meeting was to inform the group's emergency response. The Caribbean Disaster Response Unit scheduled for deployment on Wednesday to Grenada. While CDERA's sub-regional focal point for Grenada in Trinidad and Tobago was actively mobilizing to get supplies to Grenada, CARILEC assembled its restoration crews to be sent to Grenada. The Emergency Assistance Funds which is operated by CDERA and Caribbean Development Bank were activated. CARICOM Secretariat was apprised of the situation.

The British Naval Ship HMS Richmond also offered immediate support and assisted the Grenada Broadcasting Network in establishing a transmitter to allow for communication to the people. They also provided medical supplies to the General Hospital and restored their power.

The Regional and International Community have responded with the deployment of its multi-discipline Rapid Needs Assessment Team (RNAT) comprising of CIDA, USAID/OFDA, UNICEF, UNIFEM, UNDAC, PAHO, Red Cross, Environment and Sustainable Development Unit of the OECS and CARILEC. There has also been a major clean up effort with the support of the Venezuelan contingent. The government of Trinidad and Tobago has deployed a military contingent to assist with the recovery relief and rehabilitation efforts, in addition to providing material assistance. The details are presented in table 5.

Internal security has been provided by security personnel from the Regional Security System. A high level mission consisting of the Secretary General of CARICOM, the Director General of the OECS and the President of the CDB arrived in Grenada on September 10 to undertake a first hand assessment.

Agency	Type	Cost
T&T Regiment (Contingent of 250 soldiers)	Security; School repairs; contribution of 1,276 tons food, water, and generators; food distribution, restoration of water and sewage systems; restoration of electrical cable and poles and telecommunications,; medics, engineers; and 638 tons of construction material.	USD 1.3 Million
Venezuelan Regiment (Contingent of 146 soldiers)	Repairing schools and prison; debris removal; 8 tons water ; 25.5 tons food; 2 tons medicines, 8 tons construction material.	…
UNICEF	Rehabilitation of schools; medical and psycho-social support in the form of a doctor and an psychosocial expert; 200 collapsible water containers; trauma kits; 5,000 health kits and 5000 doses of oral rehydration packets .	…
PAHO/WHO	Cash grant	USD 500,000.
PAHO/WHO &OXFAM	Technical assistance in water restoration, water management and quality.	…
IFRC	Distribution of food water purification tablets, hygiene kits and plastic sheeting; Water bladders and 10,000 jerry cans, 3,500 tarpaulins, 10,000 bags rice, 9,600 cans corned beef, 10,000 bags red beans	…
Telecommunication without Borders	Provided free international communication, including internet connection	…
UNDP	Emergency relief, including supplies and logistics	USD 100,000.
CIDA	Assessment and relief efforts, technical assistance in areas of water and airport, supplies and ground transportation and other associated costs.	CAN$550,000.
WRB Enterprises Inc	Appeal funds to CDERA	USD250,000
UNOCHA	Cash Grant	USD100,000

Table 5 Summary of Relief Assistance[15]

[15] Source: OECS estimates based on official information and consultation with Government officials

II. Assessment of the Damage

This chapter contains an assessment of the damage caused by Hurricane Ivan to the social sector (housing, education and health), infrastructure and telecommunications, and production sectors (agriculture,including fisheries; manufacturing; retail and wholesale trade; and tourism), and to the environment, including water and sanitation. The assessment was carried out on the basis of information available during the mission. Direct damages or effects were assessed, that is, damage to physical infrastructure and the country's capital reserves, and indirect damages or effects, such as lower production of goods and services and emergency outlays.

The costs of rebuilding damaged assets have also been calculated where relevant. If the aim were to return to the situation prior to the hurricane, the value would be the same as the direct cost according to this methodology. However, for the purpose of a reconstruction programme, the assessment should also take into account the value of improved replacement, including disaster prevention and mitigation criteria, such as better technology and quality and more resistant structures. Natural disasters provide a country with an opportunity to rebuild, taking into account the approaches to economic, social and environmental development, which could simultaneously reduce its vulnerability to natural disasters.

The OECS mission interviewed representatives of the government, the private sector, and international organizations, who frequently provided information and valuable suggestions for the preparation of this document.

The figures used in this chapter were calculated in local currency.

1. Social Sectors

1.1 Housing

Just under 28,000 houses or 89% of the country's housing stock of 31,122 houses have been damaged by Hurricane Ivan. Near 10,000 houses, or 30%, have been so badly damaged that they require complete replacement. Approximately 22,000 or 70% require repair. Table 6 presents an estimation of the proportion of houses requiring repair and reconstruction based on the population census data. The cost of damage to the housing sector has been estimated at $EC1,380 million dollars, as detailed in table 7. Of that, 36% represents costs of repair and 64% reconstruction costs.

Parish	Total Number of Households	Proportion requiring Repair		[c] Proportion requiring reconstruction	Proportion Suffering No damage	Total Number of Houses damaged
		Minor [a]	Major [b]			
St. George's	11367	15	70	15	0	11367
St. John's	2739	60	20	0	20	2191
St. Mark's	1210	55	15	0	30	847
St. Patrick	3210	50	20	0	30	2247
St. Andrew's	7140	35	50	10	5	6783
St. David's	3530	15	70	15	0	3530
Carriacou	1926	35	5	0	60	770
Totals	31,122					27,735

Table 6 Households affected by Hurricane Ivan by type of repair required by Parish[16]

[a] Minor damage includes windows , doors destroyed or damaged and damage to partial roof covering;
[b] Major damage includes roof structure destroyed or damaged;
[c] Requiring reconstruction due to significant damage to structural frame
Note those parishes where houses were not damaged

In a number of parishes, the entire housing stock of a particular village was destroyed. In the parish of St. David the village of Après Toute was moved from the hillside, with only a pile of wood and sheets of zinc as an indication of its previous location. In St Georges, Darbeau, Vendome and Grande Anse Valley had been swept away and in St. Andrew, Soubise which was by the sea, took the brunt of the winds and sea surges from the hurricane, leaving a small number of houses standing.

