TCP/ RLA/3101

Assistance to Improve Local Agricultural Emergency Preparedness in Caribbean Countries Highly Prone to Hurricane Related Disasters

Good Agricultural Practices for Climate Risk Management in Grenada

Summary Report

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Summary Report

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EXECUTIVE SUMMARY

Natural disasters have severely destabilized the socio-economic fabric of the Caribbean region in the last two decades, with the most devastating impacts experienced in 2004. According to the Centre for Research on the Epidemiology of Disasters (2005), at least 6,000 lives were lost, and over one million people were affected by natural disasters in the region in 2004. Comprehensive assessments of the impacts of natural disasters on five Caribbean countries[1] revealed that the extraordinary active hurricane season during that year resulted in damages approximating US $5.7 billion (ECLAC, 2004). Moreover, the productive sectors which include agriculture accounted for over one third (35.2%) of associated damages and losses (ECLAC, 2004). Such events have exposed the socio-cultural and environmental vulnerabilities of the Caribbean basin, and the urgent need to rethink disaster management options. A comprehensive approach to disaster risk reduction however, has not been integrally incorporated into the agriculture sector within the region. This strategic deficient landscape has significantly reduced the resilience of the sector to cope with extreme hydro-meteorological hazards such as Hurricane Ivan.[2] In recognition of the immense negative impact of the 2004 hurricane season on the farming community, and the urgent call for assistant from regional policy makers, the Food and Agricultural Organization funded the regional project "*Assistance to improve local agricultural emergency preparedness in Caribbean countries highly prone to hurricane related disasters*." The project implemented in four Caribbean[3] countries seeks to:

> "assist governments of participating countries to support the food security of farmers in the most hazard prone areas by improving institutional frameworks and technical options for hurricane related disaster preparedness, emergency response and post emergency agricultural assistance (FAO, 2006)."

The project applies a qualitative research paradigm. This is supported by content analysis of secondary data. The overarching project goal is to stimulate more proactive disaster management in the agriculture sector. Specifically, project results would inform the selection of good hazard risk management practices in the agricultural sector for demonstration and future replication at the community level of participating countries.

This report highlights the main outcomes of Phase 1 of the project. Interim findings and recommendations are summarized along the following headings: profile of pilot sites, recommendations to augment the disaster risk management framework, and assessment of good practices.

PROFILE OF PILOT SITES

The pilot sites selected by the project are Ludbur, an upland area located in the Eastern Agricultural District, and Beausejour, a low lying community situated in the Beausejour

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1 Countries included were Jamaica, Bahamas, Cayman Islands, Grenada and Dominica Republic.

2 Hurricane Ivan, the strongest hurricane of the 2004 Atlantic Hurricane Season passed through Grenada as a category 3 hurricane on September 7, 2004.

3 The project is currently implemented in Cuba, Grenada, Haiti and Jamaica.

River Basin, part of the Western Agricultural District. They show the following key characteristics:

- On average, 30 farmers conduct farming activities in the two sites. Approximately five of these individuals are involved in full time farming in each of the selected pilot areas. The majority of farmers supplement their income through involvement in the construction, transportation, and fishing sectors.
- The steep sloping lands, the type of agricultural production system and the socio-economic conditions of farmers in Ludbur increase the vulnerability of the site to natural hazards, specifically storms and to a lesser extent landslide.
- The topography of Beausejour, its proximity to the Beausejour River, inadequate river maintenance, degraded riparian zone and mangrove ecosystem contribute to the site's vulnerability to floods and storms.
- Coping strategies employed by farmers to reduce the impact of natural hazards include soil conservation practices, such as contour farming, a diversified cropping system, and cultivation of root crops in the case of Beausejour. These practices have been fairly effective in reducing the impact of heavy rain during the rainy season; however, have not prevented the devastating impacts of floods and storm/hurricane forced winds.
- The local NGO GRENED was perceived to contribute most significantly to the recovery efforts in the in the Ludbur area, followed by the Ministry of Agriculture and the Grenada Red Cross Society. Moreover, the main organizations contributing to post disaster assistance in the Beausejour farming community were the Grenada Red Cross Society and the Ministry of Agriculture.

GOOD PRACTICES FOR DRM IN AGRICULTURE

The project initiated the documentation of a wide range of good practices to reduce the risk of hydro-meteorological hazards in the agricultural sub-sectors. The majority of practices identified relate to storms and to a lesser extent landslides and floods. Only a small number of good practices were identified to address the challenge of dry spells. The latter is therefore an area that could potentially benefit from inter-country exchange and technical assistance.

The following five practices were selected among 29 identified good practices as the most suitable good practices with high potential for replication at the regional level:

- Diversified cropping systems (strip cropping and mixed intercropping).
- Integrated agro-forestry practices with the cropping system.
- Soil erosion control structures and practices (contour farming and grass barriers).
- Routine tree management (pruning and top-working).
- Construction code for hurricane resistant poultry units.

As part of stimulating awareness among farmers in Grenada of good practices for DRM and promoting the adoption of a mitigation culture, the selected practices were demonstrated in the pilot community of Ludbur. A number of lessons as listed below were learnt from this initiative:

- Use of a participatory approach was very effective in supporting successful demonstration of good practices.
- The process used to select the demonstration farmer is critical – it must be transparent and validated by farmers.
- Choice of the demonstration farmer is very important in promoting involvement of other farmers – demonstration farmer must be one deemed by other farmers as approachable, easy to work with and actively involved in the farming community.
- Farmers are more willing to consider the adoption of good practices that are:
    - Culturally relevant;
    - Affordable and easy to implement;
    - Adopted by other farmers in their league;
    - Observed to be effective in withstanding the effects of tropical systems - seeing is believing.
- Farmers are unwilling to invest in mitigation if land tenure is uncertain.
- Demonstration activities build camaraderie among farmers, and increased their willingness to established farmers groups or cooperatives.
- Financial disbursement must be facilitated to limit lapses in the implementation process, which could negatively impact stakeholders' morale.

REPLICATION OF GOOD PRACTICES

Wide scale replication of good practices identified through the FAO funded project is critical for project sustainability and increase impact. The following are recommended for achieving greater adoption of good practices among farmers at the national level.

- Provide support in implementing good practices on a one-to-one basis to farmers through the Extension Division.
- Sensitize farmers of the direct benefits of practices to their livelihood.
- Provide incentives to adopting farmers (e.g. fertilizers, planting material, machinery services etc).
- Document and disseminate information on good practices to all key stakeholders including the education system for integration in their line of work.
- Facilitate ongoing publicity of the usefulness of good practices in mitigation. More importantly, have strategic partners (e.g. National Disaster Management Agency, Departments of Forestry and Land Use, and Commodity Boards) endorse practices to create spread effect.

- Implement training in DRM for support services e.g. Extension, Agronomy, farm mechanization etc.
- Include "integration of mitigation practices in farming system" as one criterion for selecting farmer of the year.

RECOMMENDATIONS TO AUGMENT THE DRM FRAMEWORK IN GRENADA

The following recommendations were purported among farmers, technicians and other informants to ensure more effective inclusion of the agriculture sub-sectors in disaster risk reduction at the national and community levels. These include:

- Facilitate a major paradigm shift from response and recovery to comprehensive disaster management in all productive sectors.
- Disseminate the findings of this project (TCP/RLA/3101) to the National Disaster Management Advisory Council (NaDMAC).
- Make recommendations to ensure adequate inclusion of agriculture-related issues in the presently developed National Hazard Mitigation Policy.
- Foster more effective inter-departmental coordination within the Ministry of Agriculture.
- Develop a Disaster Risk Management Plan as part of the Ministry of Agriculture 2007 workplan. This was prioritized as the most critical intervention needed to support comprehensive disaster risk reduction in the agriculture sector. The following points were recommended for inclusion in the disaster plan inter alia:
    - Ensure adequate representation of the agriculture sector at all levels in the National Disaster Management Agency. For instance, prioritize representation at the National Disaster Management Advisory Council (NaDMAC) to ensure that the needs of the sub-sectors are adequately included. Additionally, facilitate effective involvement of the District Agricultural Offices in the District Disaster Committees.
    - Establish and routinely update an agricultural database that is easily accessible. This can be implemented in collaboration with the NaDMA, the Agency for Reconstruction and Development and the Grenada Red Cross Society.
    - Develop and implement a plan to train all officers attached to the Ministry of Agriculture in disaster management.
    - Establish a mechanism to ensure availability and equitable disposal of emergency food supplies prior to the commencement of each hurricane season.
    - Augment the managerial capacity of the chairpersons of the Disaster Management and other committees to ensure effective execution of tasks.
    - Establish a National Agriculture Committee on disaster management within the Ministry of Agriculture.

- Depoliticize disaster management. Specifically select volunteers based on competence, interest and time available to execute duties, and not solely on political affiliation.
- Collaborate with regional institutions and countries in establishing a risk transfer program for the agriculture sector.

PROPOSED KEY ELEMENTS FOR A REGIONAL DRM FRAMEWORK

The following are recommended as critical elements of a national and/or regional DRM framework.

1. Mainstream DRM in development planning at the national level – DRM should become a major national priority as evident in key national policy documents
2. Ensure adequate representation of the agriculture sector at all decision making levels pertaining to disaster management.
3. Facilitate proper representation of farmers groups or cooperatives at the district & village disaster committees.
4. Provide resources to allow for the development and implementation of a sector disaster plan which focuses on all stages in the disaster cycle.
5. Facilitate the development of a mechanism to ensure effective and efficient dissemination of information from the National Disaster Office to all levels within the Ministry of Agriculture (from policy to grass roots).
6. Formalized mechanisms for horizontal coordination between the Ministry of Agriculture and other key partners e.g. Red Cross Society.
7. Develop and implement a plan that augments farmers' resilience to recovery after a natural disaster.
8. Establish a national and regional fund to assist farmers post disaster.

CONCLUSION

Although no formal evaluation was conducted of the project, it can be viewed as a *critical first step* in changing the paradigm of disaster management among Caribbean agricultural sectors. Specifically, the following principles became much more relevant and important to stakeholders as a result of this project.

1. The need for proactive disaster planning that addresses *all phases of the disaster cycle,* and not limited exclusively to the response and recovery components of the disaster.
2. The importance of mainstreaming disaster planning and management in national development planning.
3. The urgent need for a well developed and managed agriculture sector disaster plan.

4. The importance of providing mechanisms for integrating the needs and views of the agriculture sector at all decision making levels.
5. The importance of building accountability and responsibility among the farming community for their own disaster management, particular their responsibility for mitigation, recovery and rehabilitation of their farming units.
6. The need to enhance the capacity of local non governmental organizations and community based groups to access resources for disaster planning and recovery.
7. The role of the Extension Department in supporting the adopting of mitigation practices and technologies among the farming community.

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LIST OF ABBREVIATIONS

CARDI	Caribbean Agriculture Research and Development Institute
CCC	Climate Change Committee
DRM	Disaster Risk Management
EC	Eastern Caribbean Dollars
ECLAC	Economic Commission for Latin America and the Caribbean
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GOG	Government of Grenada
IPCC	Intergovernmental Panel on Climate Change
KPH	Kilometers Per Hour
MOA	Ministry of Agriculture
NaDMA	National Disaster Management Agency
NaDMAC	National Disaster Management Advisory Committee
OECS	Organization of Eastern Caribbean States
TCP	Technical Cooperation Programme

1.0 INTRODUCTION AND COUNTRY CONTEXT

1.1 BACKGROUND AND REPORT STRUCTURE

Natural disasters have severely destabilized the socio-economic fabric of the Caribbean region in the last two decades, with the most devastating impacts experienced in 2004. According to the Centre for Research on the Epidemiology of Disasters (2005), at least 6,000 lives were lost, and over one million people were affected by natural disasters in the region in 2004. Comprehensive assessments of the impacts of natural disasters on five Caribbean countries[4] revealed that the extraordinary active hurricane season during that year resulted in damages approximating US $5.7 billion (ECLAC, 2004). Moreover, the productive sectors which include agriculture accounted for over one third (35.2%) of associated damages and losses (ECLAC, 2004). Such events have exposed the socio-cultural and environmental vulnerabilities of the Caribbean basin, and the urgent need to rethink disaster management options.

A comprehensive approach to disaster risk reduction however, has not been integrally incorporated into the agriculture sector within the region. This strategic deficient landscape has significantly reduced the resilience of the sector to cope with the onslaught of hydro-meteorological hazards such as Hurricane Ivan.[5] In recognition of the immense negative impact of the 2004 hurricane season on the farming community, and the urgent call for assistant from regional policy makers, the Food and Agricultural Organization funded the regional project "*Assistance to improve local agricultural emergency preparedness in Caribbean countries highly prone to hurricane related disasters*." The project implemented in three Caribbean[6] countries seeks to:

> "assist governments of participating countries to support the food security of farmers in the most hazard prone areas by improving institutional frameworks and technical options for hurricane related disaster preparedness, emergency response and post emergency agricultural assistance (FAO, 2006)."

This document divided into two sections reports on the outcomes of the project implementation in Grenada. Section 1 contains 7 chapters as outlined below:

> **Chapter 1** provided an overview of the project and its context. This includes Grenada's geographical position, its socio-economic status, a summary of the impact of natural disasters on the agricultural sector, and the project's methodology.
>
> **Chapter 2** presents the Disaster Risk Management Framework in Grenada and the linkages to the agricultural sector. The key challenges with the current

[4] Countries include Jamaica, Bahamas, Cayman Islands, Grenada and Dominica Republic.
[5] Hurricane Ivan, the strongest hurricane of the 2004 Atlantic Hurricane Season pass through Grenada as category 3 hurricane on September 7, 2004.
[6] The project is currently implemented in Jamaica, Haiti and Grenada. Plans are also in place for programme execution in Cuba.

system, and proposed recommendations for more effective incorporation of the sector's needs in disaster management at national and community levels are discussed.

Chapter 3 summarizes the outcomes of the PRA process in the two pilot communities. Specifically, the following information is provided: Site description, socio-economic and vulnerability context, and farmers' perception of disaster risk reduction.

Chapter 4 provides an overview of the good practices identified for reducing the impact of hurricane related hazards on the cropping, livestock and forestry sub-sectors.

Chapter 5 presents the outcomes of the national workshop.

Chapter 6 outlines the strategy employed for demonstration of good practices at the farm level, and discusses principal lessons learnt as a result of this initiative.

Chapter 7 identifies the key constraints to disaster risk management at the national level, proposes recommendations for augmenting the national framework and presents key elements of an ideal regional DRM framework.

1. 2 THE COUNTRY CONTEXT

1.2.1 Geographical Position

Grenada, part of a tri-island state (Grenada, Carriacou and Petit Martinique), is the southernmost windward island in the Eastern Caribbean (Refer to Figure 1). The island group located at 12° N latitude and 61° W longitude covers approximately 344 square kilometers, with Grenada amassing an area of 307 square kilometers or 89% of the total island group. The island state is divided into 15 constituencies[7] (14 in Grenada and one comprising Carriacou and Petite Martinique) which form the administrative basis for the establishment of the 17 national disaster districts[8] (Refer to Section 2.2.3).

