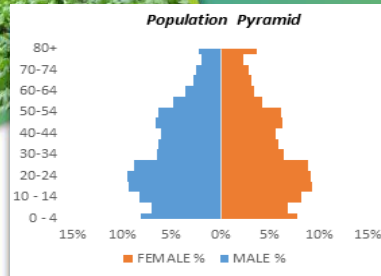




GRENADA



COMPENDIUM ON ENVIRONMENTAL STATISTICS 2020



Central Statistical Office
Ministry of Finance, Planning,
Economic Development and Physical
Development

Melville Street – St. George's
Grenada



MAP OF GRENADA



PREPARED BY

ENVIRONMENTAL STATISTICAL UNIT

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FOREWORD

The Central Statistical Office (CSO), Ministry of Finance, Planning, Economic Development and Physical Development of Grenada is pleased to publish its second compendium of Environmental Statistics. As a small island developing state, the environment is extremely important to us and our livelihood and as a matter of fact a great percentage of our population can attribute the state of the environment as a contributing factor to the generation of a daily wage or a monthly salary.

The publication of this data is also in keeping with the mandate for collection, analysis, interpretation and dissemination of timely accurate statistics to all stakeholders. The compilation of environmental statistics is supported by both the Caribbean Community (CARICOM) Secretariat and the United Nations Statistics Division (UNSD) whose mandate is to strengthen and build capacity in the generation of social, economic, gender and environmental statistics and indicators at the regional and global levels respectively. This publication also falls in line with the monitoring of the United Nations Sustainable Development Goals indicators, where more than half are environmentally-related. It our hope and goal that in future; with the consistent collection of environmental statistics; to compile Gross Domestic Product (GDP) by use of the System of Environmental-Economic Accounting (SEEA) method which takes into consideration the impact economic activity has on our environment. It is felt that we need to be able to assess tradeoffs when we exploit our ecosystem and environmental assets for economic gain (or losses in some instances).

The Office acknowledges the efforts of all area experts and stakeholders with whom we consulted, to gather a better understanding of our statistical information. And would like to single out the efforts of the teams from CARICOM and UNSD. The CSO recognizes the efforts of Mr. Junior Alexis and Ms. Tamika George in the collection, compilation and publication of the statistics on the environment.

Special Dedication to Ms. Nikoyan Philbert

Halim Brizan (Mr.)
Director of Statistics
Central Statistical Office

Introduction

Statistics of the Natural Environment refer to the environmental media of air, water and land as well as the biota (flora and fauna), according to Concepts and Methods of Environment Statistics: A Technical Report by the United Nations in 1991. This type of statistics is relatively new, however, the demand for this data is ever increasing as countries now realize that the well-being of its population depends on better management of its environmental resources. There is a growing list of environmental concerns on which decisions must be taken such as climate change, biodiversity and natural resource management according to the Framework for the Development of Environment Statistics (FDES).

The objective of environment statistics is to provide information about the environment, its most important changes over time and across locations, and the main factors that influence them. Ultimately, environment statistics aim at providing high quality statistical information to improve knowledge of the environment, to support evidence-based policy and decision making, and to provide information for the general public, as well as for specific user groups. This objective was established in the Framework for the Development of Environment Statistics (FDES) in 2013 by the United Nations Statistics Division.

Environment statistics serve a variety of users, including but not restricted to:

- Policy and decision makers at all levels;
- The general public, including media and civil society;
- Analysts, researchers and academia; and
- Regional and International agencies.

Environment statistics synthesize data originating from a wide range of source types. This means that the data used for the production of environment statistics are not only compiled by many different collection techniques but also by many different institutions. Source types include:

- I. Statistical surveys (e.g., censuses or sample surveys of population, housing, agriculture, enterprises, households, employment, and different aspects of environment management);
- II. Administrative records of government and non-government agencies in charge of natural resources as well as other ministries and authorities;
- III. Remote sensing (e.g., satellite imaging of land use, water bodies or forest cover);
- IV. Monitoring systems (e.g., field-monitoring stations for water quality, air pollution or Climate);
- V. Scientific research;
- VI. Special projects undertaken to fulfil domestic or international demand.

Table of Contents

Map of Grenada.....	i
Foreword.....	iii
Introduction.....	iv
List of Table.....	v
List of Chart.....	vi
List of Figures.....	vii
List of Maps.....	viii
Definitions and Explanatory Notes.....	85
Acknowledgement	89
References	90
Chapter 1: POPULATION	1
Chapter 2: TOURISM	4
Chapter 3: ENVIRONMENTAL HEALTH	11
Chapter 4: WEATHER, NATURAL and ENVIRONMNETAL DISASTERS	25
Chapter 5: ENERGY AND TRANSPORT	34
Chapter 6: AGRICULTURE.....	40
Chapter 7: COASTAL AND MARINE RESOURCES	52
Chapter 8: BIODIVERSITY	62
Chapter 9: WATER AND SOLID WASTE	64
Chapter 10: FORESTRY AND LAND USE	68

List of Tables

Chapter1: POPULATION

Table 1.1: Population figures from 1871 - 2011	1
Table 1.2: Population and percentage Population by Parish	2
Table 1.3: Population by five - year Age Group and Sex, 2011 and 2001.....	3

Chapter 2: TOURISM

Table 2.1: Tourist, Cruise ship arrivals and Tourist Night.....	4
Table 2.2: Tourist Arrivals from Country of Origin, 2007 - 2018.....	9
Table 2.3: Visitor Expenditure from 2006 - 2018.....	10

CHAPTER 3: ENVIRONMENTAL HEALTH

Table 3.1: Number of Reported Cases and Incidence of Environmentally Related Diseases.	11
Table 3.2: Household by Type of Dwelling and Toilet Facilities, 2011	13
Table 3.3: Number of Health Personnel and Population, 2006 - 2010.....	15
Table 3.4: Number of Health Personnel and Population, 2011 - 2014	18
Table 3.5: Number of Health Personnel and Population 2015 - 2018	21
Table 3.6: Distribution of Households by Safe Water Supply, 2011 Census	24

CHAPTER 4: WEATHER, NATURAL and ENVIRONMENTAL DISASTERS

Table 4.1: Historical Weather and Climate-related events in Grenada.....	26
Table 4.2: Monthly Rainfall in millimeters, 2009 - 2018	27
Table 4.3: Total Rain Days, 2006 - 2018	28
Table 4.4: Average Monthly Temperatures, 2009 - 2018	29
Table 4.5: Monthly Maximum/Minimum/Average Temperatures, 2009 - 2012	30
Table 4.6: : Monthly Maximum/Minimum/Average Temperatures, 2013 - 2015.....	31
Table 4.7: : Monthly Maximum/Minimum/Average Temperatures, 2016 - 2018.....	32
Table 4.8: Average Annual Humidity, 2006 - 2018.....	33

CHAPTER 5: ENERGY AND TRANSPORT

Table 5.1: Production and Consumption of Electricity, 2006 – 2017.....	34
Table 5.2: Average Petroleum Products Retail Prices (EC\$/IG), 2015 - 2019.....	35
Table 5.3: Registration of New and Used Vehicles by Category, 2006 - 2017	36
Table 5.4: Passenger Traffic, 2007 - 2018.....	37
Table 5.5: Number of Aircraft Landings, 2005 - 2017	39

CHAPTER 6: AGRICULTURE

Table 6.1: Importation of Insecticides, 2007-2018.....	42
Table 6.2: Importation of Pesticides, 2007-2018.....	43
Table 6.3: The Use of Fertilizers and Agro-Chemicals by Parish, 2012.....	44
Table 6.4: Type of Chemicals by Parish, 2012.....	45
Table 6.5: Number and Area of Farms Growing Permanent Crops in Pure Stand	46
Table 6.6: Farms Reporting Livestock by Type and Quantity	47
Table 6.7: Number and Area of Farms Growing Permanent Crops in Pure Stand.....	49
Table 6.8: Farms Reporting Livestock by Type and Quantity.....	50

CHAPTER 7: COASTAL AND MARINE RESOURCES

Table 7.1: Representation of Marine Protected Environments in Protected Area based on data in 2009...	52
Table 7. 2: The Value Amount (\$EC) of Fish Landed, 2006 – 2018	54
Table 7. 3: Quantity of Fish Landed, 2006 - 2018	55
Table 7.4: Pelagic Species of Fish Landed in Metric Tonnes, 2006 - 2014	56
Table 7.5: Fish Landed in Metric Tonnes, 2006-2014	57
Table 7.6: Fish Landed in Metric Tonnes, 2006 – 2014	58
Table 7.7: Fish Landed in Metric Tonnes, 2006 - 2014	59
Table 7.8: Persons living on the Coast; 2001 and 2011.....	60
Table 7.9: Number of Fisher Folk by Parish in 2012	60

CHAPTER 8: BIODIVERSITY

Table 8.1: Showing Information on Carbon in Protected Areas, 2012	62
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CHAPTER 9: Water and Solid Waste

Table 9.1: Production of Water in metric Gallons, 2006 - 2018	64
Table 9.2: Use of Water Supply Facility, 1970 - 2011.....	65
Table 9.3: Waste Generation by Source, 2006 – 2018	66

CHAPTER 10: Forestry and Land Use

Table 10.1: Representation Environments in Protected Areas.....	81
Table 10.2: Areas in Grenada considered as Forest	82
Table 10.3: Carbon Emission per Hectare	83
Table 10.4: Valuable trees by Parish	84

List of Charts

<i>Chart 1.1: Change in Population, 1871-2011.....</i>	<i>1</i>
<i>Chart 1.2: Population Distribution by Parish 1981, 1991, 2001 and 2011</i>	<i>2</i>
<i>Chart 1.3: Population Pyramid 2011</i>	<i>3</i>
<i>Chart 1.4: Population Pyramid 2001</i>	<i>3</i>
<i>Chart 2.1: Mode of Transportation of Visitors</i>	<i>4</i>
<i>Chart 2.2: Cruise passengers and Tourists</i>	<i>5</i>
<i>Chart 2.3: Same-day Visitor (or Excursionist)</i>	<i>6</i>
<i>Chart 2.4: Cruise ship arrival</i>	<i>7</i>
<i>Chart 2.5: No. of Tourist Nights Spent</i>	<i>8</i>
<i>Chart 2.6: Country of Origin of Tourists</i>	<i>9</i>
<i>Chart 2.7: Total Visitor Expenditure</i>	<i>10</i>
<i>Chart 3.1: Reported Incidences of Major Environment Related Diseases.....</i>	<i>11</i>
<i>Chart 3.2: Reported Incidences of Major Environment Related Diseases.....</i>	<i>12</i>
<i>Chart 3.3: Reported Incidences of Other Environment Related Diseases</i>	<i>12</i>
<i>Chart 3.4: Household by Type of Dwelling and Toilet Facilities</i>	<i>14</i>
<i>Chart 3.5: Household by Type of Dwelling and Toilet Facilities</i>	<i>14</i>
<i>Chart 3.6: Number of Medical Personnel per Population 2006 - 2010</i>	<i>16</i>
<i>Chart 3.7: Number of Medical Personnel, 2006 - 2010</i>	<i>17</i>
<i>Chart 3.8: Number of Medical Personnel, 2006 - 2010</i>	<i>19</i>
<i>Chart 3.9: Number of Medical Personnel per Population 2011- 2015</i>	<i>20</i>
<i>Chart 3.10: Number of Medical Personnel 2016 - 2018</i>	<i>22</i>
<i>Chart 3.11: Number of Medical Personnel per Population 2016 - 2018</i>	<i>23</i>
<i>Chart 3.12: Distribution of Households by Safe Water Supply</i>	<i>24</i>
<i>Chart 4.1: Damages by Major Hurricanes</i>	<i>26</i>
<i>Chart 4.2: Damages Other Natural Hazards</i>	<i>26</i>
<i>Chart 4.3: Monthly Rainfall in millimeters, 2009 - 2018</i>	<i>27</i>
<i>Chart 4.4: Annual Rainfall.....</i>	<i>28</i>
<i>Chart 4.5: Percentage Rain Days 2006 -2018</i>	<i>28</i>
<i>Chart 4.6: Average Monthly Temperature, 2009 - 2018</i>	<i>29</i>
<i>Chart 4.7: Average Annual Humidity, 2006 - 2018.....</i>	<i>33</i>
<i>Chart 5.1: Electricity Production and Consumption, 2006 - 2017</i>	<i>35</i>
<i>Chart 5.2: Average Petroleum Retail Prices</i>	<i>35</i>
<i>Chart 5.3: Registration of New & Used Vehicles</i>	<i>36</i>
<i>Chart 5.4: Estimated Stock of Vehicles Year End</i>	<i>37</i>
<i>Chart 5.5: Mode of Transportation of Visitors</i>	<i>38</i>
<i>Chart 5.6: Number of Aircraft Landings by Type of Airlines</i>	<i>39</i>
<i>Chart 6.1: Importation of Insecticides, 2007 – 2014.....</i>	<i>42</i>
<i>Chart 6.2: Importation of Insecticides, 2015 -2018.....</i>	<i>43</i>
<i>Chart 6.3: Importation of Pesticides, 2007 – 2014.....</i>	<i>44</i>
<i>Chart 6.4: Importation of Pesticides, 2015 -2018.....</i>	<i>45</i>
<i>Chart 6.5: Use of Type of Chemicals by Level and Types by Parish</i>	<i>46</i>
<i>Chart 6.6: Age Range of Farmers by Sex</i>	<i>46</i>
<i>Chart 6.7: SEX of Famers in 1995</i>	<i>47</i>
<i>Chart 6.8: SEX of Famers in 2012</i>	<i>48</i>
<i>Chart 6.9: Number and Area of Farms Growing Permanent Crops</i>	<i>48</i>

Chart 6.10: Livestock by Type and Quantity, 1995	48
Chart 6.11: Livestock by Type and Quantity, 2012	49
Chart 6.12: Livestock by Type and Quantity, 2012	50
Chart 6.13: Livestock by Type and Quantity, 2012	51
Chart 7.1: Percentage Marine Protected Environments	52
Chart 7.2: Annual Total Value of Fish Landed	54
Chart 7.3: Quantity of Fish Landed.....	55
Chart 7.4: Quantity of PELAGIC SPECIES of Fish Landed	56
Chart 7.5: Quantity of PELAGIC SPECIES of Fish Landed	57
Chart 7.6: Quantity Demersal Species of Fish Landed.....	58
Chart 7.7: Quantity of Demersal Fish Landed.....	59
Chart 7.8: Number of Fisher Folk by Parish in 2012	61
Chart 8.1: Total Estimated Carbon Stock in Protected Area	63
Chart 9.1: Water production in Grenada, 2006 - 2018	64
Chart 9.2: The Trend in Water Supply Facility.....	65
Chart 9.3: Total Waste Generation	66
Chart 10.1: Terrestrial representation Chart	82
Chart 10.2: Marine representation Chart	82
Chart 10.3: Types of Land Cover.....	82
Chart 10.4: Carbon Emission per hectare	83
Chart 10.5: Number of Valuable trees by Parish	84

List of Figures

Figure 2.1: Mode of Transportation of Visitors	4
Figure 2.2: World Famous Grand Anse Beach at sunset, Dive Grenada, St. George's Harbour.....	5
Figure 2.3: Concord waterfall – St. John's, Clabony Volcanic Hot Spring.....	6
Figure 2.4: Cruise ships at St. George's Port.....	7
Figure 2.5: Spice Island Beach Resort, Coyaba Beach Resort, Calabash Luxury Boutique Hotel.....	8
Figure 2.6: Flags of Canada, Germany, United Kingdom, United States of America and West Indies.....	9
Figure 2.7: Underwater Sculptures.....	10
Figure 4.1: Effects of Hurricane Ivan, Landslides and Flash Floods	25
Figure 4.2: Rainbow indicating Water Vapour in the Atmosphere	33
Figure 5.1: Electricity Transmission Lines.....	34
Figure 5.2: Airline Bringing Visitors to Grenada	38
Figure 6.1: Main Agricultural Export Crops.....	41
Figure 7.1: Marine Protected Area-Underwater Museum, Moliniere, St. Georges.....	53
Figure 7.2: Underwater sculptures, Moliniere, St. Georges	53
Figure 7.3: Fisher Folk Bringing a Catch.....	61
Figure 8.1: The Grenada Dove, an Endangered Specie	63
Figure 9.1: Clear Drinking Water, Water Storage Facility, Water Meter	64
Figure 9.2: Waste Material Collected at the Landfill.....	67
Figure 10.1: Grand Etang Lake and Surrounding Forest Reserve	68

Figure 10.2: Morne LaBaye Trail	70
Figure 10.3: Beausejour Trail.....	70
Figure 10.4: Mount Qua Qua Trail	71
Figure 10.5: Concord Trail.....	71
Figure 10.6: Seven Sisters Trail.....	72
Figure 10.7: Annandale Trail and Waterfall	72
Figure 10.8: Vendome-Les Avocats Trail.....	73
Figure 10.9: Cross Trail	73
Figure 10.10: Fedon's Camp Trail.....	73
Figure 10.11: Herbaceous Plants in Grenada	74
Figure 10.12: More Herbaceous Plants in Grenada	75
Figure 10.13: Nonvascular plants in Grenada	76
Figure 10.14: Grand Etang Fern	77
Figure 10.15: Cabbage Palm.....	77
Figure 10.16: Palm Break.....	78
Figure 10.17: Montane Thicket	78
Figure 10.18: Elfin Woodlands.....	78
Figure 10.19: Montane Rainforest	78
Figure 10.20: Morne Gazo	79
Figure 10.21: Cactus Scrub	79
Figure 10.22: Levera Pond	80
Figure 10.23: Blue Mahoe (Hibiscus Elatus)	80
Figure 10.24: Pine (Pinus Caribae).....	81
Figure 10.25: Mahagony (Sweitenia sp.)	81
Figure 10.26: Cupressus Lusitanica	81

List of Maps

Map 10.1: Two Areas of Central Forest Reserve	68
Map 10.2: Area of Watershed Protection and Forest Production	69
Map 10.3: Percentage of Land available for use in Grenada, 2000 and 2009.....	83

CHAPTER 1: POPULATION

Population 1871-2011

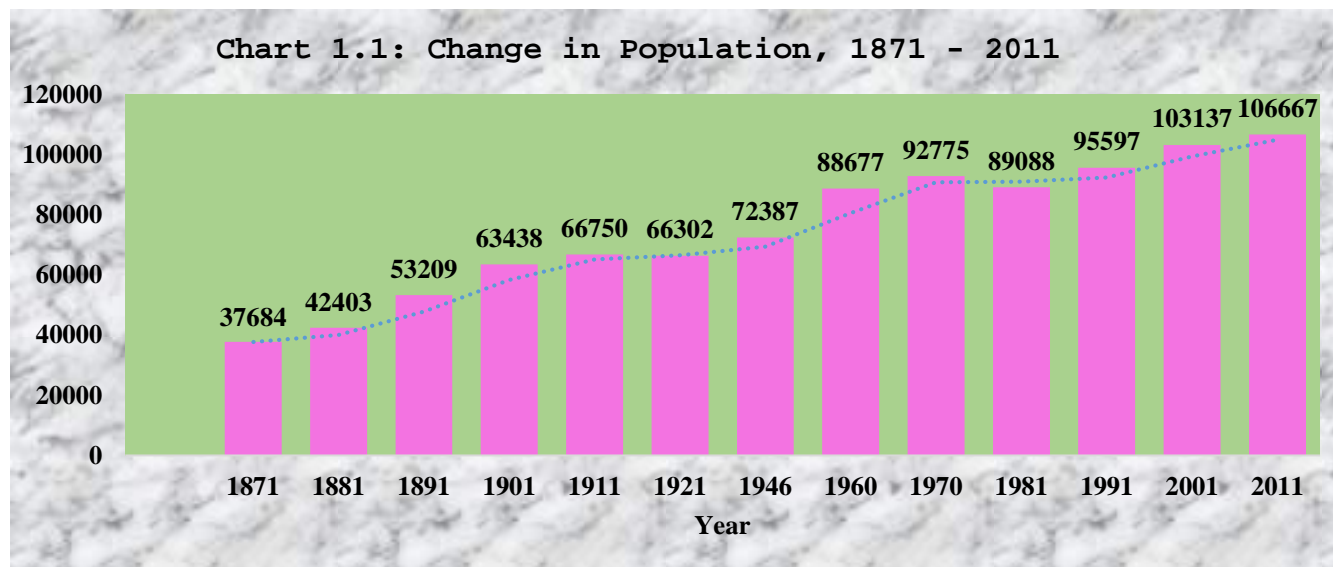
Census data reveals that within 140 years of data collection in Grenada the population has tripled moving from 37,684 in 1871 to 106,667. According to the census report, the Census was routinely conducted from 1871 to 1921 and recorded a steady increase in population with the exception of the period 1911 to 1921 which recorded a slight decline of 0.7 percent.

Based on research, the Great Depression and World War 11 seriously impacted the execution of the Census during the period 1921-1945 which resulted in the census not being conducted. The census conducted in 1946 revealed a 9.2 percent increase in the population.

The population decreased by 4.1 percent between the period 1970 and 1991 due to migration. There was also a decrease of 4.5 percent between 1981 and 1991. The last two censuses recorded population growth of 7.9 percent in 2001, and 3.4 percent in 2011.

Table 1.1: Population from 1871 - 2011

Years	1871	1881	1891	1901	1911	1921	1946	1960	1970	1981	1991	2001	2011
Total Population	37,684	42,403	53,209	63,438	66,750	66,302	72,387	88,677	92,775	89,088	95,597	103,137	106,667



Source: Census and Surveys Unit, Central Statistical Office

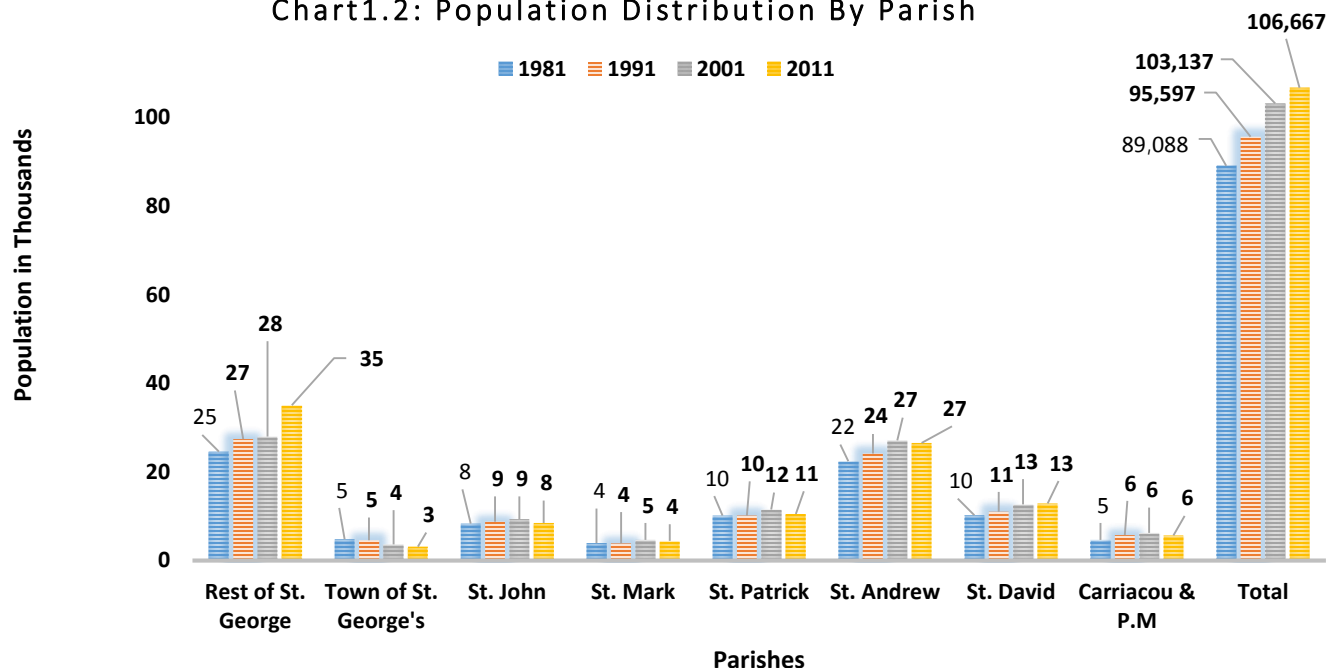
Population Distribution by Parish

The trend continues in the latest census with the decline in the population of the town of St. George's over the forty-year period. The decline could be attributed to increased commercialization of the town Centre giving rise to more commercial space and less resident housing.

Table 1:2: Population and percentage Population by Parish

Parish	1981		1991		2001		2011	
	Population	Percentage	Population	Percentage	Population	Percentage	Population	Percentage
Rest of St. George	24,581	27.6	27,373	28.6	27,951	27.1	35,076	32.9
Town of St. George's	4,788	5.4	4,621	4.8	3,631	3.5	3,171	3.0
St. John	8,328	9.4	8,752	9.2	9,376	9.1	8,469	7.9
St. Mark	3,968	4.5	3,861	4.0	4,675	4.5	4,408	4.1
St. Patrick	10,132	11.4	10,118	10.6	11,537	11.2	10,504	9.9
St. Andrew	22,425	25.2	24,135	25.3	27,116	26.3	26,501	24.9
St. David	10,195	11.4	11,011	11.5	12,636	12.3	12,877	12.1
Carriacou & P.M	4,671	5.2	5,726	6.0	6,215	6.0	5,661	5.3
Total	89,088	100	95,597	100	103,137	100	106,667	100

Chart1.2: Population Distribution By Parish



Source: Grenada Population and Housing Census Reports

Comparison of Population by Age, 2001 and 2011

The population of Grenada has been growing particularly in the youth age group. Notwithstanding, the 80+ age category has also exploded when comparing the census data for 2011 with the data for 2001. The 2001 census counted 1,941 persons in this category while the 2011 census counted 3,066.

Table 1.3: Population by five – year Age Group and Sex, 2011 and 2001.

AGE - GROUP	2011			2001		
	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
0 - 4	4,380	4,128	8,508	5,068	4,851	9,919
5 - 9	3,762	3,604	7,366	5,458	5,377	10,835
10 - 14	4,413	4,294	8,707	6,376	6,345	12,721
15-19	5,013	4,875	9,888	5,437	5,673	11,110
20-24	5,091	4,823	9,914	3,866	3,755	7,621
25-29	4,721	4,697	9,418	3,500	3,239	6,739
30-34	3,440	3,384	6,824	3,287	3,222	6,509
35-39	3,419	3,081	6,500	3,651	3,430	7,081
40-44	3,225	2,960	6,185	3,383	3,157	6,540
45-49	3,531	3,353	6,884	2,573	2,332	4,905
50-54	3,427	3,279	6,706	1,863	1,832	3,695
55-59	2,562	2,254	4,816	1,330	1,424	2,754
60-64	1,921	1,794	3,715	1,504	1,729	3,233
65-69	1,461	1,621	3,082	1,464	1,698	3,162
70-74	1,353	1,488	2,841	1,174	1,393	2,567
75-79	1,025	1,222	2,247	747	1,058	1,805
80+	1,154	1,912	3,066	701	1,240	1,941
TOTAL	53,898	52,769	106,667	51,382	51,753	103,135

Source: Grenada Population and Housing Census Report 2011

Chart 1.3: Population Pyramid 2011

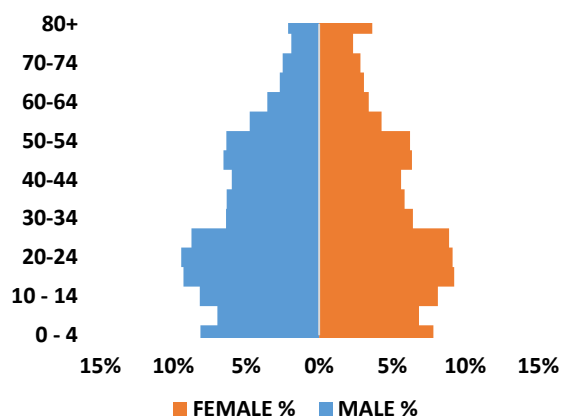
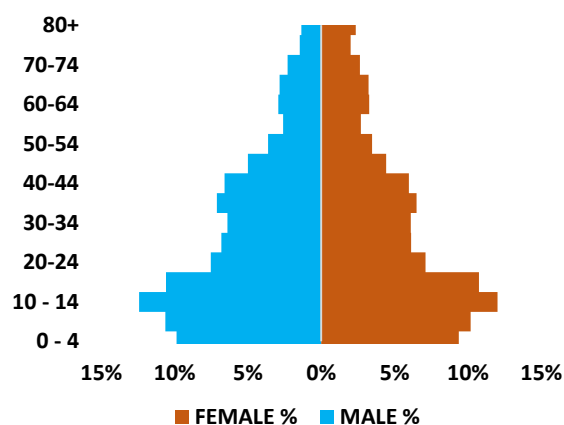


Chart 1.4: Population Pyramid 2001



CHAPTER 2: TOURISM

Tourism a significant contributor to the Tri – Island Nation’s economy. Nonetheless, the tourism industry can be considered to be very fickle in that it is highly susceptible to the slightest changes in fortunes of the world economy and environmental conditions. When the economy of developed countries are in recessions or suffer other economic downfall, the tourism industry is severely impacted and as a consequence the entire economy of the country.

Table 2.1: Tourist, Cruise ship arrivals and Tourist Nights, 2007 - 2018

Visitor Arrival Method by:	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Air (Includes Students)	130,100	130,363	113,914	110,471	113,947	112,307	112,812	133,521	140,735	144,333	155,170	170,341
Sea (yacht)	5,353	5,288	16,962	21,153	18860	20060	22163	24650	22115	20220	21911	25406
Cruise Ship	270,323	292,712	342,852	333,291	309,564	242,454	197,309	235,140	280,518	314,913	299,449	342,826
Same Day/excursionist	5,491	2,405	2,829	2,448	1,571	2,341	1729	1660	1579	3270	1063	555
No. of tourist nights spent	7.63	8.69	8.45	8.33	8.27	8.21	9.08	9.12	8.71	8.81	8.99	8.99
Total	411,224	430,806	464,081	467,363	443,942	377,162	334,013	394,971	444,947	482,736	477,593	539,128

Chart 2.1: Mode of Transportation of Visitors, 2007 - 2018

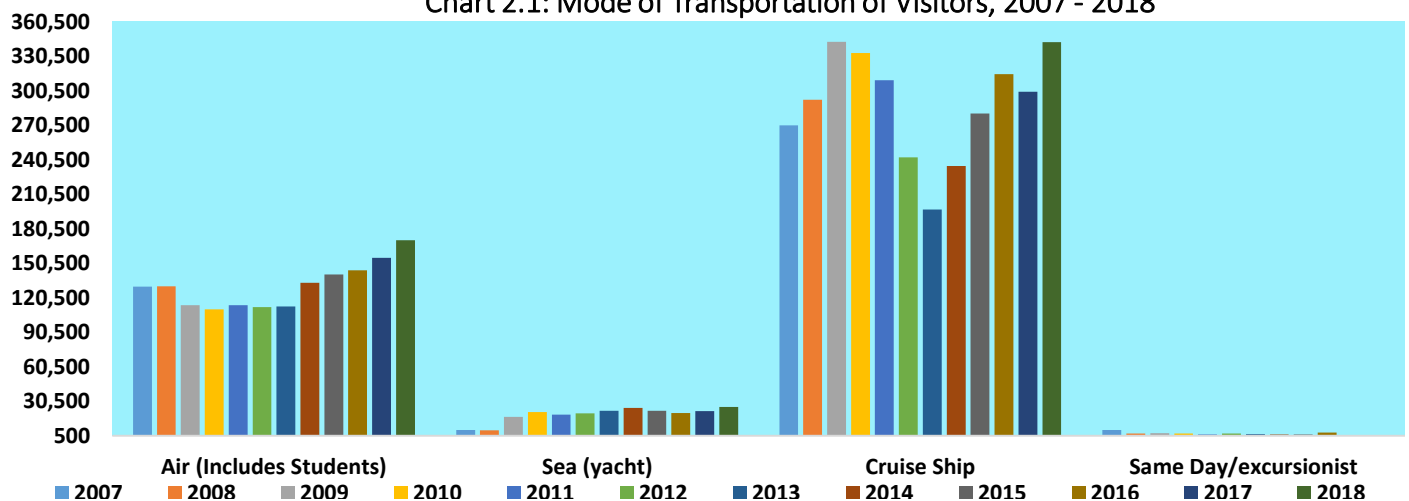


Figure 2.1: Mode of Transportation of Visitors



Source: Grenada Tourism Authority

Stay over Visitors, 2006 - 2018

A stay over tourist is a tourist that stays in a country or island for more than 24 hours. In Grenada, this type of visitor contributes significantly to the national economy.