Although a vast number of houses were still without roof and in a state of collapse, many houses were being made livable through the efforts of a custom called "marooning"[17] which involves villagers coming together in groups to help each other construct a house without payment. The housing stock of Grenada was a fairly sturdy one, with at least 40% having been built before 1980. At least 48% of the houses were constructed of wood and concrete and 30% of wood alone. In regard to roofing, some 79% the houses had their roofs covered with galvanize or alu-zinc sheeting.

Hurricane force winds of 115 miles per hour tore off roofs belonging to persons in the low and high income houses without distinction. The Prime Minister's Official residence, personal house and the official house of the Governor General were extensively damaged, good illustrations of the more substantial houses being damaged along with houses put together by members of the squatter community. Although the

[16] Source: OECS estimates based on official sources and consultation with government officials

[17] Marooning comes from the notion of 'maroonage' found among Africans brought to the new world, who having escaped slavery, built independent societies. It is a custom rooted in the notions of independence and self-help.

Governor General's house was over 100 years old, making it a peculiar case. In the example, however, where houses were totally destroyed or severely damaged, in many instances they could be identified as having been constructed of light wood and precariously built. Poorly constructed housing, built without adherence to the building codes, or to land use guidelines, makes persons more vulnerable to hurricanes. Many housing settlements of this nature were built upon steep hillsides increasing their vulnerability to the wind force of hurricane Ivan.

	Thousands of EC Dollars
Total	**1,380,851,015.00**
Direct effects	**1,372,325,015.00**
i. Reparation of damaged houses	495,229,840.00
ii. Replace of lost houses	877,095,175.00
Imported component [a]	1,097,860,012.00
Indirect effects	
i. loss income from rent [b]	8,526,000.00

Table 7 Summary effects on the Housing sector[18]

a/ imported component calculated at 80% of direct effects
b/ based on the cost of an average two bedroom flat – rate EC$1,000.00 for a period one year.

The repairs and replacement to similar conditions have a value of EC$1,380 million as presented in table 7. Reconstruction with some required improvements to reduce vulnerability is a larger figure, and amounts to some EC$1,945 million dollars as can be seen in Table 8.

	Thousands of EC Dollars
Total	**1,945,827,517.00**
Direct effects	
i. Reparation of damaged houses	544,752,824.00
ii. Replace of lost houses	1,064,804,693.00
iii. Cost of furnishings	336,270,000.00
Imported component [a]	1,556,662,014.00

Table 8 Estimated Reconstruction costs[19]

a/imported component calculated at 80%

1. 2 Education

[18] Source: OECS estimates based on official sources and consultation with government officials

[19] Source: OECS estimate based on official sources and consultations with Government officials

Damage to the education sector was second only to the housing sector in its severity. The estimated cost to the sector is $EC196 million dollars, as detailed below. A more correct figure however, would be approximately $EC215 million[20]. This figure would accurately reflect the damage to the entire network of schools and skills training institutions in the country.

The destruction to the education sector is a particularly hard blow to the Grenadian society as much emphasis and hope had been placed on education in order to transform the economy and the society. Some, 30,481 students have been affected, in the aftermath of hurricane Ivan. The Government of Grenada's medium Term Economic Strategy paper 2000-2002, notes that the development of the human resources constitutes the single most important element of Grenada's national development. The most recent poverty Assessment Report for Grenada concluded that at the base of poverty reduction in Grenada must be a radical human resource strategy that embraces the entire nation and excites it to acquire knowledge and skills.

The government recently concluded a Strategic Plan for the Educational Enhancement and Development 2002-2010, SPEED, with significant support from the international donor community. The first three objectives of the plan: to provide universal access to education; to improve radically the quality of education; and provide learners with relevant knowledge attitudes and skills, is going to be seriously challenged by the effects of the disaster on the education sector.

Parish	Schools										
	Pre-primary			Primary			Secondary			Tertiary	
	No	Repair	Recon	No	Repair	Recon	No	Repair	Recon	No	Repair
St. George's	18	1,806,984	84,150	19	11568850	2772350	7	8429250	2662400	1	45,000,000
St. Andrew's				8	3415900	0					
Carriacou					24,000		2	10,000			
Totals	18	1,806,984.	84,150.	22 49	15,008,750.	2,772,350.	9	8,439,250	2,662,400	1	45,000,000

Table 9 Number Public Schools affected by Hurricane Ivan: Cost of repair and reconstruction by selected Parishes[21]

Table 9 above shows the details of the costs of repair and reconstruction to the public schools by selected parishes. The main tertiary level institution in the country the T.A. Marryshaw Community College has been severely damaged and requires repair costs of $EC4.5 million dollars. The main boys secondary school, Grenada Boys Secondary School, suffered damage to the tune of $EC 2.6 million dollars. Particularly hard hit

[20] This information was based on discussions with government officals and verified by the independent information collected..