The island state is divided into 15 constituencies[9] (14 in Grenada and one comprising Carriacou and Petite Martinique) which form the administrative basis for the establishment of the national district disaster committees (Refer to Section 2.2.3).

[7] A demarcated area within the island used for ease of administration during the electoral process.
[8] To ensure effective and efficient management, two of the constituencies, Carriacou and St. David's (located on mainland Grenada) were split into two resulting in the formation of 17 disaster districts.
[9] A demarcated area within the island used for ease of administration during the electoral process.

1.2.2 Socio - Economic Conditions

1.2.2.1 Economy

The economic fortunes of Grenada have been linked historically to the performance of the agriculture industry. However, a number of internal problems,[10] exacerbated by the removal of preferential treatment of Grenada's bananas on the international market, negatively affected the industry during the 1980s – 1990s. It rebounded to record real

Figure 1: Map of Grenada

Source: Grazette et al, 2005

growth of 3.4% in 2003, resulting in a current account surplus of EC$38.3 million. This creditable performance was due primarily to increased economic activity in most of the productive and service sectors of the economy.

The notable improvement in the economic climate was dramatically nullified after the passage of Hurricane Ivan on September 7th, 2004. Documented as the most powerful natural disaster to hit the Caribbean region, Ivan resulted in a scale of devastation that shocked the global community. Translated into monetary terms, the economy suffered damages in excess of EC$2.4 billion, twice the national's annual Gross Domestic Product (Ministry of Finance, 2005). As a result of the widespread destruction of various socio-

[10] Problems included the effect of the mealy bug, low international prices for banana and cocoa, suspension of banana exports, inadequacy of agricultural inputs and decreased productivity (MOA, 2004).

economic sectors, economic activity declined by 3% in 2004, in contrast to the 4.7% growth projected for the middle of the year (Ministry of Finance, 2005).

Real growth of 1.5 % was recorded in 2005 and 2006 due to increased activity in the construction industry supported by a revitalized cruise tourism sector (Ministry of Finance, 2006). Conditions in the agriculture sector remained subdued following the additional devastation suffered as a result of Hurricane Emily[11] in 2005. The Ministry of Finance Budget report projected economic growth of 6 – 6.5 % in 2006. Notwithstanding the above positive trends, the economic base of Grenada remains unsatisfactory and would require continued strategic financial management to ensure sustained growth and development in the future (Ministry of Finance, 2006).

1.2.2.2 Poverty assessment

A national poverty assessment survey conducted by Kairi Consultants in 1998 estimated that 32.1% of all individuals in Grenada were poor, in that their annual expenditure was less than EC$3,362 - the cost of meeting their minimal food and other requirements. Additionally, 12.9% of all individuals were found to be extremely poor or indigent. Other key features of national poverty highlighted in the report included the following:

- Poverty is seriously affecting young people, *with over 56% of the poor being less than 25 years old;*

- Poverty was distributed almost evenly throughout the country, with the highest levels being found in St. George's (31.7%), St. Andrew's (26.6%) and St. Patrick's (14.0%).

- *Approximately 64% of the population had no form of educational certification.* The country had a limited human capital stock, as represented by the level of education attained by the majority of the population.

Following the passage of Hurricane Ivan, significant socio-economic destabilization occurred (Refer to Section 1.2.2.1). The OECS *Macro Socio-economic Assessment of Damages Caused by Hurricane Ivan* (2004) reported that the poor who lived in the most affected parishes by Hurricane Ivan (St. George's, St. Andrew's, St. David's and St. John's), *accounted for approximately 75% of all the persons who were poor across the nation*. The effect of the disaster on the parishes with the significant proportions of the poor, exacerbated an already difficult situation (OECS, 2004), thus enhancing their vulnerabilities.

1.2.2.3 Employment

Unemployment, which registered 13% in the pre-Ivan period, increased sharply immediately after the disaster as many persons lost their jobs (Ministry of Finance, 2005). The Government of Grenada with tremendous assistance from the international community has made significant progress in promoting economic recovery at the national

[11] Hurricane Emily, a category 1 Hurricane passed through Grenada on July 14, 2005.

level. A number of initiatives have been implemented in the post-Ivan era to revitalize the economic situation in Grenada. Unemployment for 2006 is projected at 12% (Ministry of Finance, 2006).

1.2.2.4 Population

Results of the 2001 census reported that the population was 101,000, which represented an increase of approximately 7.4% of the 1991 population. The population was fairly evenly distributed along gender lines, with slightly more females than males. The majority of the population, (80%) was 0 - 49 years. Age distribution showed that 47% were less than 20 years old, and 16% were 50 years and over (Ministry of Finance, 2002). Persons of African decent dominated the population, with a smaller percentage representative of Indians and Caucasians.

1.3 IMPACTS OF NATURAL DISASTERS ON THE AGRICULTURAL SECTOR

Grenada is situated just south of the historical paths of most tropical storms and hurricanes. Although the probability of direct impact is low, the island is very vulnerable to these major weather systems. During the 50 year period spanning 1955 – 2005, three major hurricanes directly affected Grenada: Janet in 1955, Category 3 Ivan in 2004 and Category 1 Emily in 2005.[12] Similarly, the island was directly hit by at least four major storms between 1990 to present including Hurricane Lenny in 1999 (Peters, 2006). Information on the impact of these hazards on the agriculture sector prior to 2004 is very limited.[13] The subsequent sections summarize the impacts to the sector resulting from Hurricanes Ivan and Emily.

1.3.1 Impact of Hurricane Ivan

The impact of Hurricane Ivan was widespread throughout Grenada and severely affected the agriculture sector. The damage imposed on the sector was most intense in the parish of St. Andrew accounting for 60 percent of total damage, followed by St. David with 20 percent, St. George's five percent, with St. Mark and St. Patrick sharing the remaining five percent (OECS, 2004). Total direct and indirect costs to the agriculture sector inclusive of the cropping, livestock and fisheries sub-sectors were 55 and 46 million EC$ respectively (OECS, 2004). Almost two fifth (39.5 percent) of the damage was attributable to crops; 24.1 percent to farm roads; less than 10 percent to livestock (7.9 percent) and other infrastructure (5.9 percent) (Ministry of Agriculture, 2004). Additional impacts on the agriculture sector included the following:

[12] The passage of Hurricane Flora in Grenada in 1963 resulted in minor damages estimated at US$25,000.00. Six persons died however, due to drowning (Wilkepedia Foundation, 2006).

[13] Approximately 75 percent of the nutmeg trees in Grenada were destroyed as a result of Hurricane Janet (Timelines of History, no date) with total damage estimated at US4 2.8 million (Storm Carib, 2005).

- Destruction of 70 percent of the 555,000 nutmeg trees (OECS, 2005).[14] The OECS assessment team predicted a reduction in nutmeg production over the next 5 years, and a concomitant reduction in foreign exchange earnings to about 8 percent once current stocks are exhausted.

- Damages to the physical infrastructure supporting the nutmeg industry were also considerable. Eleven of the nineteen nutmeg receiving stations sustained considerable damage at an estimated cost of EC$5.7 million, while the nutmeg distillation plant located in Marli St. Patrick's will require approximately EC$ 650,000 to refurbish the plant to a desired level of operation (OECS, 2004).

- The extensive cocoa building infrastructure including private operators such as Belmont Estate incurred damages of approximately EC$1.8 million.

- Additional cropping damage included:

    - One hundred percent destruction of the 350 acres of bananas estimated at EC$1,440,134.
    - Destruction of 15.4 percent of the 120 acres of citrus estimated at EC$ 2,610,623.
    - Complete obliteration of the 114.5 acres of vegetables valued at EC$2,792,000.
    - Destruction of minor fruits[15] estimated at EC$2,792,000, and almost one fifth of the 282 acres of roots and tubers valued at EC$837,125.

- Ninety one percent of the forest lands and watershed were stripped of vegetation.

- Damages estimated at EC$ 9,338,117.00 were incurred in the livestock industry due to destruction of housing infrastructure and loss of stock. Damage was most severe in poultry, pigs, sheep and goats.

- One hundred and fifty miles of farm roads were damaged during Hurricane Ivan with an estimated reconstruction value of EC$28.67 million.

1.3.2 Impacts of Hurricane Emily

Hurricane Emily a category 1 hurricane with sustained winds of 90 mph impacted Grenada and its dependencies on Thursday July 14, 2005 ten months after the passage of Hurricane Ivan. According to the OECS macro socio-economic analysis, 40 percent of the state was reported to have been impacted, and approximately 38 percent of the population affected. Total damage incurred was EC$140 million, 12.9 percent of current Gross Domestic Product (GDP) (OECS, 2005).

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[14] The macro socio-economic assessment conducted for Hurricane Ivan by the OECS team reported 90 percent damage of nutmegs. However, this figure was modified to 70 percent by the OECS team during the assessment of damages resulting from Hurricane Emily (OECS, 2005).

[15] Include sapodilla, papaya, passion fruit, golden apple etc.

The damage caused by Hurricane Emily was not widespread but disrupted a critical path of recovery in the agriculture sector (OECS, 2005). Approximately one quarter of the total damages resulting from Hurricane Emily occurred in the agriculture sector (OECS, 2005). As shown in Table 1, direct and indirect damages were EC$35.51 million.

Table 1: Summary of direct and indirect damages to the agriculture sector after Hurricane Emily (OECS, 2005)

Damage	Direct/EC$	Indirect/EC$	Total/EC$
Crops[16]	4,801,597	1,749,945	6,551,542
Livestock	223,376	145,075	368,451
Fisheries	398,000	435,312	833,312
Farm roads[17]	16,917,200	-	16,917,200
Forestry	524,600	-	524,600
Farm soil loss	620,163	9,691,320	10,311,483
	23,484,936	**12,021,652**	**35,506,588**

1.3.3 Needs of the Agriculture Sector Post Hurricanes Ivan and Emily

Hurricane Ivan and Emily have weakened the internal capacity of the Ministry of Agriculture (MOA, 2004), and have aggravated historical challenges. The revitalization and rehabilitation plan for the agricultural sector developed after Hurricane Ivan identified five strategic needs for the industry. These include:

- Institutional modernization.[18]
- Trade and market development and promotion.
- New and value added product development.
- Profitable and sustainable production systems.
- Infrastructural development.
- Improvement in the technical services and managerial capabilities of stakeholders (MOA, 2004).

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16 This crop damage includes the cost of the loss of secondary flows as a result of inaccessibility to farms caused by the destruction to farm road. It must also be pointed out that those farms which would have been most impacted because of the inaccessibility were the banana farms; in this instance however, the hurricane has already toppled most of the crop (OECS, 2005).

17 The damage to farm roads did not prevent accessibility to all farms. In some instances, farmers were able to access their farms through dirt tracks while in other cases, the roads were motorable once the debris were cleared (OECS, 2005).

18 Identified Institutional challenges were: Limited integration and coordination of activities among key institutions and/or major divisions/departments; inadequate agricultural information system, excessive rules and procedures; lack of adequately trained personnel; high institutional cost of providing services to the farming community and lack of recognition of the dual nature and characteristics of the agricultural sector.

The need to implement culturally appropriate technologies and practices to mitigate the impact of hurricanes on the sector (e.g. soil conservation practices such as levees, terraces, strip cropping, special cover crops, diversion ditches) was also highlighted (OECS, 2004).

1.4 VULNERABILITY TO CLIMATE VARIABILITY AND CHANGE

Climate variability and change represent major threats to the local agriculture sector. The international scientific community has announced that average global temperatures are expected to increase by up to 5.8 degrees Celsius within the next 100 years, with the following projected changes:

- Rising sea levels caused by the melting of the artic ice and the thermal expansion of the sea water.
- Longer dry seasons and wetter wet seasons, accompanied by reductions in total rainfall. A four percent reduction in total rainfall has been predicted for the Caribbean region.
- More intense rainfall when it occurs (CCC, 2006).

Major projected impacts of climate change to the local agriculture sector included the following:[19]

- High temperatures would increase evapotranspiration while carbon dioxide enrichment would boost productivity in C3 plants.[20] Greenhouse grown type vegetables could show yield increases up to 10 – 70 percent. These climatic changes could also push the nutmeg growing belt to higher elevations reducing the capacity of the water producing watershed.
- Need for irrigation would be greater.
- Under normal conditions, pasture grasses which are C4 plants normally drop their yield productivity under high carbon dioxide concentrations. Lower animal yield can be expected especially in Carriacou[21] as a result of reduce grass yields.
- Decrease annual precipitation and higher temperatures could lead to reduce domestic water availability in the dry season, and to diminish yield among the principal agricultural export crops.

1.5 METHODOLOGY

Figure 2 summarizes the methodology employed during project implementation.