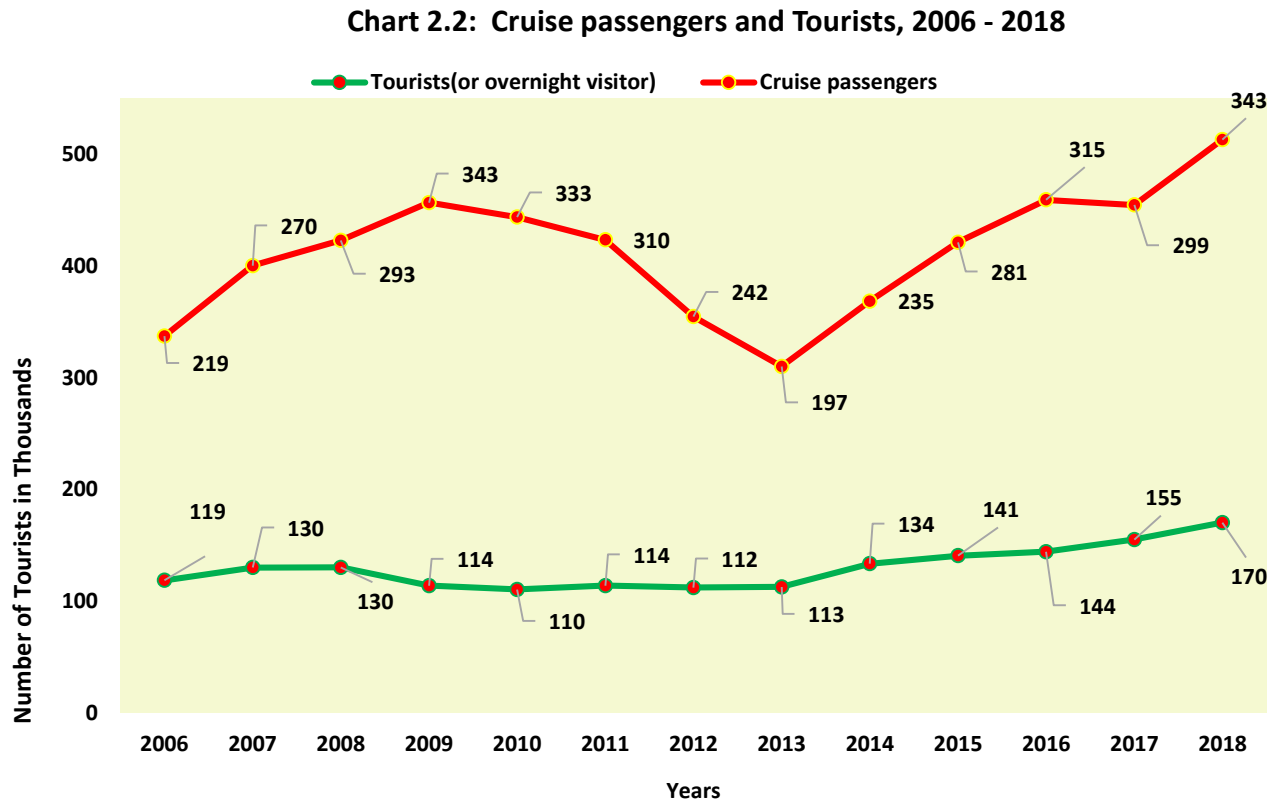
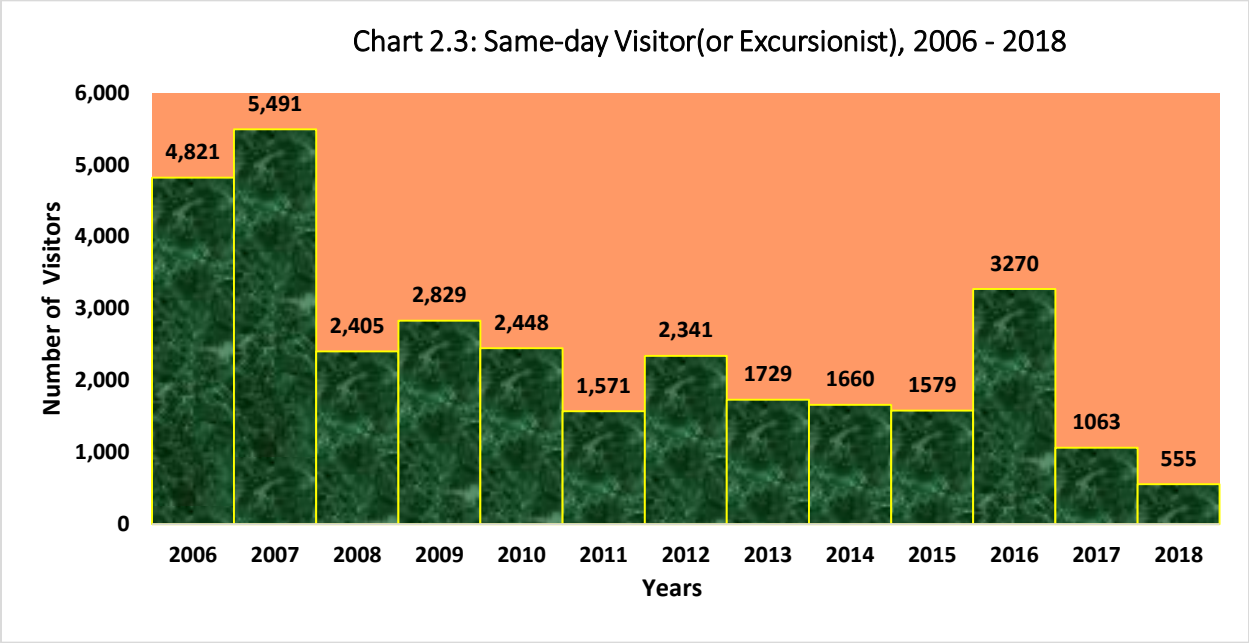


Figure 2.2: World Famous Grand Anse Beach at sunset Dive Grenada

St. George's Harbour

Source: Grenada Tourism Authority



Source: Grenada Tourism Authority

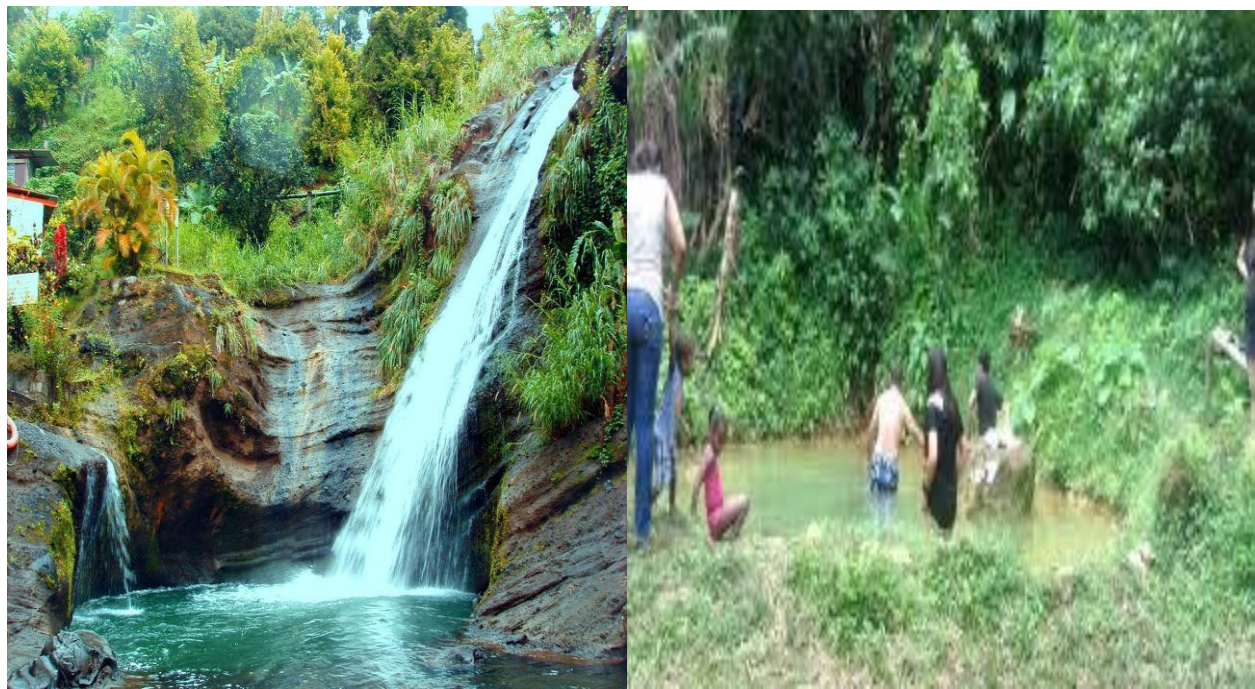
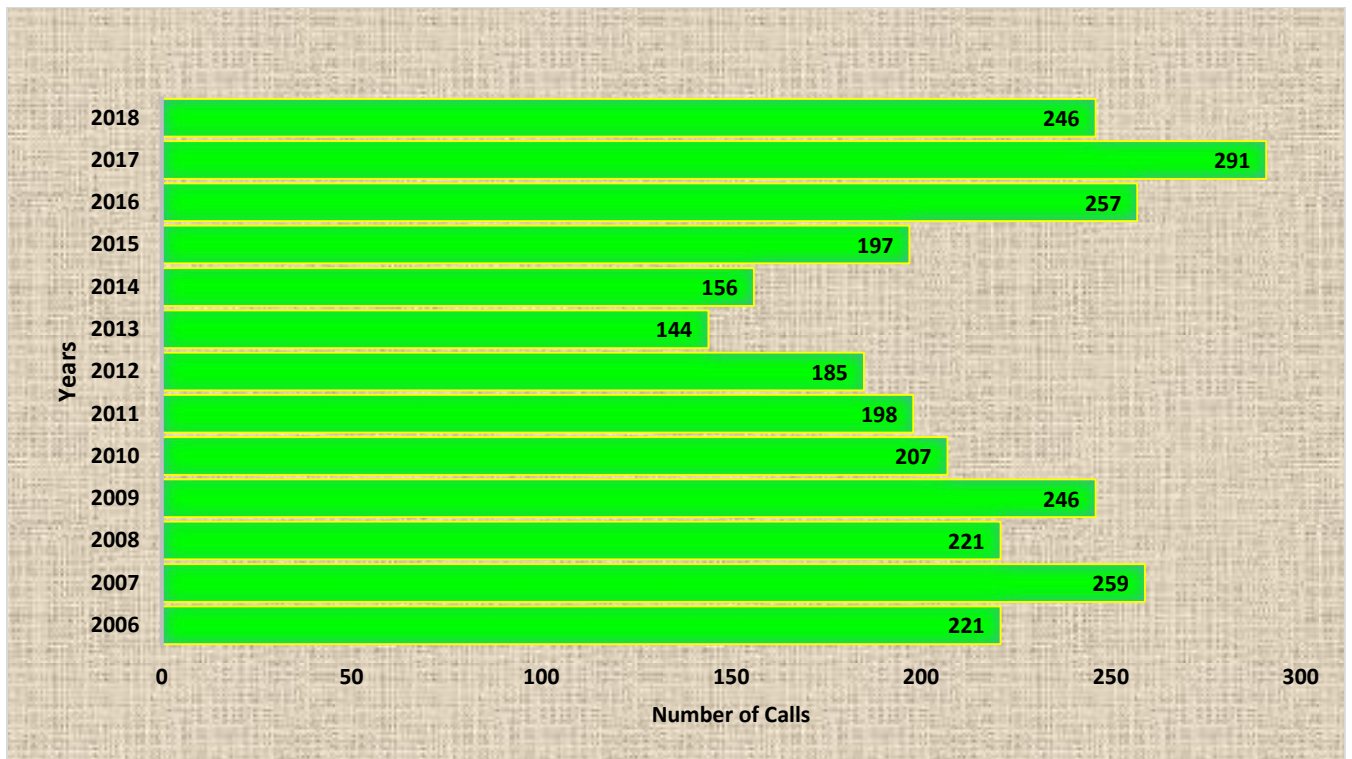


Figure 2.3: Concord waterfall – St. John’s

Clabony Volcanic Hot Spring

Chart 2.4: Cruise Ship Arrival, 2006 - 2018



Source: Grenada Tourism Authority

Figure 2.4: Cruise Ships at St. George's Port



Chart 2.5: Average Number of Nights Spent by Tourists, 2007 - 2018

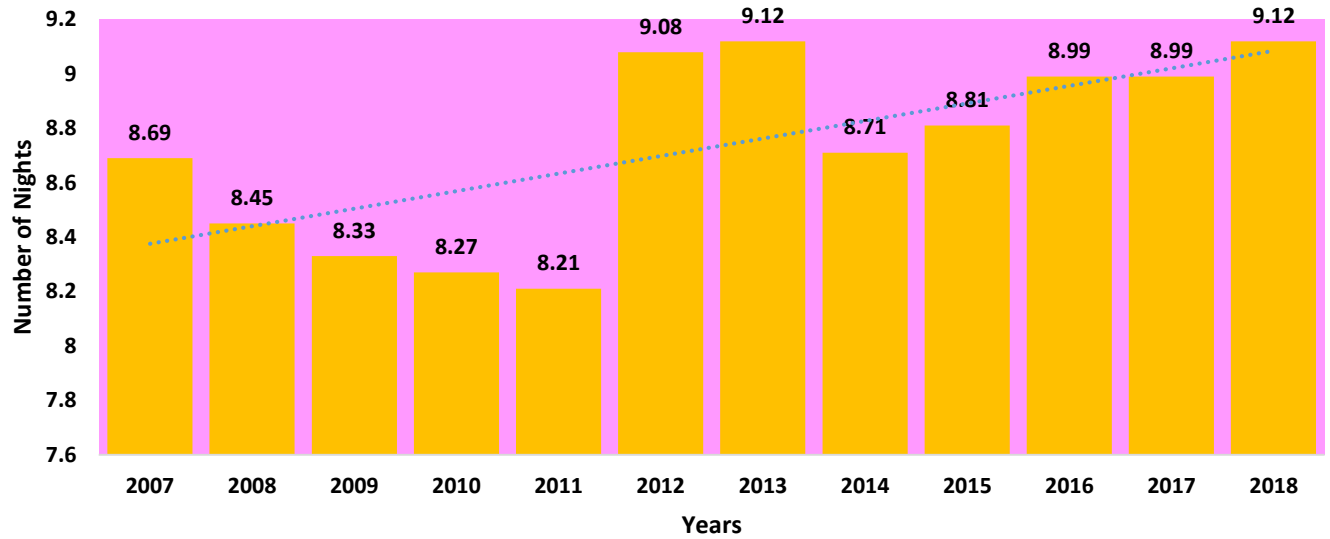


Figure 2.5: Spice Island Beach Resort



Coyaba Beach Resort



Calabash Luxury Boutique Hotel



Source: Grenada Tourism Authority

Country of Origin of Tourist

Based on the data compiled via surveys and the immigration cards, the United States of America is the number one source of tourist arrivals, followed by the United Kingdom.

Table 2.2: Tourist Arrivals from Country of Origin, 2007 - 2018

Country of origin	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
United States of America	27,352	22,011	24,734	24,590	27,356	30,196	34,561	41,467	40,914	45,316	54,801	61,422
United Kingdom	33,976	35,235	27,090	25,927	27,236	24,486	20,588	23,479	24,681	24,108	22,501	22,753
West Indies	29,054	29,349	25,739	23,368	26,476	24,838	24,456	22,604	22,364	23,122	25,269	27,000
Canada	6,067	6,377	6,921	6,992	7,237	7,822	9,648	13,979	10,790	10,723	11,383	13,784
Germany	2,737	3,167	2,311	2,146	2,022	1,312	720	1,918	2,377	2,032	2,467	2,419
Others	30,914	34,224	27,119	27,448	23,620	23,653	22,839	30,074	53,536	50,291	51,865	58,998

Source: Grenada Tourism Authority

Chart 2.6: Country of Origin of Tourists, 2007 - 2018

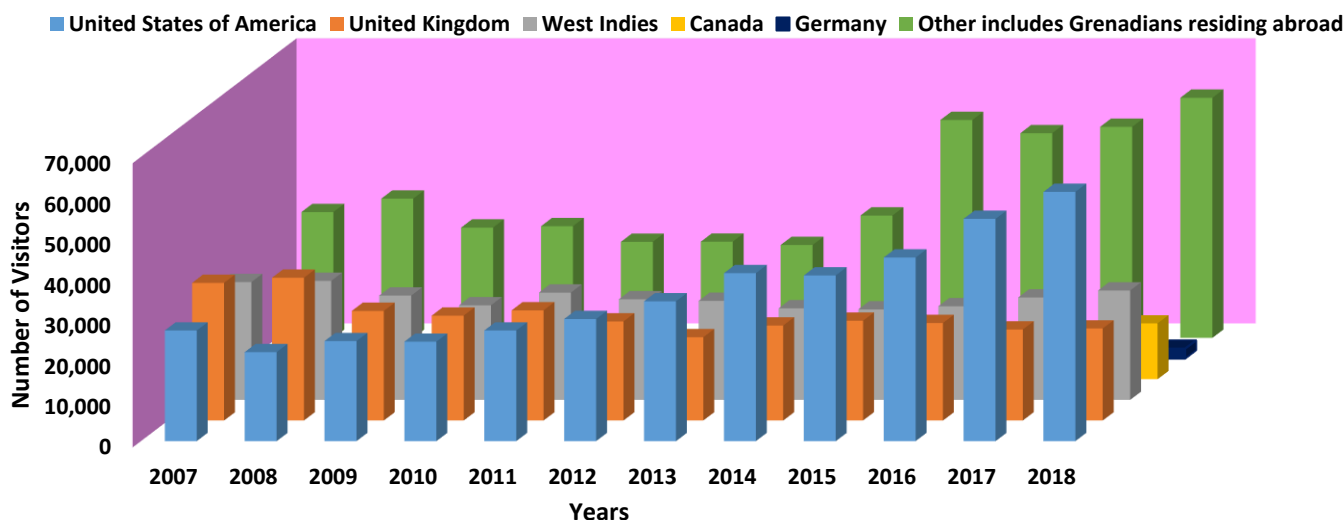


Figure 2.6: Flags of Canada Germany United Kingdom United States of America WEST INDIES

Table 2.3: Visitor Expenditure, 2006 - 2018

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Expenditure in Thousands (EC \$)	310	342	342	312	301	316	333	329	362	393	406	408	536

Source: Grenada Tourism Authority

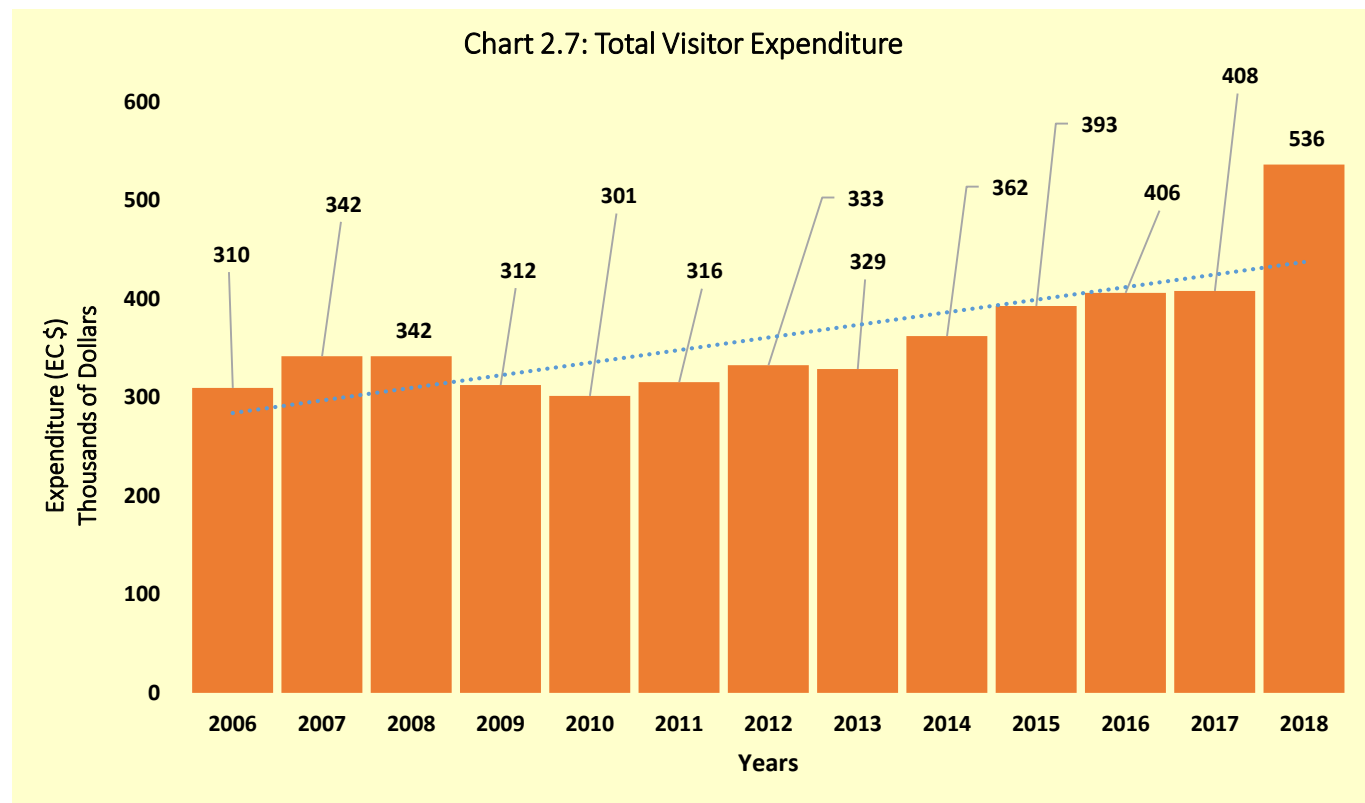


Figure 2.7: Underwater Sculptures



CHAPTER 3: ENVIRONMENTAL HEALTH

The World Health Organisation (WHO) defines Environmental Health as the physical, chemical and biological factors external to a person, and all other related factors impacting behaviors. It also involves the assessment and control of these factors which can affect health, through the prevention of disease and creation of healthy environments. Health is one of the most fundamental requirements of human wellbeing, and as such environmental issues are a growing concern, not only to human health, but also to the health of plants and animals.

Table 3.1: Number of Reported Cases and Incidence of Environmentally Related Diseases Cause, 2006 - 2018

	Years												
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Gastroenteritis	2,052	1,155	1,509	2,819	2,413	2,007	3,744	1,795	3,307	606	1,633	2,303	2,977
Typoid	0	0	0	0	0	0	0	0	0	...	...	...	...
Malaria	0	0	0	0	0	0	0	0	0	1	...	...	...
Dengue	14	7	7	28	134	92	85	155	39	1	63	181	406
Cholera	0	0	0	0	0	0	0	0	0	...	...	...	...
Accidental pesticide poisoning	...	...	...	...	...	...	...	...	...	...	...	...	...
Poisoning	...	...	...	...	...	...	...	...	...	...	...	...	...
Diarrhoea	...	...	...	...	...	...	...	...	...	...	...	1	...
Respiratory tract diseases	7,608	7,625	6,282	8,292	11,027	13,762	16,497	10,042	10,067	1,928	4,583	10,837	9,020
Acute bronchitis	...	...	...	...	...	...	...	...	...	...	...	...	...
Chronic sinusitis	...	...	...	...	...	...	...	...	...	...	...	...	...
Leptospirosis	3	4	4	7	2	11	23	5	6	2	3	14	15
Chicken Pox	52	33	61	98	46	197	116	21	61	29	175	83	105
Food Borne Illness	39	67	57	108	94	128	109	119	96	16	87	136	122
Scabies	197	...	215	260	200	244	230	177	179	34	154	119	97
Total cases, all causes	9,677	8,791	7,802	11,146	13,577	15,872	20,350	11,997	13,419	2,617	6,698	13,674	12,748

Chart 3.1: Yearly Reported Incidences of Major Environment Related Diseases, 2006 - 2018

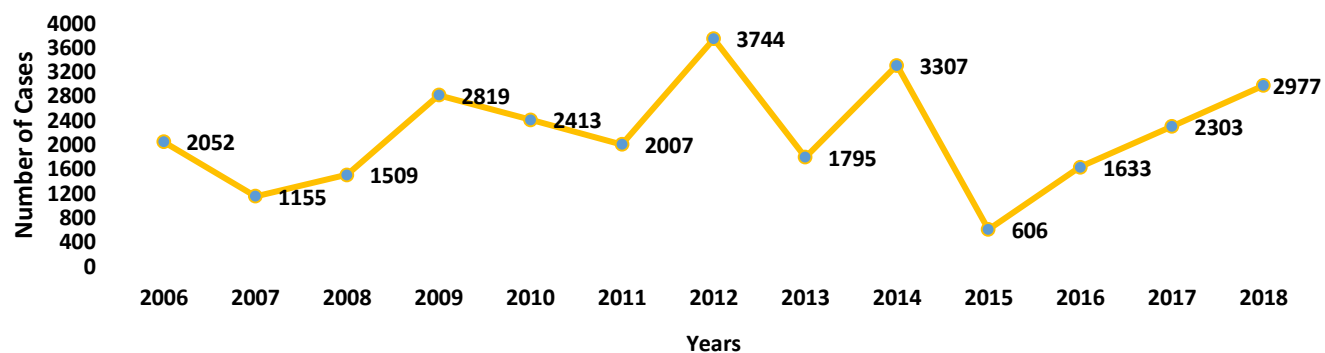


Chart 3.2: Reported Incidences of Major Environment Related Diseases, 2006 - 2018

Respiratory tract diseases(Acute respiratory infection), 2006-2018

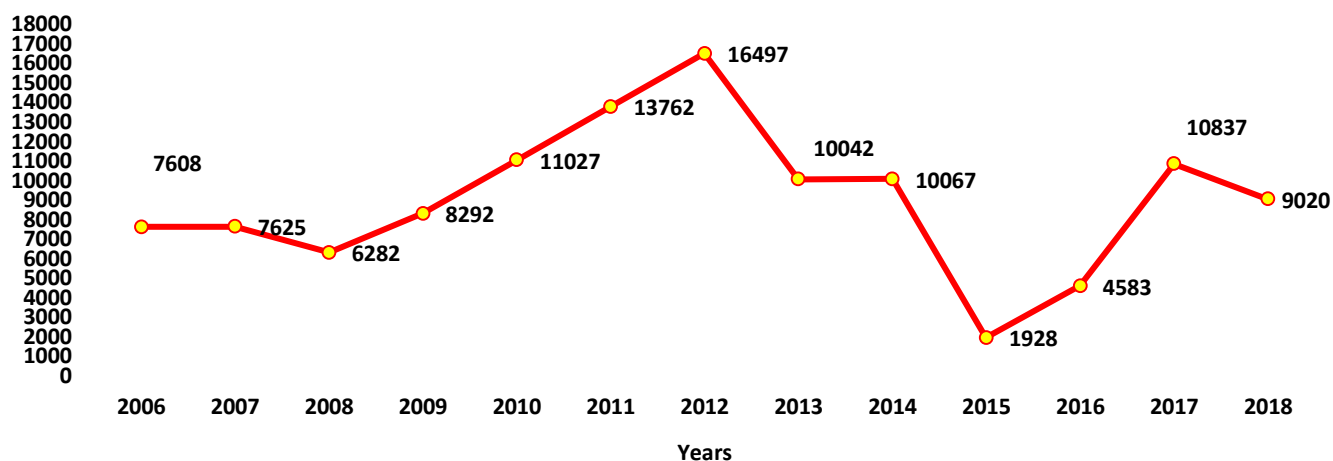


Chart 3.3: Reported Incidences of Other Environment Related Diseases, 2006 - 2018

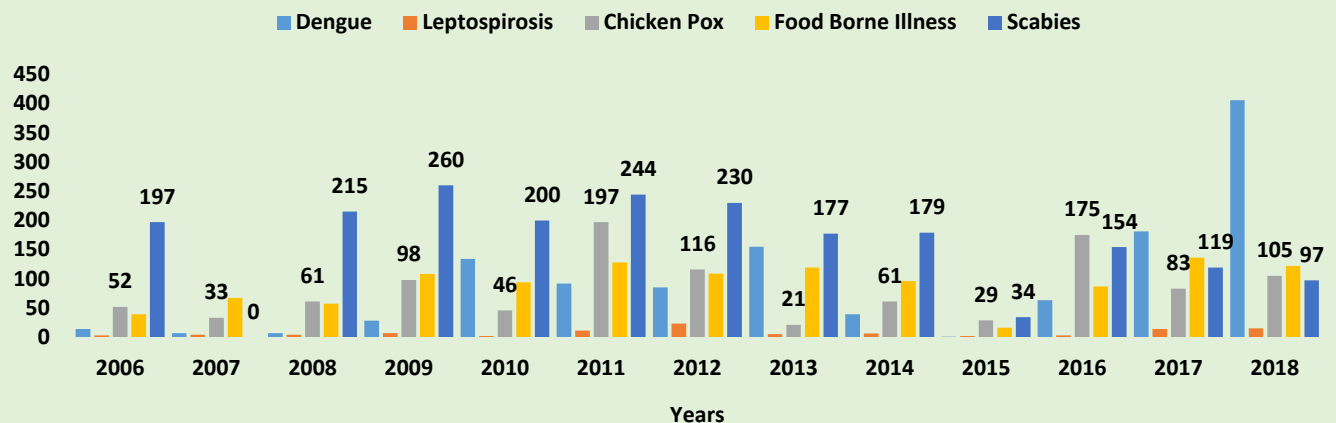


Table 3.2: Household by Type of Dwelling and Toilet Facilities, 2011

Type of Dwelling	Flush toilets linked to sewer	Flush toilets linked to septic	Pit latrine /ventilated	Pit latrine/not ventilated	Pit latrine ventilated and not elevated	None	Other	Don't know	Not stated	Total
Separate house	996	17,041	4,231	4,393	1,803	1,638	91	18	763	30,974
Part of a private house	143	1,870	159	115	43	100	9	0	54	2,493
Flat/apartment/condo	131	1,018	16	9	2	53	0	4	18	1,251
Townhouse	34	31	0	5	1	2	0	0	4	77
Double house/duplex	87	437	15	15	2	15	0	2	8	581
Business & dwelling	47	446	31	22	16	32	0	0	22	616
Barracks	0	1	2	0	0	0	0	0	0	3
Outhouse	0	3	5	3	1	2	2	1	2	19
Group dwelling	1	9	1	1	4	0	0	0	0	16
Improvised housing unit	0	0	0	15	0	14	0	0	0	29
Other	1	12	5	7	4	16	0	0	3	48
Total	1,440	20,868	4,465	4,585	1,876	1,872	102	25	874	36,107

Source: Population and Housing Census, 2011, Central Statistical Office

Chart 3.4: Household by Type of Dwelling and Toilet Facilities

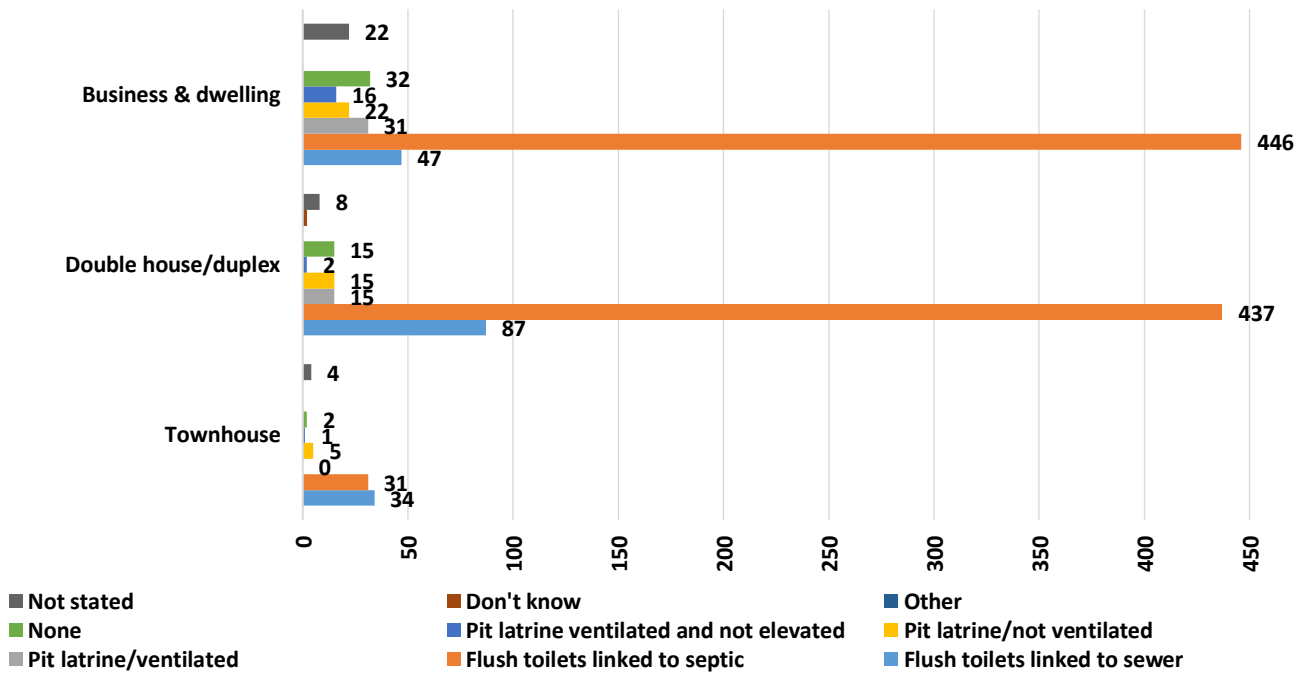
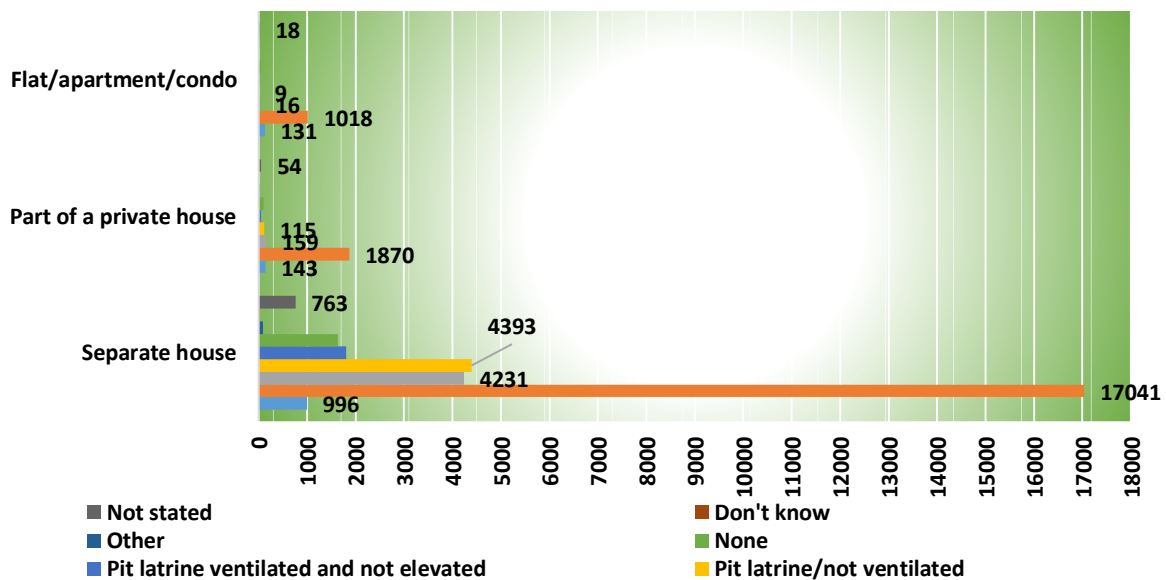


Chart 3.5: Household by Type of Dwelling and Toilet Facilities



Source: Population and Housing Census, 2011, CSO

Table 3.3: Number of Health Personnel and Population, 2006 - 2010

Category	Pop.per personnel	2006	Pop.per personnel	2007	Pop.per personnel	2008	Pop.per personnel	2009	Pop.per personnel	2010	Pop.per personnel
Physicians	1,838	58	1,880	58	1,316	80	1,315	80	1,313	80	1,147
Dentists	11,845	9	12,114	9	11,700	9	11,686	9	11,671	9	11,852
Dentists Auxiliaries	26,651	4	27,257	4	26,325	4	26,294	4	26,260	4	26,667
Nurses	496	215	507	215	4,590	215	489	215	333	315	345
Nurse Practitioners	21,321	5	21,806	5	21,060	5	21,035	5	35,013	3	35,556
Nurse Assistants	730	146	742	147	540	195	539	195	547	192	547
Community Health Aides	2,479	43	2,536	43	2,393	44	2,337	45	2,334	45	2,319
Social Workers	26,651	4	27,257	4	26,325	4	21,035	5	21,008	5	21,333
Nutritionist/Dietician	53,303	2	54,514	2	52,649	2	105,175	1	105,038	1	106,667
Lab Technicians	8,200	13	8,387	13	8,100	13	8,090	13	8,080	13	8,205
Radiographers	17,768	6	18,171	6	17,550	6	17,529	6	17,506	6	17,778
Pharmacists	4,846	22	4,956	22	4,786	22	4,781	22	5,002	21	5,079
Physiotherapists	106,605	1	109,028	1	105,298	1	105,175	1	105,038	1	106,667
Occupational therapists	0	0	0	0	0	0	0	0	0	0	0
Environmental health Officers	7,107	15	7,269	15	7,020	15	8,765	12	8,080	13	8,205
Hospital Administrators	26,651	4	27,257	4	26,325	4	26,294	4	26,260	4	35,556