[21] Source: OECS estimate based on official sources and consultations with Government officials

were other secondary and primary schools that suffered damage to their roofs and to their structures due to the high winds of the hurricane. Many of the schools can be found in the St. Georges parish but the network of primary and secondary schools spread throughout the length and breath of the country. Those located in St. David's and St. Andrew and St. John, also suffered loss of their roofs.

Parishes	Schools			
	Special Education		Day Care Centres	
	No	Repair	No	Repair
St. George's	2	222,750.00	14	314,306.00
Totals	2		14	314,306.00

Table 10 Number Public, Special Education Schools and Day Care Centres affected by Hurricane Ivan: Cost of repair and Reconstruction for the Parish of St. George's[22]

Table 10 above details the number of special education schools and day care centres in the parish of St. George's requiring repair as a result of hurricane Ivan. The loss of school facilities at the start of the school term for children with special needs could be a critical setback to their development.

The cost of damages to sporting facilities, which received a severe battering from Hurricane Ivan, amounted to over $EC 83 million dollars. Pavilions were broken, hard courts damaged and bleachers turned into rubble. Table 11 details the number of facilities and costs by parish. Of particular significance was the damage sustained by the premier sporting facility of the country the Grenada National Stadium, in St. George's, which accounted for the lion's share of the cost at $EC80 million.

Parishes	No.	Extent of Damage	Cost of damages
St. George's	4	Structural damage to roof, pavilion and perimeter fence and clearing of debris	1,165,000.00
St. David's	2	Structural damage and clearing of debris	350,000.00
St. Andrew's	2	Structural damage and clearing of debris	430,000.00
St. Marks's	1	Structural and Clearing	100,000.00
St. John's	1	Structural damage and clearing of debris	600,000.00
St. Patrick's	3	Structural damage and clearing of debris	410,000.00
Grenada National Stadium in St. Georges	1	Roof and supporting structure of all pavilions destroyed; private press boxes destroyed; Electronic score boards destroyed; Mondo Track damaged; Office Equipment destroyed	80,100,000.00
Totals	14		83,155,000.00

Table 11 Number of sporting facilities affected and cost of damage by Parish[23]

[22] Source: OECS estimates based on official sources and consultations with government officials
[23] Source: OECS estimates based on official sources and consultations with government officials

Damage to historical sites due to hurricane Ivan, in the town of St. George, the capital of Grenada, is of considerable concern. St. George's unique characteristic of fish scale roof, Georgian Architecture and system of fortifications has been a source of pride and a unique tourism attraction. The damage to the historic sites in the city has been estimated at approximately EC$8 million dollars. The details are presented in table 12. The sites include Government House – Governor General's Residence, the Roman Catholic Cathedral and Presbytery, the Presbyterian Kirk and a number of historic Forts, and the Tourist Shopping Centre on the Carenage. This cost does not include cost of materials and training which would be necessary to enable skilled workers to undertake the repair and refurbishment that is necessary.

Historic Sites	Cost
House of parliament	790,000
Supreme Court Registry	450,000
Roman Catholic Cathedral and Presbytery	1,500,000
Equity House/ Methodist manse	60,000
Fletcher's Residence	75,000
Leroy Robinson residence	575,000
Grenada Cooperative Bank Building	50,000
Grenada Building and loan Offices	50,000
Fort George	400,000
Forth Matthew	100,000
Fort Federick	50,000
Grenada National Museum	120,000
Grenada Public Library	60,000
Presbyterian kirk	1,6000,000
Knox House	40,000
Julien's Building	60,000
Huggins Buildings	
Hubbards main Office Building Young Street	50,000
Hubbards lumber Yard	150,000
La Chappelle	50,000
Technical and Allied Workers Union Bldg.	350,000
Government House – Governor General's Residence	1,850,000
Tourist Shopping on the Carenage	50,000
1810 Building and three other on Melville Street	125,000
Hassan Building Melville Street	35,000
Total	**7,940,000.00**

Table12 Historical Sites damaged by hurricane Ivan in the town of St. George's and the cost of repair[24]

[24] Source: OECS estimates based on official sources and consultations with government officials

Parish	Name of facility	Nature of damage	Cost of damages
St. George's	River Road multi-purpose centre (pre school and library)	Roof blown off, flooding and structural damage	50,000.00
	Brizan Multi-purpose Centre	Partial roof damage , windows and flooding	40,000
	Mt. Moritz multi-purpose centre	Roof blown off	40,000
	Happy Hill Community Centre	Roof blown off	10,000
	Vendome Multi purpose centre	Roof blown off	40,000
	Mt. Gabon/Mt. Toute Community Centre	Roof blown off, windows lost	30,000
	Calliste Community Centre	Roof blown off	20000
	Waburn Community Centre	Roof blown off windows and doors lost	25,000
	St. Paul's Multi purpose centre	Roof , windows, doors	70,000
	Belmont Community Centre	Roof blown off, windows and structural damage	40,000
St. David's	Bellevue Community Centre	Roof blown off, windows and toilet facilities destroyed	40,000
	Wisden Forest Comm. Centre	Roof damage, structural damage	35,000
	Corinth Comm. Centre	Roof blown off	20000
	Westerhall Comm. Centre	Roof blown off	20000
	Berrotte Comm. Centre	Roof blown off	15,000
	Beaton Comm. Centre	Partial roof destroyed	7,000
	Belle isle Cmm. Centre	Roof blown off	10,000
	Après Toute Comm. Centre	Total destruction	30,000
Totals	18 community centers		542,000

Table 13 Number of Community Centres affected and cost of damage by Parish[25]

Community centres play a central role in the community. Many serve as community libraries, day care centres during the day, adult skills training centres and adult literacy centres in the evening and as a location for community meetings. The loss of these centres may negatively impact the strength of social capital in Grenada and reduce the support services which the government and civil society, can make available to members of the various communities. Because Grenada does not have local government institutions, the community centres can perform a vital link in the people's participation in the governance process. Sturdy community centres may be able to replace schools as a shelter in the event of a natural hazard, thus reducing the wear and tear of the school buildings in the event of a natural disaster.