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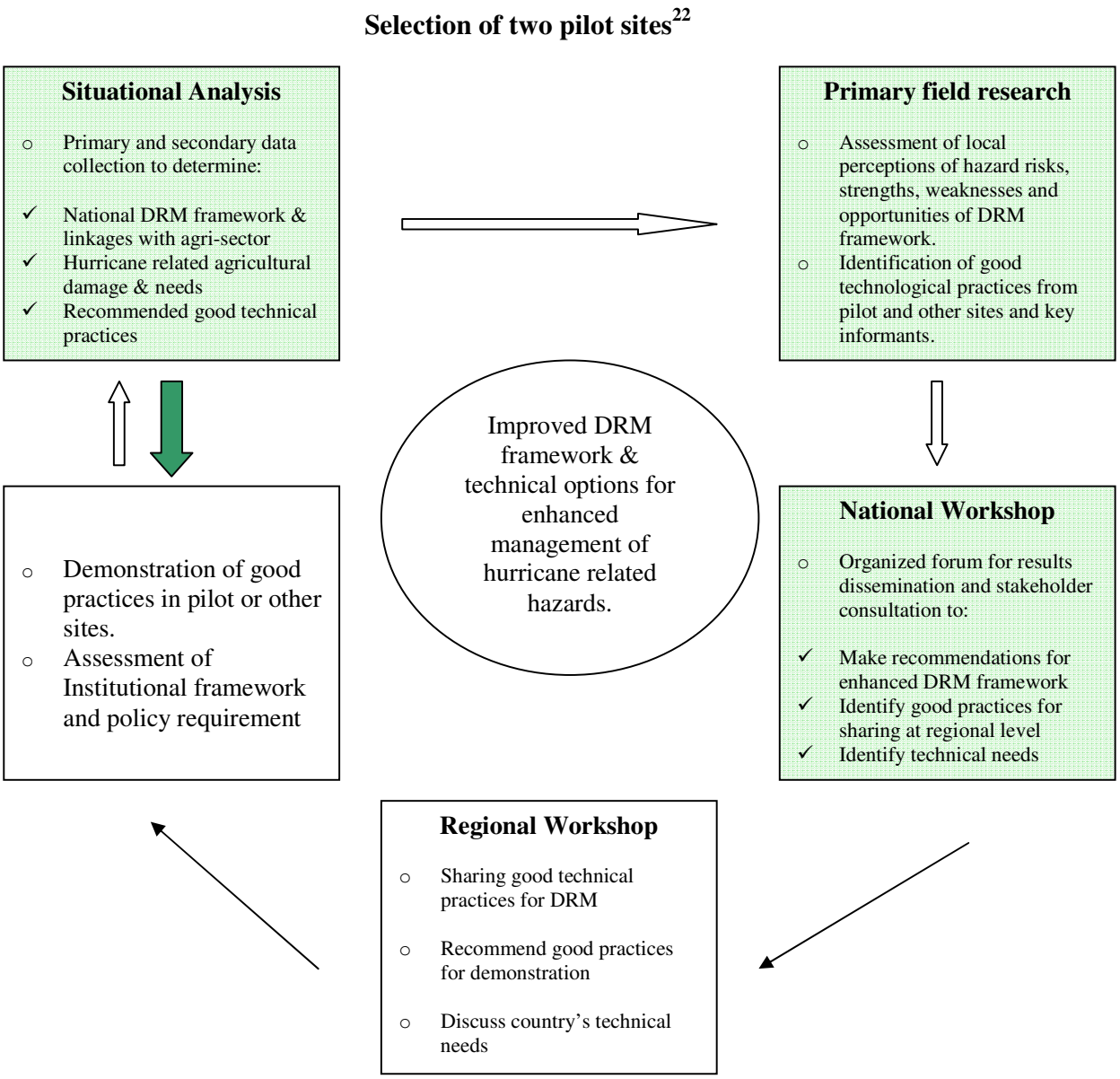
19 Based on the vulnerability assessment conducted in 2000; and research to support the development of the Climate Change Policy in 2006.

20 These include nutmeg, cocoa, cassava, maize, yam, banana, sweet potatoes, pigeon peas and beans (Wittwer, 1992 as quoted in).

21 Carriacou accounts for 30 percent of the total livestock population in Grenada (GOG, 2000).

Figure 2: Schematic of project methodology



Notes: Shaded boxes denote completed activities.

[22] The following criteria guided the selection of pilot sites: prior interventions in the community by FAO and/or NGOs; vulnerability to hydro-meteorological hazards, and impact of hazard/s within the last 5 years; evidence of local capacity to respond to, and mitigate hazards; representation of different agricultural production systems; sole dependence on agriculture for a livelihood; level of cooperation with the Ministry of Agriculture and presence of a collaborative mechanism at the farm level.

2.0 NATIONAL DISASTER RISK MANAGEMENT FRAMEWORK

This section summarizes the key components of the disaster risk management framework at the national and local levels, and the linkages with the agriculture sector in Grenada. The major limitations of the framework in incorporating the needs of the agriculture sector are also emphasized. The section concludes with a list of recommendations to facilitate more effective and sustainable integration of agricultural issues in national and community based disaster planning.

2.1 ORGANIZATIONAL STRUCTURE

The Grenada National Disaster Management Agency (NaDMA) is the principal organizational framework that governs disaster management at the national level (Refer to Figure 3). NADMA is comprised of the following entities:

- National Disaster Management Advisory Council (NaDMAC).
- National Emergency Executive Council.
- National Disaster Coordinator.
- National Hazard Mitigation Council.
- National Disaster Office.
- National Disaster Management Committees.
- District and Village Disaster Committees.

The Ministry of Agriculture is represented through provisions made by the National Disaster Plan 2005 in four of the above disaster management entities: The NaDMAC, the National Disaster Management Committees, the district and village committees (See Figure 1, green boxes). The subsequent section describes the primary functions of each of the four entities, and the specific representation of the Ministry of Agriculture.

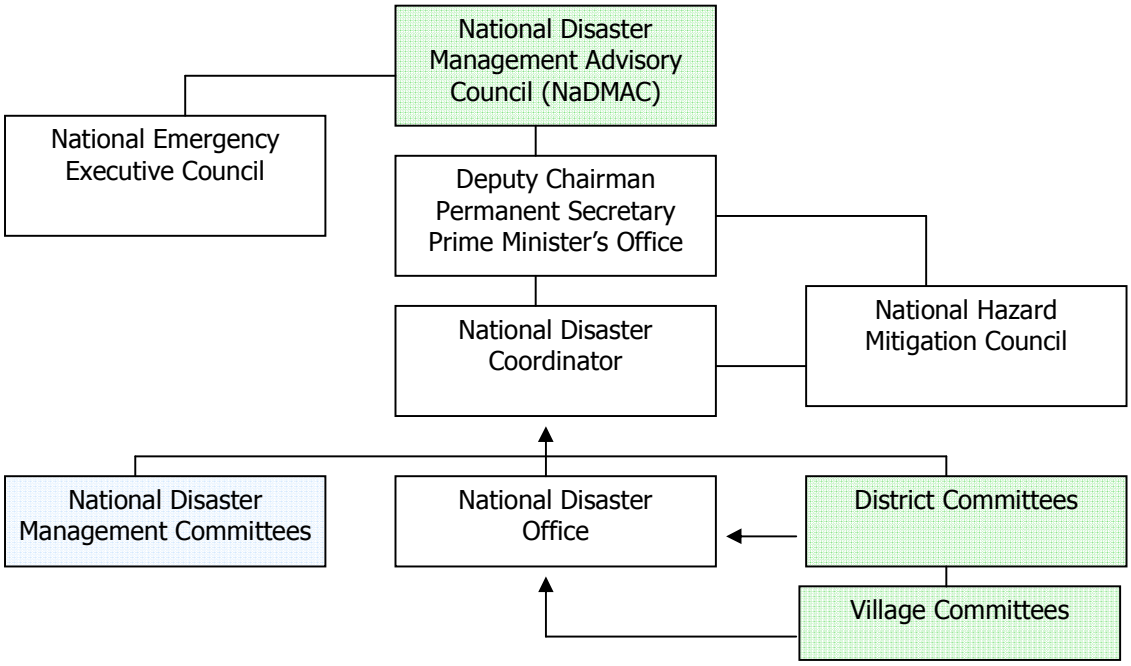
2.2 REPRESENTATION OF THE AGRICULTURE SUB-SECTOR IN NaDMA

2.2.1 National Disaster Management Advisory Council

The National Disaster Management Advisory Council (NaDMAC) is the leading authority on disaster risk reduction at the national level. Headed by the Prime Minister, the Council's principal role is to develop appropriate policies that ensure effective implementation of the National Disaster Plan. Chief responsibilities of the NaDMAC include:

- To ensure that all disasters and emergency preparedness processes and resources are adequate.
- To mobilize, direct and co-ordinate preventative, mitigative, preparedness, response, rescue and relief mechanisms for all hazards and emergency situations.

Figure 3: Organizational Structure of NADMA



Notes: The highlighted boxes represent the avenues provided through the National Disaster Plan 2005 for representation of the Ministry of Agriculture.

- To promote preventative mechanisms and activities, and rapid response techniques by all organizations and agencies with disaster functions or services especially Police, Fire, Health Services, etc..
- To prepare for approval by Cabinet, guidelines and administrative policy for all sections of the National Disaster Organization.
- To ensure the acquisition and dissemination of adequate public information and to promote and approve educational and training activities on emergency situations.

The Permanent Secretary, Ministry of Agriculture is one of the participating members of the NaDMAC.

2.2.2 National Disaster Management Committees

Fifteen (15) national disaster management committees[23] have been established by the NaDMA to facilitate better distribution of services, and as a method of streamlining and co-coordinating all services within the country. The national disaster management

[23] Public information and education; damage and needs assessment; transport and road clearance; shelter management; health services; emergency telecommunications; disaster relief management; public utilities; rehabilitation and reconstruction; search and rescue; welfare and voluntary services; security services; evacuation; earthquakes; volcanic eruptions; landslides and flooding; marine pollution and oil spills; hazardous materials and waste.

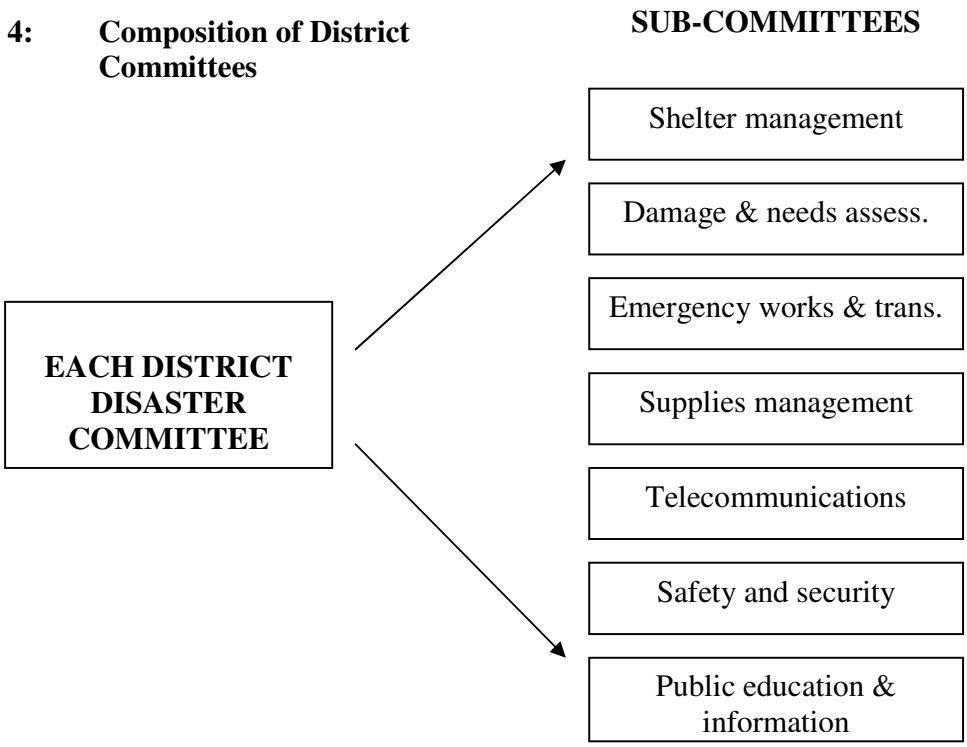
committee's primary responsibility is to ensure that the required preparedness and preventative measures have been instituted, in order to minimize loss of life and reduce property damage where possible (GOG, 2005). According to the National Disaster Plan, 2005, these committees should be involved in pre-disaster planning, i.e. establishing management systems for implementation of an adequate response, and responding if an emergency or a disaster occurs.

The Ministry of Agriculture is represented on four committees: damage and needs assessment; disaster relief management; public utilities rehabilitation and reconstruction; hazardous materials and waste; and Earthquakes, volcanic eruptions, landslides and flooding, marine pollution and oil spills[24] (Refer to Appendix 1 for a list of the duties of each committee).

2.2.3 District and village disaster committees

Seventeen (17) district disaster committees[25] (one in each disaster district) have been commissioned to facilitate the involvement of communities in disaster planning (Refer to Section 1.2.1). Eight (8) subcommittees comprised of volunteers are established in each district (See Figure 4). These district committees are coordinated by the District Disaster Coordinator, attached to the National Disaster Office.

Figure 4: Composition of District Committees



[24] Representation on the latter committee is facilitated through the supervisor of the Department of Forestry or a nominee.

[25] Committees include shelter management, damage and needs assessment, emergency works and transport, supplies management, telecommunications, safety and security and public education and information.

The National Disaster Plan provides avenues for the integration of agriculture related issues at the district level through representation on the damage and need assessment and supplies management committees. The model used for establishing the district committees would be employed for replication at the village level.[26]

2.3 PUBLIC SECTOR INSTITUTIONS

All Government Agencies and Ministries are responsible for designing their own continuity of operations and emergency response plans. These plans must provide for security of the organizations' facilities, materials, information, vehicles, equipment, uniforms and personnel as well as to determine emergency response procedures to provide assistance to the population according to the specific organizations' role during emergencies and disasters (GOG, 2005). In this regard, the Ministry of Agriculture is expected to fulfill the following requirements:

- Design, update, test and evaluate continuity of operations and emergency response plans and procedures.
- Distribute welfare supplies (other than food).
- Maintain adequate stocks of blankets, beds, feeding utensils, lanterns, torch lights, etc. during hurricane season (GOG, 2005).

2.4 LEGISLATIVE FRAMEWORK

Grenada presently lacks legislation to govern disaster management issues. It is important to note however, that the National Disaster Management Agency is currently in the process of developing the Disaster Management Act.

2.5 SHORTCOMINGS IN THE PRESENT DISASTER RISK MANAGEMENT FRAMEWORK

Four windows of opportunities are provided for the involvement and incorporation of the agricultural sector in disaster management at the national and community levels. They include the National Disaster Advisory Council, four national disaster management committees, and the various district and village disaster committees. Albeit these mechanisms, the current system is not fully conducive to effectively incorporate the sector's needs. The following section summarizes the primary constraints hindering more appropriate integration of agriculture related issues in national disaster risk reduction.

- The Ministry of Agriculture's representation at the NaDMAC (and the public utilities, rehabilitation and reconstruction disaster management committee) addresses issues exclusively related to public utilities.[27] Issues specific to agriculture such as

[26] The village committees are not yet in operation.

[27] The Ministry of Agriculture is responsible for the following: Agriculture, Lands, Forestry, Fisheries, Public Utilities and Energy.

cropping, livestock and forestry *are not* part of the Permanent Secretary's mandate at any of these decision making levels.

- The relief management and damage and needs assessment management subcommittees are focused primarily on preparedness and emergency response issues. Prevention and mitigation aspects of these thematic areas are not fully included in the mandate of the above management committees. Moreover, effective and efficient relief management and damage and needs assessment are constraint by a number of factors including but not limited to the following:
    - Limited baseline information on the status of farms prior to the disaster which hinders effective post disaster planning and intervention.
    - Inadequate definition of roles and responsibilities of key stakeholders.
    - Overwhelming responsibilities of the chairpersons of different management committees.[28]
    - Lack of integration of disaster management in the job description of representatives of these management committees.
- No mechanism currently exists that effectively facilitates comprehensive prevention and mitigation planning for hurricane related disasters at the farm level.
- The problems inherent in volunteerism such as burnout, loss of interest and limited incentives seriously hinders proper functioning of the district and village communities.
- The Ministry of Agriculture does not have in place an agriculture disaster management plan that comprehensively deals with disaster risk reduction.[29]

2.6 RECOMMENDATIONS TO AUGMENT THE DRM FRAMEWORK

Five main recommendations[30] were proposed to ensure effective and sustainable integration of the agricultural sector unique needs in national and community disaster planning as outlined below.