Source: Epidemiology Unit. Ministry of Health

Chart 3.6: Number of Medical Personnel per Population, 2006- 2010

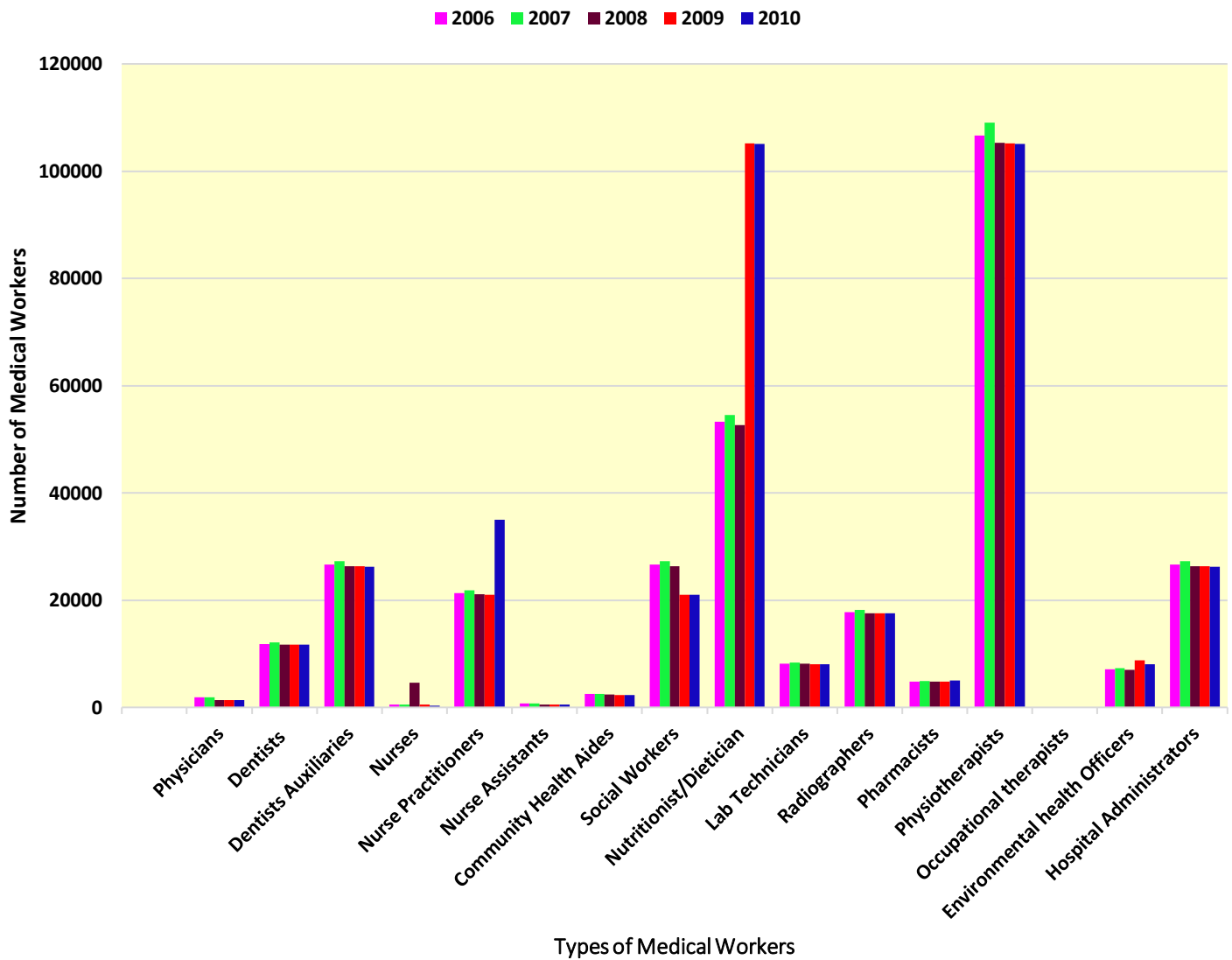


Chart 3.7: Number of Medical Personnel, 2006 - 2010

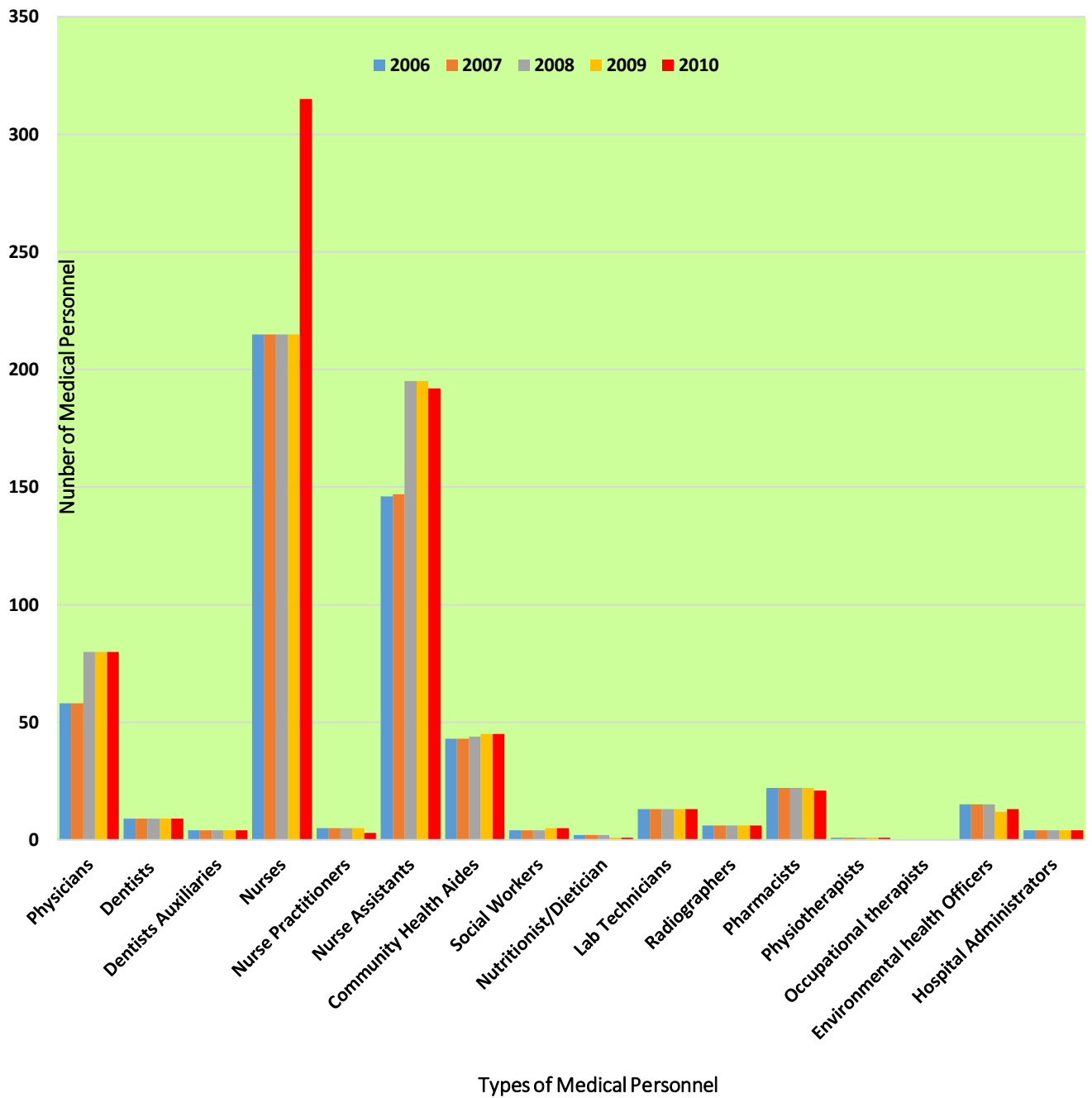


Table 3.4: Number of Health Personnel and Population, 2011 - 2015

Category	Pop.per personnel	2011	Pop.per personnel	2012	Pop.per personnel	2013	Pop.per personnel	2014	Pop.per personnel	2015
Physicians	1,147	93	1,157	93	1,168	93	994	101	1,003	110
Dentists	11,852	9	11,955	9	12,064	9	12,153	9	12,255	9
Dentists Auxiliaries	26,667	4	26,900	4	27,145	4	27,344	4	27,573	4
Nurses	345	309	327	331	320	339	312	351	314	351
Nurse Practitioners	35,556	3	53,800	2	54,290	2	54,687	2	55,146	2
Nurse Assistants	547	195	552	195	557	195	889	123	897	123
Community Health Aides	2,319	46	2,339	46	2,525	43	2,878	38	2,902	38
Social Workers	21,333	5	21,520	5	21,716	5	27,344	5	27,572	4
Nutritionist/Dietician	106,667	1	107,599	1	108,580	1	54,687	1	55,146	2
Lab Technicians	8,205	13	8,277	13	8,352	13	7,292	15	7,353	15
Radiographers	17,778	6	17,933	6	15,511	7	15,625	7	15,756	7
Pharmacists	5,079	21	5,124	21	4,524	24	4,557	24	4,596	24
Physiotherapists	106,667	1	107,599	1	108,580	1	54,687	2	55,146	2
Occupational therapists	0	0	0	0	0	0	0	0	0	0
Environmental health Officers	8,205	13	8,277	13	8,352	13	6,434	17	6,488	17
Hospital Administrators	35,556	3	35,866	3	36,193	3	36,458	3	36,764	3

Source: Epidemiology Unit. Ministry of Health

Chart 3.8: Number of Medical Personnel, 2011 -2015

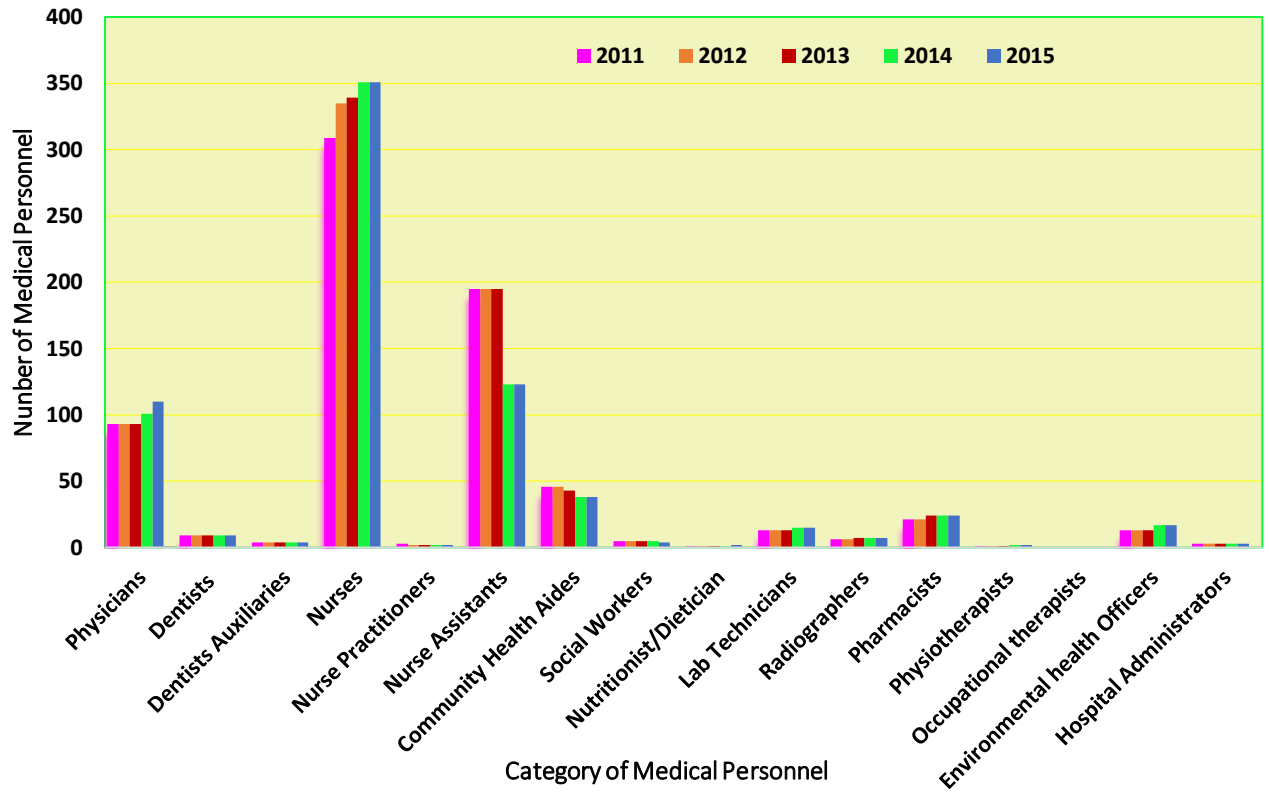


Chart 3.9: Number of Medical Personnel per Population, 2011- 2015

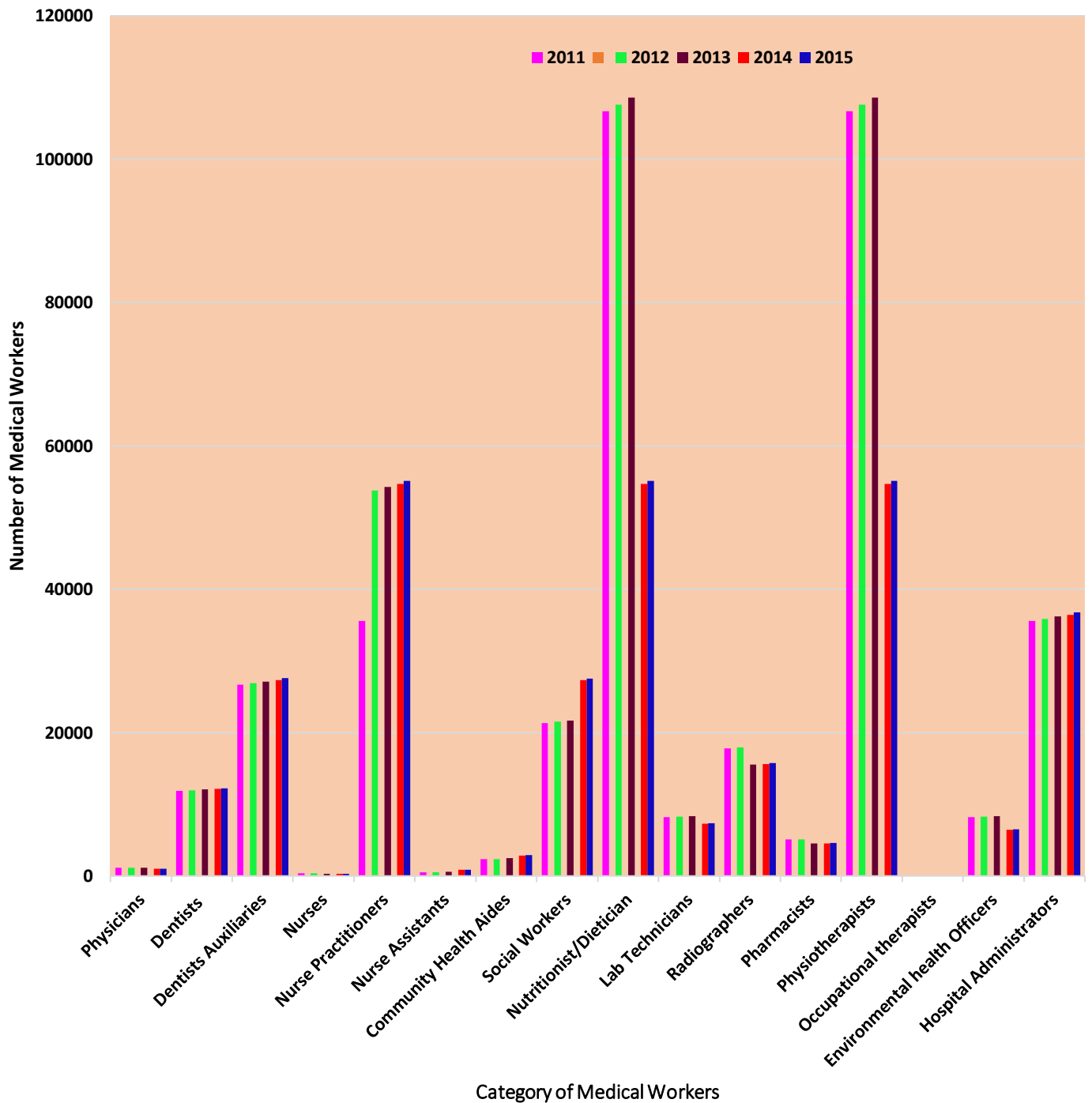


Table 3.5: Number of Health Personnel and Population, 2016 - 2018

Category	Pop.per personnel	2016	Pop.per personnel	2017	Pop.per personnel	2018
Physicians	964	115	1,104	101	1,230	91
Dentists	12,323	9	10,133	11	12,440	9
Dentists Auxiliaries	27,728	4	55,734	2	55,980	2
Nurses	331	335	332	336	351	319
Nurse Practitioners	110,910	1	111,467	1	0	0
Nurse Assistants	672	165	808	138	882	127
Community Health Aides	2,919	38	3,013	37	2,382	47
Social Workers	27,728	4	18,578	6	18,660	6
Nutritionist/Dietician	55,455	2	55,734	2	111,959	1
Lab Technicians	7,394	15	6,193	18	5,598	20
Radiographers	15,844	7	15,924	7	15,994	7
Pharmacists	5,281	21	5,067	22	5,089	22
Physiotherapists	55,455	2	37,156	3	37,320	3
Occupational therapists	0	0	111,467	1	0	0
Environmental health Officers	6,524	17	6,557	17	6,586	17
Hospital Administrators	36,970	3	37,156	3	37,320	3

Source: Epidemiology Unit. Ministry of Health

Chart 3.10: Number of Medical Personnel, 2016 - 2018

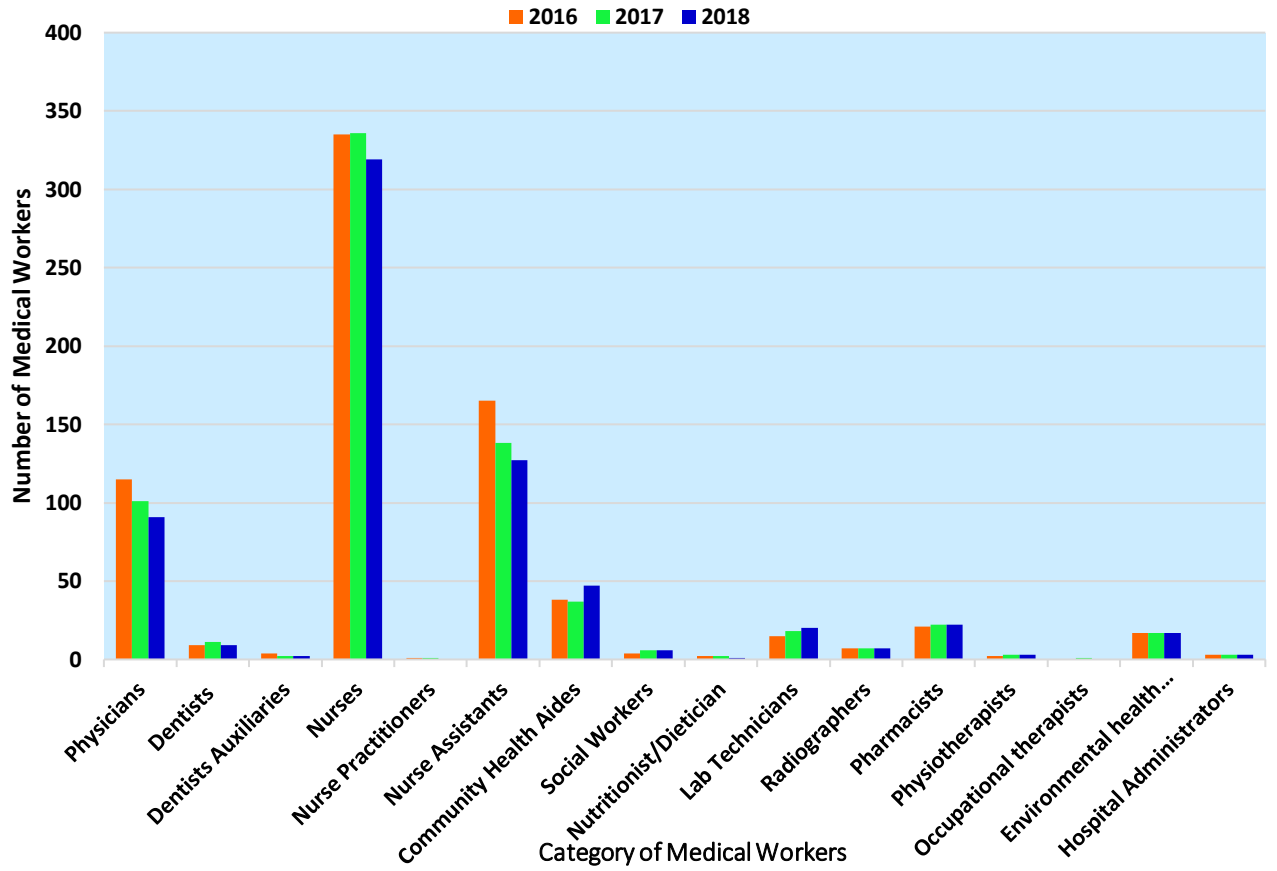


Chart 3.11: Number of Medical Personnel per Population, 2016 - 2018

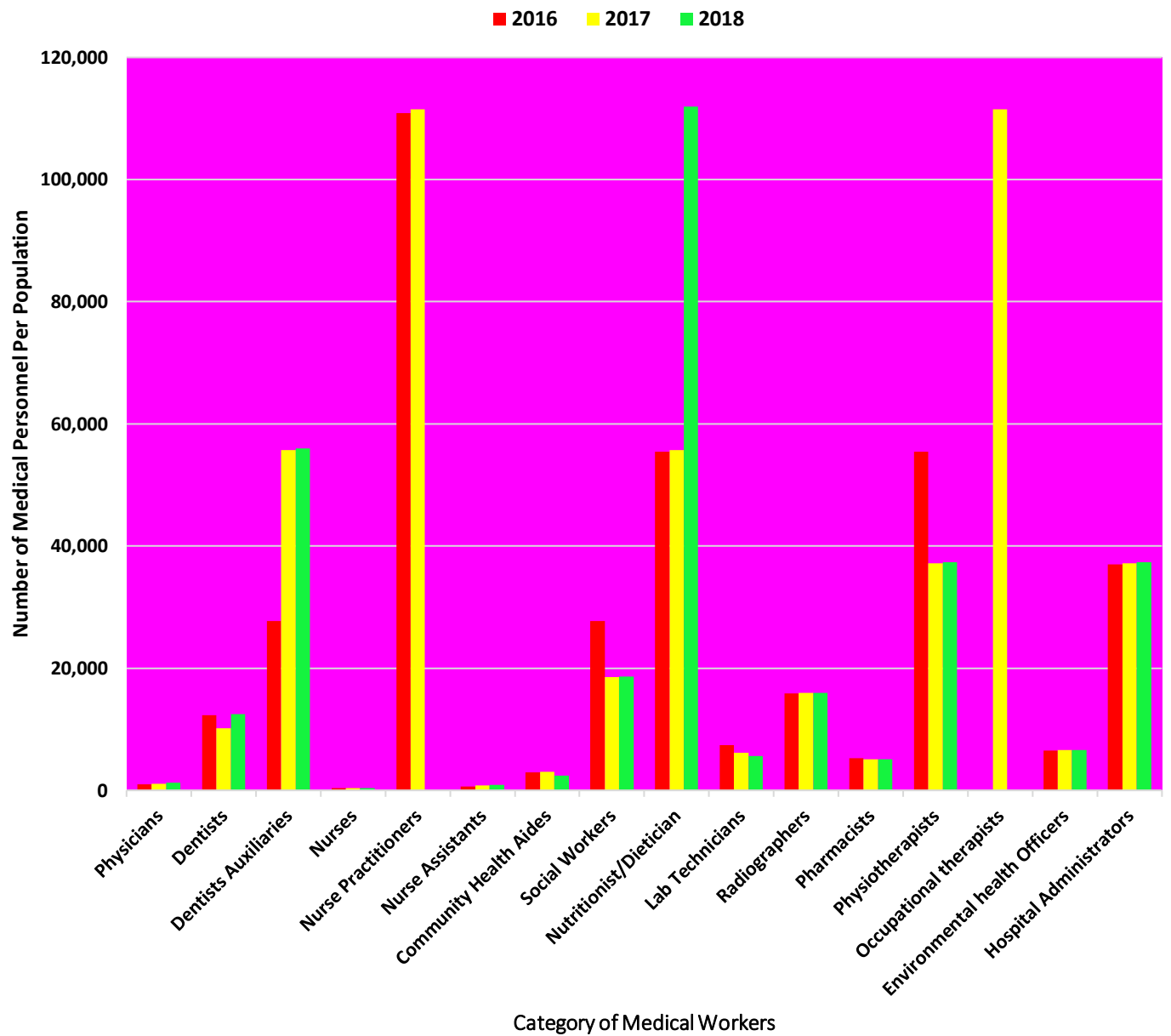
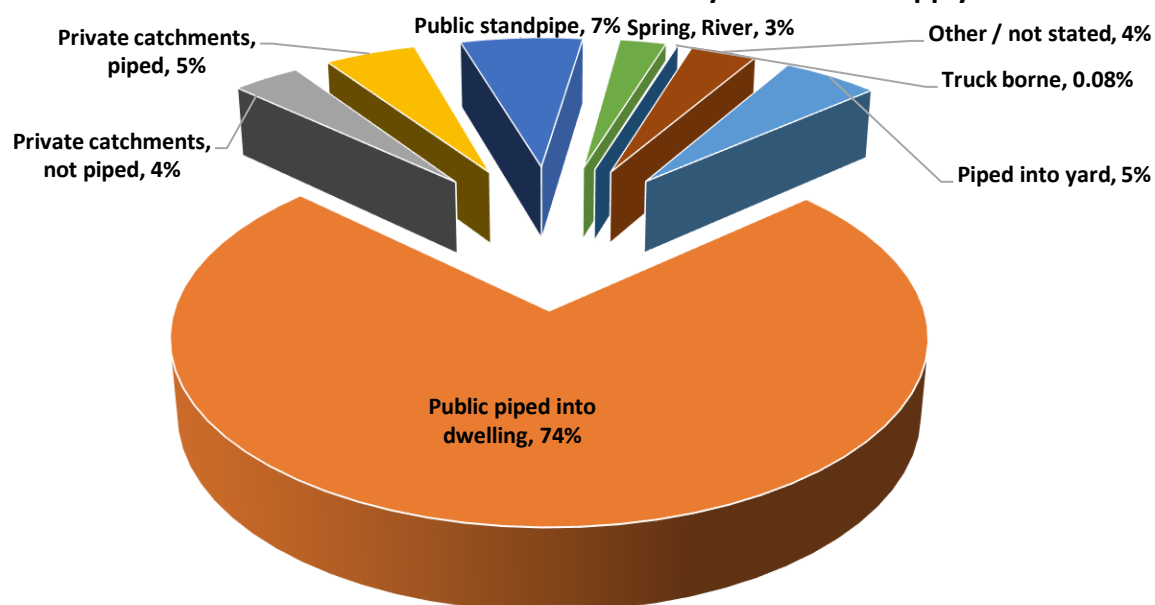


Table 3.6: Distribution of Households by Safe Water Supply, 2011 Census

Parish	Public, piped into dwelling	Public, piped into yard	Public standpipe	Private catchment not piped	Private, piped into dwelling	Truck borne	Spring, River	Other	Total
St. George's	10,623	514	398	131	167	3	153	410	12,399
Town of St. George	1,068	54	15	5	4	0	2	29	1,177
St. John's	1,938	211	162	43	183	0	122	136	2,795
St. Mark's	1,049	86	177	32	10	1	20	79	1,454
St. Patrick's	2,452	184	314	57	260	0	60	127	3,454
St. Andrew's	6,004	463	1,085	41	81	10	191	305	8,180
St. David's	3,397	346	224	69	30	14	356	122	4,558
Carriacou & Petite Martinique	11	6	21	928	1,045	2	3	78	2,094
Total	26,542	1,864	2,396	1,306	1,780	30	907	1,286	36,111

Chart 3.12: Distribution of Households by Safe Water Supply



CHAPTER 4: WEATHER, NATURAL and ENVIRONMENTAL DISASTERS

NATURAL DISASTERS

Grenada is vulnerable to climate related hazards such as floods, hurricanes, extreme heat and landslides. Since Grenada's major towns and economic activity are located along the coast, the state is particularly vulnerable to hazards such as hurricanes and storms (GFDRR 2018).

Over the past decades, Grenada has been impacted by severe weather events (Table 1). The most catastrophic being 2004 Hurricane Ivan that caused damage of over 200% of the country's 2004 GDP. Only a year after, hurricane Emily further affected Grenada's GDP. With the onset of climate change these impacts are projected to be exacerbated.

Grenada's economy is heavily dependent on tourism and agriculture, both of which are sensitive to climate related events and have been negatively affected in the past.

Forest fires also occur, depending on the intensity of the dry season.

Additionally, Grenada is situated near a fault line and from time to time may get some tremors.

Figure 4.1: Effects of Hurricane Ivan, Landslides and Flash floods



Houses damaged after hurricane Ivan

Landslide near Sendall Tunnel

Flash Flood in River Road

Table 4.1: Historical Weather and Climate-related events in Grenada

Event (Year)	Disaster Type	Number of Persons Affected	Damages and Loss in % of GDP	Damages (UDS)
Hurricane Janet (1955)	Storm	500 deaths(in the Caribbean)		25,000
Flood (1975)	Flood	...	...	4,237,000
Hurricane Allen (1980)	Storm	...	7.7	5,300,000
Tropical Storm Arthur (1990)	Storm	1,000	200	3,000,000
Hurricane Lenny (1999)	storm	295		94,340,000
Hurricane Ivan (2004)	Storm	81,553	200	889,000,000
Hurricane Emily (2005)	Storm	39,085		75,478,000
Severe Drought (2009-2010)	Drought	100,000		
Flood (2011)	Flood/Landslide	60		3,904,000
August 1 st , 2018	Flood			

Source: van Westen, 2016, IMF, EM-DAT, CHARIM

Chart 4.1: Damages by Major Hurricanes

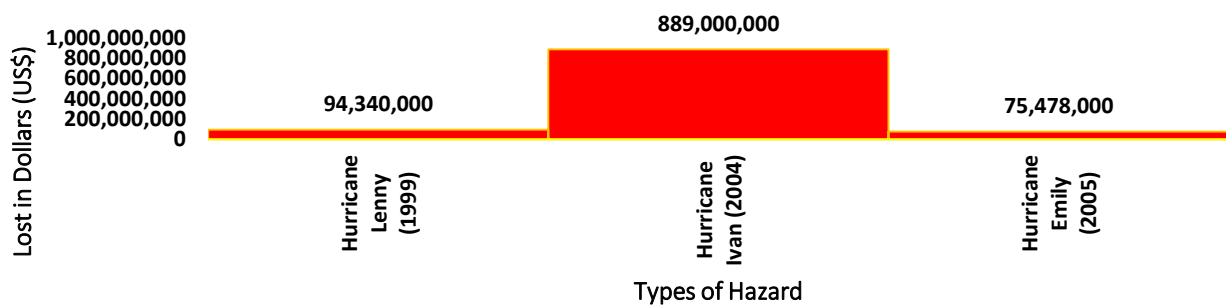
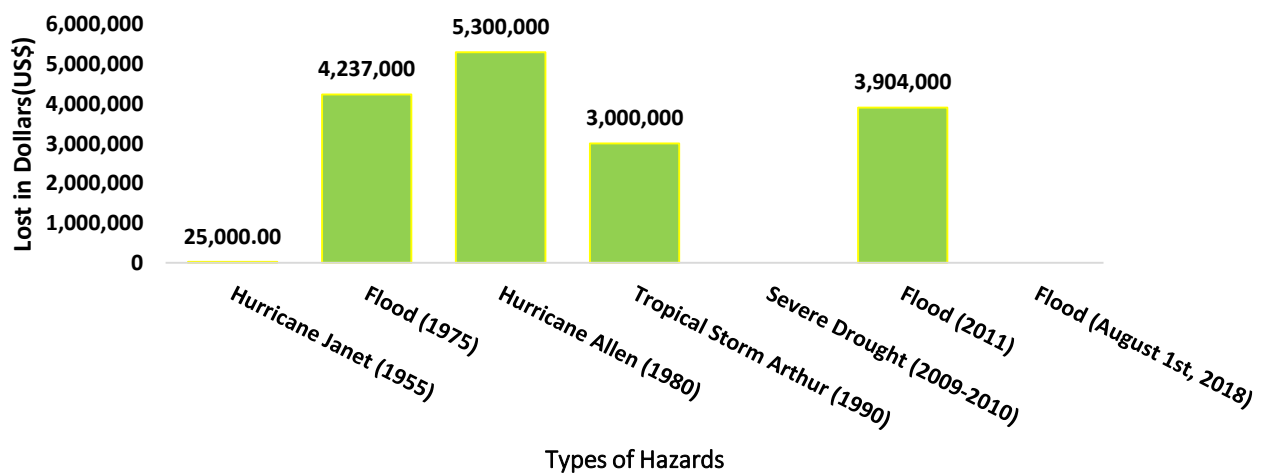


Chart 4.2: Damages Other Natural Hazards



WEATHER

The weather in Grenada is dominated by rainfall and hot sunshine. Sunshine dominates the majority of the weather conditions. The climate is considered to be tropical which is basically hot and humid.

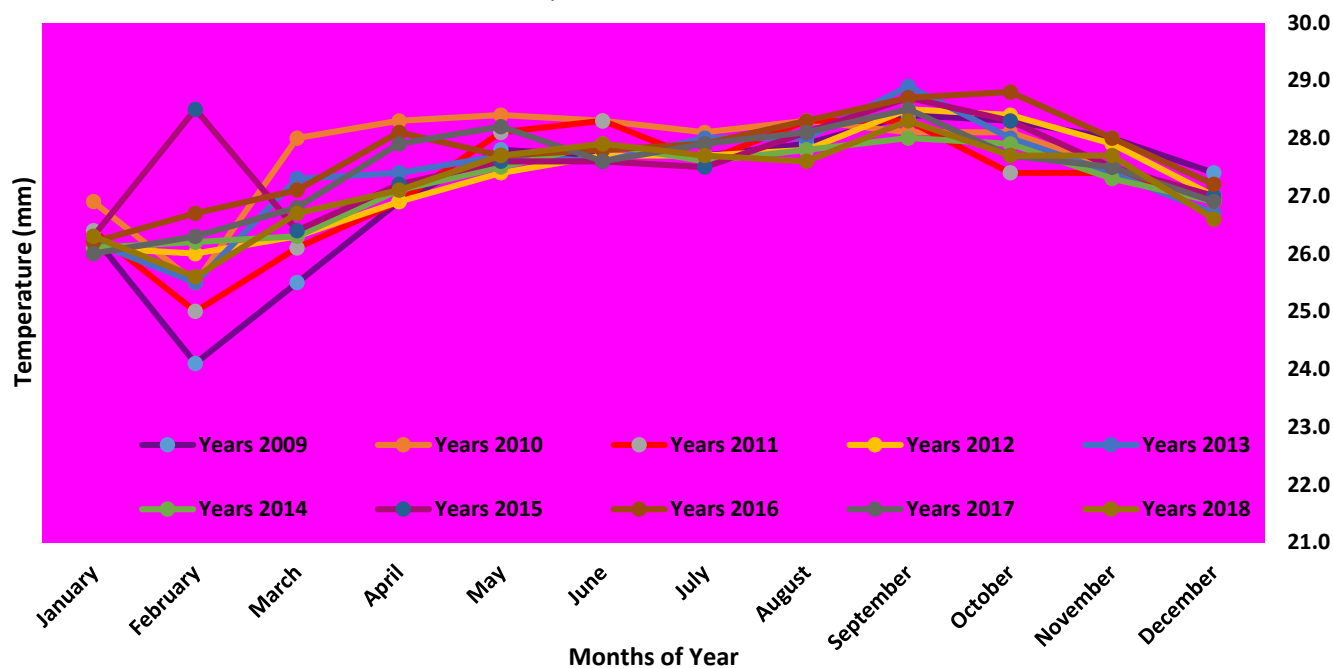
The rain fall patterns fluctuate from year to year and even from month to month.

However, of late there have been serious changes to these seasonal patterns and many have attributed this to climate change.