[25] Source: OECS estimates based on official sources and consultations with government officials

	Thousands of EC Dollars
Total	**195,820,884.00**
Direct Effects	194,560,884.00
i. Reparation of Schools (without improvement)	99,773,884.00
ii. Replacement of school materials and furnishings	3,150,000.00
iii. Damage to libraries, national archives and historic sites	7,940,000.00
iv.Damage to Community Centres	542,000.00
v. Damages to sport facilities	83155000.00
Indirect effects	
i. Damages from use as shelters	1,260,000.00

Table 14 Summary of Effects on the Education System[26]

Table 14 presents the direct and indirect costs of damage to the education sector which stands at $EC 195 million dollars. Reconstruction and reinforcement of existing structures in order to reduce vulnerability will increase the cost of repair and reconstruction to some $EC215 million, as presented in table 15.

	Thousands of EC Dollars
Total	**215,402,972.00**
Direct effects	214,016,972.00
i. Reparation of damaged schools	109,751,272.00
ii. Replacement of lost schools	3,465,000.00
iiiRepair to libraries , national archives and historic sites	8,734,000.00
iii. Repair of Damage Communities centres	596,200.00
iv. Repair to sport facilities	91,470,500.00
Indirect effects	1,386,000.00
Imported component [a]	171,213,577.00

Table 15 Estimated Reconstruction Costs for the Education Sector[27]

a/ imported component calculated at 80%

1.3 Health

The damage to the major public hospitals, health centers and other health care institutions has been estimated at $EC 11 million dollars following the aftermath of hurricane Ivan. The damage to various aspects of the Government's health system, will

[26] Source: OECS on the basis of official information and consultations with Government officials
[27] Source: OECS estimate based on official sources and consultations with Government officials

cause hardship to the users of the system and to the care givers seeking to provide the services to which the public is accustomed, while maintaining optimum quality.

The medical laboratory at the two hundred bed St. George's General hospital suffered the worst damage within the hospital compound; the laboratory lost approximately 40 % of its roof, 25 % windows, and all reagents. Due to the continued power outage at the laboratory following the hurricane, estimating the extent of damage caused by the disaster, was not feasible, though it was expected to be extensive. The physical structure of the laboratory was already dilapidated prior to the catastrophic event, and was due to be incorporated in the second phase of the General hospital renovation project. Hurricane Ivan has exacerbated already deteriorating circumstances and accelerated the urgent need to construct a new medical laboratory. The roofs of several ancillary buildings within the General hospital's complex have also been destroyed. The ophthalmic ward suffered extensive damage. Total damage to the general hospital is estimated to be $EC 4.5 million dollars. Table 16 presents the cost of damage by health institutions.

Institutions	Cost EC $
Carlton Drug Rehabilitation Centre	2,625,000.00
Central Medical stores	1,750,000.00
Community health Centres	590,500.00
Princess Alice Hospital	3, 550,000.00
Princess Royal hospital (Carricaou)	60,000.00
Richmond home for the elderly and indigent	525,000.00
St. Georges General Hospital	4,500,000.00
School of nursing	70,000.00
Vector Control building	109,000.00
Project Office building for General hospital	75,000.00
Pharmaceuticals in Health Centres	70,000.00
Total	**10,599,500.00**

Table 16 Summary of damage to Public Health Institutions[28]

The 30 bed Princess Alice hospital in St. Andrew suffered major damage and is mostly dysfunctional. It lost 90 % of its roof, and most of its equipment, furniture, and supplies were looted. Within this complex, the roofs of the nurse's hostel and a doctor's quarters were completely lost, while the other doctor's residence was destroyed. The cost of damage to the complex is estimated at $ 3.5 million. The remaining two hospitals in Grenada, the psychiatric and Princess Royal, were spared. Carriacou's 35 bed hospital,

[28] Source: OECS estimated based on official sources and consultations with Government officials.

Princess Royal, sustained roof damage, and its cistern water supply was contaminated, at total replacement cost of $ 60,000.

The complete galvanize sheeting, and 30 % of the ceiling of Central Medical Stores (CMS) was destroyed, at a cost estimated at $ EC1.7 million dollars. The pharmaceuticals section of CMS was unscathed, but 30,000 examination gloves, 65,000 needles, and related medical supplies valued at approximately $EC 60,000 had deteriorated. Fortunately, prior to the hurricane, refrigerated items were relocated to another safe building. CMS lacks electrical power to store vital pharmaceuticals, such as vaccines and insulin. Pharmaceuticals valued at $ 70,0000 in the health centres were reported destroyed.

The roof of the Richmond home for the elderly, which cares for 110 aged and underprivileged citizens, was completely destroyed and the Carlton Drug Rehabilitation Centre suffered a similar fate resulting in an estimated cost of $ 2.6 million

The damage to the community health institutions is of concern to the health sector as primary health care is a critical component of the health service. Of the country's total listing of thirty six health facilities, eight or 22 %, completely lost their roofs, and are dysfunctional. There was varying damage to the remaining peripheral clinics, ranging from partially destroyed roofs, broken doors and windows, and disrupted electricity lines.