- Select a focal point from the Ministry of Agriculture that can competently champion the needs and challenges of the agricultural sub-sectors at the level of the NaDMAC. This individual would complement the work done by the Permanent Secretary at the Council.
- Develop an agriculture disaster management plan as part of the Ministry's 2007 workplan (initiative to be lead by the Permanent Secretary).

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28 For instance the Permanent Secretary in the Ministry of Agriculture chairs the public utilities management committees, and represents the ministry at the NaDMAC.

29 It is important to note that the Permanent Secretary, Ministry of Agriculture mandated the development of disaster plans for the hurricane season 2006 by all ministerial departments /units.

30 These recommendations emanated from key information interviews conducted prior to the national workshop.

- Make recommendations to ensure adequate inclusion of agriculture-related issues in the presently developed National Hazard Mitigation Policy.
- Review the current model for inclusion of agriculture at the district and village disaster management committees, and make recommendations for more appropriate representation of needs.
- Address the challenges of volunteerism by conducting a rapid assessment of organizations such as Grenada Red Cross Society who have established volunteer programmes to determine best practices for sustaining volunteer effort. Develop and implement resulting volunteer management plan.
- Disseminate findings of the FAO study (TCP/RLA/3101) to the NaDMAC.

3.0 THE PILOT SITES

Two pilot sites, Ludbur and Beausejour were selected for this project using the criteria as outlined in Section 1.5 (Refer to Figure 5). Field visits conducted in September with officials from the Food and Agricultural Organization fueled the selection of Ludbur. Selection of the second site occurred in consultation with the National Consultant, Extension and Land Use Officials. This section provides a profile of each site with specific emphasis on the following: Site description, socio-cultural and hazard vulnerability context, and perception of disaster risk management. Consultations with farmers and extension staff in the pilot areas, complemented by secondary literature analysis provided information to support this section.

3.1 LUDBUR/MIRABEAU

3.1.1 Site Description

3.1.1.1 Location and physical characteristics

Ludbur, a small rural agricultural village located in Mirabeau, St. Andrew's is part of the Eastern Agricultural District. The pilot site approximating 35 - 45 acres is an intensely farmed upland area situated towards the northeastern part of the Mirabeau Agricultural Station.

Photo 1a: Typical setting in Ludbur

Photo 1b: Contour beds in Ludbur

3.1.1.2 Micro-meteorology and soil

Climatically the site is described as having a very long growing period (300 – 330 days). Annual average rainfall is moderate and ranges from 1500mm to 2000mm, approximately 50% less than the national average of 4000mm (Land Use Division, Ministry of Agriculture, 2006). Climate is normally warm to very warm, with the mean annual temperature and the temperature during the growing period between 25 – 27.5 ◦C. According to the Land Use Division, the site experiences a relatively short dry season during three and four months per year.

The soil type of the general area is ***Capital Clay Loam***; it is pretty stable, moderately well drained. Additional information on soil characteristics is provided in Box 1.

Box 1: Soil Characteristics

Parent Material: Basic igneous rock
Soil pH: 4.5 – 5.5 @ 50 and 150 cm
Soil depth: > 150 cm
Slope: 10 – 20◦

Source: Land Use Division. 2006

3.1.1.3 Natural resource base

Field visits supported by consultations with farmers and key informants revealed the presence of two natural features in Ludbur: a quarry and natural spring.

- The quarry, owned and operated by the Government of Grenada is situated towards the northeastern part of the pilot area (Refer to Figure 7). Operations occur predominantly during the dry season (January – May) to provide building materials for the national construction industry. No major degradation was identified within that area.
- A natural spring which flows throughout the year is located within a farmers plot in the southeastern end of the pilot site. It is used by farmers for drinking purposes while on the farm and to supply the owner's domestic water needs.

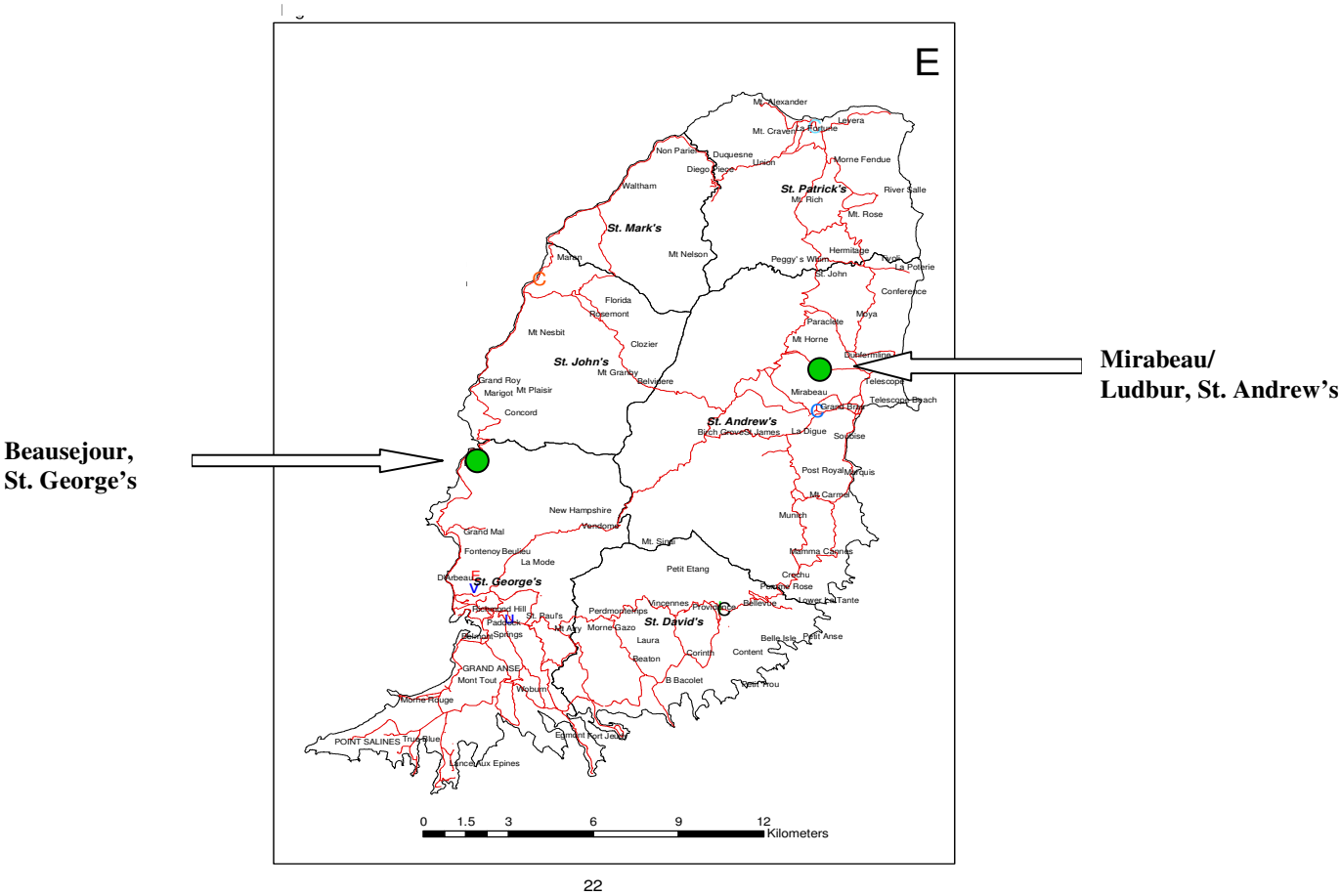
3.1.2 Socio-cultural Setting

3.1.2.1 Demography

The community of Mirabeau[31] accounted for less than 0.1 percent of the national population (Central Statistical Office, Ministry of Finance, 2007). According to the 2001 population and housing census, Mirabeau had a population of 581 persons, with slightly more males (305 persons) than females (276 persons). Age distribution revealed that approximately four fifths (86.6 percent) of the population was between 0 - 49 years old.

[31] It was not possible to find demographic information specific to Ludbur. Information on the general area of Mirabeau would therefore be used in most cases.

Figure 5: Map of Grenada showing approximate location of pilot sites



No significant changes have occurred in the community over time. Persons of African descent represent the main racial group within the community.

3.1.2.2 Livelihood strategies

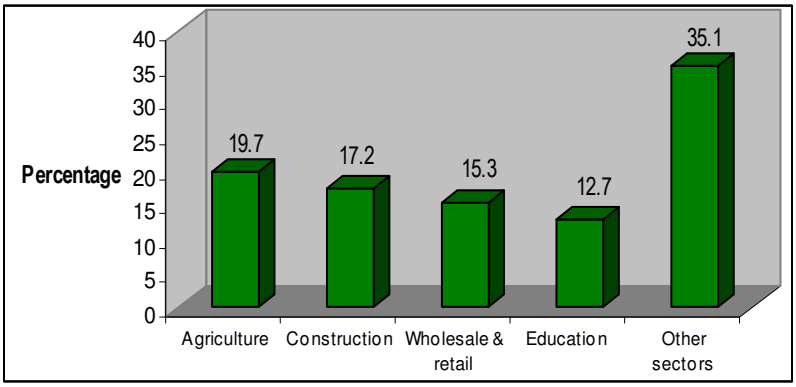
The 1998[32] Labour Force survey reported that the number of persons employed and unemployed were 174 and 33 respectively. Moreover, agriculture, forestry and hunting represented the most predominant employment sectors in the community (19.7%) followed by construction (17.2%) and wholesale and retail trade (15.3%) as illustrated in Figure 6.

Consultations with farmers and extension staff reported the following:

- Agriculture contributes significantly to the socio-economic development of the community.

[32] This is most current information available on the national labour force.

Figure 6: Employment profile of population of Mirabeau



- Approximately 30 - 35 farmers currently farm lands within the Ludbur area. Approximately six of these farmers are full time. Part-time farmers are engaged in construction, transportation and other agricultural activities.[33]
- Farmers are involved in a mixed cropping system which includes vegetables and fruit trees, and to a lesser extent tree crops.
- Farmers holding vary between small plots of ¼ acre to 2¼ acres. Most of the landholdings have been lease to farmers in a lease to purchase agreement by the government of Grenada during the 1980's. Farmers currently pay a mortgage to the government based on financial resources with the goal of acquiring ownership of the property at the end of the payment period.
- Agriculture is severely impacted by natural hazards as indicated by Section 1.3.1 and 1.3.2. It is important to note though that the construction sector is normally positively impacted in the short to medium term by large scale hurricane related disasters, thus providing part-time employment for some farmers.

3.1.3 Hazard Vulnerability Context

The pilot area is very vulnerable, as any other part of the island to the impacts of tropical storms and hurricanes. However, the steep to moderately steep sloping lands, the type of agriculture production system and the socio-economic conditions of householders increases the vulnerability of the site to natural hazards specifically storms, heavy rainfall and to a lesser extent landslides (Refer to Table 2). It is important to note that a number of the houses located directly to the north of the farms are very vulnerable to any major tropical system due to the construction materials and design used.[34]

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33 Some individuals work at the Mirabeau Agricultural Station on a part-time basis.

34 Houses are wooden structures made mainly from ply. Hurricane resistant methods and materials have not been consistently used in the construction of these low cost homes. In fact, one farmer indicated that he is currently seeking assistance to construct a new home due to its obvious vulnerability to high winds.

Table 2: Vulnerability analysis of pilot site (Ludbur)

Type of hazard	Frequency of event	Probable impact
Storm/hurricane	Two events in the last three years (future frequency is uncertain)[35]	Very high
Landslide	Once per year[36]	Low
Dry spell	Rare	Low

As shown in Table, storms and hurricanes impose the greatest burden on the pilot area. The recent passage of Hurricane Ivan and Emily severely impacted the socio-economic base of farmers and householders within the project site. No formal documentation exists on the extent of damage that occurred within the area, but the damage was typical of most communities. The following excerpts capture farmers' perceptions of the resultant impact:

> "I loss everything, all my vegetables … even some of my beds were broken. The only thing that was standing was some of my fruit trees."

> "The hurricane really affected us. It was very bad, we lost most of what we had. It was really sad. Most of us loss our houses … when Emily came we did not even get over Ivan yet, so you could imagine the problems we faced."

According to farmers, occasional heavy rainfall during the year has resulted in some losses, which affects yield. Landslides and dry spells however, are very rare events.

A number of coping strategies are employed within the pilot community to reduce the impact of disasters, and to recover from their impacts. Soil conservation practices such as contour farming, grass barriers and a diversified cropping system are used fairly consistently to reduce the negative impacts of storms, hurricanes and landslides. These practices have been fairly effective in reducing the impact of rain during the rainy season, however, have not prevented the devastating impacts of storm or hurricane forced winds. Coping strategies used after a hurricane involves seeking assistance to re-construct homes and farms, re-establishing farm system, and finding alternative employment opportunities[37] in the case of part-time farmers.

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35 Heavy rains which occur during the raining season spanning January to May of each year increase the potential for soil erosion within the pilot area. The magnitude of impact varies from low to moderate, and is dependent on the extent of rainfall and conservation practices employed.

36 Landslides normally occur in restricted areas slightly outside the border of the pilot area.

37 Most likely construction.

Figure 7: Hazard vulnerability map of pilot site in Ludbur

3.1.4 Perception of disaster risk management

3.1.3.1 Institutions

Very few organizations exist in Mirabeau. Notwithstanding this, two faith based groups (Mirabeau Pentecostal and Youth Ministries) and at least one sport organization exist in the Mirabeau/Ludbur area. Farmers are involved, though very loosely in the Mirabeau/Ludbur Farmers Association. According to reports from farmers the latter organization functions inadequately due to limited cooperation and inadequate managerial skills among farmers.

A local Non Governmental Organization GRENED (Grenada Education and Development Programme) located in Telescope St. Andrew's contributes to some extent to the development of the Ludbur/Mirabeau area. GRENED established in 1996, seeks to provide educational opportunities and resources to the nation to help reduce poverty, and to nurture economic self determination and social development.[38] Similarly, the Grenada Red Cross Society (GRCS) though not situated in the pilot site contributes to disaster preparedness and management at the national and community levels specifically in the areas of public awareness and education, training and development of family plans, and relief and recovery assistance. The Society is also involved in other activities including first aid, youth development, HIV and AIDS and welfare operation.

3.1.3.2 Disaster prevention and mitigation

Consultations with farmers revealed that disaster prevention and mitigation has not been a major thrust of their farming operations. Albeit this, some level of interest and expertise in disaster risk reduction exists among the farming community in the pilot area.

3.1.3.3 Preparedness and post disaster management

The following summarizes farmers' perceptions of disaster preparedness, recovery and rehabilitation efforts.

- A well established and efficient early warning system for storms and hurricanes exist at the national and community levels facilitated through the local media houses. This information is augmented and/or supported by access to ***The Weather Channel***[39]**.**

- All farmers reported not having a properly developed contingency plan to deal with major natural disasters. Planning tended to be reactive.