Table 4.2: Monthly Rainfall in millimeters, 2009 - 2018

Total rainfall in millimeters	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January	144.3	11.4	91.3	126.5	71.9	87.6	122.2	24.1	52.3	105.5
February	55.1	0.8	136.4	52.2	23.3	61.7	23.4	3.9	28.2	82.6
March	18.5	9.7	41.9	82.2	3.6	33.3	37.4	12.8	22.4	58.3
April	12.2	18.1	86.6	88.8	71.3	11.0	5.9	39.7	1.2	31.8
May	7.0	141.1	28.7	171.2	85.1	9.1	28.0	126.4	58.5	18.8
June	86.4	141.7	110.2	50.4	120.6	62.1	98.6	113.8	256.4	49.6
July	120.7	111.1	154.3	109.0	48.0	92.9	110.1	202.6	110.3	86.1
August	121.7	165.0	99.9	158.4	61.1	142.7	94.7	115.3	172.1	217.8
September	81.1	276.1	229.0	79.4	78.1	193.5	86.4	85.9	143.3	75.3
October	53.1	168.6	158.7	52.2	136.6	196.0	162.9	57.1	204.5	197.7
November	65.6	215.4	122.8	71.1	60.1	213.3	281.9	135.9	147.1	126.1
December	24.9	69.4	52.4	179.4	167.4	40.1	139.5	187.2	89.4	67.3
Average	65.9	110.7	109.4	101.7	77.3	95.3	99.3	92.1	107.1	93.1

Chart 4.3: Monthly Rainfall in millimeters, 2009 - 2018



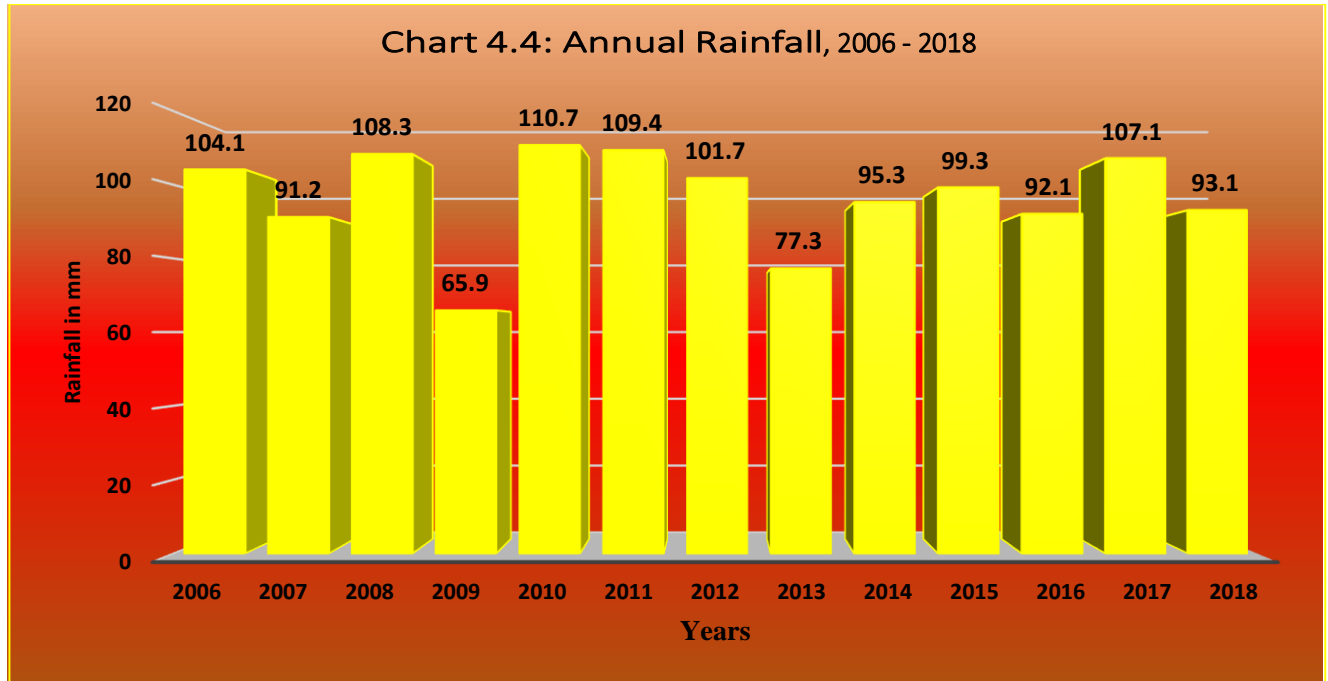
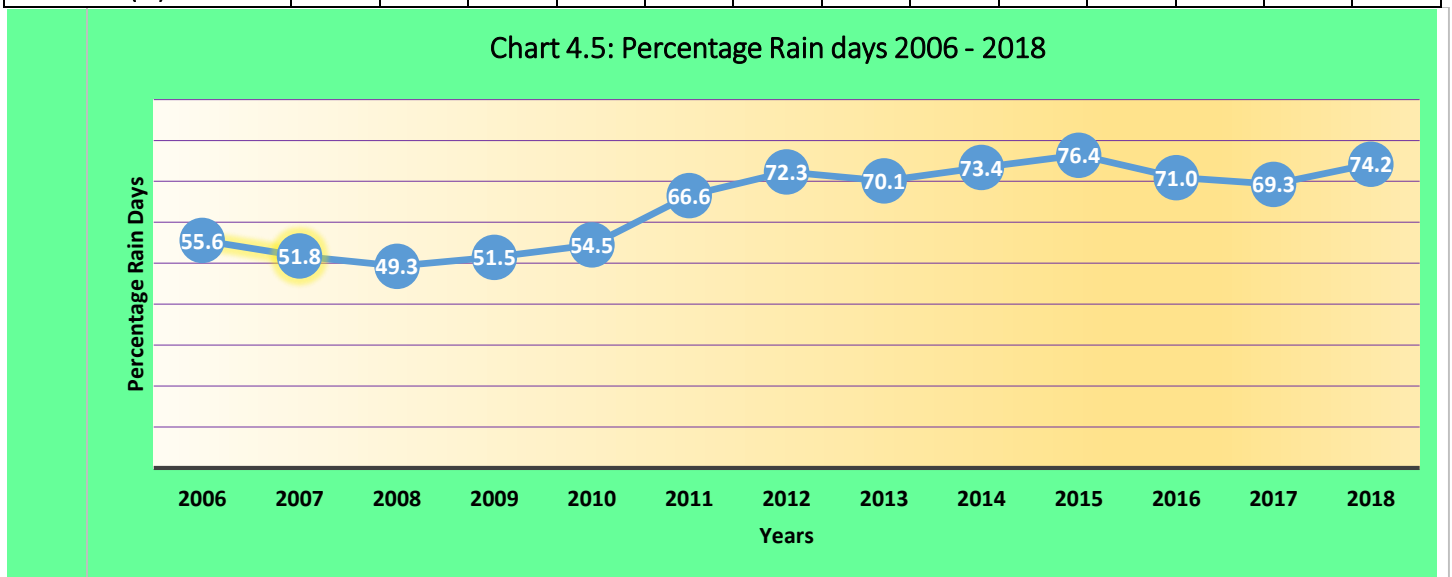


Table 4.3: Total Rain Days, 2006 - 2018

Years	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rain Days	203	189	180	188	199	243	264	256	268	279	259	253	271
Percentage Rain days (%)	55.6	51.8	49.3	51.5	54.5	66.6	72.3	70.1	73.4	76.4	71.0	69.3	74.2



Temperature

The average daily temperature in Grenada lends itself to be considered a tropical climate. The minimum of 21°C in January and maximum of 34° in October. Night time temperatures can fall to as low as 18°C inland in January and February. August and September are considered to warmest and most humid months of the year. December is considered to be the best month to visit Grenada with its cool daily temperature and low rainfall patterns.

Table 4.4: Average Monthly Temperatures, 2009 - 2018

Average Temperatures	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January	26.3	26.9	26.4	26.1	26.2	26.1	26.3	26.2	26.0	26.3
February	24.1	25.5	25.0	26.0	25.5	26.2	28.5	26.7	26.3	25.6
March	25.5	27.1	26.1	26.3	27.3	26.3	26.4	27.1	26.8	26.7
April	26.9	28.3	26.9	26.9	27.4	27.1	27.2	28.1	27.9	27.1
May	27.8	28.4	28.1	27.4	27.7	27.5	27.6	27.7	28.2	27.7
June	27.7	28.3	28.3	27.7	27.6	27.9	27.6	27.8	27.6	27.9
July	27.7	28.1	27.6	27.7	28.0	27.6	27.5	27.9	27.9	27.7
August	27.9	28.3	28.3	27.8	28.0	27.8	28.1	28.3	28.1	27.6
September	28.4	28.1	28.3	28.5	28.9	28.0	28.7	28.7	28.5	28.3
October	28.3	28.1	27.4	28.4	28.0	27.9	28.3	28.8	27.7	27.7
November	28.0	27.5	27.4	27.9	27.4	27.3	27.5	28.0	27.5	27.7
December	27.4	26.9	26.9	27.0	26.7	26.9	27.0	27.2	26.9	26.6
Average	27.2	27.7	27.2	27.3	27.4	27.2	27.6	27.7	27.5	27.2

Source: MBIA, Meteorological Office

Chart 4.6: Average Monthly Temperature, 2009 - 2018

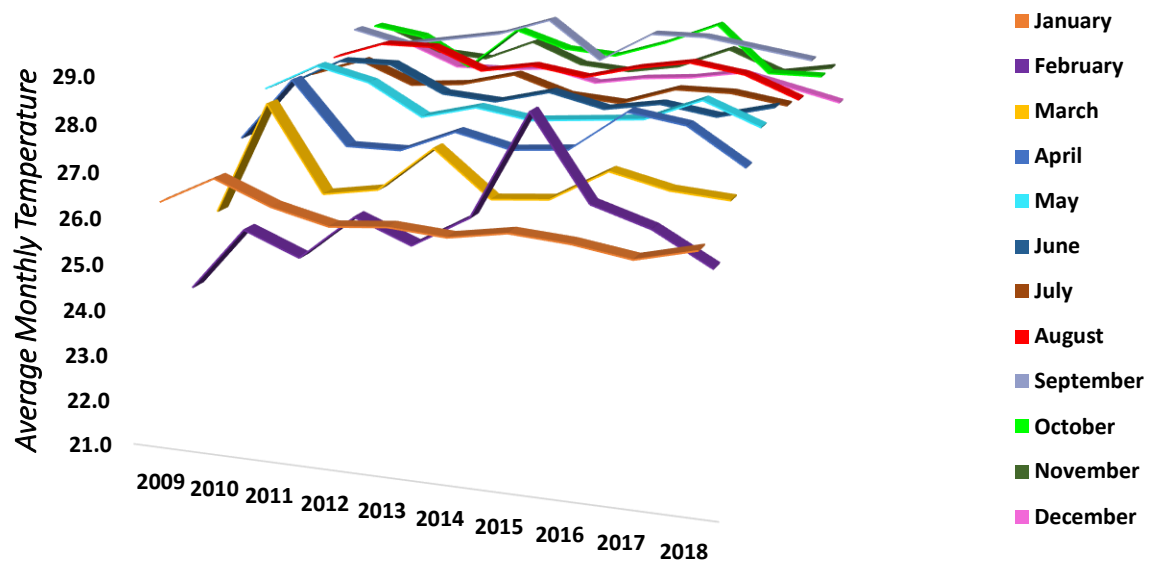


Table 4.5: Monthly Maximum/Minimum/Average Temperatures, 2009 - 2012

Maximum & minimum temperatures (°C) as recorded at Point Salines, St. George's		2009		2010		2011		2012	
		Highest Max & Lowest Min	Average	Highest Max & Lowest Min	Average	Highest Max & Lowest Min	Average	Highest Max & Lowest Min	Average
January	Max	30.4	29.3	31.3	30.1	30.5	29.6	30.5	29.5
	Min	21.8	23.2	22.2	24.0	21.4	23.0	20.7	22.8
	Mean		26.3		27.1		26.3		26.1
February	Max	29.7	29.0	31.4	29.8	30.4	29.2	31.2	29.6
	Min	21.4	22.9	23.3	24.5	21.2	22.5	20.7	22.7
	Mean		26.0		27.2		25.8		26.1
March	Max	31.3	29.5	31.9	30.4	30.5	29.5	30.2	29.4
	Min	20.5	22.4	22.9	25.4	20.4	22.6	21.3	23.3
	Mean		26.0		27.9		26.1		26.4
April	Max	31.3	30.0	32.3	31.1	31.6	29.9	31.8	30.0
	Min	21.6	24.0	23.5	25.6	22.1	23.6	22.4	24.1
	Mean		27.0		28.3		26.8		27.0
May	Max	31.3	30.1	33.1	31.1	32	30.8	30.9	30.0
	Min	23.3	25.4	22.9	25.3	22.9	25.3	22	24.4
	Mean		27.8		28.2		28.1		27.2
June	Max	31.4	30.1	31.7	30.7	32.1	31.0	31.5	30.3
	Min	22.5	24.9	23.4	25.2	22.8	25.0	21.4	24.7
	Mean		27.5		27.9		28.0		27.5
July	Max	31.4	30.3	32.3	30.9	31.3	30.3	32.1	30.6
	Min	22.1	24.6	22.7	25.0	22.8	24.4	21.9	24.5
	Mean		27.5		27.9		27.3		27.6
August	Max	32.5	30.7	32.5	31.0	32.2	31.1	32.3	30.4
	Min	21.7	24.9	23.3	24.9	23.6	24.9	22.1	24.5
	Mean		27.8		28.0		28.0		27.5
September	Max	33.1	31.1	32.7	31.3	32.3	31.2	32.6	31.5
	Min	23.4	25.6	22.3	24.6	21.7	25.1	22.6	25.1
	Mean		28.4		28.0		28.1		28.3
October	Max	32.6	31.4	32.7	31.2	32.4	30.8	32.9	31.7
	Min	23.6	24.9	22.5	24.7	22	24.1	23.4	25.2
	Mean		28.2		27.9		27.4		28.4
November	Max	32.0	30.7	31.9	30.6	31.4	30.5	33.5	31.9
	Min	23.0	25.1	22.3	24.6	22.3	24.3	23	24.5
	Mean		27.9		27.6		27.4		28.2
December	Max	31.7	30.6	30.8	30.1	31.8	30.3	32.7	31.0
	Min	21.4	24.4	22	23.6	21.6	23.4	21.5	23.5
	Mean		27.5		26.9		26.9		27.3

Source: MBIA, Meteorological Office

Table 4.6: Monthly Maximum/Minimum/Average Temperatures, 2013 - 2015

Maximum & minimum temperatures (°C) as recorded at Point Salines, St. George's		2013		2014		2015	
		Highest Max & Lowest Min	Average	Highest Max & Lowest Min	Average	Highest Max & Lowest Min	Average
January	Max	31.4	30.2	30.3	29.0	31	29.7
	Min	20.6	22.6	21.6	22.9	21.4	23.2
	Mean		26.4		26.0		26.4
February	Max	31.9	30.1	30	28.9	31.2	29.9
	Min	21.1	23.2	21	23.1	22.1	23.9
	Mean		26.7		26.0		26.9
March	Max	32.5	30.3	30.6	29.4	31.8	30.0
	Min	22.8	24.4	21.2	23.3	21.7	23.5
	Mean		27.4		26.3		26.7
April	Max	31.2	30.1	31.1	30.3	30.9	29.9
	Min	22.5	24.6	22.5	24.4	22.4	25.1
	Mean		27.3		27.3		27.5
May	Max	31.8	30.1	31.6	30.4	31.4	30.5
	Min	22.5	25.0	23	25.0	23.1	25.5
	Mean		27.5		27.7		28.0
June	Max	31.1	29.9	32.4	30.9	31.1	30.2
	Min	22.5	24.6	21.2	24.7	24.1	25.4
	Mean		27.3		27.8		27.8
July	Max	31.6	30.5	32.1	30.3	31.4	30.1
	Min	23.2	25.0	21.6	24.6	23	25.3
	Mean		27.7		27.5		27.7
August	Max	32.5	31.0	32.2	30.7	32.5	30.8
	Min	23	24.7	23.1	24.8	23.9	25.5
	Mean		27.9		27.7		28.1
September	Max	32.6	31.4	32.3	31.0	33	31.2
	Min	23.7	25.4	21.9	24.8	23.7	26.4
	Mean		28.4		27.9		28.8
October	Max	33.5	30.9	33.7	31.1	32	30.8
	Min	22.6	25.0	21.9	24.3	23	25.8
	Mean		27.9		27.7		28.3
November	Max	31.6	30.5	31.6	30.4	31.5	30.5
	Min	22.3	24.0	22.2	24.1	23	24.8
	Mean		27.2		27.2		27.6
December	Max	30.7	29.7	31.2	30.3	31	29.6
	Min	21.8	23.7	22.5	23.9	21.2	24.4
	Mean		26.7		27.1		27.0

Table 4.7: Monthly Maximum/Minimum/Average Temperatures, 2016 – 2018

Maximum & minimum temperatures (°C) as recorded at Point Salines, St. George's		2016		2017		2018	
		Highest Max & Lowest Min	Average	Highest Max & Lowest Min	Average	Highest Max & Lowest Min	Average
January	Max	30.2	29.1	30.4	29.3	30.7	29.5
	Min	20.9	23.8	20.8	23.4	22.3	23.8
	Mean		26.4		26.4		26.7
February	Max	30.8	29.6	31.6	29.7	30.3	29.3
	Min	21.5	24.5	20.9	23.4	20.9	22.9
	Mean		27.1		26.6		26.1
March	Max	31.5	30.1	31.4	30.0	30.2	29.4
	Min	21.9	24.7	22.6	24.2	21.5	24.4
	Mean		27.4		27.1		26.9
April	Max	31.7	30.6	31.7	30.6	30.8	30.0
	Min	24.4	26.2	24.7	25.9	23.5	24.9
	Mean		28.4		28.3		27.5
May	Max	31	30.0	32.2	31.1	31.3	30.5
	Min	22.1	25.3	23.7	26.0	24	25.6
	Mean		27.7		28.5		28.1
June	Max	31.5	30.2	32	30.3	32.3	31.0
	Min	23.8	25.5	23	25.2	24.4	25.8
	Mean		27.9		27.8		28.4
July	Max	31.5	30.5	31.7	30.6	31.8	30.9
	Min	23.4	25.2	23.4	25.4	24	25.8
	Mean		27.9		28.0		28.3
August	Max	32.3	30.8	32.1	30.9	31.2	30.3
	Min	22.5	25.1	23	25.3	22.9	25.2
	Mean		28.0		28.1		27.8
September	Max	32.6	31.6	33.2	31.0	32.4	31.1
	Min	23.8	25.8	22.7	25.7	24	25.9
	Mean		28.7		28.5		28.6
October	Max	32.3	31.4	32.3	30.5	32	30.6
	Min	24.6	26.2	22.8	25.0	23.3	25.2
	Mean		28.8		27.7		27.9
November	Max	32.3	30.8	31.2	30.2	31.6	30.8
	Min	22.9	25.6	23.4	24.8	23	25.0
	Mean		28.2		27.5		27.9
December	Max	31.6	30.3	31.2	30.2	30.6	29.7
	Min	22.4	24.6	22.1	24.3	22.4	23.9
	Mean		27.5		27.2		26.8

Source: MBIA, Meteorological Office

Humidity

Humidity is defined as the amount of water vapour in the atmosphere. It is a climate variable and is affected by the proximity of the location to bodies of water, rain fall, temperature and winds. High humidity can make the body hotter than it is. The reason is because the human body uses evaporative cooling to regulate temperature. Under humid conditions, the rate at which perspiration evaporates from the skin is lower than it would be under arid conditions.

Table 4.8: Average Annual Humidity, 2006 - 2018

Years	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Average Annual Humidity	80	79	80	81	82	83	82	81	81	82	83	83	80

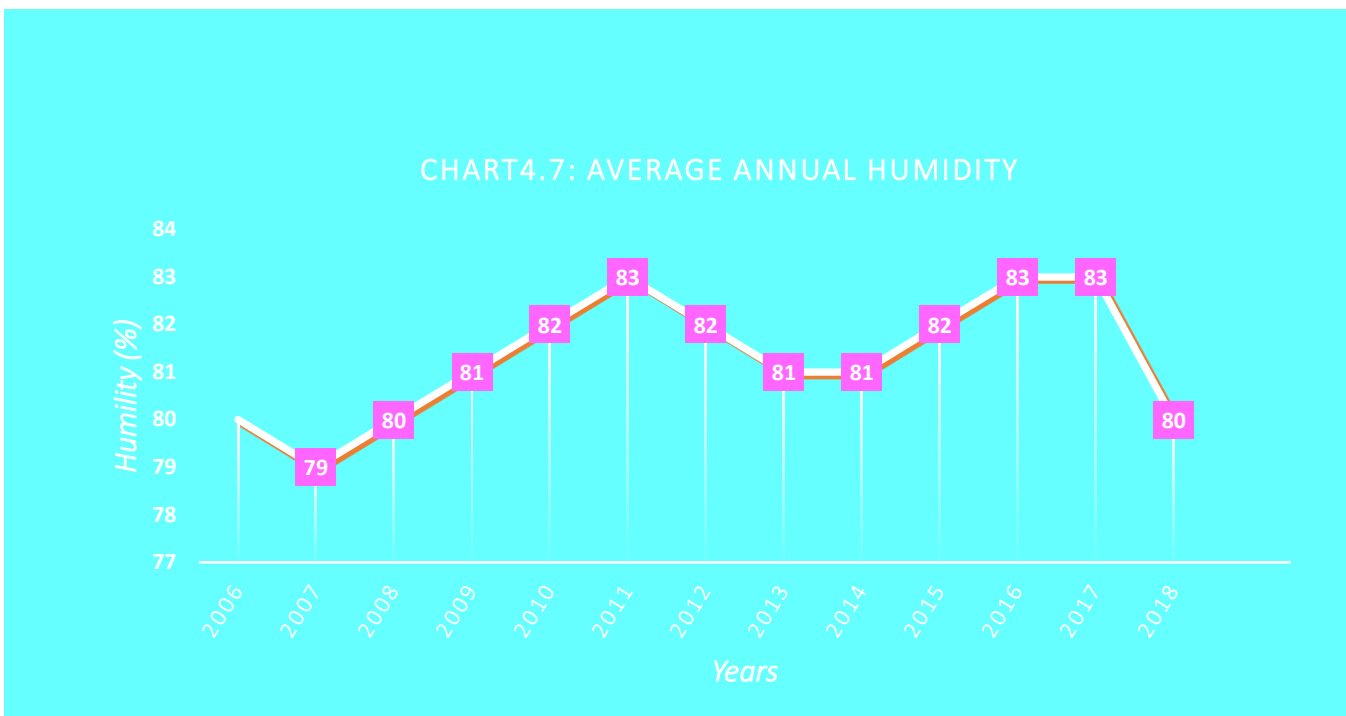


Figure 4.2: Rainbow indicating water vapour in the atmosphere



CHAPTER 5: ENERGY AND TRANSPORT

Energy in Grenada for both commercial and residential activities is produced from the processing of fossil fuels. Electricity is manufactured by the country's lone electricity producing entity although there is in recent times an attempt to produce solar energy. This type of energy source is still on a very small scale. However, there is a trend towards the use of other sources of renewable energy. Despite this, the number of households using electricity as their main source of energy has grown steady as seen in the graph.

Electricity

Figure 5.1: Electricity Transmission Lines



Table 5.1: Production and Consumption of Electricity, 2006 - 2018

Category	Electricity Production in Thousands of KWH	Electricity Consumption in Thousands of KWH
2006	173,490.3	151,007.6
2007	185,569.2	165,225.1
2008	195,957.2	172,500.6
2009	202,992.2	177,328.8
2010	208,728.4	184,783.7
2011	203,973.9	180,913.7
2012	199,703.9	178,431.7
2013	196,655.6	175,810.0
2014	199,908.9	179,161.8
2015	205,961.0	184,038.6
2016	217,634.1	196,228.8
2017	221,741.2	198,909.2
2018	229,266.20	208,070.49

Source: Grenada Electricity Company Limited

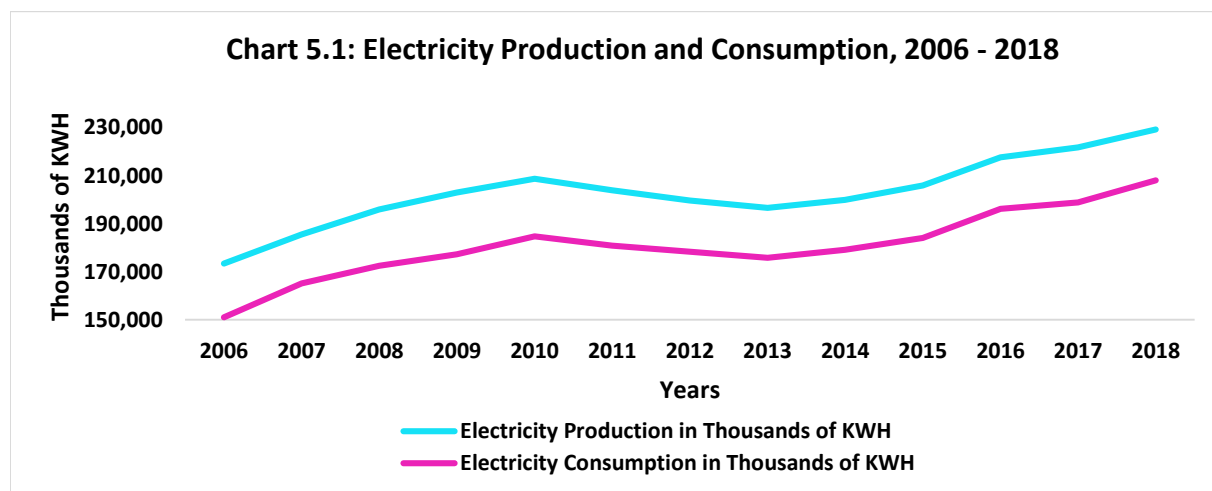
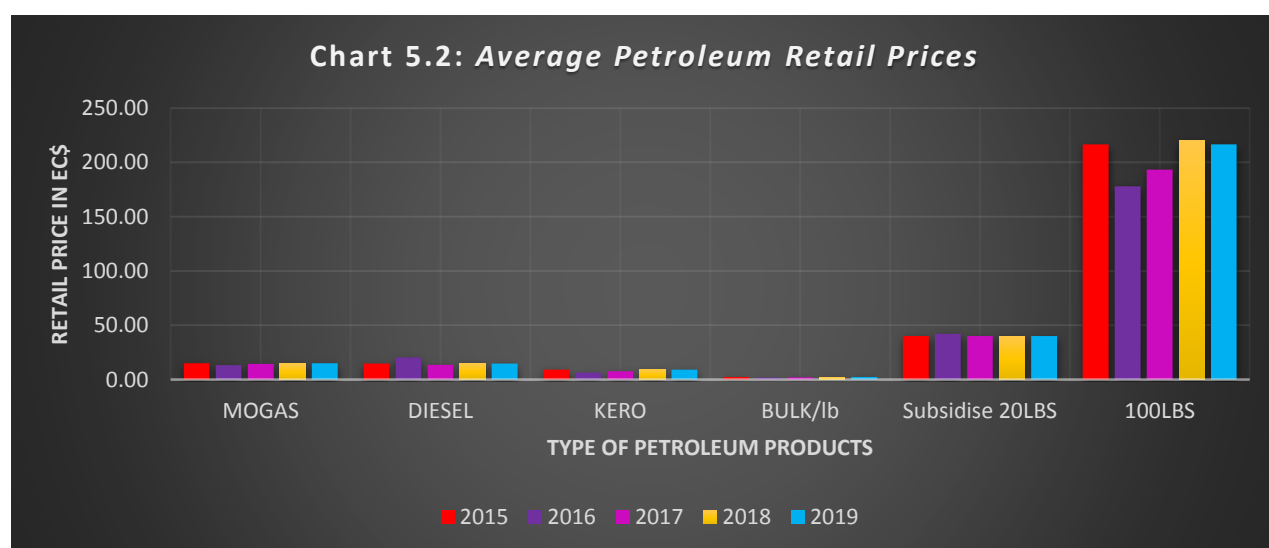


Table 5.2: Average Petroleum Products Retail Prices (EC\$/IG), 2015 - 2019

YEAR	MOGAS	DIESEL	KERO	BULK/lb	Subsidise 20LBS	100LBS
2015	14.99	14.65	9.13	2.25	40.00	216.55
2016	13.31	20.43	6.54	1.84	42.00	178.11
2017	14.42	13.42	7.66	2.01	40.00	193.35
2018	14.71	14.90	9.40	2.28	40.00	220.09
2019	14.99	14.65	9.13	2.25	40.00	216.55

SOURCE: MEAN OF THE CARIBBEAN POSTING

Prepared by: Energy Division, Ministry of Infrastructure Development



Transportation

Table 5.3: Registration of New and Used Vehicles by Category, 2006 to 2017

Category	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cars	416	393	334	298	240	231	165	156	199	356	552	824	1,028
Buses	113	109	141	93	49	60	27	18	37	76	118	139	95
Trucks	159	113	83	34	31	21	9	19	22	37	144	57	96
Jeeps	745	736	663	551	441	453	380	446	553	756	1,172	1,550	1,634
Vans	173	154	119	107	91	44	35	38	71	97	174	273	361
Pick-Ups	100	112	117	87	74	95	69	96	94	113	150	187	138
Land Rovers	5	3	2	1	0	0	0	1	0	0	0	0	8
Ambulances	1	3	3	0	3	0	2	1	0	1	1	0	5
Motor Cycles	115	99	101	127	114	92	108	62	110	182	292	231	166
Heavy Equipment	17	20	11	9	3	10	12	7	20	3	6	18	9
Other	6	6	3	2	15	9	19	102	63	5	7	4	17
Total	1,850	1,748	1,577	1,309	1,061	1,015	826	946	1,169	1,626	2,616	3,283	3,557

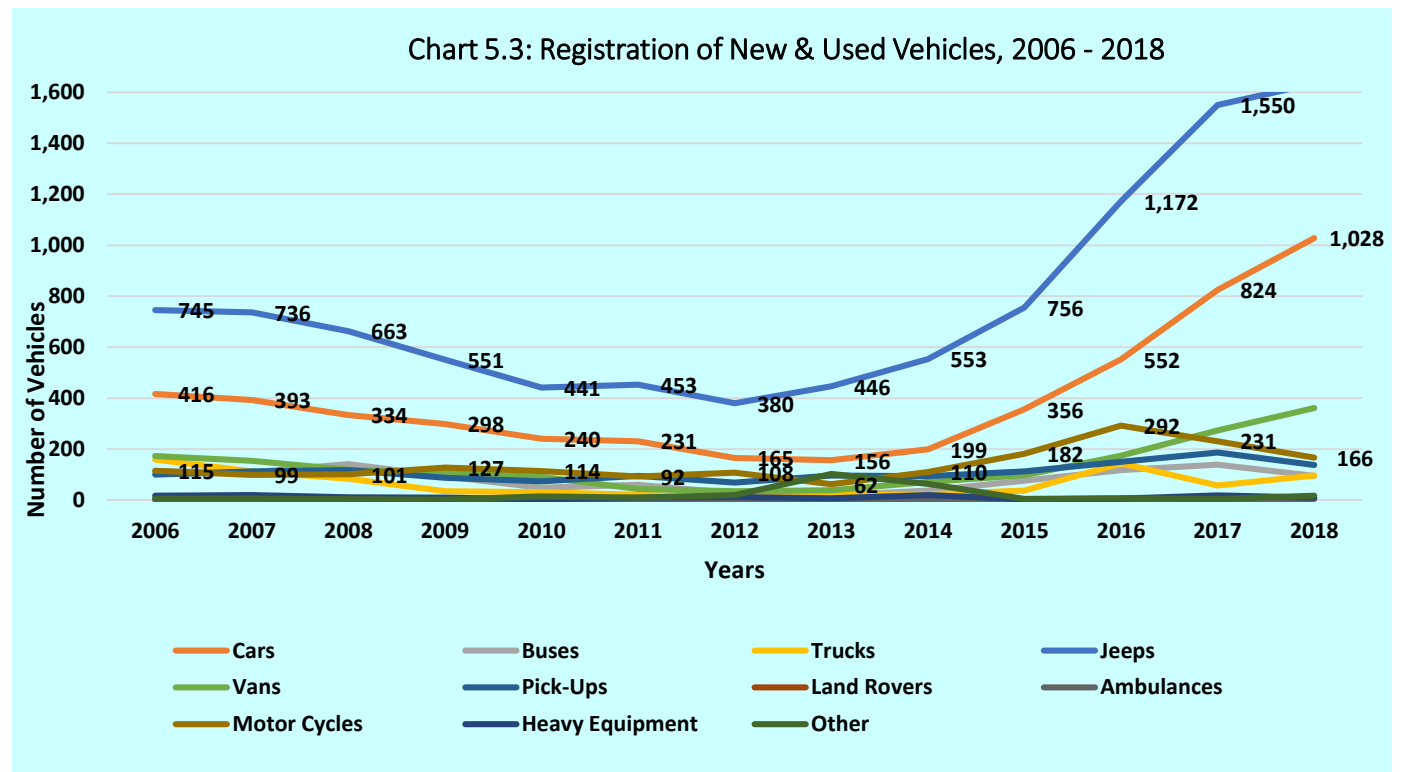
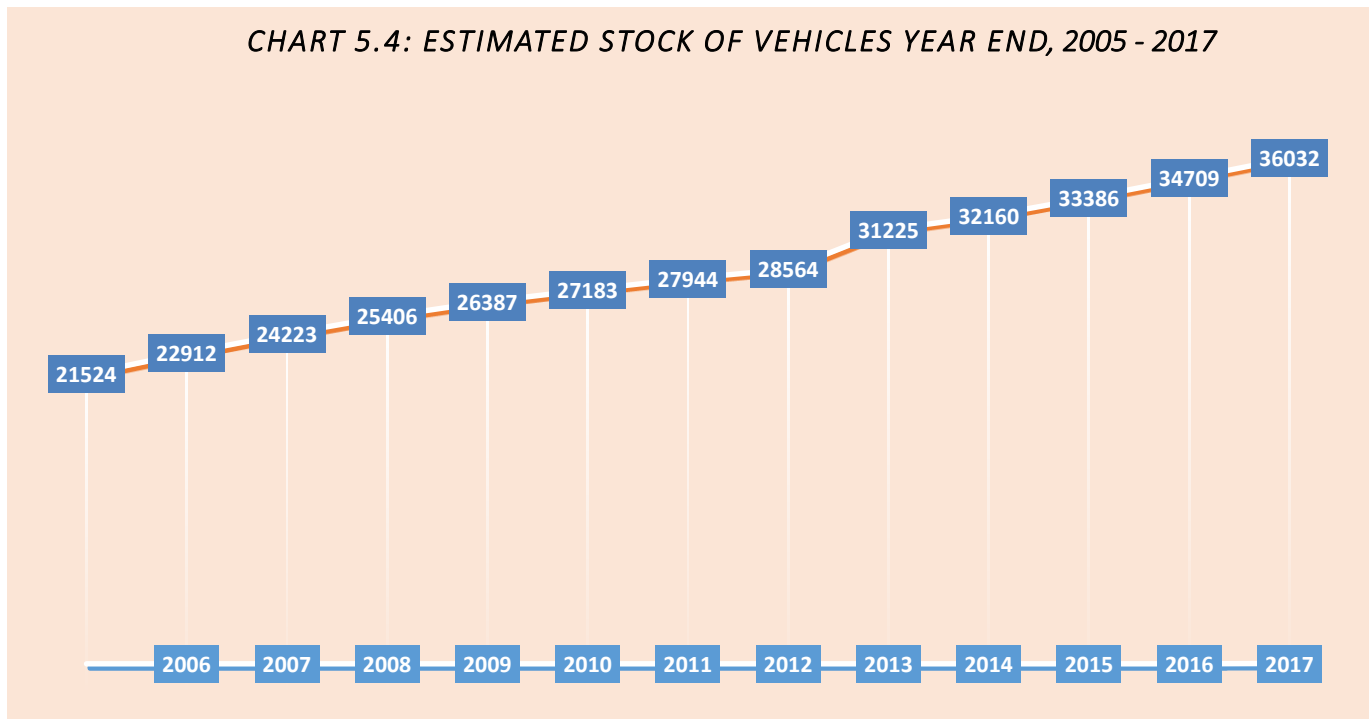