The following buildings sustained heavy damage, mainly from damaged roofs : school of nursing , books and equipment; Vector control building , equipment and vaccines; and the project office building for the reconstruction of the general hospital

The ministry also incurred a variety of indirect cost consequent to the hurricane. In seeking to maintain optimal health service operations, care givers worked round the clock and ambulances and health vehicles were commandeered into rescue and relief efforts. An aggregate of the direct and indirect costs to the Ministry of Health was estimated at $EC 10.7million dollars as presented in table 17.

	Thousands EC Dollars
Total	**10,782,150.00**
Total Direct	**10,599,500.00**
i. Damages to Hospitals	8,110,000.00
ii. Damage to Community Health Centres	590,500.00
iii. Health Care Institutions	1,899,000.00
Indirect Cost	
i. Increased cost of Communications	60,000.00
ii. Increased work hours of health care professionals	68,400.00
iii. Increased use of health vehicles in rescue and relief efforts	54,250.00
Total indirect cost	**182,650.00**
Imported component	**8,479,600.00**

Table 17 Summary Effects on Health Sector[29]

[29] Source OECS Estimates based on official sources and consultations with Government officials.

In order to maintain the health status of the Grenadian population, the Government will find it necessary to reconstruct the damaged health institutions. Table 18, depicts the reconstruction costs for the various health institutions, which amounts to $EC11.6 million dollars, representing an increase for mitigation and reduced vulnerability.

Thousands of EC Dollars	
Total	11,658,900
Total Direct cost	11,658,900.00
Reparation of damaged hospitals	8,921,000.00
Reparation of damaged community Health centres	649,000.00
Repair to Health care institutions	2,088900.00
Imported component	9,327,120.00

Table 18 Estimated Reconstructed costs for the Health Sector[30]

2. Productive Sectors

2.1 Agriculture, Livestock and Fisheries Sector

2.1.1 Overview

The agriculture sector in Grenada is critical in maintaining an environment of social and economic stability. The sector plays a vital multi-functional role in generating foreign exchange, providing employment and contributing to food security.

Since 1997, the performance of the sector can be described as mixed. With a negative growth of 0.89 percent in 1997 followed by a negative 1.20 percent in 1998, the sector grew by 10.02 percent in 1999. The ensuing two years 2000 and 2001 registered negative growth of 2.15 and 2.85 percent respectively. In 2002, the sector again registered positive growth of 19.0 percent. These changes in the growth of the sector are closely related to the output of the principal crops cocoa, nutmeg and banana. This is exemplified in the 2.4 percent negative decline in 2003, which was attributed to a 7.9 percent fall in output in the main crops cocoa, nutmeg and banana. The production of nutmeg declined by 20.8 percent to 5.4m pounds. A 12 percent decline in mace output naturally accompanied the fall in nutmeg production. Cocoa continued its downward trend in 2003 to register a 29.4 percent fall in output. Banana output declined by 21.7 percent as very little is now produced for the export market.

[30] Source OECS Estimates based on official sources and consultations with Government officials

Prior to the disaster growth in the sector was projected to register positive growth in, at least the medium run, In 2004, the sector was expected to expand by 4% , by 12% in 2005 mainly due to the production cycle of traditional crops (and in particular of nutmeg) and stabilize around 4% for 2006 and 2007. . Livestock and forestry has been fairly steady since 1997, registering only positive growth. Fish output has been steadily increasing since 2000. The sector grew by 13.1 percent in 2003. The sector provides direct employment for 2200 fishermen and many more along the commodity chain as the product moves to the consumer. A wide range of non traditionals are grown in Grenada. These range from roots and tubers, vegetables, brassicas, and cucurbits among others. The non traditionals play a significant role in ensuring food security.

2.1.2 Description, analysis and estimation of the damage

The impact of hurricane Ivan was widespread throughout the island inflicting severe damage to the agriculture sector. The damage was most intense in the parish of St. Andrew accounting for 60 percent of total damage, followed by St. David with 20 percent, St. Johns 10 percent, St. Georges 5 percent with St. Mark, and St. Patrick sharing the remaining 5 percent. As a result of the high velocity winds experienced with hurricane Ivan, extensive losses were recorded in the crop sub sector, livestock, fisheries and in the seventy two (72) water catchments.

Table 19 provides a summary of the direct, indirect, and total damage to crops, livestock, fisheries, propagation units and nurseries, irrigation and drainage, and farm roads by parish. The total direct and indirect damages were estimated at 55 and 46 million EC$ respectively.

Crops

The principal export crop nutmeg, which was concentrated in the north eastern parishes of St. Patrick and St Andrew, was severely damaged as well as other crops ready for harvesting at the time of the disaster. The nature of the damage ranged from toppling to uprooting, snapping, defoliation and scorching.

The effects on the nutmeg sub-sector, which employs approximately 30,720 persons either directly or indirectly will deny the dependents of their livelihoods and may draw some closer or beyond the indigence curve. This situation will worsen unless steps are taken in the short run to replant and rehabilitate the production base which has declined by approximately 10 percent of the pre-disaster level. The new plantings must be encouraged in solid stands as this will allow for optimal use of the cultivable resource and the opportunity for diversifying the sector.