- Relief supplies and post emergency assistance were provided largely by three institutions: GRENED through funding provided by the United Nations Development Programme, the Ministry of Agriculture, and the Grenada Red Cross Society. Figure 8 illustrates farmers' perceptions of the contribution made by the above organizations in their recovery and rehabilitation efforts.

- As illustrated, the local NGO GRENED was perceived to contribute most significantly to the farming community. Farmers reported receiving a range of inputs that they requested such as seeds, fertilizers, chain saws, hoes, irrigation supplies etc. The Ministry of Agriculture (MOA) through its Agriculture Emergency Recovery Programme also made notable contributions followed by the Grenada Red Cross society (which provided agricultural inputs).

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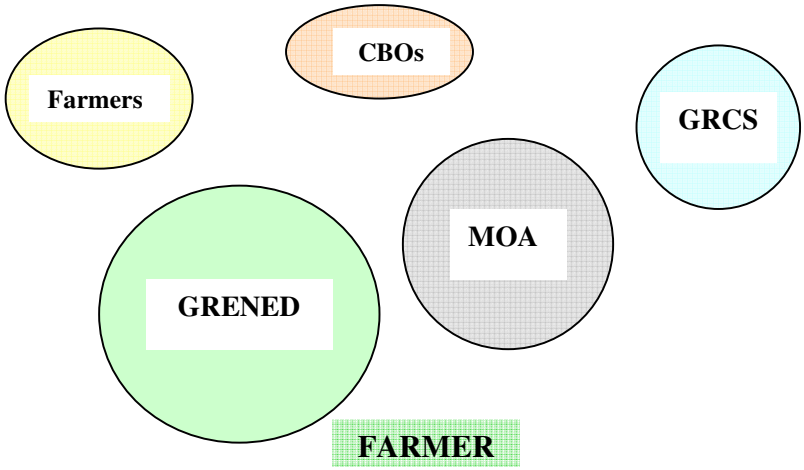
38 GRENED's vision/mission statement.

39 The Weather Channel is a U.S. based network which produces continuous 24-hour national and international weather related information.

Figure 8: Venn diagram showing farmers perception of the contributions of local institutions to post hurricane recovery efforts



Notes: Size and proximity of circle to the farmer denotes perceived importance.

3.2 BEAUSEJOUR

3.2.1 Site Description

3.2.1.1 Location and physical characteristics

Beausejour, a small sub-urban village located in St. George's is part of the Western Agricultural District. The pilot site, a low lying area is situated within the Beausejour River Basin (Refer to Figure).

Photo 2: Part of pilot site in Beausejour

Micro-meteorology and soil

Climatically the site is described as having a long growing period (270 - 300 days). Annual average rainfall is moderate and ranges from 1500mm to 2000mm, approximately 50% less than the national average of 4000mm (Land Use Division, Ministry of Agriculture, 2006). Climate is normally warm to very warm, with the mean annual temperature and the temperature during the growing period between 25 - 27.5 ◦C. According to the Land Use Division, the site experiences a short dry season during three and four months per year.

The soil type of the general area is ***Plains Loamy Sand***; it is fairly stable and well drained. Additional information on soil characteristics is provided in Box 2.

Box 2: Soil Characteristics

Parent Material: Colluvium/Alluvium
Soil pH: 6.5 – 7.5 @ 50 and 150 cm
Soil depth: > 150 cm
Slope: 10 – 20◦

Source: Land Use Division. MOA. 2006

3.2.1.3 Natural resource base

Field visits supported by consultations with farmers and key informants reviewed the presence of the following natural features in Beausejour: the Beausejour River and estuary and the adjacent marine environment. Unsustainable activities specifically sandmining has resulted in deterioration of the mangrove ecosystem and associated coastal resources. This could potentially increase the frequency and intensity of flooding within the Study Area, and sedimentation and reduction of biodiversity abundance in the marine environment.

3.2.2 Socio-cultural Setting

3.2.2.1 Demography

The community of Beausejour accounted for approximately 0.2 percent of the national population (Central Statistical Office, Ministry of Finance, 2007). According to the 2001 population and housing census, Beausejour had a population of 169 persons, with more females (92 persons) than males (77 persons). Age distribution revealed that 78.1 percent of the population was 0-49 years old; approximately 32 percent of the population were children; while four in every ten persons were between the ages of 15 - 49.

No significant changes have occurred in the community over time. Persons of African descent represent the main racial group within the community.

3.2.2.2 Livelihood strategies

The 1998 Labour Force survey reported that 55 persons were employed in Beausejour. In addition, the report indicated that the agriculture, forestry and hunting industry employed only 1.8% of these individuals during the period, while the majority of

residents were employed in the construction (23.6%) and retail and wholesale trade (16.4%) sectors (Refer to Figure 7).

Figure 9: Employment profile of population

Consultations with farmers and extension staff reported the following:

- Agriculture currently plays a significant role in the community. However, from observation, most persons are employed in other sectors.
- Approximately 30 farmers currently reside in the community. However only 16.7 percent (5 persons) are full time farmers.
- The majority of farmers are employed in the cropping sector on a part-time basis. Most of these persons are also engaged in the fishing and to a lesser extent construction industries.
- Typically, farming occurs on ½ - 2 acre holdings. However, a few farmers own plots up to four acres. Holdings have been leased from a private landholder.
- Agriculture and other micro-enterprises are severely impacted by natural hazards such as floods and storms (Refer to Box 2).

3.2.3 Hazard Vulnerability Context

The pilot area is extremely vulnerable to flooding and the impacts of tropical storms and hurricanes. The low lying area, its proximity to the Beausejour River, inadequate river maintenance, degraded riparian zone and mangrove ecosystem contribute immensely to current problems. Fortunately, no residences are located directly within the farming community.

Farmers reported at least four major floods within the area in the last decade with severe socio-economic consequences. Box 3 captures farmers' perceptions of the problems associated with flooding in the Study Area.

Box 3: The impact of storms and floods on farming in Beausejour

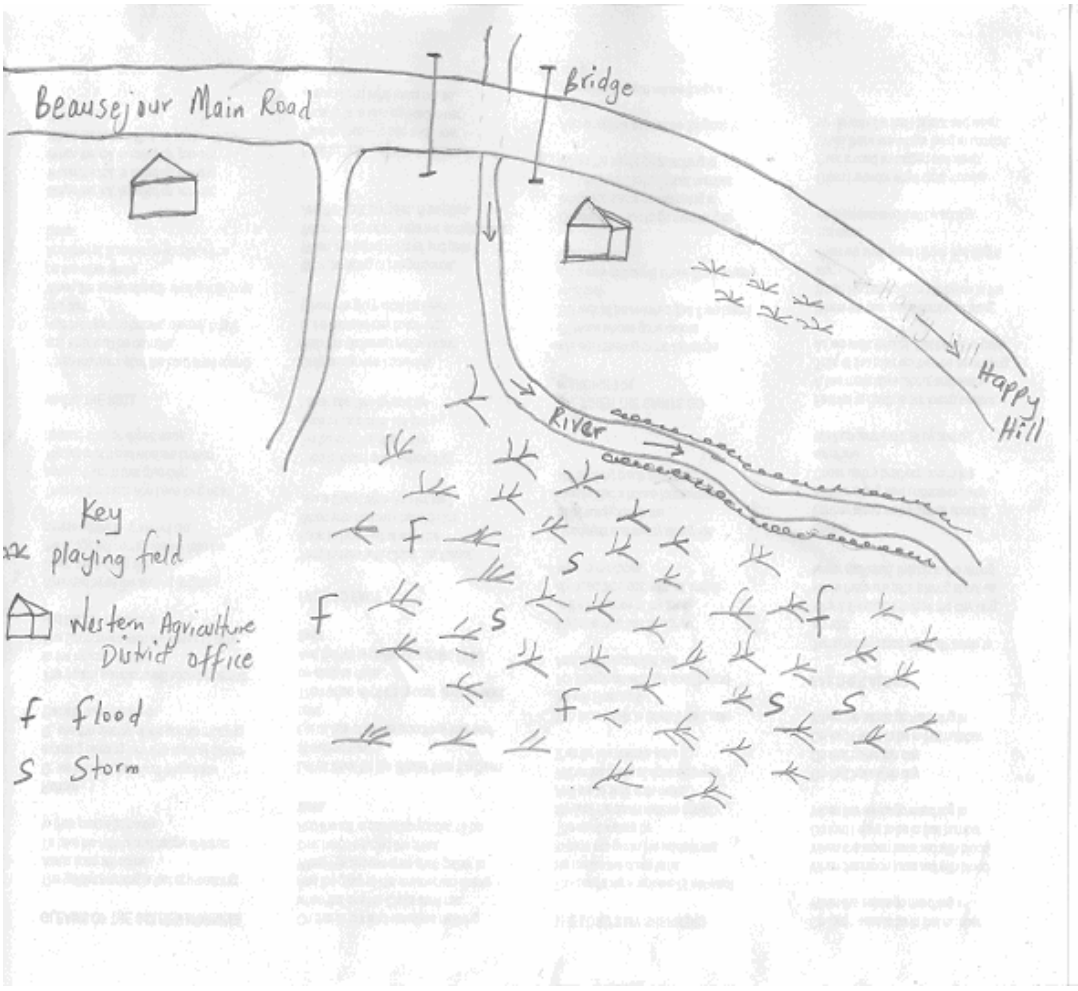
The following excerpts captures the losses incurred from natural hazards among farmers with the last decade:

- "In the last ten years, we had about four major floods. I lost most of my yams during those times."
- "Since I know myself, the river is always a problem. I have to use boulders to block out sides of the river. I use to rear pigs now I can't do that - we hade a lot of losses."
- I loss a lot of plantains after Hurricane Ivan - I lost about 200 stools of plantain, which was about EC$ 5000.00. I also loss 3000 lbs of yams - water go with everything - our customers were affected because we provide a lot of the yams for the south of Grenada."
- "I loss about 250 lbs of yams, which was about EC$ 7000.00 - we are also affected because the storms and floods destroy all our planting material - we sometimes get a little from the Ministry but its never enough to go round."

When asked about the coping strategies employed to reduce the impact of flood in the pilot area, most farmers indicated that *nothing can be done to stop the floods.* In fact one farmer commented: *Since I know myself, the river is always a problem – I have to use boulders to block it out*. The cultivation of root crops such as yams has been identified as a good practice in reducing to some extent the impact of floods. However, farmers noted that this practice is inadequate in preventing the devastating impacts of storm or hurricane forced water. Coping strategies used after a hurricane involves seeking assistance to reestablish crops and drainage system, and finding alternative employment opportunities[40] in the case of most farmers.

[40] Most likely construction and fishing – it is important to note also that major flooding events seriously affect the fishing industry in short term, increasing farmers' vulnerability.

Figure 10: Hazard vulnerability map of Beausejour



3.2.4 Perception of disaster risk management

3.1.3.2 Institutions

No community based organizations were reported to operate in Beausejour. However, the Grenada Red Cross Society has played a major role in disaster response and recovery after Hurricane Ivan and Emily (Refer to Section 3.2.2).

3.1.3.4 Disaster prevention and mitigation

Consultations with farmers revealed that disaster prevention and mitigation have not been a major thrust of their farming operations. Conservation practices as outlined in Section 3.1.2 have traditionally been used largely because the soil type supports the successful growth of root crops. Albeit this, some level of interest and expertise in disaster risk reduction exists among the farming community in the pilot area, although not specific to flooding.

3.1.3.5 Preparedness and post disaster management

The following summarizes farmers' perceptions of disaster preparedness, recovery and rehabilitation efforts.

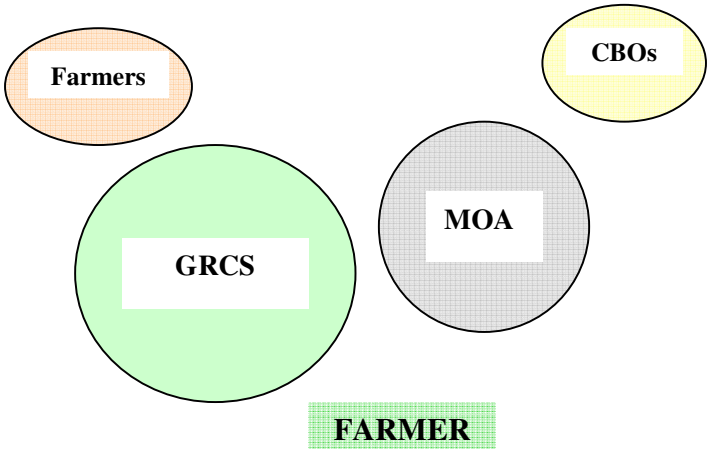
- A well established and efficient early warning system for storms and hurricanes exist at the national and community levels facilitated through the local media houses. This information is augmented and/or supported by access to ***The Weather Channel***[41]**.** One farmer noted however, that the local television station sometimes disseminate weather information that is not very current.[42]

- All farmers reported not having a properly developed contingency plan to deal with major natural disasters. Planning tended to be very reactive.

- Relief supplies and post emergency assistance was provided largely by two institutions: the Ministry of Agriculture and the Grenada Red Cross Society. Figure 11 illustrates farmers' perceptions of the contribution made by the above organizations in their recovery and rehabilitation efforts.

- As illustrated, the Grenada Red Cross Society was perceived to contribute most significantly to the farming community. Farmers reported receiving a range of inputs including tools and fertilizer. The Ministry of Agriculture (MOA) through its Agriculture Emergency Recovery Programme (Refer to Section) also made significant contributions through provision of funding to support land clearing.

Figure 11: Venn diagram showing Beausejour farmer's perceptions of the contributions of local institutions to post hurricane recovery



41 The Weather Channel is a U.S. based network which produces continuous 24-hour national and international weather related information.

42 The accuracy of this latter statement was not determined during the preparation of this report.

4.0 GOOD PRACTICES FOR HAZARD PREPAREDNESS IN AGRICULTURE

This section presents the good technical practices identified during situation assessment either at field level on the pilot and other sites, and/or recommended in the secondary literature to reduce the impact of hurricane related hazards on the agriculture sector. The field survey and consultation with farmers revealed that only a selected number of the identified good practices – those listed below - were currently or previously practiced on the pilot sites.

- Diversified cropping system (both sites)
- Integrate agro-forestry practices (Ludbur)
- Contour farming (both sites)
- Harvest all mature fruits (both sites)
- Maintain vegetative cover (both sites)
- Routine tree management (Ludbur)
- Grass barriers (Ludbur)
- Maintain a store of farm inputs
- Secure farm inputs (both sites).
- Cultivate long term crops on steep slopes (Ludbur).