CHART 5.4: ESTIMATED STOCK OF VEHICLES YEAR END, 2005 - 2017



Source: Inland Revenue Department of the Ministry of Finance

Table 5.4: Passenger Traffic, 2007 - 2018

Visitor Arrival Method by:	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Air (Includes Students)	130,100	130,363	113,914	110,471	113,947	112,307	112,812	133,521	140,735	144,333	155,170	170,341
Sea (yacht)	5,353	5,288	16,962	21,153	18,860	20,060	22,163	24,650	22,115	20,220	21,911	25,406
Cruise Ship	270,323	292,712	342,852	333,291	309,564	242,454	197,309	235,140	280,518	314,913	299,449	342,826
Same Day/excursionist	5,491	2,405	2,829	2,448	1,571	2,341	1,729	1,660	1,579	3,270	1,063	555
Total	411,224	430,806	464,081	467,363	443,942	377,162	334,013	394,971	444,947	482,736	477,593	539,128

Source: Grenada Tourism Authority

CHART 5.5: Mode of Transportation of Visitors, 2007 - 2018

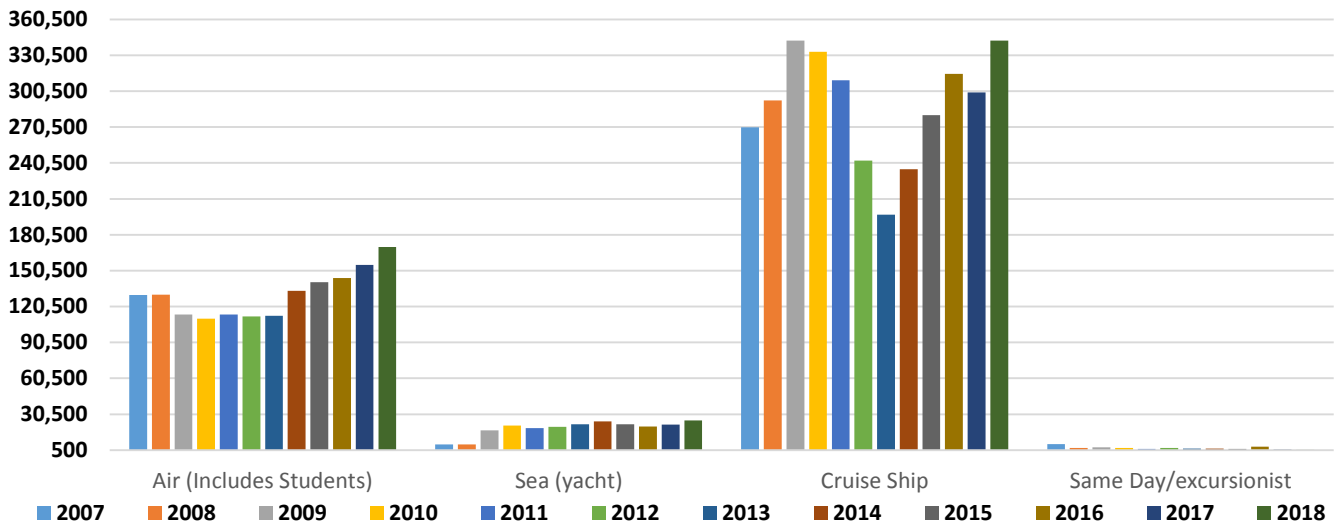


Figure 5.2: Airline bringing visitors to Grenada

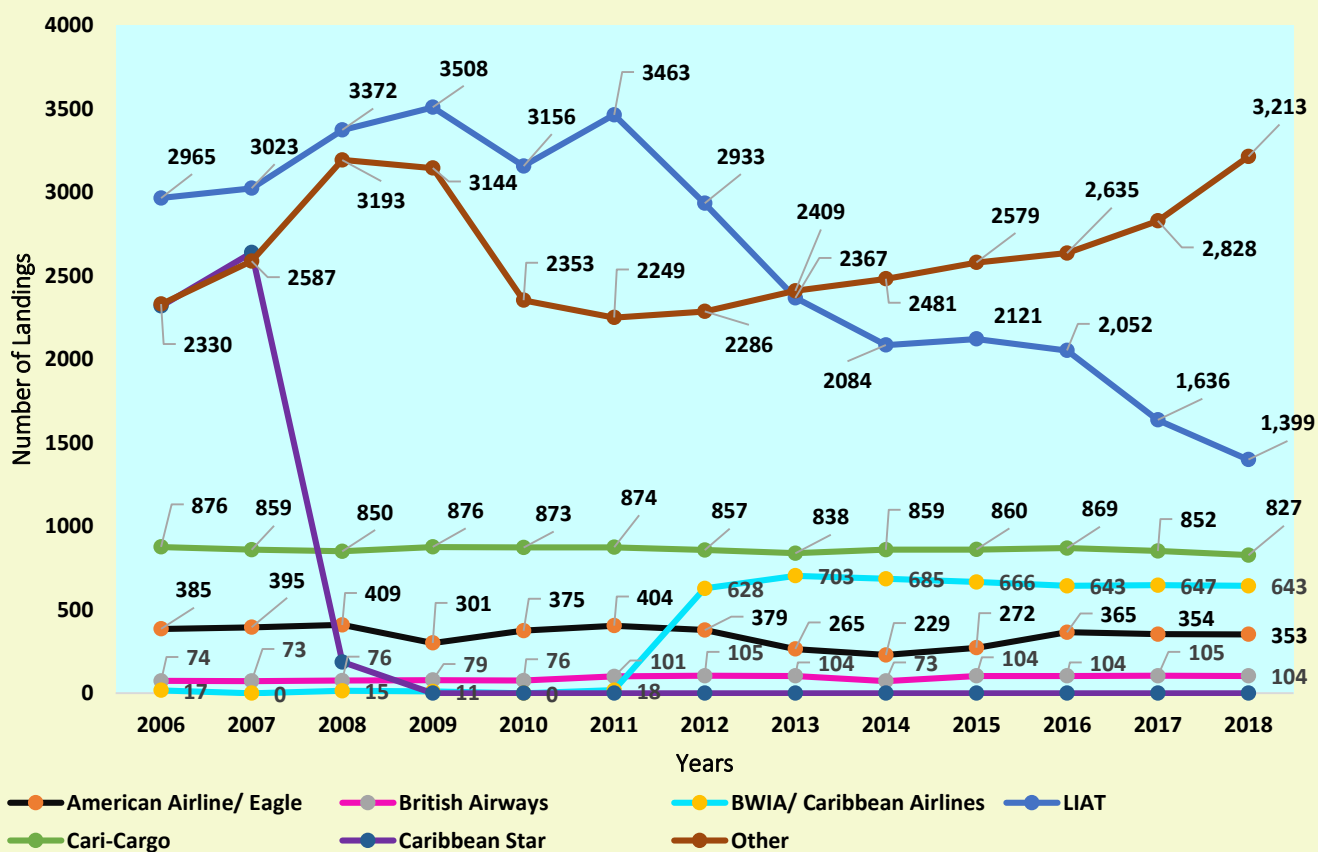


Environmentally, aircraft landings can mean more toxic emissions in our atmosphere. There is a cost associated with the destruction of our atmosphere by emissions from aircrafts. From a tourism perspective more landings mean more revenue for the country albeit from fuel purchased or landing fees paid.

Table 5.5: Number of Aircraft Landings, 2006 – 2018

Airline	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
American Airline/ Eagle	395	409	301	375	404	379	265	229	272	365	354	353	361
British Airways	73	76	79	76	101	105	104	73	104	104	105	104	104
BWIA/ Caribbean Airlines	0	15	11	0	18	628	703	685	666	643	647	643	599
LIAT	3,023	3,372	3,508	3,156	3,463	2,933	2,367	2,084	2,121	2,052	1,636	1,399	1,747
Cari-Cargo	859	850	876	873	874	857	838	859	860	869	852	827	845
Caribbean Star	2,638	187	0	0	0	0	0	0	0	0	0	0	0
Other	2,587	3,193	3,144	2,353	2,249	2,286	2,409	2,481	2,579	2,635	2,828	3,213	3,112

Chart 5.6: Number of Aircraft Landings by Type of Airlines, 2006 - 2018



CHAPTER 6: AGRICULTURE

Agriculture is one of the major sources of income for the economy and many Grenadians earn a living directly and indirectly from this industry. It is a well-known fact that the Grenadian economy depends on the foreign exchange revenue earned from the export of cocoa, nutmeg and other spices such as cinnamon and cloves.

Nutmeg was brought to Grenada in 1843.

The crop is of great importance to the island and in fact has a privileged place on the Grenadian flag. The nutmeg is known as “Grenada’s Black Gold” given its numerous uses.

In the years after the devastation of Hurricanes Ivan and Emily, Grenada’s nutmeg industry experienced significant decline.

In June 2019, Grenadian nutmeg also received US Food and Drug Administration (FDA) approval, allowing it to exploit untapped opportunities within the United States export market. Grenada is set to become a more significant producer and exporter in the years to come. Its impressive yields make it the most spice-dense country in the world and its superior quality place it in high demand, enabling it to attract premium prices.

The cocoa trees were first introduced to the island in 1714. By the 1760s, Grenada was the largest producer and exporter of cocoa, responsible for about 50 percent of British West Indian cocoa exports. In 1772, Grenada exported 343,400 pounds of cocoa.

But while Grenada’s colonial history was filled with cocoa growing, for centuries, little of it actually found its way into chocolate.

In 1999 Mott Green, Doug Browne and Edmond Brown banded to create a cooperative for cocoa farmers around the island and created Grenada's first modern "tree to bar" integration in a factory in St. Patrick's.

It later became the Grenada Chocolate Company and put Grenadian chocolate on the map, and paved the way for the internationally **award-winning** organic dark chocolate.

Today, there are four major chocolate companies on the island: the Grenada Chocolate Company, Jouway, Crayfish Bay and Belmont Estate.

In recent times, farmers rely on what is commonly called short crops such as lettuce, tomatoes, cucumbers and cabbages. These crops are sold to vendors, supermarkets and hotels.

Figure 6.1: Main Agricultural Export Crops
Cocoa



Sour sop



Nutmeg and Mace

Pesticides and Insecticides

A **pesticide** is any substance or mixture of substances intended to prevent, destroy or control any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term pesticide also includes substances intended for use as a plant growth regulator, defoliant, desiccant (agent for thinning fruit or preventing the premature fall of fruit), and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

Table 6.1: Importation of Insecticides, 2007 - 2014

Indicators	Years							
	2007	2008	2009	2010	2011	2012	2013	2014
Insecticides I ¹	0	0	0	15.4	5.8	3.3	11.7	6.2
Insecticides II ²	0	0	0	143.8	101.3	82.1	99.5	109.4
Other Insecticides	0	0	0	22.8	7.6	5.6	8.1	8.1
Insecticides III ³	6	8.4	6.7	0	0	0	0	0
Insecticides (Packaged)	52.3	154.8	168.3	0.1	0.1	0	0	0
Other Insecticides	0.8	1.7	1.5	0.2	0	0	0	0
Total (mTonnes)	59.1	165	176.5	182.4	114.8	91	119.3	123.7

Source: Trade Unit, Central Statistical Office

1- Approved by the Ministry of Agriculture; 2-Packed for Retail Sales; 3-Approved for use by the competent Authority

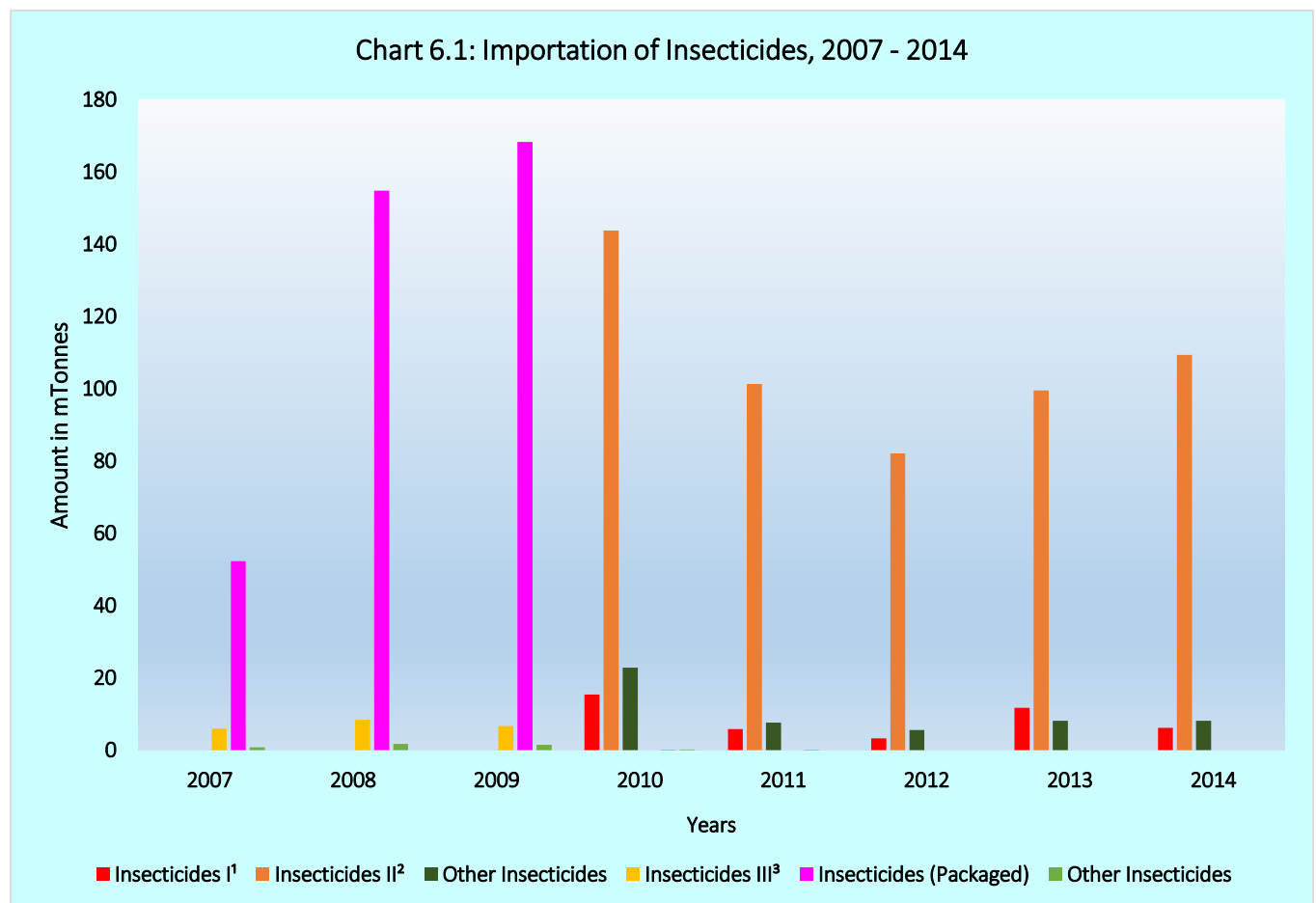


Table 6.2: Importation of Insecticides, 2015 - 2018

Please note: The classification of Insecticides changes periodically

Indicators	Years			
	2015	2016	2017	2018
For use in Agriculture, approved by competent authority	10.3	6.0	48.4	4.3
Mosquito coils	9.2	4.7	28.7	11.4
Other, in forms or packings for retail sale or as preparation or articles	11.2	2.1	26.2	14.9
Other	11.6	3.1	33.0	8.1
Total (mTonnes)	42.2	15.8	136.3	38.7

Source: Trade Unit, Central Statistical Office

Chart 6.2: Importation of Insecticides 2015 -2018

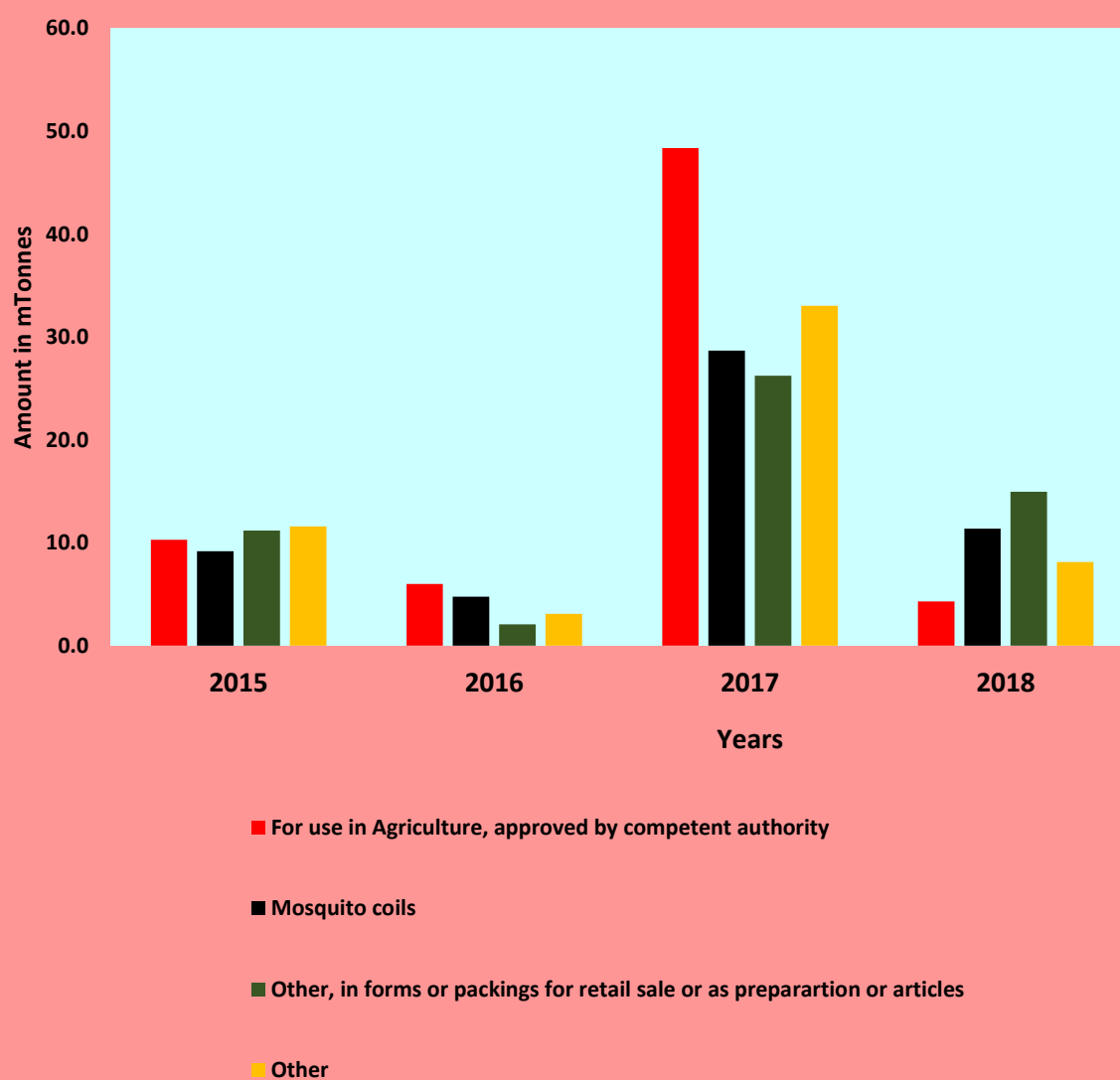


Table 6.3: Importation of Pesticides, 2007 - 2014

Indicators	2007	2008	2009	2010	2011	2012	2013	2014
Rodenticides (For Retail)	0.0	0.0	0.0	9.3	11.1	5.3	17.8	2.1
Rodenticides (As Preparation)	4.7	5.7	2.7	0.1	0.0	0.0	0.0	0.0
Other Rodenticides	2.5	8.0	8.1	0.0	0.0	0.0	0.0	0.0
Retail Rodenticides (Put in Package)	1.9	1.0	2.9	0.0	0.0	0.0	0.0	0.0
Insecticides, Rodenticides, Fungicides, Herbicides, Anti-Sprouting	1.2	1.6	1.0	0.3	0.5	0.0	0.0	0.0
Total (mTonnes)	10.4	16.3	14.7	9.7	11.6	5.3	17.8	2.1

Source: Trade Unit, Central Statistical Office

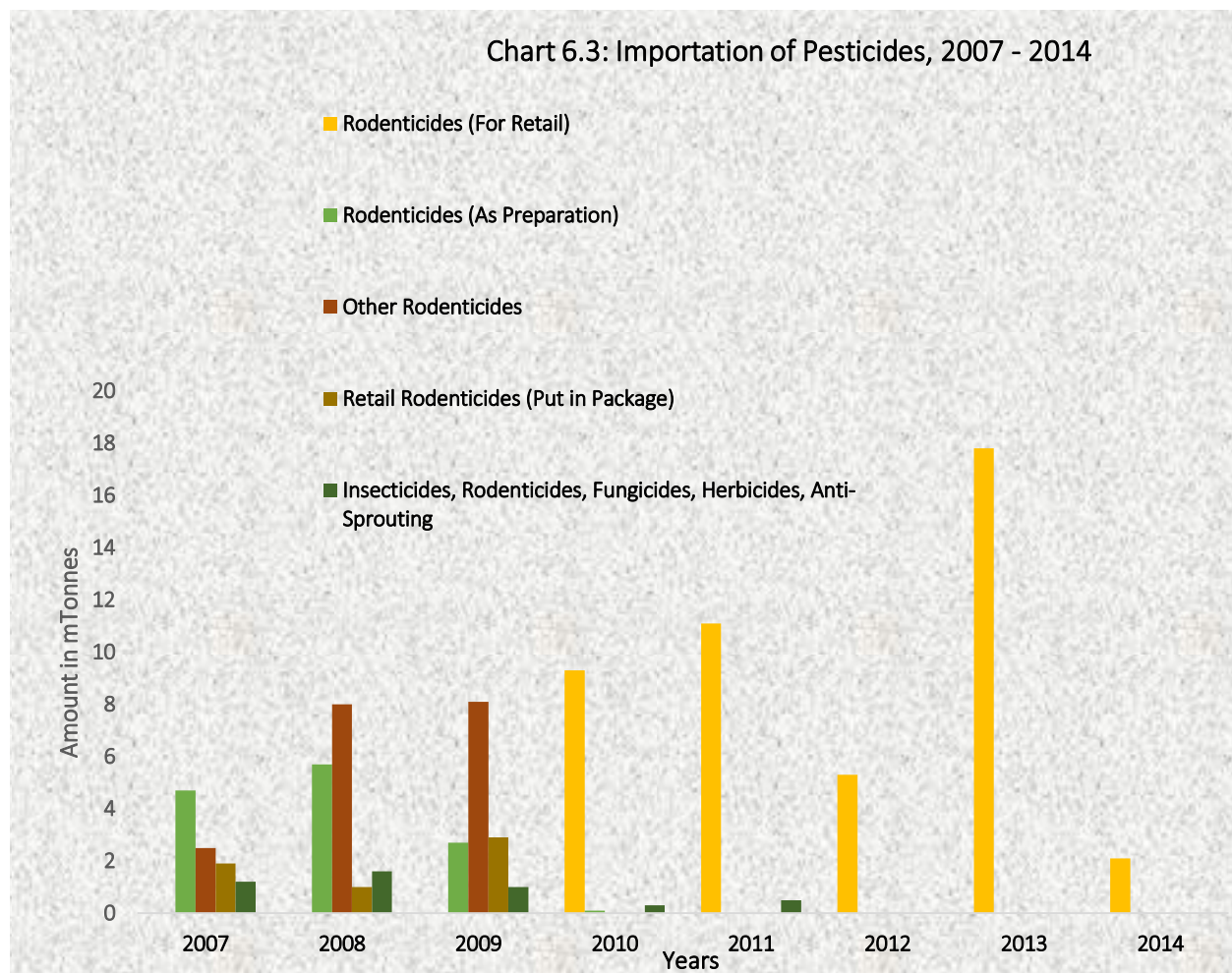
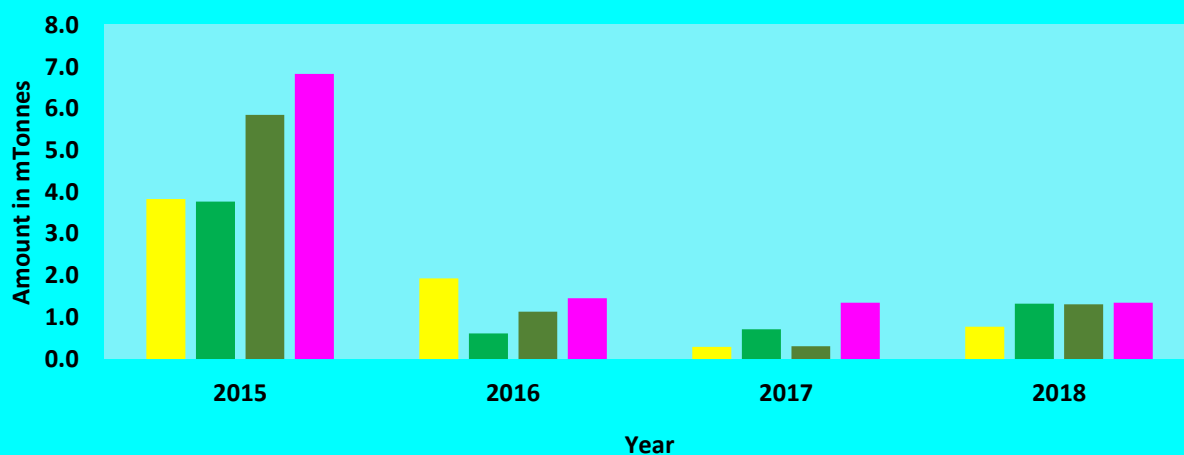


Table 6.4: Importation of Pesticides, 2015 – 2018
Please note: The classification of Pesticides changes periodically.

Indicators	Net weight			
	Year			
	2015	2016	2017	2018
Rodenticides, not put up in forms or packings for retail sale or as preparations or articles.	3.8	1.9	0.3	0.8
Other rodenticides, not elsewhere specified or included.	3.8	0.6	0.7	1.3
Other products similar to insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growing regulators and disinfectants.	5.8	1.1	0.3	1.3
Other products similar to insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growing regulators and disinfectants, not elsewhere specified or included.	6.8	1.5	1.3	1.3
Total (mTonnes)	2.5	0.7	0.3	1.6

Chart 6.4: Importation of Pesticides 2015 -2018



■ Rodenticides, not put up in forms or packings for retail sale or as preparations or articles

■ Other rodenticides, not elsewhere specified or included.

■ Other products similar to insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growing regulators and disinfectants.

■ Other products similar to insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growing regulators and disinfectants, not elsewhere specified or included.

Table 6.5: The Use of Fertilizers and Agro-Chemicals by Parish, 2012

Parish	Used Fertilizers and Agro-Chemicals					
	Chemical Fertilizers	Organic Manure	Fungicide	Herbicide	Insecticide	Other Pesticide
St. George	411	721	38	36	82	49
St. John	427	327	64	124	94	51
St. Mark	113	95	14	22	3	2
St. Patrick	484	526	67	87	93	45
St. Andrew	1,277	1,219	161	273	283	136
St. David	536	740	81	86	147	95
Carriacou & Petite Martinique	9	83	7	9	15	7
Total	3,257	3,711	432	637	717	385

Source: 2012 Agriculture census, Ministry of Agriculture, CSO Ministry of Finance and Energy

Chart 6.5: Use of Type of Fertilizers, 2012

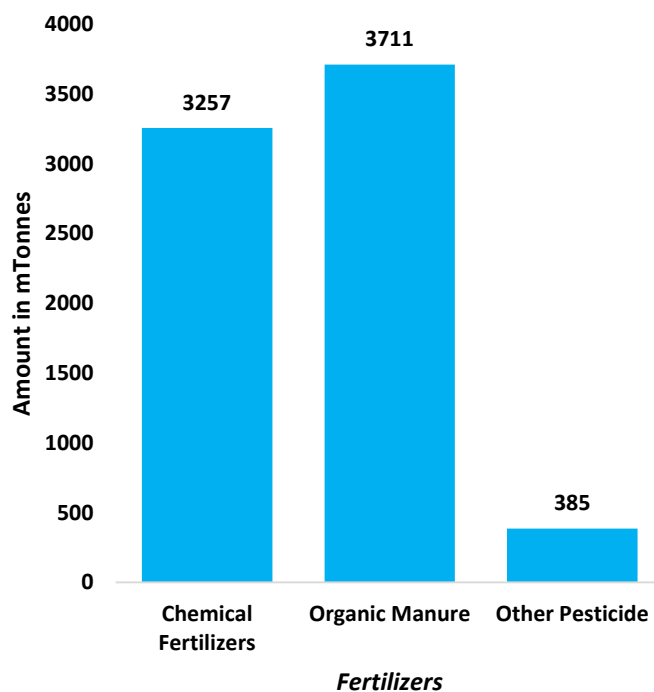


Chart 6.6: Use of Agro - Chemicals, 2012

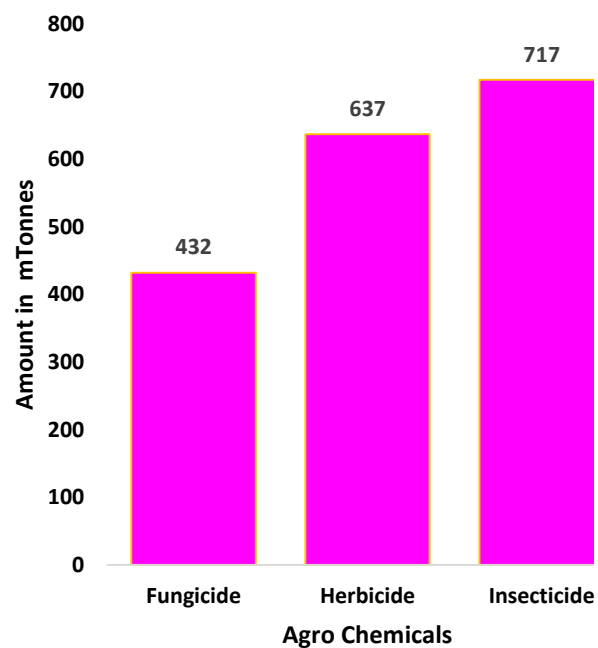
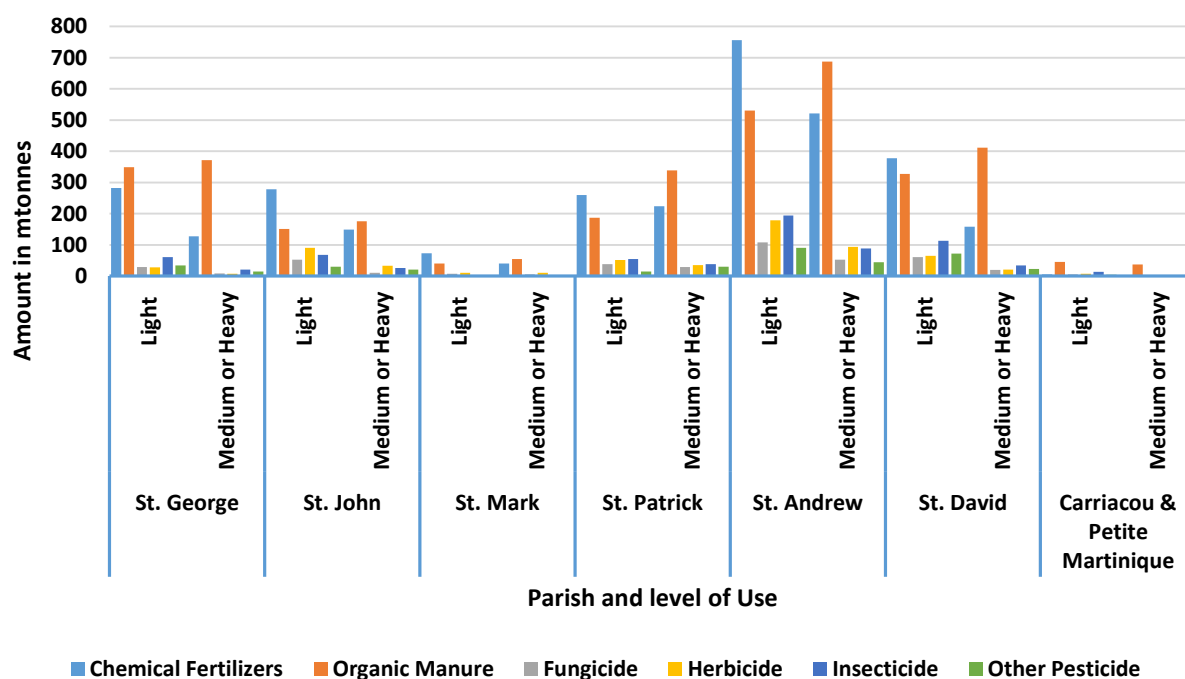


Table 6.6: Type of Chemicals by Parish, 2012

Parish	Level of Use	Types of Chemicals						Total
		Chemical Fertilizers	Organic Manure	Fungicide	Herbicide	Insecticide	Other Pesticide	
St. George	Light	283	349	29	28	61	34	784
	Medium or Heavy	128	372	9	8	21	15	553
St. John	Light	278	151	53	91	68	30	671
	Medium or Heavy	149	176	11	33	26	21	416
St. Mark	Light	73	40	8	11	3	2	137
	Medium or Heavy	40	55	6	11	0	0	112
St. Patrick	Light	260	187	38	52	55	15	607
	Medium or Heavy	224	339	29	35	38	30	695
St. Andrew	Light	756	531	108	179	194	91	1,859
	Medium or Heavy	521	688	53	94	89	45	1,490
St. David	Light	378	328	61	65	113	72	1,017
	Medium or Heavy	158	412	20	21	34	23	668
Carriacou & P. M	Light	6	46	6	8	14	5	85
	Medium or Heavy	3	37	1	1	1	2	45
Total	Light	2,034	1,632	201	434	508	249	5,058
	Medium or Heavy	1,223	2,079	122	203	209	136	3,972

Source: 2012 Agriculture census, Ministry of Agriculture, CSO Ministry of Finance and Energy

Chart 6.7: Use of Type of Chemicals by Level and Types by Parish

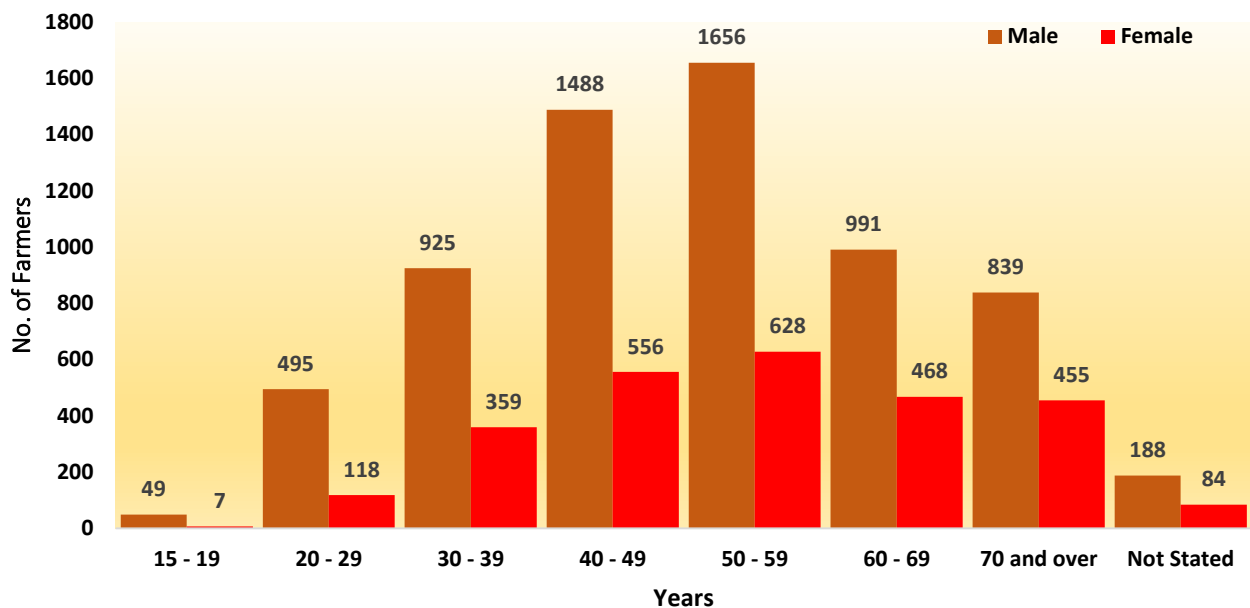


The Age of Farmers

The parish of St Andrew has the highest number of farmers, just over 3000 farmers, followed by the parish of St. George but with 43% fewer farmers than St. Andrew. Males, at over 70% of total farmer population, continue to dominate agricultural production.