Direct damage	Crops	Livestock	Fisheries	Propagation units and private nurseries	Irrigation and drainage	Farm roads	Total
St. John	1,304,493	359,832	545,000	2,030,000.00	17,242	3,062,480	7,319,047
St. George	1,455,336	1,863,137	1,535,000	727,115.00	25,763	3,758,540	9,364,891
St. David	2,320,840	1,335,064	137,000	858,530.00	71,563	4,680,790,	9,403,787
St. Patrick	1,505,934	995,218	280,000	70,000.00	142,938	2,259,130	5,253,220
St. Mark	895,073	118,067	191,000	10,000.00	14,313	2,099,400	3,327,853
St. Andrew	5,044,351	1,949,862	468,000	2,262,760	114,500	10,170,460	20,009,933
Carriacou and Petite Martinique			20,000				20,000
Total	12,526,027	6,621,180	3,176,000	59,958,405	386,319	26,030,800	54,698,731
Indirect damage							
St. John	4,372,267	430,680	738,000	203,000	3485	306,248	6,053,680
St. George	1,806,600	1,695,720	645,000	72,712	5153	375,584	4,600,769
St. David	4,842,740	2,329,216	120,000	85,853	14,313	468,079	7,860,201
St. Patrick	3,708,334	565,770	248,000	7,000	28,588	225,913	4,783,605
St. Mark	2,694,494	114,142	247,500	1,000	2,863	209,940	3,269,939
St. Andrew	15,048,011	2,343,683	378,000	226,276	22,900	1,017,046	19,035,916
Carriacou and Petite Martinique			180,000				180,000
Total	32,472,446	7,479,211	2,556,500	595,841	77,302	2,602,810	45,784,100
Total damage							
St. John	5,676,760	790,512	1,283,000	2,233,000	20,727	3,368,728	13,372,727
St. George	3,261,936	3,558,857	2,180,000	799,827	30,916	4,134,124	13,965,660
St. David	7,163,580	3,664,280	257,000	944,383	85,876	5,148,869	17,263,988
St. Patrick	5,214,268	1,560,988	528,000	77,000	171,526	2,485,043	10,036,825
St. Mark	3,589,567	232,209	438,500	11,000	17,176	2,309,340	6,597,792
St. Andrew	20,092,362	4,293,545	846,000		137,400	11,187,506	
Carriacou and Petite Martinique	0	0	200,000	0	0	0	200,000
Total	44,998,473	14,100,391	5,732,500	6,554,246	463,621	28,633,610	100,482,841

Table 19 Summary of Direct and Indirect Damage by Parish in Eastern Caribbean Dollars

Other negative implications of the disaster include a reduction in nutmeg production over the next five years and a concomitant reduction in foreign exchange earnings, which will decrease to about 8 percent once current stocks are exhausted.

Plant and building infrastructure also suffered from the onslaught of Ivan. Eleven on the nineteen stations sustained considerable damage at an estimated cost of EC $5.7 million.

The distillation plant at Marli suffered significant damages and will require approximately EC$150,000 to secure and repair the factory shell and another EC$500,000 to return the plant to a desired level of operation. The reconditioning plant also suffered damages that will require repairs costing EC$100,000. The organic plant, because of the extensive damages will have to be replaced. The replacement cost is estimated to be EC$750,000.

Cocoa, another major contributor to the economy is grown on approximately 8000 acres of land. The sub-sector employs approximately 7,500 active farmers spread throughout the parishes. According to information sourced from the Grenada Cocoa Association, production in 2004 prior to the hurricane reached 1,800,000 lbs valued at EC$5,580, 000.
The extensive cocoa building infrastructure used for buying, propagation and servicing the industry suffered substantial damage. The estimated value of the damage, which includes the private operators, such as Belmont, which is also a tourist attraction is approximately EC$1.8 million. The effect on employment is expected to be drastic on all dependents of the industry along the commodity chain.

The banana industry, which has some level of importance both for local consumption and export was demolished. The 350 acres grown throughout the parishes suffered 100 percent damage. The total estimated damage to the industry is estimated to be EC$1,440,134.

The minor fruits which include sapodilla, papaya, passion fruit, golden apple and others were demolished. They were either uprooted, toppled or scorched beyond regeneration. The damage to minor fruits is estimated at EC$2,792,000.

Citrus also suffered similar type damage to the other tree crops. Of the 120 acres planted island-wide, 18.50 acres were destroyed. The estimate of direct and indirect cost for citrus is EC$2,610,623.

The 114.5 acres of vegetables being cultivated at the time of the hurricane was completely wiped out. Tomatoes, cucurbits, brassicas, okra, sweet pepper, pigeon pigeons and corn were among the range of vegetables lost. The irrigation systems used in vegetable production was also badly damaged. The total estimated cost of the loss in vegetables is EC$2,792,000

The category roots and tubers which comprise sweet potato, yams, dasheen and tannia also suffered damages. Of the 282 acres planted before the disaster, 66.47 acres was damaged. The estimated cost of the damages to roots and tubers is EC$837,125.

The 41 propagation stations in the country have been severely damaged. These stations including the central propagation station and private stations have been severely destroyed and are non functional. The estimated cost of the damage to all these stations is EC$6,554,246

Forestry

Ninety one percent of the forest lands and watershed now lay bare and stripped of the vegetation, which once supported an ecosystem where much fauna and flora benefited directly or indirectly. The 72 watersheds on the island have been devastated. A major concern remains over the level of water which the aquifers can now support and for how long. Urgent action needs to be taken in the very short run to ensure regeneration and growth of vegetation in the forest and watershed areas. This may mean introducing some fast growing species while the indigenous plants slowly emerge.