4.1 COLLECTION OF GOOD PRACTICE SAMPLES

Preliminary summary descriptions of identified good practices are summarized below. More detailed descriptions following a standard format developed by the project will be provided as inputs to a regional database on Good Practices for Disaster Risk Preparedness in Agricultural Sectors, which is currently under construction by the project. The below collection of good practices is understood as "living document" and will be enhanced and amended as project work progresses.

1a. Diversified cropping system: Strip cropping	
Item	**Description**
Location where successfully applied	Farm in St. David's (other site)
Suitability by hazard	Storms and floods
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Prevention and mitigation of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o High
Implementation & maintenance requirement	o Inputs: Planting material, labour, mechanized equipment o Costs: ✓ Labour: EC$40.00/day ✓ Machine: EC$90/hour
Method of implementation	Strips of equal distances are laid out along the contour or across the general slope if sheet or rill erosion is a concern or perpendicular to the prevailing wind to limit wind erosion. The crops are arranged so that strips requiring intense cultivation with less protective cover are alternated with grass or legume or other protective crop (e.g. corn). Practice is most effective when used as part of a planned conservation system.
Institutional requirement	Technical support and advice from Extension Division
Contribution to disaster reduction/prevention	o Reduces water and wind induced soil erosion o Protect growing crops from wind-borne soil particles o Protects water quality o Increases farm resilience
Recommendations for further improvements	

1b. Diversified cropping system: Mixed cropping	
Item	**Description**
Location where successfully applied	Farm in St. David's (pilot site)
Suitability by hazard	Storms and floods
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Prevention and mitigation of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o Medium o High o High o High
Implementation & maintenance requirement	o Inputs: Planting material, labour o Costs: Labour: EC$40/day; Machine: EC$90/day
Method of implementation	Farmer selects crops with varying resource requirements and growth patterns. Soil is prepared based on crop needs, and crops are cultivated simultaneously in no specific pattern. For instance tree crops (e.g. banana), fruit trees (oranges), vegetables (tomatoes) and root crops can all be grown on one plot at the same time. To ensure effective planning, the following must be considered: spatial arrangements of plants, planting rates, and maturity dates.
Institutional requirement	Technical support from Extension Division
Contribution to disaster reduction/prevention	o Reduces water and wind induced soil erosion o Protect growing crops from wind-borne soil particles o Protects water quality o Increases farm resilience
Recommendations for further improvements	

2. Integrate dwarf varieties into cropping system	
Item	**Description**
Location where successfully applied	Pilot and other sites
Suitability by hazard	Storms
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Mitigation of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o Medium
Implementation & maintenance requirement	o Inputs: Propagating materials o Costs: EC$20/plant
Method of implementation	Dwarf varieties can be propagated using a number of techniques such as grafting, marcotting, air-laying etc. ***Marcotting*** ▪ Select desired parent material, and produce a wound on branch base ▪ Keep the branch split upwards and support to prevent breaking ▪ Add rooting powder and put moist organic matter on the wound - cover with transparent plastic. Create and strengthen new tree (6 – 12 months)
Institutional requirement	Technical support from Extension Division and other relevant institutions
Contribution to disaster reduction/prevention	o Reduces water and wind induced soil erosion o Protect growing crops from wind-borne soil particles o Protects water quality o Increases farm resilience
Recommendations for further improvements	

3. Propagate windbreak and other disaster resistant species	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Storms, floods & dry spells
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Prevention and mitigation of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o Medium
Implementation & maintenance requirement	o Inputs: parent & supporting propagating materials o Costs: Labour: EC$40/day; EC$5/propagated plant
Method of implementation	▪ Select desired parent material ▪ Chose and implement appropriate propagation technique ▪ Nurture propagated plant ▪ Transplant and maintain using best agronomic practices ▪ Examples of plants: citrus, mahogany, galba, white cedar, casuarinas, mahoe, sweet potato, yams etc
Institutional requirement	Provision of plants from Mirabeau or other propagating stations, and technical support from Extension Division
Contribution to disaster reduction/prevention	o Increases farm resilience to natural hazards, reducing crop loss
Recommendations for further improvements	

4a. Routine tree management - Pruning	
Item	**Description**
Location where successfully applied	Other site (CARDI)
Suitability by hazard	Storms
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Mitigation of storms in cropping sub-sector
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o Low
Implementation & maintenance requirement	Inputs: Pruning knife or saw and ladder
Method of implementation	Identify and remove dry branches and suckers in the case of citrus. Remove branches working from the top centre of the plant to increase the amount of light entering tree. Remove unnecessary branches to ensure that is tree is properly balanced. Pruning should be done once a year prior to blossoming time (October – December).
Institutional requirement	Training and technical support and advice from Extension Division
Contribution to disaster reduction/prevention	Produces short trees which are very resistant to hurricane strength winds
Recommendations for further improvements	

4b. Routine tree management - Top-working	
Item	**Description**
Location where successfully applied	Other site
Suitability by hazard	Storms
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Mitigation of storms in the cropping sub-sector
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o Low
Implementation & maintenance requirement	Inputs: Pruning knife, saw, tar, empty container, transparent plastic
Method of implementation	Using saw or other appropriate tool, cut the terminal shoot at a certain height. Apply a small amount of tar on the cut surface and cover with a plastic or other water resistant container to prevent rotting. Maintain height of tree (nutmeg) about 20-30 feet by routinely toping of terminal shoot allowing auxiliary branches to expand.
Institutional requirement	Technical support from Extension Division
Contribution to disaster reduction/prevention	Produces short trees which are very resistant to hurricane strength winds
Recommendations for further improvements	

5. Integrate agro-forestry practices	
Item	**Description**
Location where successfully applied	Pilot and other sites
Suitability by hazard	Storms
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Mitigation of storms in the cropping and livestock sub-sectors
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o High o High
Implementation & maintenance requirement	o Appropriate plant species o Costs: EC$20-30/plant
Method of implementation	***Windbreaks and shelter belts:*** Trees suited to the agroecosystem are planted in lines across the direction of the damaging winds to reduce wind erosion and damage to crops. E.g. mahogany, white cedar, citrus, bamboo, mango ***Boundary planting:*** Plant permanent trees along the field boundaries. ***Trees on erosion control structures:*** add trees to each structure employed for soil and water conservation such as terraces, grass barriers. ***Hedgerow intercropping:*** Hedges are planted as parallel rows, with plants closely spaced, and crops are grown in the alleys between them. E.g. citrus
Institutional requirement	Planting material, training and technical support from Extension Division
Contribution to disaster reduction/prevention	Produces short trees which are very resistant to hurricane strength winds
Recommendations for further improvements	

6. Establish grass barriers	
Item	**Description**
Location where successfully applied	Pilot (Ludbur) and other sites
Suitability by hazard	Storms, floods & landslides
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Prevention and mitigation of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o High o High
Implementation & maintenance requirement	o Grass species: e.g. lemon grass, vetiver grass
Method of implementation	***Grass barriers:*** Plant a suitable species of grass (e.g. Vetiver and Lemon grass) along the contour in the areas that needs stabilization. Optimal species should form an erect, stiff and uniformly dense hedge; should be able to survive stress with quick secondary growth; should not proliferate as a weed; and must require only a narrow width to be effective (The Australian Society of Agronomy, 1996).
Institutional requirement	Technical and financial support from Extension Division
Contribution to disaster reduction/prevention	Soil and water conservation
Recommendations for further improvements	

7. Adopt fallow practices in hazard prone areas	
Item	**Description**
Location where successfully applied	Pilot (Beausejour) and other sites
Suitability by hazard	Storms, floods, dry spells
Environmental suitability	Flat lands close to water body, lands in very dry areas
Contribution to disaster risk reduction	Hazard mitigation
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o Low
Implementation & maintenance requirement	N/A
Method of implementation	Lands that are extremely vulnerable e.g. located adjacent to a river are allowed to rest during risky periods e.g. hurricane season.
Institutional requirement	None
Contribution to disaster reduction/prevention	o Prevent major crop loss o Enhances soil fertility
Recommendations for further improvements	

8. Build low cost hurricane resistant farm structures	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Storms and floods
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Hazard mitigation
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o High o Low
Implementation & maintenance requirement	o Building materials
Method of implementation	Principles to guide construction of a storm resistant farm unit: ▪ Select safe site ▪ Gable roof ▪ In some cases, detachable buildings are ideal e.g. greenhouses ▪ Properly secured rafters e.g. with hurricane straps ▪ Well constructed foundation and good quality bricks ▪ Properly secured galvanize sheets ▪ Proper drainage around building for effective storm water management
Institutional requirement	Technical support from Extension Division
Contribution to disaster reduction/prevention	o Reduces likelihood of building and farm inputs and building damage o Increases farmers ability to respond and recover after disaster
Recommendations for further improvements	

9. Establish and/or maintain stream buffer zone	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Storms, landslides & floods
Environmental suitability	Along bank of river or other water body
Contribution to disaster risk reduction	Prevention and mitigation of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o High o High
Implementation & maintenance requirement	o Plant species suitable to ecosystem o Minimal financial input o Remove weeds and/or replant disrupted areas
Method of implementation	Maintain the vegetative corridor on either side of stream channel up to at least 20 feet. If the buffer zone has been removed or destroyed, re-plant suitable plant species (particularly ones that have historically grown along the water course or river bank) along a delineated buffer zone.
Institutional requirement	Technical support from Extension Division and Environmental Department, Ministry of Health and the Environment
Contribution to disaster reduction/prevention	o Prevent agricultural pollution from contaminating water body o Reduces overflow of river banks and flooding of farmland o Promotes soil and water conservation
Recommendations for further improvements	

10. Routine river cleaning	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Storms and floods
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Prevention, mitigation preparedness and response to impacts of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o High
Implementation & maintenance requirement	o Inputs: excavators, chainsaws, trucks, o Costs: EC$90/hour o Clean prior to hurricane season and after any major flooding event
Method of implementation	Carefully remove dead plant matter and widen if necessary. Effort should be made to main the riparian buffer zone during the cleaning process while preventing unnecessary dredging.
Institutional requirement	Technical support from Ministry of Works and Environmental Department
Contribution to disaster reduction/prevention	Prevents overflow of river banks and flooding of farmland
Recommendations for further improvements	

11. Contour ploughing	
Item	**Description**
Location where successfully applied	Pilot and other sites
Suitability by hazard	Storms, floods, landslides
Environmental suitability	Flat and sloping land in most micro-climatic zones
Contribution to disaster risk reduction	Preventing and mitigation of storms in the cropping sub-sector
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o High
Implementation & maintenance requirement	o Inputs: mechanized equipment, hoe, fork, spade o Costs: EC$90/hour for machine use o Maintain ridges and remove weed or extra soil in furrows
Method of implementation	Using a trained machine operator, plough at right angles to the natural slope of the land to create a series of stepped ridges used for planting crops. This can also be done manually.
Institutional requirement	Training and technical support from Extension Division
Contribution to disaster reduction/prevention	o Reduce soil erosion by up to 50 percent o Increase water filtration and retention
Recommendations for further improvements	

12. Establish and maintain germplasms in strategic areas	
Item	**Description**
Location where successfully applied	Other site
Suitability by hazard	Storms, dry spells and floods
Environmental suitability	Most farm settings that are safe and easily accessible
Contribution to disaster risk reduction	Useful in all stages of the disaster cycle to mitigate the impacts of all hurricane related hazards in the cropping subsector
Farming system	N/A
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o Medium
Implementation & maintenance requirement	Inputs: hurricane resistant green houses, parent material, agronomist, potting material and bags and other supporting farm inputs
Method of implementation	
Institutional requirement	o Budgetary allocation by MOA o Staff training and technical support
Contribution to disaster reduction/prevention	o Ensures effective and efficient response to the impacts of a disaster o Increases probability of quick recovery
Recommendations for further improvements	

13. Maintain a store of farm inputs	
Item	**Description**
Location where successfully applied	Pilot and other sites
Suitability by hazard	All hazards
Environmental suitability	N/A
Contribution to disaster risk reduction	Response and recovery in all agriculture sub-sectors
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o High o Medium
Implementation & maintenance requirement	o Different types of seeds, fertilizers, clearing equipment, animal medicines, generator etc. o Restore expendable inputs
Method of implementation	As part of the disaster management farm plan, make a list of farm inputs that should be kept in storage in the event of a disaster. Make arrangement either on the farm in another safe place to store these inputs. It is important to note that certain farm inputs should be secured and stored for use after the disaster (e.g. water)
Institutional requirement	Minimal
Contribution to disaster reduction/prevention	o Ensures effective and efficient response to the impacts of the disaster o Increases the probability of quick recovery
Recommendations for further improvements	

14. Harvest all mature fruits and flowers	
Item	**Description**
Location where successfully applied	Pilot (Ludbur) and other sites
Suitability by hazard	Storms
Environmental suitability	All farm settings
Contribution to disaster risk reduction	Useful in responding and recovering from storms in the cropping sub-sector
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o High o Low
Implementation & maintenance requirement	o Inputs: hurricane resistant storage structure, appropriate packaging o Immediately dispose of produce after disaster
Method of implementation	Survey farm and harvest all mature fruits and flowers after a hurricane/storm warning is disseminated. Safely package all produce, and store in a hurricane resistant farm or other building. The farmer should be aware of potential storage site/s prior to a disaster.
Institutional requirement	Minimal. However, some farmers indicated that the MOA should provide a central safe house for livestock such as rabbits.
Contribution to disaster reduction/prevention	▪ Reduces unnecessary losses ▪ Maintains a constant supply of produce to customers, and increases probability of recovering successfully after a disaster
Recommendations for further improvements	

15. Secure all farm inputs and supporting structures	
Item	**Description**
Location where successfully applied	Farm in St. David's (other site)
Suitability by hazard	Floods and storms
Environmental suitability	All farm settings
Contribution to disaster risk reduction	Mitigation and preparedness of hazard impacts in the cropping sub-sector
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o Low
Implementation & maintenance requirement	Inputs: hurricane resistant farm or other building, appropriate stacking and packaging materials
Method of implementation	Quickly but carefully survey farm. Dismantle greenhouses and irrigation systems and remove all farm inputs and important documents etc and store in a pre-planned hurricane resistant building.
Institutional requirement	Disaster management awareness training, technical support to construct safe farm buildings
Contribution to disaster reduction/prevention	o Reduces unnecessary loss of productivity o Maintains a constant supply f produce to customers, and increases probability of recovering successfully after a disaster
Recommendations for further improvements	

16. Cultivate crops on cambad beds	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Storms and floods
Environmental suitability	Flat lands
Contribution to disaster risk reduction	Prevention and mitigation of hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o Medium o High o Medium o Low
Implementation & maintenance requirement	o Inputs: Bed making machine, hoe, fork o Costs: Labour: EC$40/day; Machine: EC$90/day o Maintenance: Routinely remove excess soil or weeds in furrow and maintain shape of bed.
Method of implementation	Using a bed making machine or other appropriate tool construct beds along the contour no wider than 4 feet. Length can vary depending on type of crops planned for cultivation.
Institutional requirement	Subsidize cost of mechanize equipment by MOA, technical assistance from Extension Division
Contribution to disaster reduction/prevention	Reduces the potential for destruction of crops during periods of flood.
Recommendations for further improvements	