The reported median age of male farmers has increased from 48 years in 1995 to 51 years in 2012 whilst that of the females has dropped by just 1 year, from 54 to 53 years between 1995 and 2012.

Chart 6.8: Age Range of Farmers by Sex



Source: 2012 Agriculture census, Ministry of Agriculture, CSO Ministry of Finance and Energy

Chart 6.9: SEX OF FARMER IN 1995

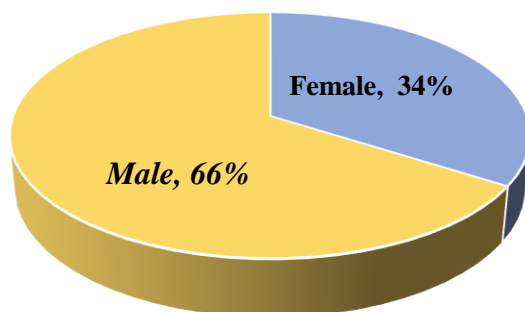


Chart 6.10: SEX OF FARMER IN 2012

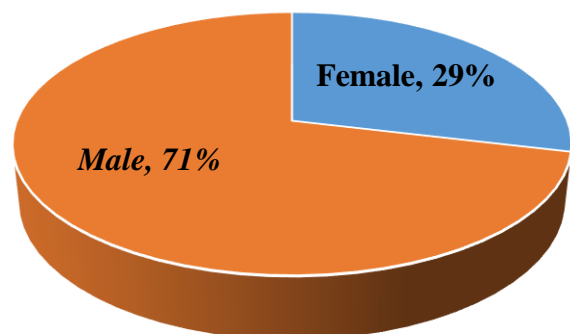
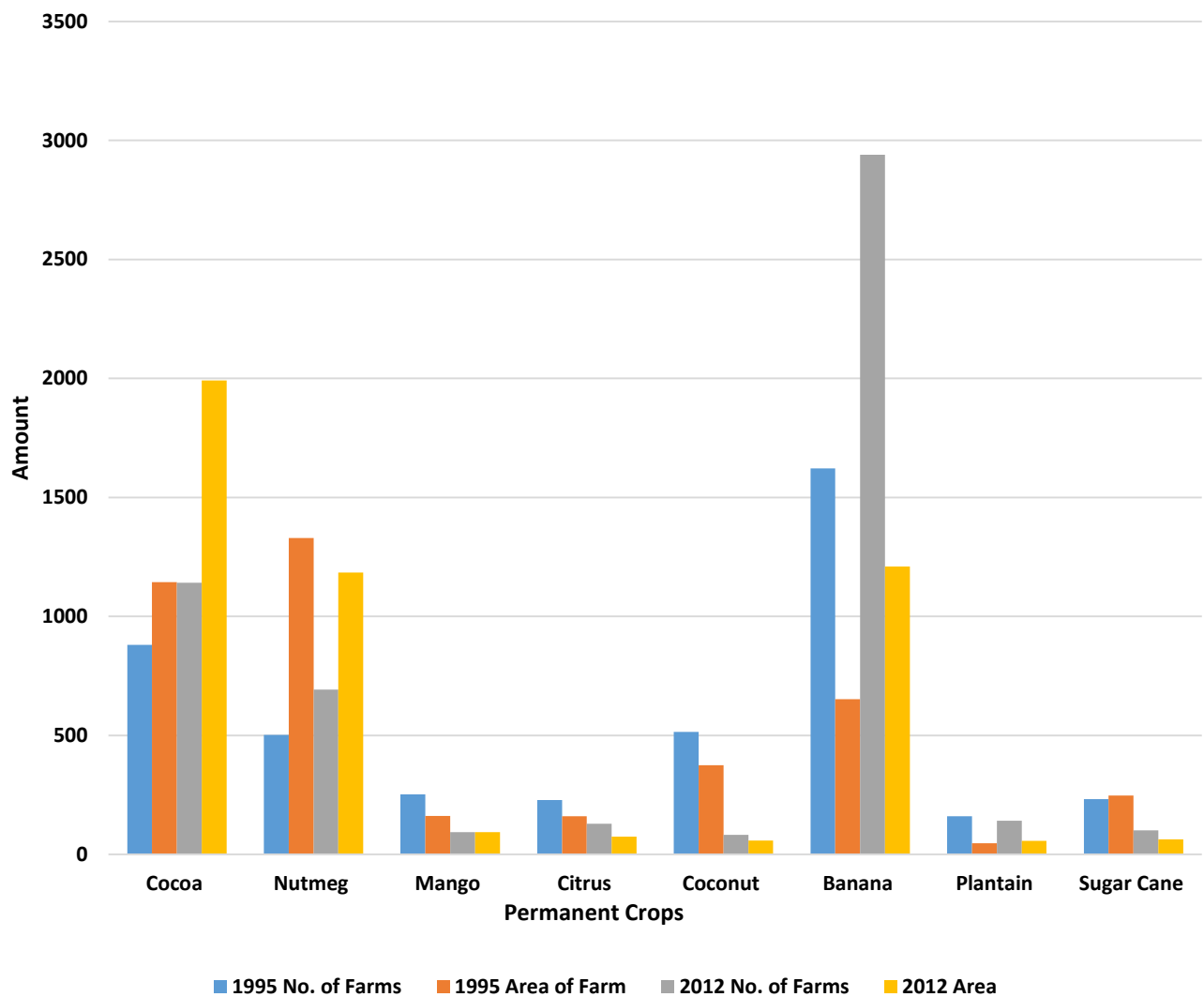


Table 6.7: Number and Area of Farms Growing Permanent Crops in Pure Stand

Crops Grown	1995		2012	
	No. of Farms	Area (acres)	No. of Farms	Area (acres)
Cocoa	880	1,144	1,142	1,992
Nutmeg	502	1,330	693	1,184
Mango	253	162	94	94
Citrus	228	160	129	75
Coconut	515	375	82	58
Banana	1,622	652	2,940	1,210
Plantain	160	47	141	57
Sugar Cane	232	248	101	63
Total	4,392	4,118	5,322	4,733

Chart 6.11: Number and Area of Farms Growing Permanent Crops

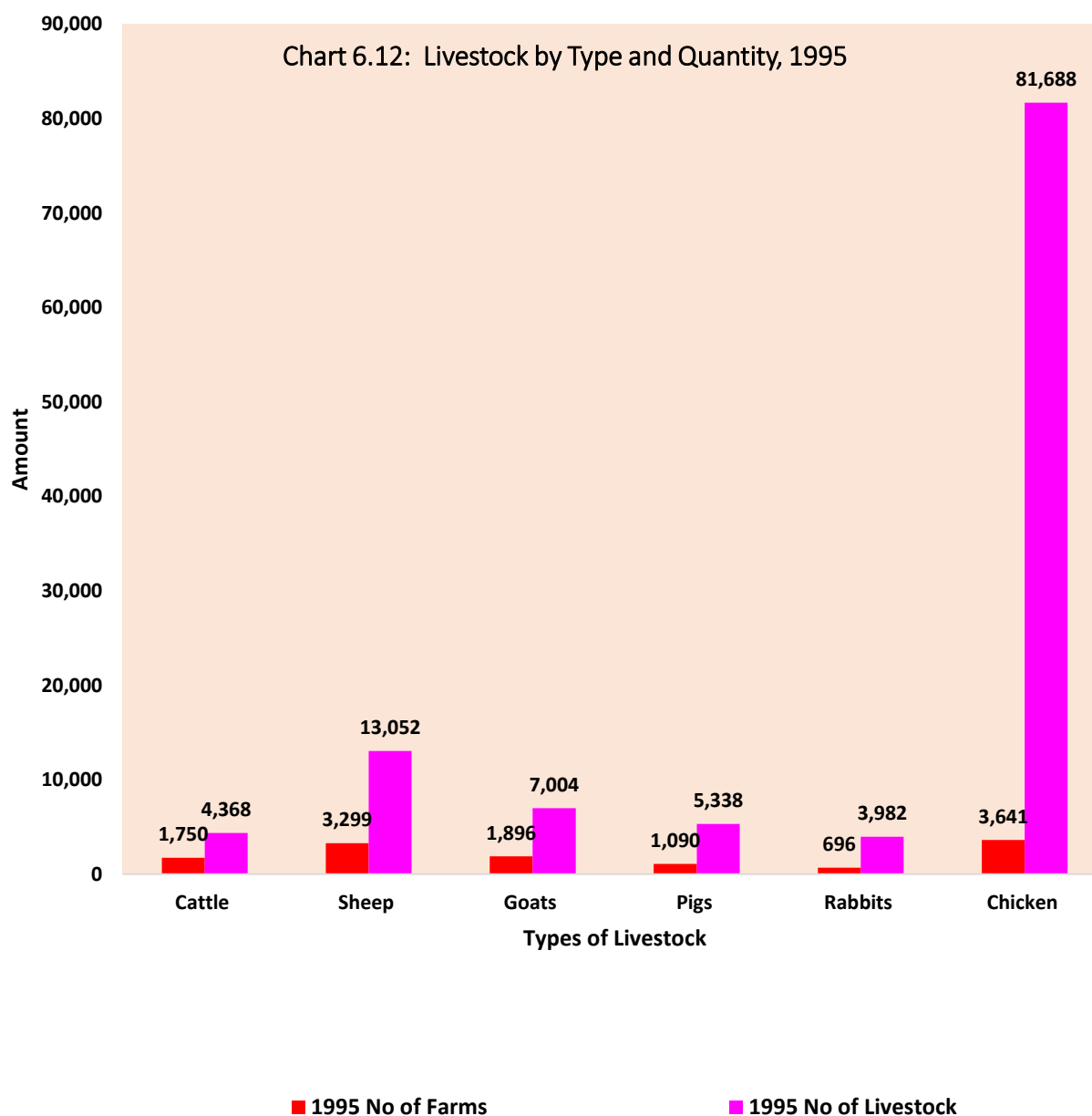


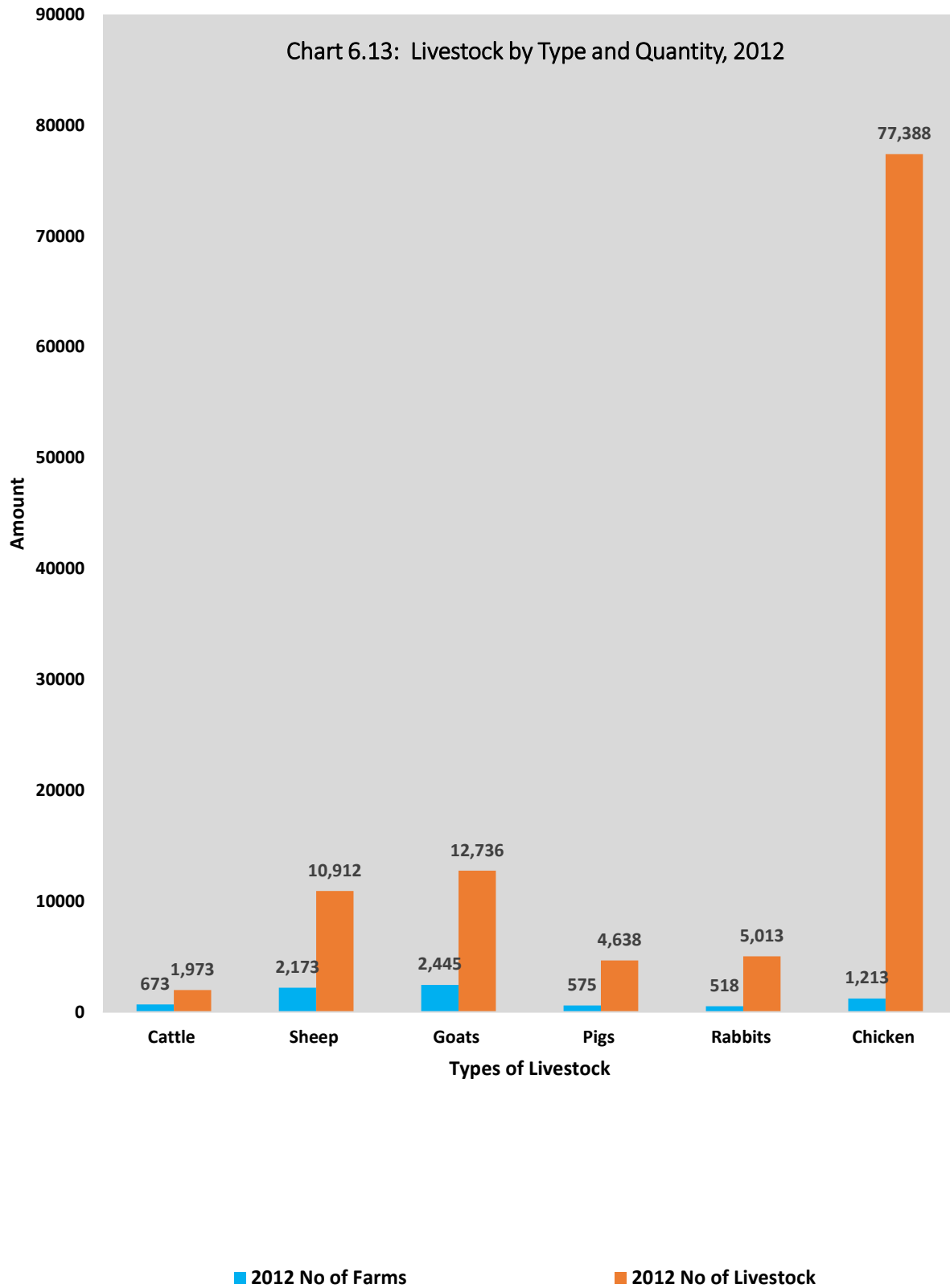
Source: 2012 Agriculture census, Ministry of Agriculture, CSO Ministry of Finance and Energy

Table 6.8: Farms Reporting Livestock by Type and Quantity

Livestock	1995		2012	
	No of Farms	No. of Livestock	No of Farms	No. of Livestock
Cattle	1,750	4,368	673	1,973
Sheep	3,299	13,052	2,173	10,912
Goats	1,896	7,004	2,445	12,736
Pigs	1,090	5,338	575	4,638
Rabbits	696	3,982	518	5,013
Chicken	3,641	81,688	1,213	77,388

Source: 2012 Agriculture census, Ministry of Agriculture, CSO Ministry of Finance and Energy





CHAPTER 7: COASTAL AND MARINE RESOURCES

Marine Protected Areas (MPAs)

Marine Protected Areas or MPAs are areas designated by legislature as important to the continuity of life and the specifics found on this planet.

The following areas were designated marine protected areas:

- Woburn/Clarks Court Bay Marine Protected Area
- Moliniere/Beausejour Marine Protected Area
- Unspecified Crown lands at Pearls
- Sandy Island/Oyster Bay

Table 7.1: Representation of Marine Protected Environments in Protected Area based on data in 2009

Environment	Sea grass	Intertidal reef flat	Rocky shore	White Sand Beach	Shelf structure	Mangroves	Reef flat	Fore reef	Leather back nesting site	Hawksbill nesting site	Black sand beach	Lagoonal habitat	Shallow terrace	Shoal
Percentage	10	5	4	2	2	1	1	1	0	0	0	0	0	0

Chart 7.1: Percentage Marine Protected Environments

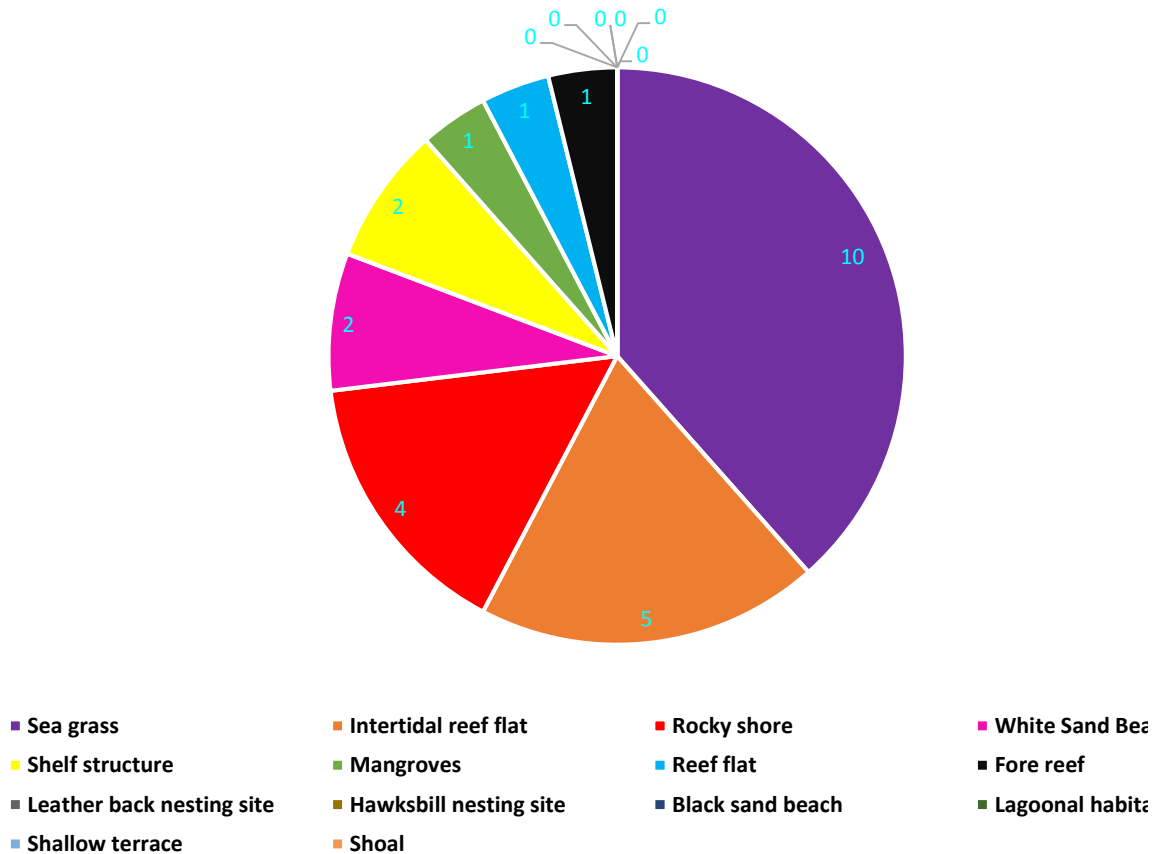


Figure 7.1: Marine Protected Area-Underwater Museum, Moliniere, St. George's



Figure7.2: Underwater sculptures, Moliniere, St. Georges



Fish Landings

Fishing plays a significant part in the economy of Grenada. In Carriacou and Petit Martinique, its contribution to their economy is even more significant. Boat building is a traditional and economic mainstay in these islands which also lends itself to fishing as a means of earning a living and recreating as well. But most importantly, the economic value of fishing has been growing significantly as catches are sold to international buyers in the United States of America and Europe. Local fish is transported via air to international cities such as New York and Miami where locally caught yellow fin tuna are sold to restaurants and hotels. A significant amount of fish is also consumed in the domestic market as it is considered a healthier dietary choice.

Contribution of Fish Value

Table 7.2: The Value Amount (Thousands of dollars, \$EC) of Fish Landed, 2006 – 2018

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Value (EC\$)	26,239	26,089	31,172	29,175	31,714	30,158	35,649	38,636	38,534	38,010	40,151	41,527	41,724

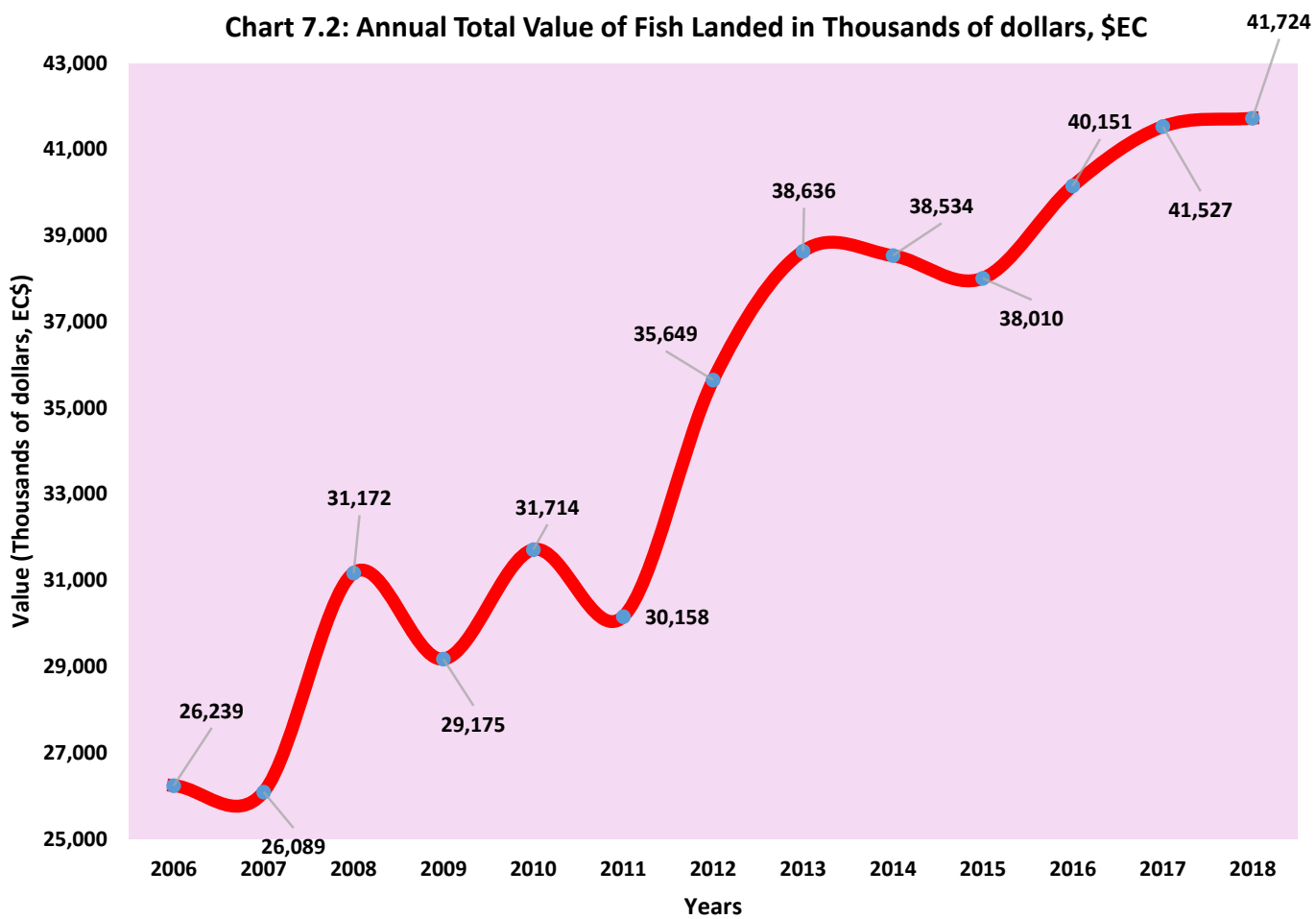


Table 7. 3: Quantity of Fish Landed in Metric Tonnes , 2006 - 2018

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Quantity (mTonnes)	2,165	2,165	2,386	2,352	2,450	2,184	2,266	2,698	2,845	2,711	2,822	2,852	2,922

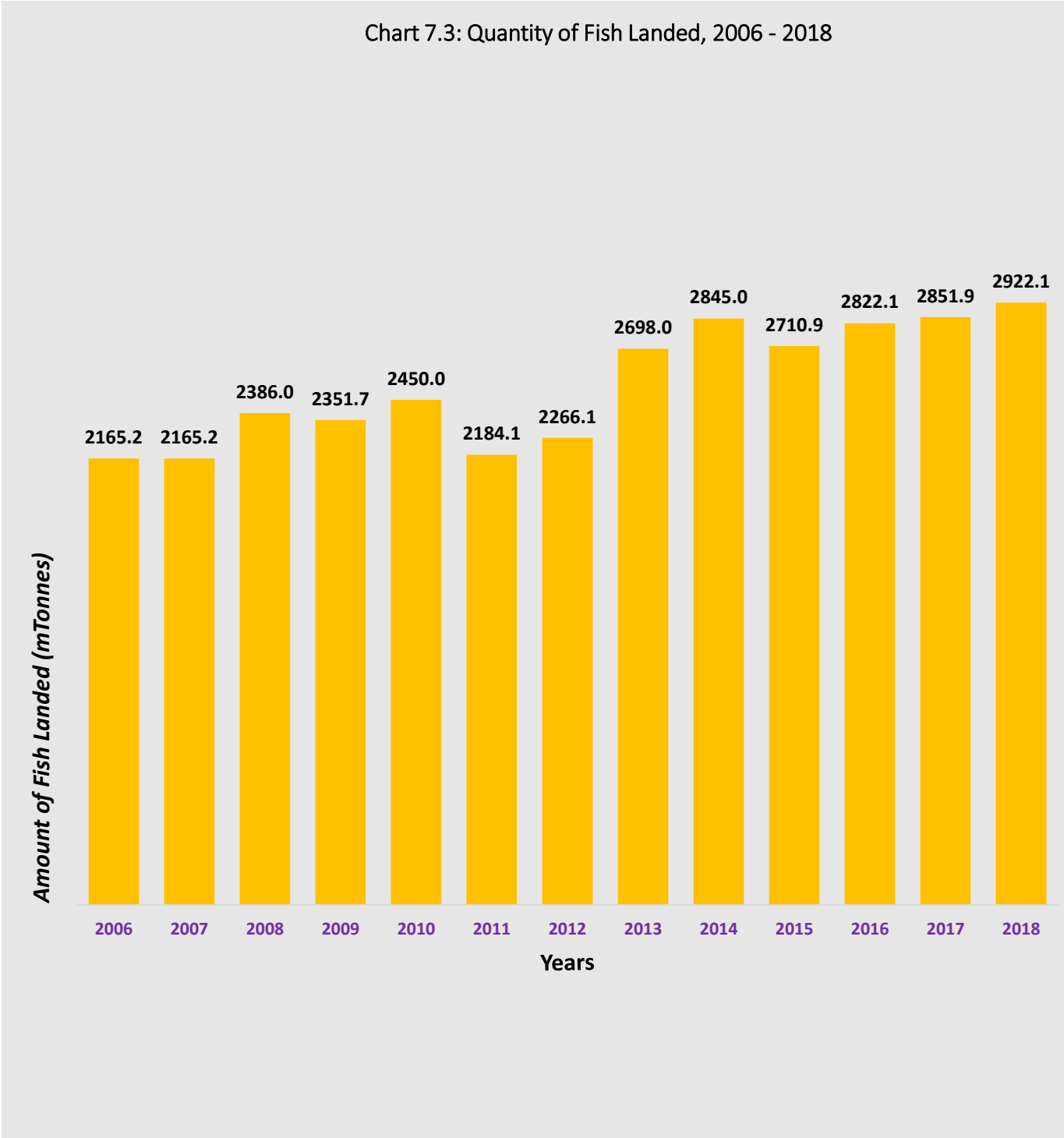


Table 7.4: Quantity of Pelagic Species of Fish Landed in Metric Tonnes, 2006 - 2016

PELAGIC SPECIES	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Great barracuda	118.0	90.6	151.1	157.3	155.6	175.3	186.2	246.8	196.8	239.0	249.6
Common dolphin fish	295.2	450.5	321.8	430.1	290.7	376.8	394.1	326.5	245.7	418.3	269.9
Pompano dolphin fish	0.4	5.3	0.0	0.0	0.3	2.9	10.5	0.0	0.0	0.7	1.4
Black jack	...	...	...	...	...	...	...	...	...	...	...
Spanish mackerel	0.5	0.7	0.2	1.8	1.4	2.4	1.7	0.7	1.4	1.3	1.4
Cero/Spanish mackerel	2.1	1.6	1.2	2.6	0.6	0.8	1.3	0.8	0.4	0.2	0.1
King mackerel	13.7	7.3	9.4	5.2	11.2	54.9	42.4	43.2	27.2	29.1	8.9
Atlantic bonito	20.7	15.0	15.0	12.4	9.9	4.8	9.4	8.1	10.1	3.0	3.9
Bluefin tuna	...	...	...	...	...	...	...	...	...	...	...
Southern sennet	...	0.1	...	...	0.6	...	...	...	...	...	...
Wahoo	129.6	140.4	124.6	176.5	134.2	121.2	131.0	79.6	88.9	81.0	79.0
Yellow fin tuna	1,107.3	1,395.8	1,666.2	1,388.8	2,107.6	1,737.9	1,829.2	2,900.7	3,060.4	2,572.8	3,543.3
Northern Bluefin tuna	...	...	...	0.5	...	...	...	...	...	0.4	...
SUBTOTAL	1,687.5	2,107.2	2,289.4	2,175.1	2,712.2	2,477.0	2,605.9	3,606.4	3,630.8	3,345.9	4,157.6

Chart 7.4: Quantity of PELAGIC SPECIES of Fish Landed in Metric Tonnes, 2006 - 2016

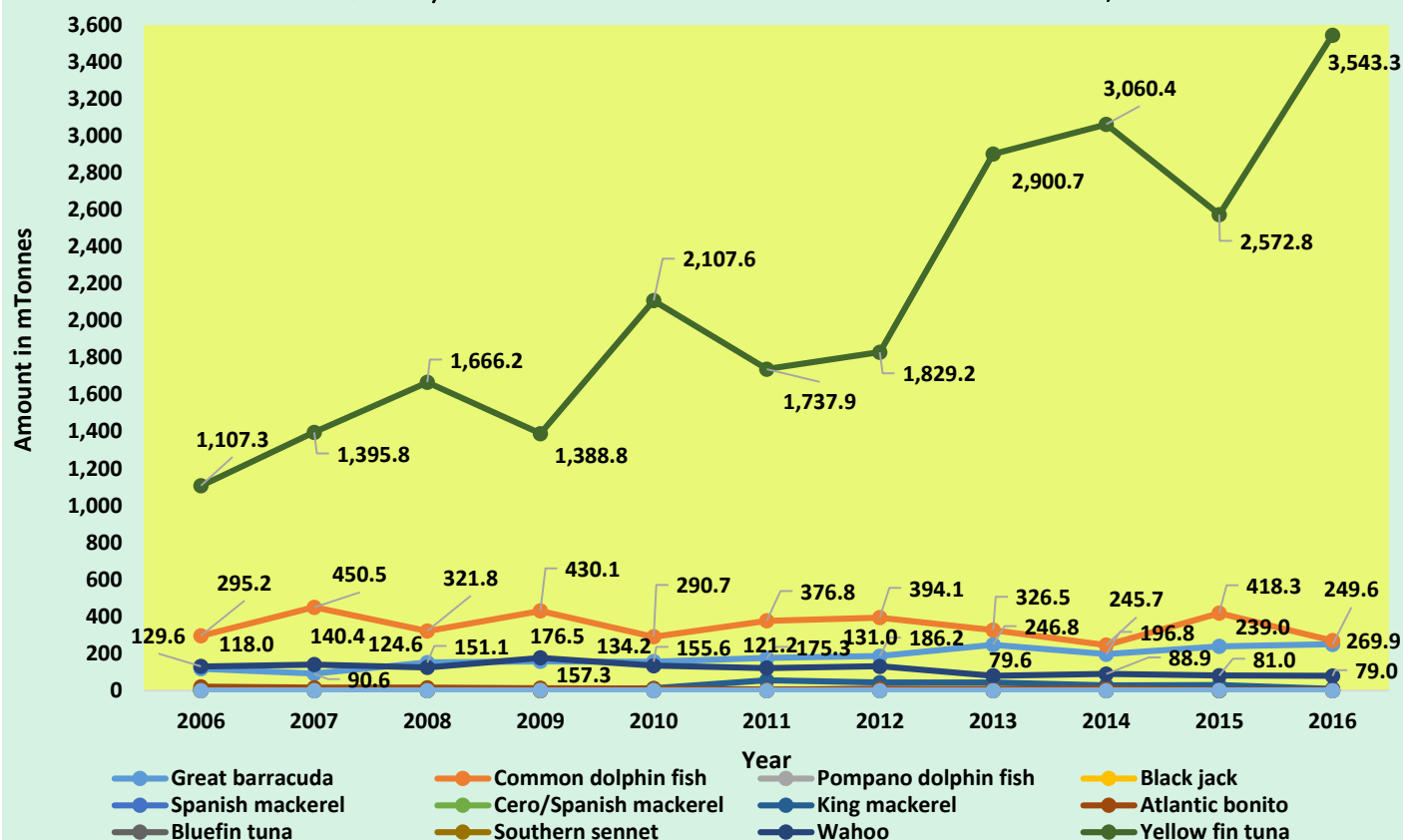


Table 7.5: Quantity of Fish Landed in Metric Tonnes, 2006 - 2016

PELAGIC SPECIES	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Little Tunny	0.6	0.5	0.5	0.0	1.6	0.2	0.1	0.7	0.6	1.9	2.5
Atlantic sailfish	349.8	384.5	475.6	356.4	391.7	478.5	393.4	324.9	461.8	463.0	302.7
Black fin tuna	818.7	642.3	640.0	411.3	351.5	301.5	353.5	332.3	250.5	244.3	220.1
Skipjack tuna	32.1	57.3	44.0	16.6	23.2	16.1	31.9	18.6	39.0	49.3	36.8
Bullet tuna	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1
Blue marlin	73.8	108.7	118.4	70.4	151.3	106.1	70.7	139.3	140.1	123.9	116.0
White marlin	26.4	25.3	37.8	33.8	20.8	35.2	41.9	24.1	60.4	80.7	33.6
Rainbow runner	28.7	16.8	35.0	29.4	40.6	36.1	71.0	45.4	17.2	31.1	33.5
Sword fish	66.8	58.3	94.2	68.5	44.8	78.3	53.6	75.8	87.2	86.7	63.0
Frigate tuna	0.8	1.8	0.6	0.6	1.9	0.3	0.2	0.5	0.3	0.2	0.0
Bigeye tuna	8.6	21.8	67.6	0.7	0.9	1.1	3.2	20.1	38.0	39.2	50.8
Shark	34.9	49.1	53.3	25.4	22.5	29.4	38.1	37.7	32.1	32.1	20.8
Albacore	40.8	44.8	32.6	41.4	37.7	38.2	51.5	39.4	107.8	174.9	110.8
Flying fish	6.4	1.4	32.2	37.2	17.8	9.8	1.8	20.7	34.4	7.2	1.9
Jack	51.0	41.9	35.3	34.5	108.3	49.8	115.3	75.5	68.4	91.4	85.6
SUBTOTAL	1,539.2	1,454.5	1,667.2	1,126.1	1,214.7	1,180.6	1,226.1	1,154.7	1,337.9	1,426.3	1,078.3