Livestock

The livestock sub-sector suffered damages to housing infrastructure of poultry and small ruminants and loss of stock of same. Losses linked to secondary effects resulting from stress and trauma were also recorded in livestock. The damage was most severe in poultry, pigs and sheep and goats.

Fisheries

The fisheries sub-sector suffered major damage to its fleet boat and equipment. The 2,200 fishermen in the sub-sector suffered loss to engines, hulls, gear, safety equipment, communicating facilities, seines and housing facilities. The damage to the fisheries sector is estimated to be EC$5,732,500.

Farm roads

150 miles of farm roads was damaged during hurricane Ivan. The damage resulted from blockage of trees, clogged drains and culverts, destruction of the road base and surface. The estimated value of reconstruction is EC$28,633,610

2.2 Tourism

2.2.1 General Overview

Tourism is jointly with agriculture the major economic sector of Grenada. The sector has been an important contributor to the diversification of the economy which has taken place in recent years. It has also a significant source of foreign exchange and labor employment. Finally as pointed out in WTO (2002) the development of tourism has "helped cushion the effects of the decline in its exports, particularly bananas and cocoa.

Within CARICOM Grenada's market share has increased over time and currently represents 5% of the total. Contrarily within the OECS, Grenada's share has exhibited a declining trend (19% and 12% of the total in 1990 and 2003).

During the 1990's decade and until 2003, the year prior to the disaster, Grenadian tourism developed significantly. The contribution of tourism to the economy grew from 5.8% in 1990 to 9% in 2000 and has remained roughly at that level. The contribution of tourism

to the overall economy is even greater when measured through the tourism satellite acounts (28% in 2003). In the same vein, the number of visitor arrivals increased from 265,167 in 1990 to 316,158 in 2000. The evolution of arrivals from 2001 to 2003 reflects the September 11th effects and the consequent recovery of the tourism sector.

In terms of its components cruiseship arrivals, which represented 63% of the total on average between 1990 and 2004, has expanded at an uneven pace. However, stayover arrivals saw a steady increase in its numbers from 76,447 to 133,724 for the same period. This translated in an increase in the contribution of stayovers visitors to the total (29% and 45% in 1990 and 2003). The rise in stayovers responded in part to the expansion of the country's hotel capacity and the upgrading of its tourist facilities during the 1990's decade. The number of rooms in tourist accommodation establishments rose from 1,115 in 1990 to 1,758 in 2003 (See table 20 below).

Revenues have risen as well. Available data for the hotel sector representing half of the saleable room stock shows that profit margins more than doubled between 1991 and 2003.

The growing number of stayover arrivals and the positive response of the Hotel Sector to satisfy the increasing demand has also had significant effects in the economy. Stay over arrivals account for 88% of total visitor expenditure (cruiseship and yacht tourist expenditure represent 8% and 3% of total expenditure respectively). In addition the sub Hotel Sector represents an important source of domestic employment (8% of the total if only direct employment is taken into account) and of domestic demand as most of its services are sourced from local products and sources.

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total visitors	300,602	317,315	369,346	386,013	368,417	391,680	378,952	316,528	277,
	31	34	29	28	30	30	33	41	
ay-over visitors	93,919	108,957	108,007	108,231	110,748	115,794	125,289	128,864	123,
nited States	30,364	30,476	30,033	30,380	29,320	29,381	34,694	32,543	32,
anada	4,214	4,987	3,920	5,748	4,977	5,290	6,136	4,829	5,
urope	…	…	…	…	…	…	…	43,862	40,
nited Kingdom	11,217	17,740	18,480	16,780	21,350	23,311	26,234	32,236	28,
ermany	…	…	…	…	…	…	…	4,586	3,
aribbean	13,692	14,729	14,615	14,357	16,407	18,636	22,204	24,112	27,
ther Countries	34,432	41,025	40,959	40,966	38,694	…	36,021	23,518	17,
xcursionists	6,622	7,880	11,450	10,800	11,057	10,011	8,202	7,359	6,
ruiseship	200,061	200,478	249,889	266,982	246,612	265,875	245,461	180,305	147,
otal visitor expenditure (EC$ m)	130	158	156	160	399	415	458	481	
tay over visitors	120	148	143	147	379	394	438	466	
ruise ship passengers	10	10	12	13	20	21	20	14	
umber of cruiseship calls	382	420	448	392	323	328	369	360	
umber of yacht calls	4,267	5,413	5,314	5,355	5,292	4,583	5,354	5,361	5,
otal number of tourist accomodations	70	73	78	78	80	87	86	94	
otels	28	27	27	27	27	28	27	30	
ppartments cottages and villages	19	21	26	26	29	30	34	34	
uest Houses	23	25	25	25	24	29	25	30	
otal number of hotel rooms by tourist accomodation	1,428	1,428	1,652	1,669	1,775	1,802	1,800	1,822	1,
otels	1,027	1,012	1,064	1,066	1,136	1,146	1,200	1,197	1,
ppartments cottages and villages	236	245	371	384	418	404	389	393	
uest Houses	165	171	217	219	221	252	211	232	
otal number of beds by tourist accomodations	2,710	2,718	2,936	2,964	318	2,995	3,274	3,091	3,
otels	1,975	1,960	1,961	1,964	2,047	1,925	2,240	1,998	2,
ppartments cottages and villages	474	490	636	659	720	669	709	722	
uest Houses	261	268	339	341	351	401	325	371	
mployment									
umber of employees in touridm establishments	1,528	1,528	1,768	1,786	1,899	1,928	1,926	1,950	1,
age bill as percentage of total revenue	…	…	…	…	…	…	31	30	
verage occupancy rate	67.3	70.1	67.2	61.1	62.1	62.3	64.8	71.0	
ed night									
oom night									
ravel and tourism account (Satellite accounts)									
apital investment in tourism as % of total	…	…	…	…	…	…	21	21	
ourism exports as % of the total	…	…	…	…	…	…	30.2	29.36	3