17. Maintain a supply of and use mulch e.g. grass or coconut shell	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Dry spells
Environmental suitability	Farm settings in very dry areas, or horticulture farms
Contribution to disaster risk reduction	Mitigation of hazard
Farming system	Mixed farming, horticulture based farms
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o Low
Implementation & maintenance requirement	o Inputs: Grass, coconut shell, compost etc. o Maintenance: Renew mulch and maintain depth
Method of implementation	Put mulch around the plant at least 2-4 times the hole diameter and about 3-6 inches depth
Institutional requirement	Minimal
Contribution to disaster reduction/prevention	o Conserves moisture o Inhibits weed growth
Recommendations for further improvements	

18. Maintain vegetative cover	
Item	**Description**
Location where successfully applied	Pilot and other sites
Suitability by hazard	Storms, floods & landslides
Environmental suitability	All farm settings
Contribution to disaster risk reduction	Prevention and mitigating the impacts of hazards in the cropping sub-sector
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o High o High
Implementation & maintenance requirement	o Appropriate planting material based on farm ecology o Proper tree management
Method of implementation	Ensure that all areas on the farm are covered with vegetation, either economic or non-economic plants. This practice is enhanced by use of minimum tillage practices on very steep slopes.
Institutional requirement	Minimal – however options for planting material selection can be provided by Extension Division or Department of Forestry
Contribution to disaster reduction/prevention	o Promotes soil and water conservation o Reduces likelihood of landslides
Recommendations for further improvements	

19. Cultivate long term crops on steep slopes	
Item	**Description**
Location where successfully applied	Pilot and other site
Suitability by hazard	Floods, storm and landslides
Environmental suitability	Steep farmlands located in all micro-climatic zones
Contribution to disaster risk reduction	Prevention and mitigation of hazards in cropping sub-sector
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o High
Implementation & maintenance requirement	o Appropriate planting material o Proper tree management
Method of implementation	Plant economic or non-economic long term crops such as pineapple, citrus, mahogany, white cedar, nutmegs on steep slopes. This ensures minimum soil disturbance, thus promoting soil and water conservation and increased resilience to storms, floods and landslide. Species of plant selected would be dependant on the farmers need and the climatic characteristics of the farm.
Institutional requirement	Minimal – however options for planting material selection can be provided by Extension Division or Department of Forestry
Contribution to disaster reduction/prevention	o Promotes soil and water conservation o Reduces likelihood of landslides
Recommendations for further improvements	

20. Collect and maintain accurate baseline data	
Item	**Description**
Location where successfully applied	None
Suitability by hazard	Hurricane related hazards
Environmental suitability	All farm settings
Contribution to disaster risk reduction	Responding to and recovering from the impacts of hurricane related hazards
Farming system	All systems
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o Low
Implementation & maintenance requirement	o Inputs: Data collectors and analyzers, hardware and supporting software o Cost: EC$100-150,000/year o Maintenance: Biannual update of information,
Method of implementation	Working in collaboration with strategic national and regional partners, develop and implement a sustainable agricultural information system. The system should include among other components the following: ▪ Information to be collected and infrastructure for data collection, analysis and dissemination. ▪ System for decision-making, planning, programming and monitoring.
Institutional requirement	Training in research and management of information systems
Contribution to disaster reduction/prevention	o Improves accuracy of damage and needs assessment and post disaster interventions o Increases potential for equitable distribution of agriculture inputs
Recommendations for further improvements	

21. Establish food storage facilities with farmers and strategic institutions	
Item	**Description**
Location where successfully applied	-
Suitability by hazard	Storms and floods
Environmental suitability	N/A
Contribution to disaster risk reduction	Responding to impacts of major disasters
Farming system	N/A
Effectiveness Replicability Sustainability Contribution to LWM	○ High ○ Medium ○ Medium ○ Low
Implementation & maintenance requirement	○ Hazard resistant storage structures in different communities, financial resources, non-perishable food supplies, strategic technical and financial partners ○ Costs: EC$300,000/year ○ Maintenance: Effective disposal of supplies post disaster
Method of implementation	▪ Partner with strategic institutions to conduct a needs and vulnerability assessment ▪ Develop a food storage and distribution contingency plan in collaboration with district disaster committees and NGOs ▪ Procure and store non-perishable foods
Institutional requirement	Political will, Grenada Disaster Plan, NaDMAC
Contribution to disaster reduction/prevention	▪ Enhances food security after a disaster and reduces chaotic behaviours among populace ▪ Capacity building within the MOA to respond effectively.
Recommendations for further improvements	

22. Set up and service a farm record system	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	All hurricane-related hazard
Environmental suitability	All farm settings
Contribution to disaster risk reduction	Useful in responding and recovering from the impacts of hurricane related hazards in the agriculture sub-sectors
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	○ High ○ Medium ○ Medium ○ Low
Implementation & maintenance requirement	○ Simple record keeping book ○ Consistently input required information
Method of implementation	Attend farm recording keeping training organized by the Ministry of Agriculture. Record in the record book provided by the Ministry all farm and home incomes as soon as they are received and all farm and home expenses as soon as they are paid. Record all information in the way specified by the record book. Organize a special place as a farm office and secure record book safely. Analyze information recorded and use in farming decision making processes (UWI, 1990).
Institutional requirement	Training provided by the MOA, monitoring by Extension Division
Contribution to disaster reduction/prevention	○ Increases awareness of farm profitability ○ Enhances decision making ○ Increases accuracy of damage assessment and input distribution
Recommendations for further improvements	

23. Establish risk transfer mechanisms	
Item	**Description**
Location where successfully applied	None nationally
Suitability by hazard	All hurricane related hazards
Environmental suitability	All farm settings
Contribution to disaster risk reduction	Useful in recovery and rehabilitation
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o Low
Implementation & maintenance requirement	Insurance instruments, catastrophic fund, credit schemes, loans etc.
Method of implementation	Working with strategic partners, establish national risk diversion mechanisms that can be implemented and managed at the national level. In addition, collaborate with regional and international organizations such as the World Bank, IICA, and IDB etc. to develop and implement appropriate instruments to provide insurance to the agricultural sector.
Institutional requirement	Strategic regional and international partnerships with financial and technical institutions
Contribution to disaster reduction/prevention	Provide a compensation mechanism for farmers to increase their capacity to recover and rehabilitate their business
Recommendations for further improvements	

24. Community based disaster awareness	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Hurricane related hazards
Environmental suitability	All farming settings/communities
Contribution to disaster risk reduction	Prevention and mitigation
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o High
Implementation & maintenance requirement	o Farmers, farmers groups, disaster trainers o EC$25-30,000/year o Maintenance: Quarterly debriefing and biannual refresher courses
Method of implementation	Train farmers from each disaster district as Disaster Risk Reduction trainers. Employing the Peer Educators approached, empower trained farmers to stimulate awareness among other farmers within their district of the importance of disaster management and best practices for reducing risk to hydro-meteorological hazards. Opportunities for debriefing and refresher courses should be integrated into the awareness plan.
Institutional requirement	Training of farmers by the GRCS or other suitable institution, training materials, incentive package
Contribution to disaster reduction/prevention	o Support desired attitudinal and behavioural modification consistent with disaster prevention and mitigation in the agriculture sub-sectors
Recommendations for further improvements	

25. Clear drains and cut diversion ditches	
Item	**Description**
Location where successfully applied	Pilot and other sites
Suitability by hazard	Storms and floods
Environmental suitability	All farm settings (diversion ditches especially useful in flood prone areas)
Contribution to disaster risk reduction	Prevention, mitigation and response to hazard
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o High o Medium o Medium
Implementation & maintenance requirement	o Input: farm tools o Cost: EC$ 40/day; machine: EC$90/hour o Maintenance: Routinely remove debris
Method of implementation	Routinely remove debris from drains within the farm. After a hurricane warning is given, large diversion ditches should be cut within the farm area running parallel to the natural hydrological flow of runoff water to an unobstructed area
Institutional requirement	Provision of tractor service, routine monitoring of water body, establishment of drainage system using a systems approach (collaboration with neighbouring farmers)
Contribution to disaster reduction/prevention	Limits flooding and loss of crops
Recommendations for further improvements	

26. Establish irrigation system	
Item	**Description**
Location where successfully applied	Other sites
Suitability by hazard	Dry spells
Environmental suitability	Farm settings in dry zones or areas that could potentially experience dry annual spells
Contribution to disaster risk reduction	Mitigation of impacts of dry spells
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	o High o Medium o Medium o Low
Implementation & maintenance requirement	o Inputs: irrigation lines, pump, fuel, filters o Costs: EC$3500-5000 (drip irrigation) o Maintenance: Flush lines with bleach and clean filters at least once every quarter. If a pump is used routine oil and filter change is advisable.
Method of implementation	▪ Conduct site assessment to determine needs ▪ Design and cost irrigation system ▪ Procure materials and equipment ▪ Construct and test irrigation system
Institutional requirement	Technical support from Irrigation Department, Land Use Division MOA
Contribution to disaster reduction/prevention	Promotes high yields despite limited rainfall and/or portable water
Recommendations for further improvements	

27. Water harvesting/cisterns	
Item	**Description**
Location where successfully applied	Cariacou
Suitability by hazard	Dry spells
Environmental suitability	Farm settings in dry zones or areas that could potentially experience dry annual spells
Contribution to disaster risk reduction	Mitigation of impacts resulting from dry spells in cropping and livestock sub-sectors
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	○ High ○ High ○ Medium ○ Low
Implementation & maintenance requirement	○ Inputs: roof area secured with sprouts, concrete storage area ○ Costs: EC$20-45,000/system ○ Maintenance: Annually clean concrete storage area to remove algae and solid debris
Method of implementation	Channel water from roof or other flat surface into a concrete water holding structure. Implement appropriate plumbing and irrigation system to transfer water to farm area.
Institutional requirement	None
Contribution to disaster reduction/prevention	○ Ensures crop productivity despite limited rainfall and/or water availability ○ Promotes water conservation
Recommendations for further improvements	

28. Establish farm dams	
Item	**Description**
Location where successfully applied	None
Suitability by hazard	Dry spells
Environmental suitability	In farm settings prone to dry spells
Contribution to disaster risk reduction	Prevention and mitigation
Farming system	Mixed farming
Effectiveness Replicability Sustainability Contribution to LWM	○ Medium ○ Medium ○ Medium ○ Low
Implementation & maintenance requirement	○ Inputs: bulldozer, water truck and trained contractor ○ Maintenance: maintain vegetative cover along dam banks; avoid using the spillway and outlet slope for vehicle access, and maintain a sealed catchment to minimize the potential silting-up of the dam
Method of implementation	▪ Select and prepare site ▪ Excavate and backfill cutoff ▪ Install pipe work (if necessary) ▪ Construct embankments ▪ Excavate the bywash ▪ Protect vulnerable areas from erosion (NRW, 2006)
Institutional requirement	Technical assistance from Extension and/or Land Use Division, MOA
Contribution to disaster reduction/prevention	○ Ensures water availability in dry prone areas ○ Promotes water conservation
Recommendations for further improvements	

Table 3 provides additional practices identified which are however related to emergency response and recovery.

Table 3: Good agricultural practices during emergency response and recovery

Name	Source	Introduction	Applicability of practice	Environmental suitability	Cost estimate	Benefits
Clear farm and access roads & reestablish drainage	Pilot and other sites, key informants, secondary literature	In the past	Useful responding and recovering the impacts of floods, storms and landslides in all agricultural sub-sectors	All farm settings	Chain saws EC$ 60.00/day Labour: EC$ 40.00/day	▪ Encourages re-commencement of farming activities ▪ Builds farm resilience
Access damage	Key informants	Post Hurricane Janet	Useful in responding, recovering and rehabilitating impacts of all hazards in all agricultural sub-sectors	All farm settings	Dependant on magnitude of impact	▪ Provides information to support assistance ▪ Encourages equitable input distribution ▪ Supports post disaster planning and interventions
Restore damage crops where possible	Pilot and other sites	In the past	Useful in responding and recovering from the impacts of storms, landslides and floods in cropping and forestry sub-sectors	All farming settings	Minimal Labour: EC$ 40.00/day	▪ Reduces losses ▪ Encourages recommencement of farming activities
Place back shade/green houses	Other sites, key informants	In the past	Useful in responding and recovering from the impacts of storms in cropping sub-sectors	All farm settings	Minimal	▪ Reduces additional seedling or flower losses ▪ Encourages recommencement of farming activities

Name	Source	Introduction	Applicability of practice	Environmental suitability	Cost estimate	Benefits
Implement proactive pest & disease management	Key informants	In the past	Useful in responding and recovering from the impacts of storms and floods in all agricultural sub-sectors	All farming settings	Cost of pesticide	▪ Reduces additional losses ▪ Builds farm resistance
Burn or bury dead animals	Other sites	In the pat	Useful in responding and recovering from the impacts of all hazards in all agricultural sub-sectors	All farm settings	Minimal	▪ Reduce additional losses through disease transfer
Reestablish nursery of critical crops	Other sites, key informants	In the past	Useful in responding and recovering from the impacts of all hazards in the forestry and cropping sub-sectors	All farm settings	Varies depending on size of nursery	▪ Increases availability of planting material ▪ Supports re-commencement of farming activities at national and community levels
Facilitate equitable input distribution	Pilot and other sties	In the past	Useful in recovering from the impacts of all hazards in all agricultural sub-sectors	All farm settings	Varies depending on extent of damage and need (Refer to Section)	▪ Builds farmers' morale and interest in continuing farming and/or forestry activities ▪ Stimulates recommencement of
Repair and rehabilitate farm equipment and infrastructure	Key informants, secondary literature	In the past	Useful in post disaster management from the impacts of storms, floods and landslides in all agricultural sectors	All farming settings	Varies depending on extent of damage and need (Refer to Section)	▪ Stimulates recommencement of farming and forestry activities