Chart 7.5: Quantity of PELAGIC SPECIES of Fish Landed in Metric Tonnes cont'd, 2006 - 2016

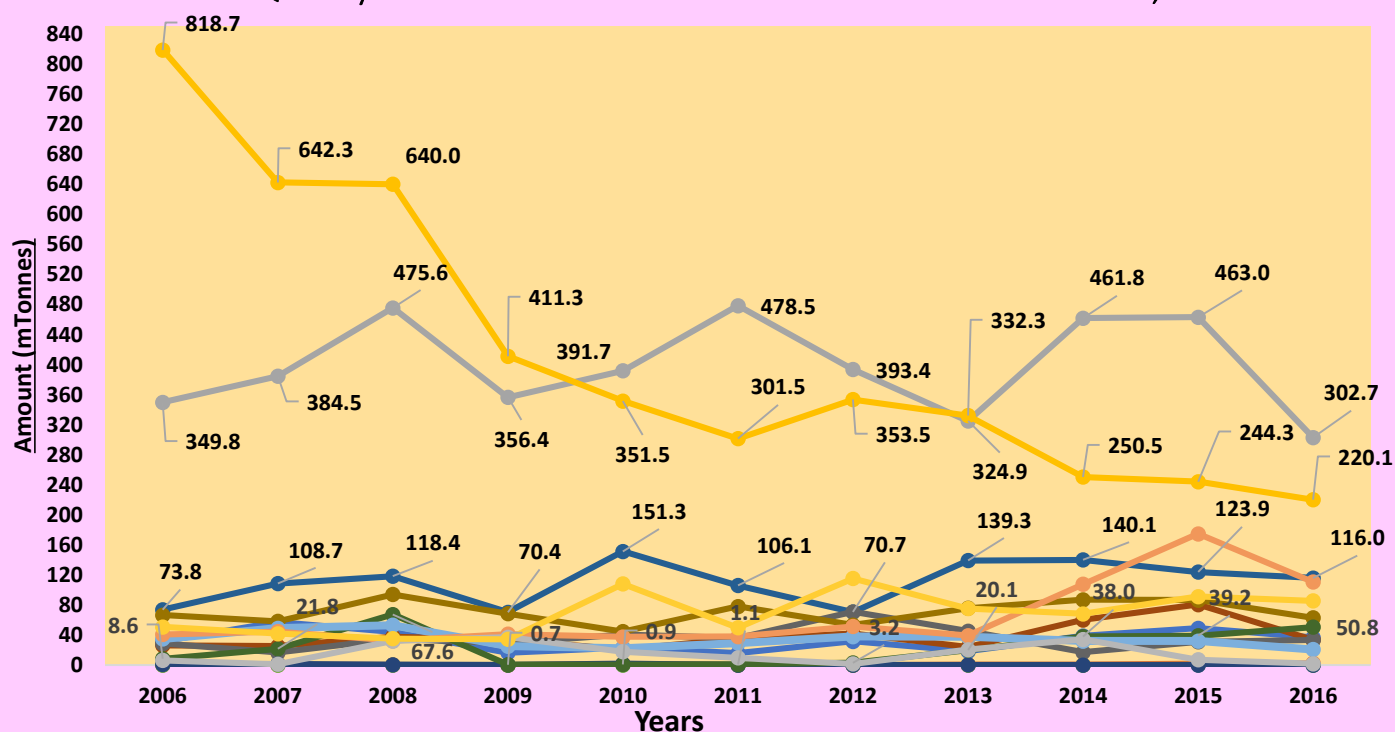


Table 7.6: Quantity of Demersal Species of Fish Landed in Metric Tonnes, 2006 – 2016

Demersal fish	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Moon fish	0.2	0.2	0.3	0.4	0.1	0.5	0.4	0.1	0.0	0.0	0.0
keeltail needle fish	7.8	5.3	3.0	1.5	0.6	1.8	1.0	1.6	1.6	0.6	1.0
Round scad	41.5	50.0	67.9	135.5	165.1	131.3	77.1	101.8	188.8	74.4	51.8
Bigeye scad	36.9	31.1	76.2	663.1	236.8	250.5	148.7	125.8	143.7	105.9	25.4
Anchovie	0.0	0.0	0.0	0.3	0.0	2.1	4.8	0.2	0.0	0.0	0.0
Ballyhoo halfbeak	13.9	17.2	3.9	7.3	1.8	2.5	3.5	5.3	5.0	4.7	2.9
Common snook	1.3	0.6	0.4	0.4	0.8	1.8	3.1	0.7	0.6	0.6	0.0
Grouper	5.1	6.4	3.7	7.3	3.9	3.5	7.2	3.5	3.1	3.1	3.0
Snapper	312.8	259.5	269.2	229.5	260.6	145.3	210.4	196.2	168.3	166.2	187.0
Squirrel fish	20.2	10.5	5.7	2.3	1.1	2.6	1.9	7.6	9.5	8.5	10.3
Parrot fish	346.4	261.5	250.6	235.8	286.7	240.2	246.1	224.5	206.4	187.7	175.9
Sandtile fish	12.5	19.6	13.7	6.7	7.0	7.2	6.1	13.5	15.0	10.1	10.0
Grun	38.6	24.9	11.5	9.6	5.2	8.7	5.0	5.6	15.2	13.1	14.5
Bermuda Chub	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Black margate	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goat fish	0.2	0.4	0.7	0.1	0.2	0.2	0.3	0.1	0.2	0.0	0.1
Red hind	442.0	353.2	364.0	325.7	385.1	229.2	264.9	281.2	279.9	252.6	273.0
SUBTOTAL	1279.5	1041.1	1071.3	1625.7	1354.9	1027.4	980.5	967.7	1037.2	827.3	754.9

Chart 7.6: Quantity of Demersal Fish Landed in Metric Tonnes, 2006 - 2016

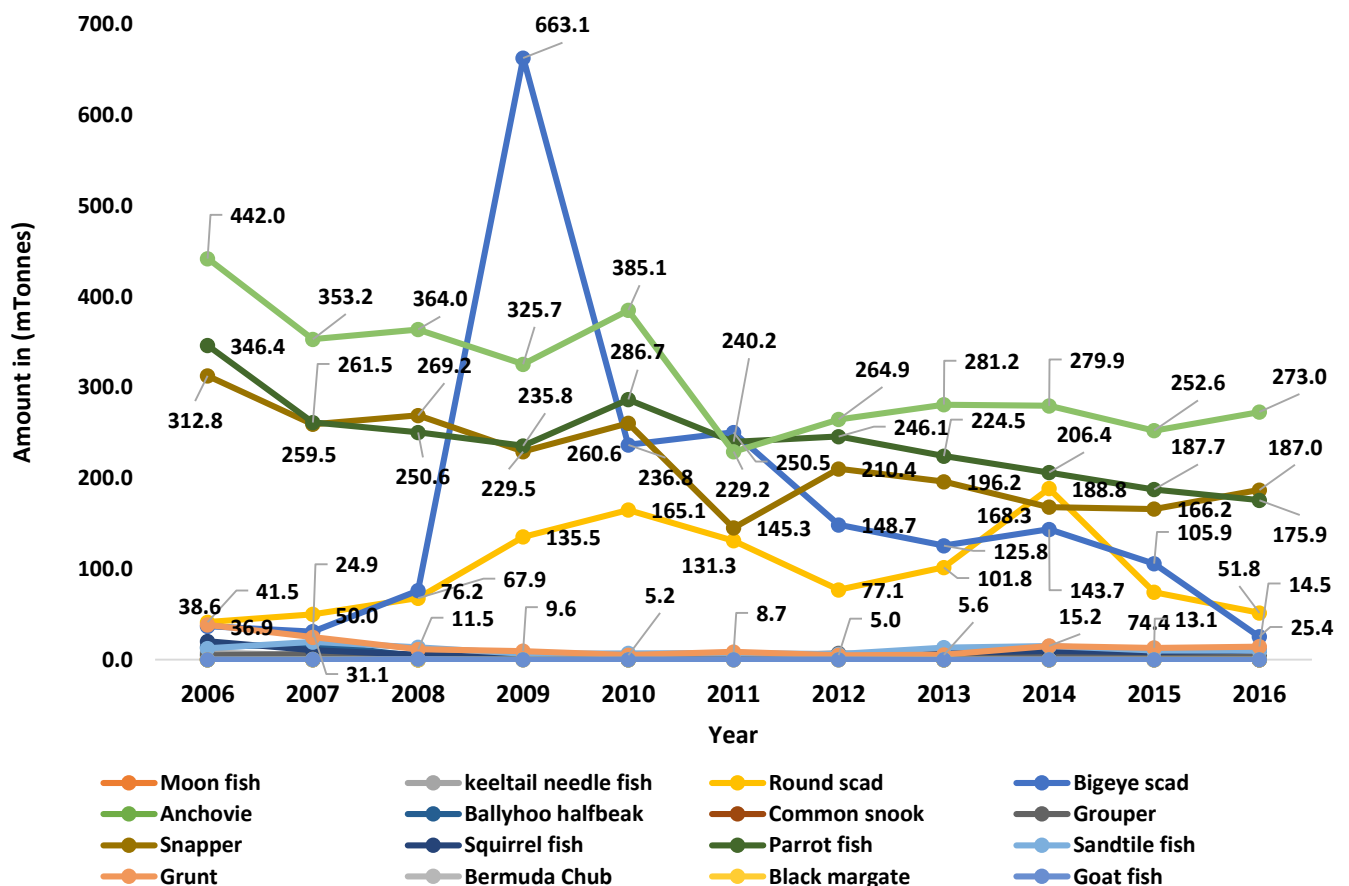
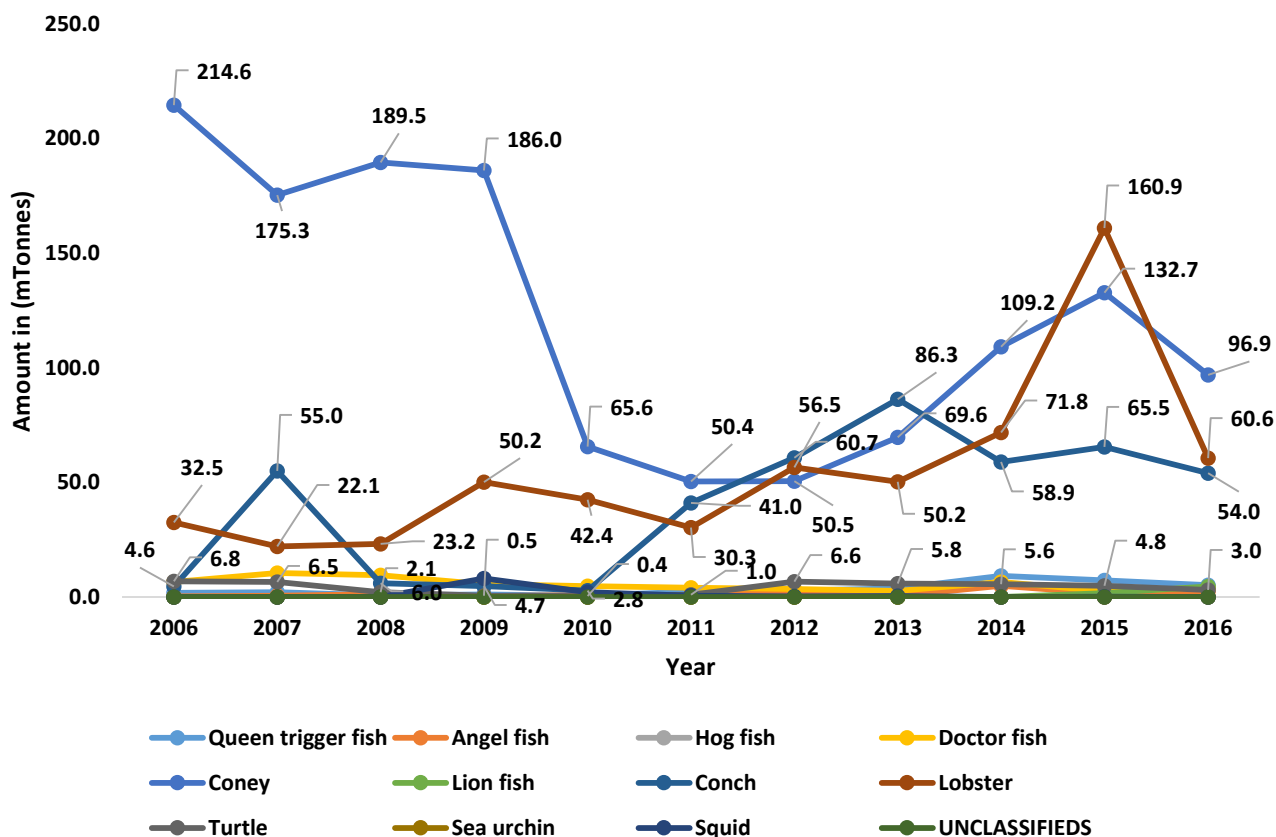


Table 7.7: Demersal Species of Fish Landed in Metric Tonne, 2006 -2016 cont'd

Demersal fish	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Queen trigger fish	1.8	2.1	0.8	1.1	0.6	2.3	2.8	3.8	9.2	7.2	5.1
Angel fish	0.3	0.6	1.2	0.5	0.9	0.7	2.2	0.5	4.9	1.5	2.5
Hog fish	...	...	...	...	...	...	...	...	...	...	...
Doctor fish	6.6	10.5	9.4	5.6	4.8	4.0	3.5	2.7	6.6	2.6	4.0
Coney	214.6	175.3	189.5	186.0	65.6	50.4	50.5	69.6	109.2	132.7	96.9
Lion fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	4.6
Conch	4.6	55.0	6.0	4.7	2.8	41.0	60.7	86.3	58.9	65.5	54.0
Lobster	32.5	22.1	23.2	50.2	42.4	30.3	56.5	50.2	71.8	160.9	60.6
Turtle	6.8	6.5	2.1	0.5	0.4	1.0	6.6	5.8	5.6	4.8	3.0
Sea urchin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squid	0.0	0.0	0.0	8.1	2.1	0.5	0.3	0.4	0.0	0.2	0.0
UNCLASSIFIEDS	...	...	...	...	...	...	...	...	...	...	...
TOTAL	267.3	272.1	232.2	256.8	119.6	130.2	183.2	219.3	266.1	377.0	230.9

Chart 7.7: Quantity of Demersal Fish Landed in Metric Tonnes cont'd, 2006 - 2018



Source: Economic Unit, Central Statistical Office

Number of Persons living on the Coastal Zones

There is 1.3 per cent increase in the number of persons considered to be living on the coastal areas in Grenada. This has implications for the preservation of the coast habitats for flora and fauna.

Table 7.8: Persons living on the Coast; 2001 and 2011

Indicators	2001	2011
Number of Families in coastal area	...	...
Population in coastal area	9,019	9,139

Table 7.9: Number of Fisher Folk by Parish in 2012

Parish	Spear Fishing	Fishing from Rocks/Shore	Fishing from Boat	Gathering whelks	Freshwater Fishing
St. George	191	725	461	139	115
St. John	47	215	194	32	61
St. Mark	16	48	61	5	24
St. Patrick	29	169	130	24	52
St. Andrew	131	304	202	56	274
St. David	125	410	176	186	384
Carriacou	49	83	130	37	5
Petit Martinique	15	15	54	12	12
Total	603	1,969	1,408	491	927

Chart 7.8: Number of Fisher Folk by Parish in 2012

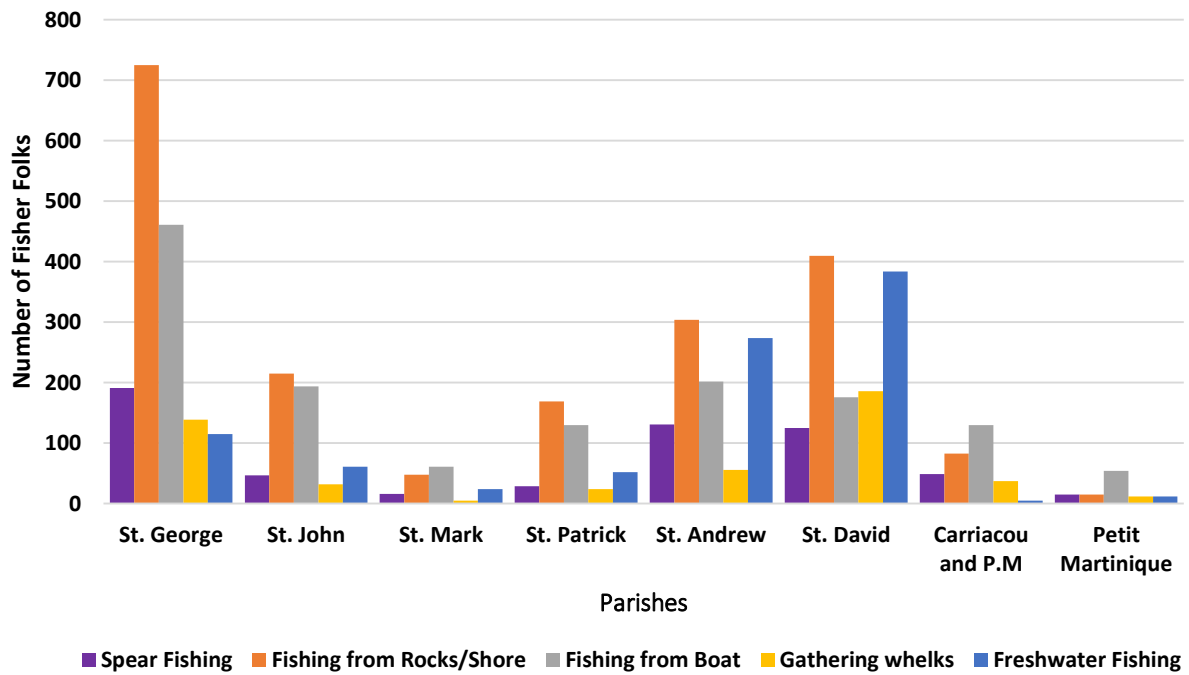


Figure 7.3: Fisher Folk bringing a catch



CHAPTER 8: BIODIVERSITY

Flora and Fauna Biota

Grenada's biodiversity includes a variety of marine species and their habitat; five (5) different types of terrestrial vegetation / forest ranging from mangrove woodlands and scrub and cactus in the coastal areas to Lower Montane Rain Forest and Elfin woodland forest in the mountainous regions. They are the natural habitat for a variety of animals, reptiles and birds (including turtle nesting sites). Some of the above are part of the National Parks and Protected Areas of Grenada.

The most important of those is the Grenada Dove and its habitat. It is the National Bird of Grenada and considered to be an endangered species located at Mt. Hartman, in the southern part of the island and at Perseverance close to the Land-field Site. It is important to note that neither of the Project Sites is located within any of those areas and their proposed activities are not likely to affect or be affected by them in any way.

Table 8.1: Showing Information on Carbon in Protected Areas, 2012

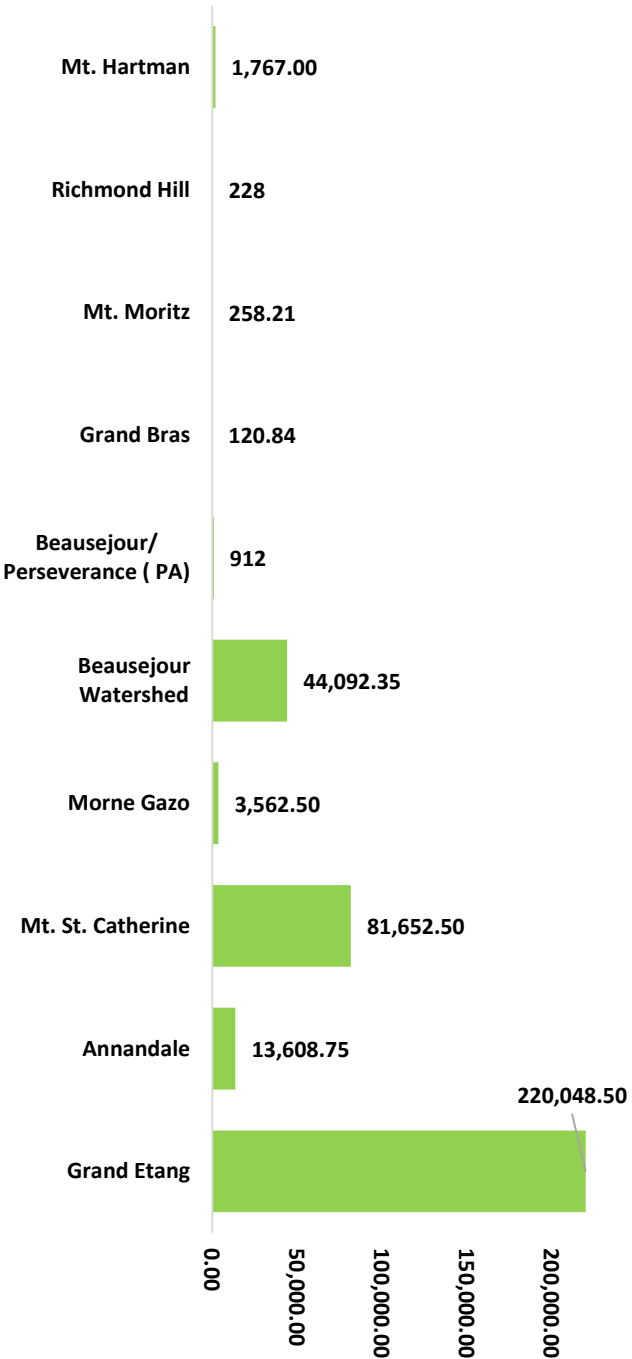
Protected Areas	Forest Type	Carbon Accumulation rate in tC/ha/yr	Total Forest Area (Ha)	Total Yearly Accumulation	Total Estimated Carbon Stock in Protected Area
Grand Etang	Rain forest /moist forest	2.5	1,544.2	3,860.5	22,0048.5
Annandale	Rain forest /moist forest	2.5	95.5	238.8	13,608.8
Mt. St. Catherine	Rain forest /moist forest	2.5	573	1,432.5	81,652.5
Morne Gazo	Moist	2.5	25	62.5	3,562.5
Beausejour Watershed	Dry Forest	0.5	1,547.1	773.6	44,092.4
Beausejour/ Perseverance	Dry Forest	0.5	32	16	912.0
Grand Bras	Dry Forest	0.5	4.2	2.1	120.8
Mt. Moritz	Dry Forest	0.5	9.1	4.5	258.2
Richmond Hill	Dry Forest	0.5	8	4	228.0
Mt. Hartman	Dry Forest	0.5	62	31	1,767.0

Source: Ministry of Climate Resilience, the Environment, Forestry, Fisheries & Disaster Management

Figure 8.1: The Grenada Dove, an endangered specie



Chart 8.1: Total Estimated Carbon Stock in Protected Area



CHAPTER 9: WATER AND SOLID WASTE

Water makes up about 75 per cent of the earth's surface and we humans only use approximately three tenths of the earth's water resource. Approximately 90% of the water reside in Antarctica. In Grenada, water is an abundance most of the times. However, a prolonged dry season would cause a decline in the amount of water produced which leads to a scarcity. The main providers of water is the National Water and Sewage Authority (NAWASA) in Grenada. In Carriacou and Petit Martinique, most household collect and store water in cisterns. NAWASA is presently implementing a project to bring pipe borne water to households on these islands. This has never been done before. The production of water consists of the collection, treatment, storage and distribution of water collected in catchment areas or pumped from underground.

On average, NAWASA produces 2,400 metric gallons of water annually. Water production is relatively consistent except for a dip in 2010 which is graphically represented below.

Water Production

Table 9.1: Water Production in Grenada, 2006 - 2018

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
WATER (M. GAL)	2465.3	2475.9	2516.2	2458.4	2161.1	2380.9	2337.6	2429.2	2362.1	2393.5	2454.6	2462.7	2653.4

Source: Economic Unit, Central Statistical Office

Figure 9.1: Clear drinking water



Water Storage facility



Water meter



Chart 9.1: Water Production in Grenada, 2006 - 2018

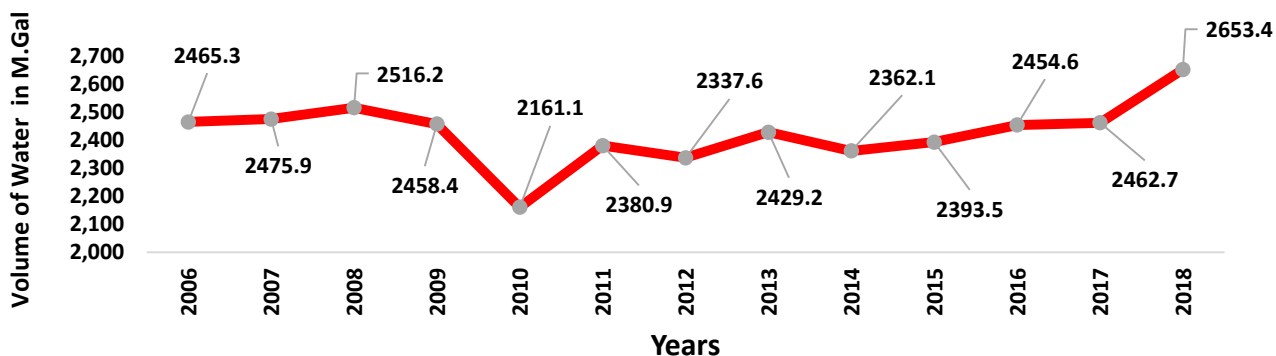
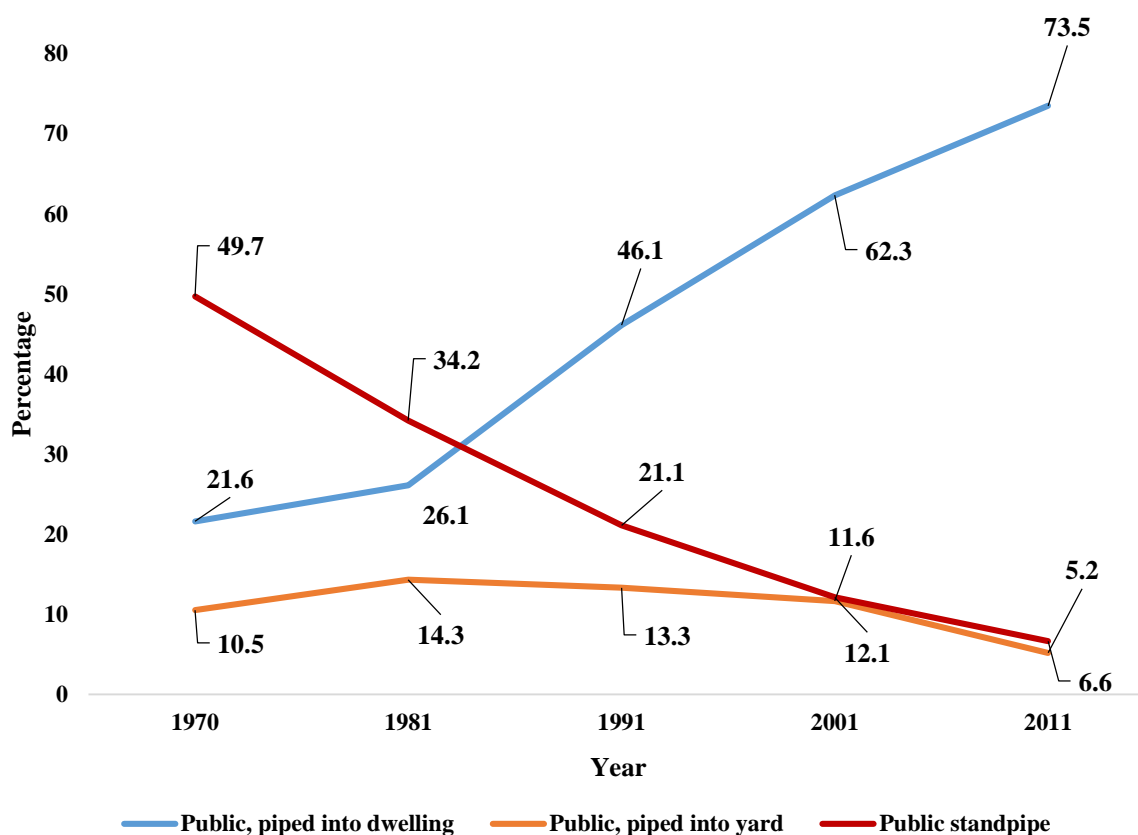


Table 9.2: Use of Water Supply Facility from 1970 - 2011

Water supply Facilities (%)	1970	1981	1991	2001	2011
Public, piped into dwelling	21.6	26.1	46.1	62.3	73.5
Public, piped into yard	10.5	14.3	13.3	11.6	5.2
Public standpipe	49.7	34.2	21.1	12.1	6.6
Private catchment not piped	5.4	7.1	7.6	3.4	3.6
Private, piped into dwelling	4.7	8.2	3.9	0.8	4.9
Other	8.1	10.1	8	9.7	6.2

Source: Population and Housing Census, Central Statistical Office

Chart 9.2: The Trend in Water Supply Facility, 1970 - 2011



Solid Waste

Waste is defined as “ any material, solid or liquid discarded by the owner of the material and includes any such material discard from residential, industrial, commercial, agricultural or government establishments or operations ships, aircraft or vehicles; public or community activities”.

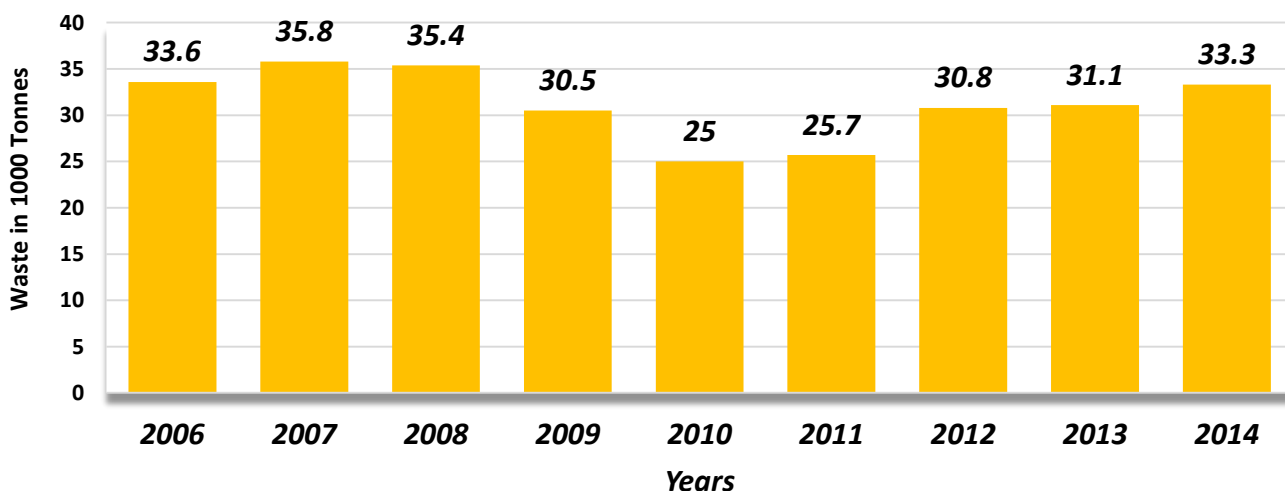
In Grenada, the Solid Waste Management Act, 1995 established the Grenada Solid Waste Management Authority and provides it with the broad mandate to manage of the waste for the country and the Waste Management Act 2001 provides the basis for an efficient waste management system. According to the data provided, an average of over 31,000 tonnes of waste is generated each year in Grenada (2006-2014). Essential waste management and disposal is critical for the sustainability of health in the Grenadian environment.

Table 9.3: Waste Collected by Source, 2006 - 2014 (1000 tonnes)

Category	2006	2007	2008	2009	2010	2011	2012	2013	2014
Agriculture, forestry and fishing	...	...	...	...	...	...	...	...	...
Mining and quarrying	...	...	...	...	...	...	...	...	...
Manufacturing	2.6	9.0	8.7	4.8	0.5	0.7	0.7	0.6	0.6
Electricity, gas, steam and air conditioning supply	...	...	...	...	...	...	...	...	...
Construction	0.0	0.0	0.0	0.0	0.0	0.0	4.5	5.3	5.2
Other economic activities excluding	11.9	7.6	6.9	6.4	5.8	5.9	6.7	6.8	8.2
Households	19.0	19.2	19.8	19.4	18.7	19.1	18.9	18.5	19.3
Total Waste Generation	33.6	35.8	35.4	30.5	25.0	25.7	30.8	31.1	33.3

Source: Grenada Solid Waste Management Authority

Chart 9.3: Yearly Waste Collected in Grenada, 2006 - 2014



The graph demonstrates that on average waste generation in Grenada is relatively constant. However, with the increase in tourism and manufacturing activities; it is expected to increase the amount of waste generated on an annual basis.

Figure 9.2: Waste material collected at the Landfill



CHAPTER 10: FORESTRY AND LAND USE

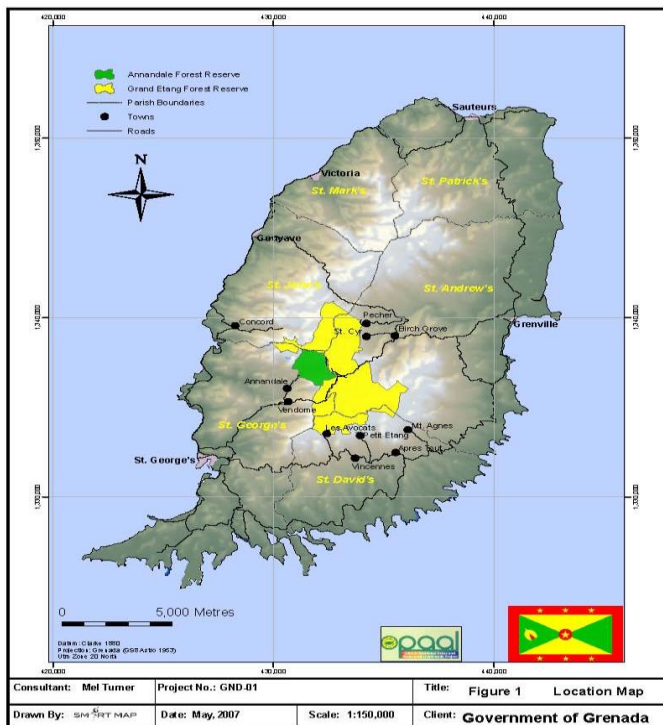
Forest Reserve

Generally encompassing elevations between 250 meters and 760 meters of the South Central Mountains and overlapping the Parishes of St. John, St. Andrew, St. David and St. George, the Grand Etang and Annadale Forest Reserves contain the best examples of four of Grenada's six major forest communities: Cloud Forest, Montane Thicket, Secondary Tropical Forest and the Rain Forest/Lower Montane Rain Forest. The Reserves receive an average of 2,500 mm of rainfall annually. The Grand Etang Forest Reserve, encompassing elevations from 300 meters at St. Cyr to 760 meters at an unnamed peak in the Reserve's north, displays a combination of ridges, the upper headwaters of over 10 steep-sided coastal valleys and the upper basin of a major tributary of the Great River. The Reserve contains four of Grenada's highest mountains: Southeast Mountain (712m), Mount Sinai (700m), Mount Qua Qua (713m) as well as the unnamed peak (760m). All of volcanic origin in the Pliocene and Pleistocene Periods, these mountains dominate the physical landscape. Volcanic activity also contributed to the formation of Grand Etang Lake as a crater lake: one of three explosive craters in the Reserve. Slopes on the flanks of these mountains and connecting ridges are generally in excess of 20 degrees and often in excess of 30 degrees. Grand Etang Lake empties into the tributary of the Great River.