Source: ECLAC, on the basis of official information and the Tourism Board of Grenada
a/ Preliminary figures.

able 20 Tourism Statistics

In 2004, the tourism sector noted a clear recovery from the effects of September 11th. As captured by national accounts the tourism industry (constituting namely the category of Hotels and Restaurants) was expected to grow by 8%. Stay over arrivals and cruiseship passengers grew by 11% and 79% in July 2004 in relation to the previous year.

On an annual basis tourist arrivals were projected to increase to 370 972 by 2004 and to 478 000 in 2006. Tourist expenditures had grown by 28% in the first semester of the year (45 and 58 million in January and July 2004 respectively) and were expected to increase by 8% for the whole year. At the broader level, if direct and indirect employment creation and the sectorial linkages between the tourism industry and the rest of the economy are considered, the travel and tourism industry was projected to account for 26% of total employment, 21% of total investment and 29% of total exports (See table above).

Hurricane Ivan severely affected the performance of the tourism industry. The sector suffered both direct and indirect damages. The former refer to damages suffered by productive assets, equipment, inventory and soft furnishings at the time of the disaster.

Indirect damages refer to damages that are a result of the interruption to the flows of goods and services and income. It is defined as the sum of income foregone and increases in costs and expenditures. More to the point indirect effects are a combination of supply side and demand side effects.

In the case of the Hotel subsector the former refers mainly to the contraction in the supply of tourist services by the host country due to the closure of hotels, the loss in room capacity, extra-costs incurred for the payment of utilities (water, electricity), making the hotel functional (i.e., the picking up of debris), security costs incurred due to the initial effects of the natural disaster on crime, and refunds for bookings that were made (whether for hotel services, tourism packages or Marina services prior to the disaster). The analogue of the loss in room capacity in the case of the yachting sector is the closure of Marinas and Harbours, and the loss in the number of slips in Marinas or the reduction of the number of stored yachts for repairs.

The main factor accounting for the demand side of the story is the change in the number of visitor arrivals due to the ocurrence of the event.

Due to the importance of the tourism sector described above, the negative effects of the Hurricane on the sector are bound to be felt through out the economy in terms of: (i) loss of aggregate income and employment; (ii) its lower contribution and negative effect to the overall rate of growth of the economy, (iii) increase in imports due to the need to purchase intermediate goods and raw materials for repairs, (iv) increase in insurance flows, and (v) lower contribution to government revenue. These aggregate effects are termed secondary effects.

2.2.2 The Tourist Accommodation Subsector

a) Direct damages

By far the majority of the tourist accommodations have sustained siginificant direct damages. The damage is geographically concentrated in Grenada, and more specifically, in the capital St. Georges. Insignificant or no damage at all was registered in Carriacou and Petite Martinique. Within St. Georges, the damage is concentrated in the area of Grand Anse (The Hotel Belt). Damages were also reported in he area of Carenage which is located near the center of St. George. At the more detailed level direct damages have been reported in:

- Roofs and ceilings.

Damages to roofs and ceiling include the removal of roofs and the pealing of the aluminium steel sheeting that covers the roofs and also protects the furniture and equipment in the room from weather conditions

- Electrical wiring and installations.

The damage to roofs has had an immediate implication for the functioning of the wiring of the infrastrture affected. The wiring has been damaged in all of these cases. As a result the electrical power has been shut down and tourist accommodations have been forced to rely on generators to provide minimum electrical power.

This has important implications for the computations of indirect cost as it forces the management to rely on an existing or newly bought electrical generator, purchase additional fuel, and in some cases reduce the number of hours during which electricity is available in order to recoup part of the additional costs incurred as a result of the damage of the Hurricane.

- Room appliances and accommodation equipment .

The damage and loss of part or whole roofs left the room equipment (air conditioning, televisions, lamps) and furniture vulnerable to the weather pattern of the hurricane. Besides equipment and furniture pertruding from the wall, some equipment (fans and air conditioning) that was in rooms located near the sea were tarnished with salt particles causing rusting. In some cases the equipment was damaged by missile parts (including aluminia pile and wood) that were flown in by the high speed of the wind. As rain was not a accompanying feature of Hurricane Ivan most of the rooms and equipment damaged did not register damages related exclusively to rain fall.

In some more dramatic cases small cottages, apartments and small restaurants that were located in separate locations from the main tourist accommodation were literally wiped out.

As a result the damages have severely limited the supply capacity of tourist accommodations. A sample of the extent of the damage is provided in table 33 below. The table lists a sample of tourist accommodations, their geographical location, room capacity of the accommodation and the number of rooms that were reported damaged. The sample of hotels accounts for more than 60% of total saleable room capacity in Grenada. The information here presented was obtained through field work of the mission with direct interviews of owners or managers and is meant to provide an overall representative of an overall view of the damage to hotel capacity.