Source: Excerpts from the Annadale and Grand Etang Forest Reserves Management plan prepared by Mel Turner

MAP 10.1: Two Areas of Central Forest Reserve

Fig 10.1 Grand Etang Lake and Surrounding Forest

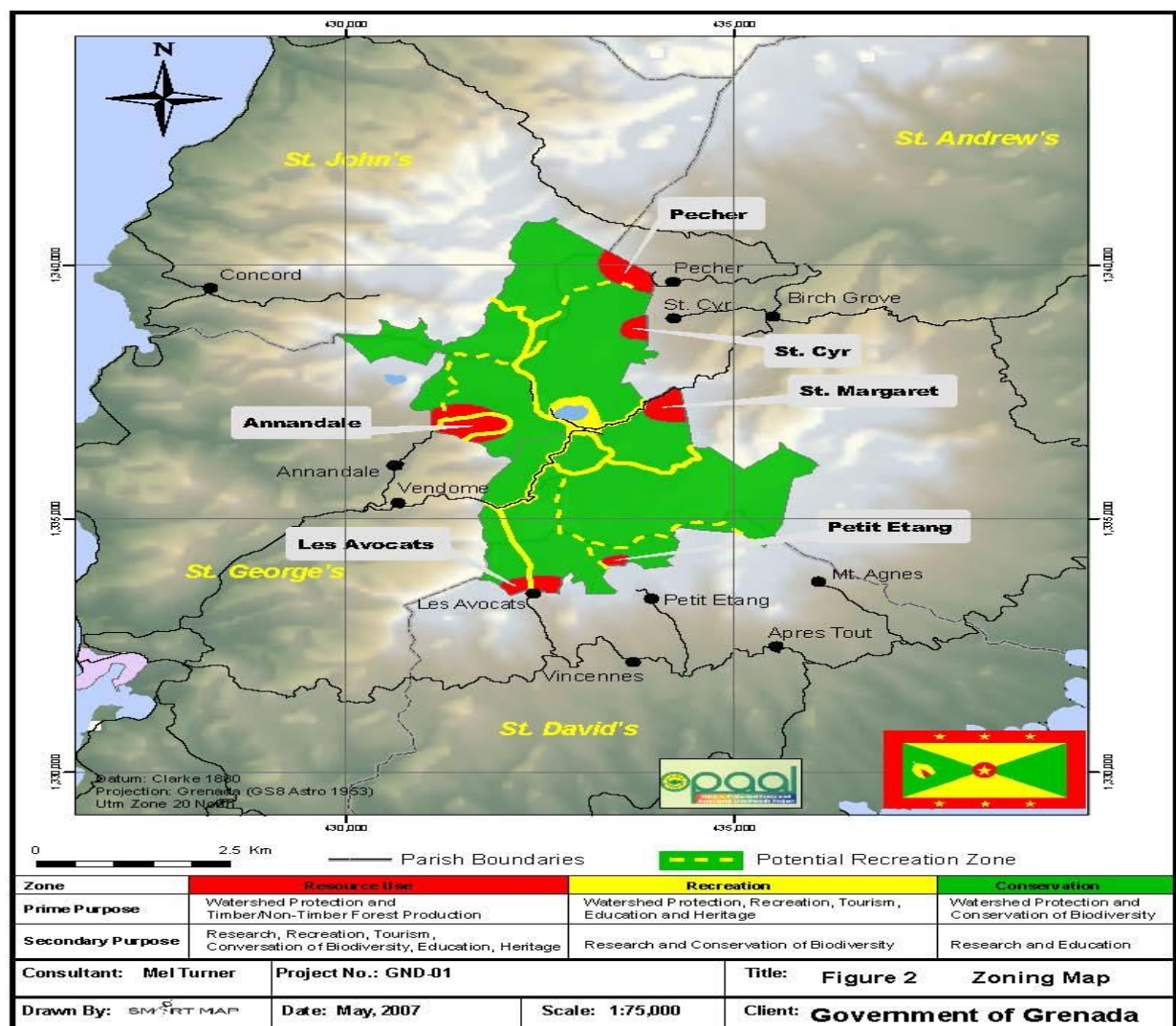


Approximately 87% of the Grand Etang Forest Reserve and Annandale Forest Reserve is zoned for conservation. This zoning protects the best remnants of the major forest communities, the steep ridge slopes and the majority of the tributary of the Great River. The nursery is included in this zone.

Approximately 5% of the Grand Etang Forest Reserve and Annandale Forest Reserve is zoned for recreation. This zone centers on the development of the Grand Etang including the visitor center and the associated concessions as well as the developed day-use area at Grand Etang Lake. This zone includes the St. George's - Grenville Highway and associated trailheads as well as all existing and potential trailheads and community gateways to both the Reserves. It also includes NAWASA infrastructure facilities and the communication sites at Hurricane Ridge (1,910).

Approximately 100 hectares or 6% of the Grand Etang Forest Reserve and 60 hectares or 25% of the Annandale Forest Reserve is zoned for resource use.

MAP 10.2: Area of Watershed Protection and Forest Production



TRAILS IN THE FOREST RESERVES

This 200 metre trail links the Grand Etang Visitor Center to a viewpoint overlooking the eastern portion of the Grand Etang Forest Reserve, including the watershed of the Great River, as well as Grenville and the Atlantic Ocean. The trail passes through a representative example of the Cloud Forest.

Fig 10.2: Morne LaBaye Trail



This 300 metre ridge-crest trail, south of the Visitor Center, passes through Elfin Forest and offers views of the Annandale Forest Reserve, St. George's, Point Salinas and the Caribbean Sea.

The 2 kilometre long Shoreline Trail loops around Grand Etang Lake. Although often well-back from the lake's shoreline, the trail offers glimpses of the Lake and the Mount Qua Qua ridge and passes through a variety of tropical forest environments, including habitat for the Mona Monkey.

Fig 10.3: Beausejour



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ATCTWN
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The 3 kilometre long (one way) Mount Qua Qua Trail links the Visitor Center complex with Mount Qua Qua. Located along the ridgeline, in the Cloud Forest, the trail offers numerous viewing and interpretive opportunities.

Fig 10.4: Mount Qua Qua



This trail links the Village of Concord with the Grand Etang Forest Reserve and the Visitor Center complex. Some 6 kilometres in length (4 kilometres in the Forest Reserve), the trail begins at the Concord Waterfall development at the end of the Concord Road and follows the valley and stream environment upwards until it joins the Mount Qua Qua Trail at the ridgeline.

Fig 10.5: Concord Trail



This 5 kilometre trail branches off the Cross Trail and follows the stream as it descends through the rainforest to the series of waterfalls, terminating at St. Margaret's Falls. The trail connects with the private trail at St. Margaret's.

Fig 10.6: Seven Sisters Trail



The 6 kilometre Annandale Trail follows an old estate road. Some 4 kilometres is within the Forest Reserve and the remaining section is on private land. With little change in elevation, the trail meanders past active forest plantations and remnants of estate plantations of cloves, citrus and nutmegs. Opportunities to highlight the history of the estate, including its role in the later 18th century rebellion, its natural recovery from natural disaster and its significance now as a protected area, are evident.

Fig 10.7: Annandale Trail and Waterfall



10.8: Vendome-Les Avocats Trail

This 3 kilometre rainforest trail follows the historic link from Vendome to Les Avocats.



The 5 kilometre Cross Trail links Hurricane Ridge with the Grand Etang Visitor Center complex and offers opportunities for tropical rainforest interpretation.

Figure 10.9: **Cross Trail**



Fedon's Camp Trail links Fedon's Camp with the Concord-Visitor Center complex trail. The Trail has historic significance with the 18th century rebellion.

Figure 10.10: **Fedon's Camp Trail**



Forestry and Natural Vegetation

There is little formal documentation available on the composition and status of Grenada's forests. It is more descriptive rather than quantitative. Some research has been conducted on a few species of trees but very little attention has been given to herbaceous and nonvascular plants.

Figure 10.11: *Herbaceous Plants in Grenada*



Figure 10.12: *More Herbaceous Plants in Grenada*



Figure 10.13: *Nonvascular plants in Grenada*



There is no information available on threatened or endangered plant species. However, three endemic species of plants are known, the Grand Etang Fern (*Danaea* sp.), the Cabbage Palm (*Oxeodora oleracea*) and one endemic tree species (*Maythenus grenadensis*).

Figure 10.14: Grand Etang Fern



Figure 10.15: Cabbage Palm



The pioneering work of J.S. Beard in the 1940's classified the major forest communities in Grenada under following types: Cloud Forest (montane thicket, palm break and elfin woodlands)

Generally these forests, located in the inaccessible upper areas of Grand Etang and on Mt. St. Catherine have suffered little degradation and appear to be under no serious threat; Rain Forest and Lower Montane Rain Forest - These forests occur below the cloud forests where rainfall exceeds 2,500 mm per annum.

Figure 10.16: *Palm Break*



Figure 10.17: *Montane Thicket*



Figure 10.18: *Elfin Woodlands*



There is little difference in floristic composition between the very tall rain forest proper and the less tall lower montane rainforest. They are largely located in the lower areas of Mt. St. Catherine and the best remnants are found in Grand Etang Forest Reserve; Evergreen and Semi-evergreen Forests - These forests occur where the rainfall is between 2,000 - 2,500mm per annum.

Figure 10.19: Montane Rainforest



A 40 - 60 ha area of this forest-type occurs at Morne Gazo in the south of the island, due to a 'cloud track' which causes more rain to fall in this area than expected. Morne Gazo

Figure 10.20: Morne Gazo



Deciduous Forest and Cactus Scrub - These occur at lower elevations where the rainfall is between 1,000 - 2,000 mm per annum, usually falling in a five-month period. They are found in the south and north of mainland Grenada and on Carriacou and Petit Martinique.

Figure 10.21: Cactus Scrub



According to the Biodiversity Strategy & Action Plan Grenada, July 2000, Littoral Woodlands occur along the coast in small stretches and should be found in Grenada, Carriacou and Petit Martinique. However, most of this woodland has been lost, although a small patch remains at the edge of Levera woodland in the north east of Grenada; Mangrove Woodlands - Grenada contains 21 patches of mangrove along the eastern coastline from Levera to Telescope, and along the south eastern coastline from Requin to True Blue, and on the north and south coasts of Carriacou. The largest areas are at Levera, Conference, Upper Pearls, Westerhall, Calivigny and Tyrrel Bay.

Figure 10.22: LEVERA POND



Timber production from natural forests has declined considerably over the past decade due to poor stocking depleted by more than 100 years of logging activities, clearance for agriculture and hurricane destruction. Commercial production of blue mahoe (*Hibiscus elatus*) which occupied 75% of the area under plantation was seriously damaged during an infestation of the pink mealy bug between 1994-1997.

Figure 10.23: Blue Mahoe (*Hibiscus elatus*)



Other plantation species include pine (*Pinus caribaea*), mahogany (*Sweitenia* sp.) and Cupressus lusitanica. Although the initial reasons for plantation establishment were to reforest and stabilise forest areas with serious hurricane damage, local demand presented an opportunity for income generation.

Figure 10.24: Pine (*Pinus caribaea*) Figure 10.25: Mahagony (*Sweitenia* sp.) Figure 10.26: *Cupressus lusitanica*



Table 10.1: Representation Environments in Protected Areas

Environments	% Representation	Environments	% Representation
Terrestrial		Marine Environment	
Transitional Cloud Forest	66	Sea Grass	10
Cloud Forest	27	Intertidal Reef Flat	5
Evergreen	25	Rocky Shore	4
Emergent Wetlands	22	White Sand Beach	2
Grenada Dove habitat	11	Shelf Structure	2
Dry Deciduous Forest	1	Mangroves	1
Semi Deciduous Forest	2	Reef Flat	1
Drought Deciduous Forest	1	Fore Reef	2
Mixed Wood Agriculture	1	Leatherback Nesting Site	0
Streams	5	Hawksbill Nesting Site	0
Rivers	1	Black Sand Beach	0
Fresh Water Bodies	1	Lagoonal Habitat	0
		Shallow Terrace	0
		Shoal	0

Source: Ministry of Agriculture

Chart 10.1: Terrestrial Representation

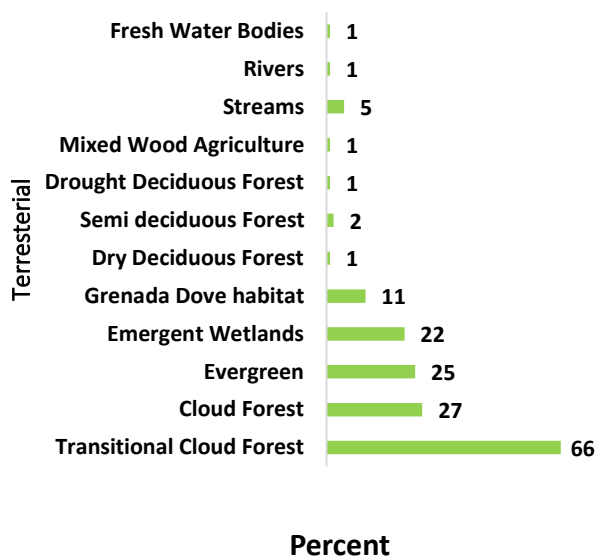
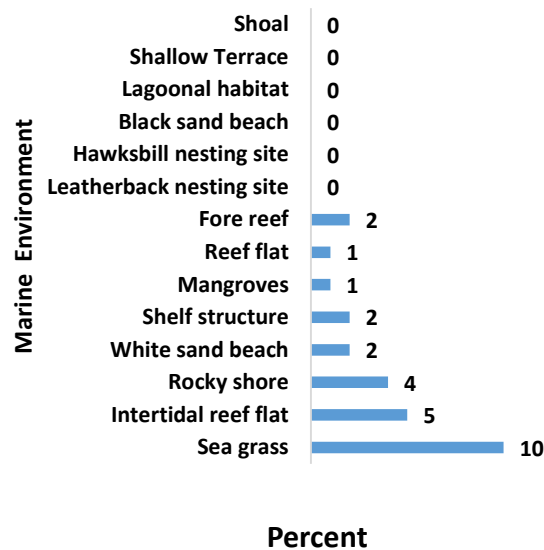


Chart 10.2: Marine Representation



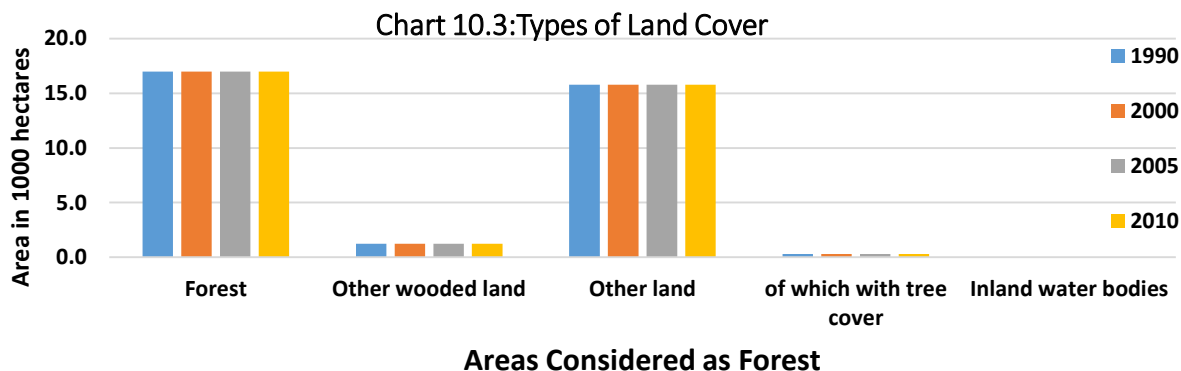
Type of Land Cover

There has not been much change in the forest cover. Hurricanes Ivan and Emily did cause severe damage to the cover, however the damage did not change the size of the forest cover and the lands considered forested areas.

Table 10.2: Areas in Grenada considered as Forest

Type	Area (1000 hectares)			
	1990	2000	2005	2010
Forest	17	17	17	17
Other wooded land	1.2	1.2	1.2	1.2
Other land	15.8	15.8	15.8	15.8
of which with tree cover	0.3	0.3	0.3	0.3
Inland water bodies	0	0	0	0
TOTAL	34	34	34	34

Source: Ministry of Agriculture



LAND USE

How we use the land is just as important as how we conserve our natural resources. After the passage of Hurricane Ivan and Emily, a lot of land that were covered in various types of vegetation became bare and naked. Acres of land where cocoa, banana and nutmeg was cultivated became abandoned and overrun with vines. In 2009, the data below indicates that 19.5% or more of crop land in Grenada is abandoned as compared to only 1.1% in 2000.

Map 10.3: Percentage of Land available for use in Grenada, 2000 and 2009

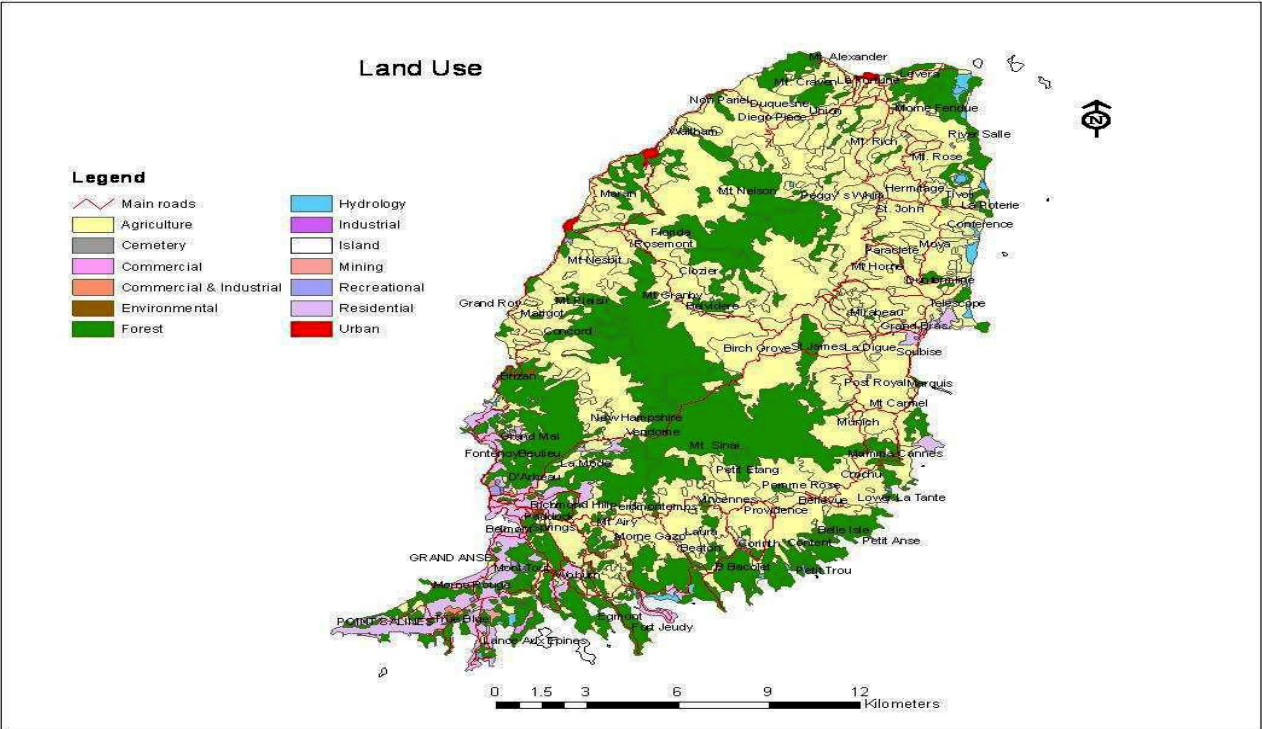


Table 10.3: Carbon Emission per hectare (ppmv)

Land Type	Carbon Emission per hectare (ppmv)
Forest	17,841.46
Cropland	10,949.95
Mangroves	159.31

Source: Ministry of Agriculture

Chart 10.4: Carbon Emission per hectare (ppmv)

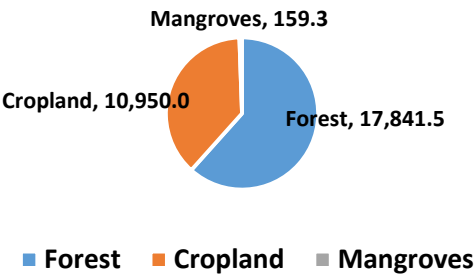
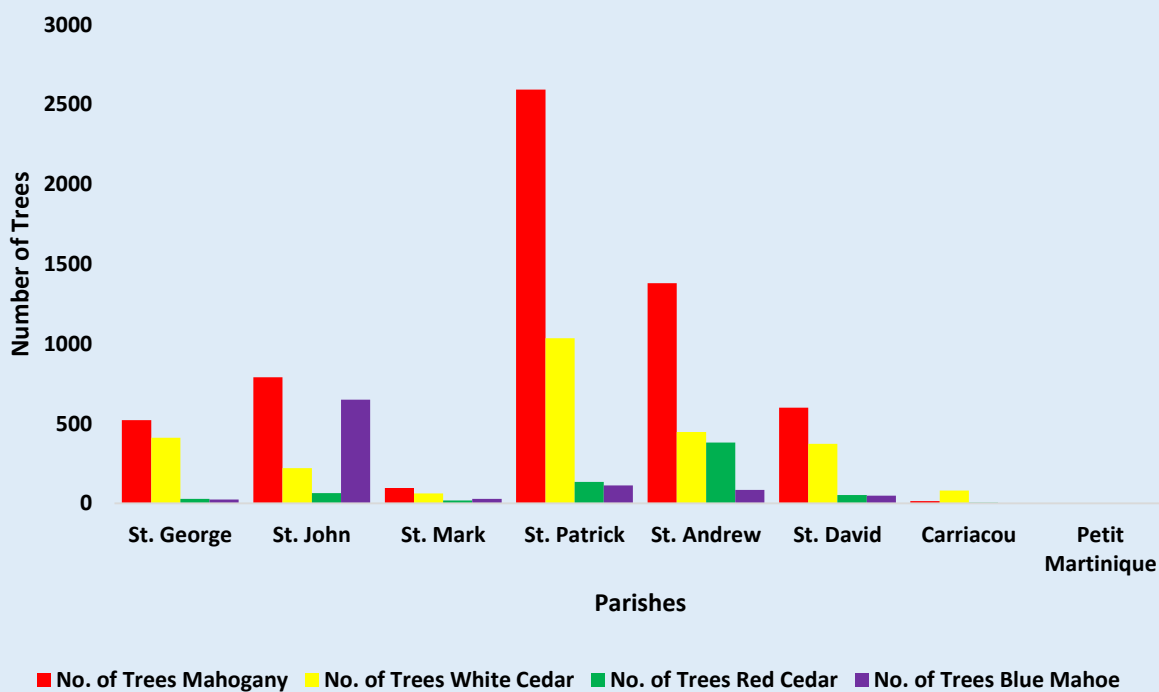


Table 10.4: Valuable trees by Parish

Parish	Mahogany		White Cedar		Red Cedar		Blue Mahoe	
	No. of Trees	Percent	No. of Trees	Percent	No. of Trees	Percent	No. of Trees	Percent
St. George	523	8.7	411	15.6	29	4.2	25	2.6
St. John	791	13.2	222	8.4	65	9.4	651	68.2
St. Mark	98	1.6	63	2.4	19	2.8	30	3.1
St. Patrick	2,594	43.2	1,036	39.3	136	19.8	113	11.8
St. Andrew	1,381	23.0	448	17.0	382	55.5	85	8.9
St. David	600	10.0	373	14.2	53	7.7	50	5.2
Carriacou	15	0.2	81	3.1	4	0.6	0	0.0
Petit Martinique	2	0.0	0	0.0	0	0.0	0	0.0
Total	6,004	100.0	2,634	100.0	688	100.0	954	100.0

Source: Ministry of Agriculture

Chart 10.5: Number of Valuable trees by Parish



DEFINITIONS and EXPLANORY NOTES

Average Length of Stay: intended length of stay or number of nights spent, unless otherwise stated.

Index of Social Pressure or Ratio of Tourists (or Visitors) to the Local Population: measures the number of tourists (or visitors) to one resident of the country at any given point in time.

Number of Hotel Rooms per km²: commonly accessible indirect proxy to measure tourism's imprint on the physical environment. It is the number of hotel rooms available divided by the total land area (344 km²).

Occupancy Rate: it is calculated by dividing the monthly or yearly sum of room nights used by the number of room nights available for use, then multiplying the quotient by 100 to express as a percentage.

Tourism: the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business, and other purposes.

Tourist: a person travelling to and staying in places outside his or her usual environment for not more than one consecutive year but who stays for more than 24 hours in a destination for leisure, business, and other purposes.

Tourist Arrivals: all stay-over visitors, not cruise passenger arrivals, given most cruise ships stop at multiple destinations, the total number of arrivals at all destinations is considerably larger than the number of cruise passengers visiting the region.

Tourism Expenditure: the total expenditure made by a visitor or on behalf of a visitor for and during his/her trip and stay at a destination.

Tourism Intensity/Density Ratio: measures the average daily tourist density per km². It is the number of tourists per unit of land area at any given point in time. That is, number of tourists times average stay divided by land area (344 km²) times 365. It shows how tourists are spread on the territory on average, and gives a general indication of pressures on land use due to tourism, with regard to a reference period (e.g. year) or in peak season.

Tourism Penetration Ratio: measures the average daily tourist density per 1,000 population. It is number of tourists per 1,000 inhabitants of the country at any given point in time. That is, the number of tourists multiplied by the average length of stay divided by the population times 365.

Visitor: any person travelling to a place other than his/her usual environment for less than 12 months and

Environmental diseases are at a low prevalence in Grenada and this can be attributed to the surveillance, vaccination and monitoring mechanism in the Ministry of Health. Despite this, incidents of Gastroenteritis and Respiratory Tract diseases appear to be on the rise.

Respiratory Tract Diseases: are diseases that affect the air passages, including the nasal passages, the bronchi and the lungs. They range from acute infections, such as pneumonia and bronchitis, to chronic conditions such as asthma and chronic obstructive pulmonary disease.

Gastroenteritis: is an inflammation of the stomach and intestines with many possible causes, such as: bacteria (responsible for acute food poisoning), parasites, food intolerances, drugs (antibiotics in particular) or most common viral infections.

Typhoid: Typhoid fever is a bacterial infection caused by ingesting contaminated food or water. Symptoms are characterized by headaches, nausea and loss of appetite.

Malaria: is caused by a parasite called Plasmodium, which is transmitted via the bites of infected mosquitoes. In the human body, the parasites multiply in the liver, and then infect red blood cells. (Please refer to the World Health Organization's website at <http://www.who.int/topics/malaria/en/>)

Dengue: is an acute, febrile illness, caused by one of four types of dengue virus. Viral transmission is through the bite of an infected Aedes aegypti mosquito. Dengue fever is usually seasonal, with an increase in cases occurring after the onset of the rainy season.

Cholera: is an acute intestinal infection caused by ingestion of food or water contaminated with the bacterium Vibrio cholerae. It has a short incubation period, from less than one day to five days, and produces an enterotoxin that causes a quickly lead to severe dehydration and death if treatment is not

promptly given. Vomiting also occurs in most patients. (Please refer to the World Health Organization's website at <http://www.who.int/topics/cholera/en/>).

Accidental Pesticide Poisoning: A case of Accidental Pesticide Poisoning is defined as any person who, after having been exposed to one or more pesticides, presents clinical manifestations of poisoning, or specific laboratory test results compatible with poisoning, in the first 24 hours after contact. Accidental refers to the unintentional and unexpected exposure to pesticides. This includes food poisoning. (PAHO/WHO Epidemiological Bulletin, December 2000)

Poisoning: A poison is any substance that causes harm if it gets into the body. Harm can be mild (for example, headache or nausea) or severe (for example, fits or very high fever), and severely poisoned people may die. When people are in contact with a poison they are said to be exposed to it.

Diarrhea: is the passage of three (3) or more loose or liquid stools per day, or more frequently than is normal for the individual. It is usually a symptom of gastrointestinal infection, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person to person as a result of poor hygiene. Severe diarrhea leads to fluid loss, and may be life-threatening, particularly in young children and people who are malnourished or have impaired immunity. (Please refer to the World Health Organization's website at <http://www.who.int/topics/diarrhoea/en/>)

Respiratory tract diseases: are diseases that affect the air passages, including the nasal passages, the bronchi and the lungs. They range from acute infections, such as pneumonia and bronchitis, to chronic conditions such as asthma and chronic obstructive pulmonary disease. (Please refer to the World Health Organization's website at http://www.who.int/topics/respiratory_tract_diseases/en/) Other: Other refers to any other environmentally related diseases not previously mentioned.

Marine Protected Area (MPA)

In 2001, Grenada established two marine protected areas under the Fisheries Act: Woburn/Clarks Court Bay and Moliniere/Beausejour. Sandy Island/Oyster Bay Marine Protected Area on Carriacou has been recently approved by Cabinet and is also expected to be established shortly

In Grenada, terrestrial and/or marine protected areas, including designation as national park, protected area, marine reserve (protected area), heritage conservation area and forest reserve, are designated under the National Parks and Protected Areas Act (1991), the Fisheries Act 1986, the 2001 Fisheries (Marine Protected Areas) Regulations, the 2002 Physical Planning and Development Control Act, the 1990 National Heritage Protection Act and the 1947 Forest, Soil and Water Conservation Act, or, in some cases of forest reserves such as Grand Etang and Annandale, by separate acts of the Legislature. The National Parks and Protected Areas Act grants authority for the Governor-General to proclaim government land, leased or purchased land or donated land, as a national park.

In addition, the Minister responsible for the Act, currently the Minister of Agriculture, can declare government land to be a protected area for the purpose of:

- preserving the natural beauty, including flora and fauna
- creating a recreation area
- commemorating an historic event of national importance
- preserving a historic landmark or a place or object of historic, prehistoric, archaeological, cultural or scientific importance

The Fisheries Act 1986 allows the Minister responsible for the Act, currently the Minister of Agriculture, to declare any area of fisheries waters and any adjacent or surrounding land as a marine reserve for the purpose of:

- affording special protection to the flora and fauna of the area and to protect and preserve the natural breeding grounds and habitats of aquatic life, with particular regard to flora and fauna in danger of extinction
- allowing for the natural regeneration of aquatic life in areas where such life has been depleted
- promoting scientific study and research
- preserving and enhancing the natural beauty

The accompanying 2001 Fisheries (Marine Protected Areas) Regulations further defines a marine reserve as a marine protected area (Once a direction is decided on protected area legislation, this minor lack of consistency between words (marine reserve and marine protected area) in the Act and Regulations can be addressed). The Regulations, in turn, allow a part of a marine protected area to be established as a:

- Marine historical site (contains structures, artefacts or human remains and which needs to be protected for its historical or cultural value)
- Marine park (reserved for public recreation)
- Marine reserve (special management for the purpose of protecting the natural resources)
- Marine sanctuary (open only for the purpose of scientific research)

NB: Carbon sequestration and consequent accumulation rate of tons of carbon per hectare per year would be significantly increased (more than double) in Protected Areas where project activities are proposed. The replacement of the invasive bamboo with fast growing indigenous species that are ecologically adapted to the particular Protected Areas (Annandale etc.) will undoubtedly sequester more carbon than that of bamboos. Additionally, the species would contribute positively to overall biodiversity and soil and water conservation. The additional support from the project will reduce incidents of forest fires (caused by uncontrolled fires of neighboring farmers/private land owners). Reduction in forest fires will consequently contribute to less carbon emission into the atmosphere.

The standard unit for measuring carbon footprints is the Carbon dioxide equivalent (**CO₂e**), which is expressed as parts per million by volume, **ppmv**. The idea is to express the impact of each different greenhouse gas in terms of the amount of CO₂ that would create the same amount of warming.

Data Notes

...	Not applicable
~	Not available
-	Negligible amount of the unit
'000	Thousands
°	Degrees
%	Per cent
\$	Eastern Caribbean dollar
ha	Hectares
km	Kilometer
km ²	square kilometer
kWh	kilowatt-hour
kg	kilograms
mT	metric Tons
mm	millimeters
mGal.	metric gallons
No.	number

Measuring Units Conversions Tables

\$1 EC- \$0.37 US dollars

LENGTH

IMPERIAL

1 inch (in)

1 foot (ft)/12 in

1 yard (yd)

1 mile/1760 yd

1 nautical mile / 2025.4 yd

METRIC

2.54 cm

0.3048 m

0.9144 m

1.6093 km

1.853 km

AREA

1 sq inch (in²)

1 sq foot (ft²)

1 sq yard (yd²)/ 9ft

1 acre /4840 yd²

1 sq mile (mile 2) / 640 acres

1 hectare (ha)

6.4516 cm²

0.0929 m²

0.8361 m²

4046.9 m²

5.59 km²

0.01 km²

MASS

1 ounce (oz) / 437.5 grain

1 pound (lb) / 16 oz

1 stone / 14 lb

1 metric tonne (mT)/1000 kg

1 ton / 2240 lb

28.35 g

0.4536 kg

6.3503 kg

0.9842 ton

1.016 metric Tonne

TEMPERATURE

°C = [5/9 x (°F-32)]

1 degree Celsius (°C)

33.8 degrees Fahrenheit (°F)

Acknowledgement

Name	Surname	Organisation
Reena	Shah	United Nations Statistics Division
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Faustina	Wiggins	CARICOM Secretariat
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Nigel	Edwards	Regional Collaboration Centre - UNFCCC/SGU
Kenny	Mitchell	St. George's University
Laverne	Mapp	Ministry of Agriculture
Joseph	Noel	Ministry of Agriculture
Sylvester	Joseph	Grenada Electricity Company
Deryck	Ramkhelawan	Ministry of Health
Christopher	Greenidge	National Water and Sewerage Authority
Kendra	Clarke	Maurice Bishop International Airport, Meteorological Office
Allison	Neptune	Grenada Solid Waste Management Authority
Cherene	Bowen	Fisheries Division
Roxanne	Bonaparte	National Disaster Management Authority
Daniel	Lewis	Ministry of Agriculture & Lands
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Michael	Church	Ministry of Agriculture and Lands
Toni	Nicholas	Customs and Excise Division
Chris	Joseph	Energy Division/ Environment
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Carlene	Sylvester	Central Statistical Office
Shawnaly	Pascal	Ministry of Infrastructure
Atkinson	Cadore	Inland Revenue Division
Aleanna	Williams	Forestry Division
Lazarus	Joseph	Grenada Port Authority
Kenton	Fletcher	Land Use Division
Aria	Johnson	Ministry of Environment and Climate Change
Trevor	Thompson	Land Use Division, Ministry of Agriculture & Lands

- Grenada Tourism Authority
- Staff of the Central Statistical Office:
 - Clerical, Economic, Trade, Social, Information Technology and Census Units

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For our children