4.2 HAZARD AND SUB-SECTOR SPECIFIC GOOD PRACTICES

Table 4: Summary of good agricultural practices for disaster risk mitigation

	Good practices in the agricultural sub-sector		
Hazards	**Cropping**	**Livestock**	**Forestry**
Storms • ***Impact prevention and mitigation***	▪ Diversified cropping system ▪ Establish erosion control structures and practices ▪ Integrate dwarf varieties into cropping system ▪ Routine tree management ▪ Build low cost hurricane resistant farm buildings ▪ Propagate windbreak species and natural disaster resistant varieties ▪ Integrate agro-forestry practices ▪ Adopt fallow practices ▪ Establish and/or maintain riparian buffer zone ▪ Routine river cleaning ▪ Contour ploughing ▪ Establish and maintain effective drainage system ▪ Establish and maintain germplasms in strategic areas ▪ Maintain a store of farm inputs ▪ Grow crops on cambad beds ▪ Maintain vegetative cover ▪ Cultivate long term crops on steep slopes ▪ Collect and maintain accurate baseline data ▪ Establish food storage facilities ▪ Set up a farm record system ▪ Community based disaster awareness ▪ Establish risk diversion mechanisms	▪ Build low cost hurricane resistant animal & storage units ▪ Establish and maintain effective drainage system ▪ Construct livestock pens in safe areas ▪ Store water in water proof containers or concrete storage sheds with 2 feet drains around them	▪ Establish and maintain a forest nursery ▪ Maintain a store of land clearing and salvage logging equipment and safety gear ▪ Train farmers and foresters in salvage logging ▪ Establish an mixed/intercrop forest system ▪ Establish border/shelter belts using strong deep rooted plants e.g. Galba ▪ Maintain vegetative cover

Hazards	Cropping	Livestock	Forestry
Storms • ***Preparedness*** • ***Response, recovery and rehabilitation***	▪ Clear drains and cut diversion ditches ▪ Secure all farm inputs and supporting structures ▪ Dismantle irrigation system and shade houses and store safely ▪ Harvest and store all mature fruits and flowers ▪ Store adequate water in barrels protected by low concrete pavement ▪ Trim overhanging branches and re-enforce all farm buildings ▪ Clear farm and access roads - reestablish drainage ▪ Access damage ▪ Restore damage crops where possible ▪ Replace shade/green houses ▪ Implement pest and disease management ▪ Reestablish nursery of critical crops ▪ Facilitate equitable input distribution ▪ Repair and rehabilitate farm equipment and infrastructure	▪ Secure farm inputs, produce and supporting structures where necessary ▪ Lock of all water supply ▪ Burn or bury dead animals ▪ Clear farm and access roads & reestablish drainage ▪ Rebuilt or retrofit livestock pens if necessary ▪ Replace litter in poultry pen	▪ Clear forest access and assess damage ▪ Salvage logs ▪ Rent salvaging equipment
Dry spells ▪ ***Impact prevention and mitigation*** ▪ ***Preparedness***	▪ Establish environmentally friendly irrigation system ▪ Maintain a supply of and use mulch ▪ Harvest rain water - construct farm dams and cisterns ▪ Implement water conservation practices ▪ Establish and maintain a farm record ▪ Plant drought resistant crop varieties ▪ Store extra water	▪ Harvest rain water - construct farm dams and cisterns ▪ Implement water conservation practices ▪ Store water in plastic barrels ▪ Store water in plastic barrels	▪ Establish plants suited to dry forest ecosystems ▪ Maintain vegetative cover

Hazards	Cropping	Livestock	Forestry
Dry spells			
▪ **Response, recovery and rehabilitation**	▪ Mulch ▪		
Floods			
▪ **Prevention and mitigation**	▪ Invest in a diversified production system ▪ Integrate flood resistant varieties in cropping system e.g. corn ▪ Establish erosion control structures and practices ▪ Establish and maintain effective drainage ▪ Build a flood resistant store house ▪ Set up a farm record system ▪ Grow crops on cambard beds ▪ Establish and maintain germplasms in strategic locations	▪ Construct livestock unit away from flood prone areas ▪ Establish and maintain effective drainage ▪ Set up a farm record system ▪ Establish erosion control structures around livestock unit	▪ Maintain adequate tree cover and effective drainage system
▪ **Preparedness**	▪ Routine river cleaning ▪ Food storage ▪ Household storage of seeds at high, safe places	▪ Move animals when needed ▪ Store forage	
▪ **Response, recovery and rehabilitation**	▪ Access damage and clear access farm ▪ Reestablish farm ▪ Salvage logging	▪ Burn or bury dead animals ▪ Clear farm and reestablish drainage	▪ Clear forest access ▪ Salvage logs
Landslides			
▪ **Prevention and mitigation**	▪ Maintain vegetative cover ▪ Establish erosion control structures and practices e.g. grass barriers and contour farming ▪ Cultivate long term crops on steep slopes ▪ Set up a farm record system	▪ Construct livestock unit in safe area ▪ Establish erosion control structures in vulnerable areas	▪ Maintain vegetative cover
▪ **Response, recovery and rehabilitation**	▪ Clear debris and plant appropriate vegetation in area	▪ Clear debris and plant erosion control structures	▪ Clear debris and plant erosion control structures

5.0 VALIDATION OF DRM SYSTEM ANALYSIS AND GOOD PRACTICES

5.1 NATIONAL VALIDATION WORKSHOP

A national workshop was held on December 7, 2006 at the Grenada Red Cross Society Conference room with the objectives to:

- Review and select good practices of hazard risk management in the agricultural sector that has applicability for broader replication in the Caribbean region.
- Discuss the Disaster Risk Management (DRM) framework and the linkages with the agricultural sector.
- Review roles of main actors involved in DRM, and design recommendations for improved preparedness and response.

The workshop was attended by thirty (30) resource persons including the National Project Coordinator and Regional Consultant, twelve farmers (inclusive of individuals representing the pilot sites, nutmeg, cocoa, banana, tree crops, flower, vegetable, poultry and agro-forestry sub-sectors), sixteen technical experts representing departments of forestry, extension, livestock, planning, agronomy, nutmeg, land use, cocoa, as well as the Caribbean Agricultural Research and Development Institute (CARDI), the Ministry of Education and NaDMA; one NGO (Grenada Red Cross Society) was also present (Refer to Appendix 3).

The workshop was formally opened by the Permanent Secretary, Ministry of Agriculture Ms. Lana McPhai. She stressed the Ministry's full commitment to the implementation of the project and the development of long term mechanisms to support disaster risk reduction in the agricultural sector. She highlighted a number of activities and policy decisions undertaken and adopted by the Ministry of Agriculture geared towards building resilience of the agricultural sector to natural hazards. These include inter alia:

- Development of departmental disaster plans for the 2006 Atlantic hurricane season.
- Budgetary allocation of EC$300,000 for food storage to support the 2006 Atlantic Hurricane season.
- Investment of EC$ 14 million for the post Hurricane Ivan Agriculture Emergency Rehabilitation Programme.
- Capital investment of EC$ 11 million in the recently launched Agricultural Enterprise Development project.[43]

The workshop was conducted in a participatory, interactive way with a number of group exercises designed to achieve the workshop objectives (Refer to Photos 3 a – f).

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[43] Project designed to rehabilitate the sector and restore its contribution to economic development. The project has three main components: Loan scheme for farmers involved in the cropping sector and fishing) sub-sectors, and a procurement scheme for agricultural inputs to be made available for farmers at a subsidized rate.

Photo 3a: Aden Forteau - Forestry Officer

Photo 3b: Roland Courtney: Nutmeg Field Officer

Photo 3c: Derek Thomas – Poultry Officer

Photo 3d: Dianne Roberts – National Consultant

Photos 3e & f: Group deliberations

5.2 FINDINGS AND RECOMMENDATIONS

5.2.1 Improving DRM Structures in the Agriculture Sector

The workshop provided a forum to discuss the current DRM framework with the objective of identifying best practices for the way forward. The key points highlighting are discussed in Section 7 of this report.

5.2.2 Validation of good DRM practices

All 29 practices presented in section 4 of this report were reviewed, validated and prioritized by the workshop, applying the following criteria:

- Replicability and ease of adoption within Grenada and the region.
- Effectiveness in risk reduction/increasing resilience.
- Cost effectiveness/affordability for small or medium farmers.
- Ease of implementation, and technical capacity to implement at the national level.
- Degree of sustainability.

The following five practices listed below were considered most effective at building resilience at the farm level.

- Diversified cropping systems (strip cropping and mixed intercropping).
- Integrating agro-forestry practices in the cropping system.
- Soil erosion control structures and practices (contour farming and grass barriers).
- Routine tree management (pruning and top-working).
- Construction of hurricane resistant poultry units.

(Appendix provides detailed implementation guides for above practices).

Photo 4a: Contour farming in Ludbur

Photo 4b: Grass barriers in Ludbur

Photo 4c: Strip cropping

Photo 4d: Windbreak

The findings and recommendations presented at the national workshop were shared and further validated at an inter-country project workshop held in Jamaica during January 22-26, 2007. The workshop brought together a FAO technical team, all national consultants and project coordinators from the 4 countries participating in the project, as well as resource persons from the agricultural sector, Jamaica, the Asian Disaster Preparedness Center, ADPC, IICA, and the University of West Indies[44]. Key decisions for follow up by the four country teams in 2007 included the following:

- National teams will prepare detailed implementation guidance sheets for all currently identified good practice examples during the second phase of the project. These will be shared among national teams and brought back for information and local planning into the pilot villages in each of the four countries; the good practice samples will also be consolidated as an on-line database by FAO.

[44] Workshop proceedings are under preparation.

- Each national team will prepare, and implement thereafter in selected pilot villages, a detailed country specific strategy for dissemination and replication of good practices; these will be tested during the second half of the project addressing inter alia:

    - Mechanisms for communication among national key stakeholders, including farmers within the pilot sites on the main outcomes of the regional workshop and documented good practices.
    - An applied action research process for selecting and demonstrating prioritized, highly validated good practices within the pilot villages;[45] The following key principles will guide applied action research and planned demonstrations at the village level: participatory bottom up risk prevention planning; interventions decided based on a negotiation process; facilitation of local action processes through the existing agricultural/livestock/ forestry extension system; harmonizing efforts by working through existing local organizations and or DRM committees; demonstrations to be conducted only on farmers fields.

- National teams will articulate technical needs for inter-country exchange and learning in order to promote implementation/replication of good practices among countries; exchange of expertise will be promoted by the project.

- Further findings, lessons learned and policy recommendations for broader dissemination and replication of good practices will be systematically recorded, analyzed and shared again at a second inter-country workshop planned for October/November 2007.

[45] Replication and/or demonstration should focus on small or medium farmers rather than on sites of 'well off' farmers.

6.0 FIELD DEMONSTRATIONS OF GOOD PRACTICES

This section of the report outlines the demonstration plan, details the lessons learnt from implementation of good practices, proposes strategies for replicating good practices at the national level, and identifies key elements of a DRM framework for Grenada and the wider Caribbean.

6.1 DEMONSTRATION PLAN

6.1.1 Components of Demonstration Plan

Table 5 outlines the main components of the demonstration plan implemented in Ludbur.[46]

Table 5: Key components of the demonstration plan

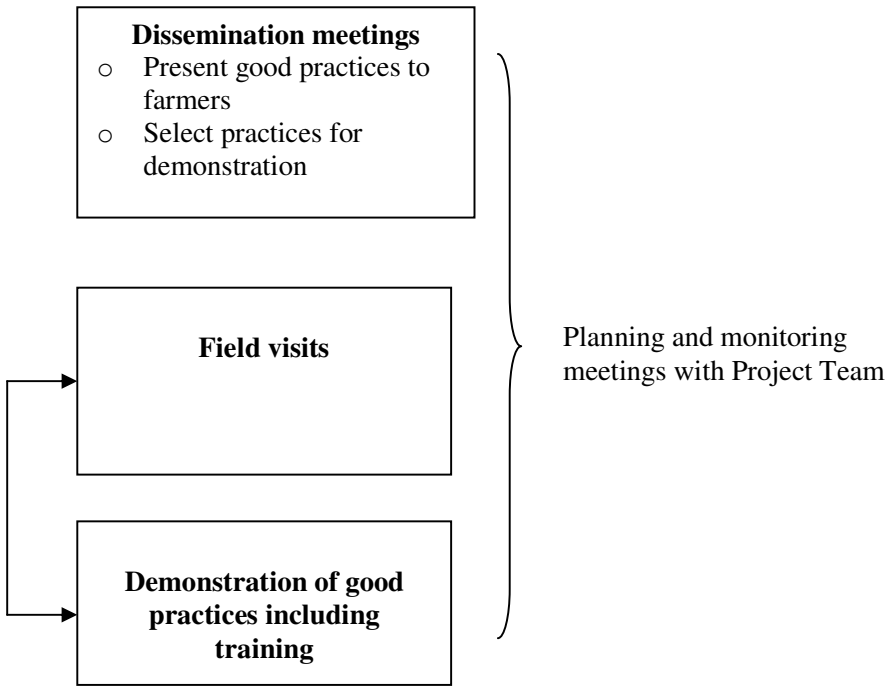
Components	Details
1	▪ Diversified cropping system o Strip cropping of corn and sweet potato ▪ Establishment of erosion control structures and practices o grass barriers o contour farming o construction of check dams ▪ Implementation of agro forestry practices o Establishment of windbreak system and citrus hedgerows ▪ Establishment of drainage system ▪ Tree management (pruning of citrus
2	▪ Training o Two field days o Training in group dynamics and financial management

6.1.2 Process/Methodology

Figure 1 summarizes the methodology used during implementation of the second phase of the project.

[46] Demonstration of good practices was conducted only in Lubbur due to unresolved land tenure issues in the second pilot site located in Beausejour, St. George's. This challenge was identified during the dissemination meeting held in that community.

Figure 12: Phase 2 methodology



Dissemination meetings

Active participation of stakeholders, particularly farmers represented a fundamental principle guiding the implementation process. Dissemination meetings facilitated by the National Consultant and Project Coordinator were conducted in each of the two pilot sites. The objectives of these meetings were as follows:

1. Share good practices documented for disaster risk reduction in the agriculture sector;
2. Select one or more disaster risk reduction practices for demonstration at each pilot site;
3. Select a demonstration farmer.

Field visits

Subsequent to the dissemination meetings, field visits were conducted in Ludbur by the National Team[47] to select demonstration plots, and to finalize plans for the demonstration of selected practices. These visits were conducted in consultations with the resident farmers to ensure that their views, interests and indigenous knowledge were incorporated into the demonstration strategy. Follow up meetings were convened with the National

[47] The National Team included the National Consultant, Project Coordinator, Supervisor of the Eastern Agriculture Division, Extension Officers and Agriculture Trainees.

Team and demonstration farmers to finalize the implementation strategy and the programme budget.

Demonstration of good practices

The Extension Division, Ministry of Agriculture provided technical assistance to the demonstration farmer and other recruited personnel during implementation of good practices. The project also facilitated collaboration with the Department of Forestry to ensure that agroforestry practices were implemented according to recommended guidelines and principles.

Two field days were conducted to facilitate information sharing among farmers. The objectives of the exercise were as follows:

- Demonstrate selected good practices implemented at Ludbur that can reduce the risk of hurricane related hazards;
- Discuss the effectiveness of implemented practices;
- Share with participants additional good practices that could potentially mitigate the effects of hurricane related hazards.

Figure 13: Demonstration photos

Photo 1: Acting Supervisor of the Eastern Agriculture District, Michael Francis addressing Participants

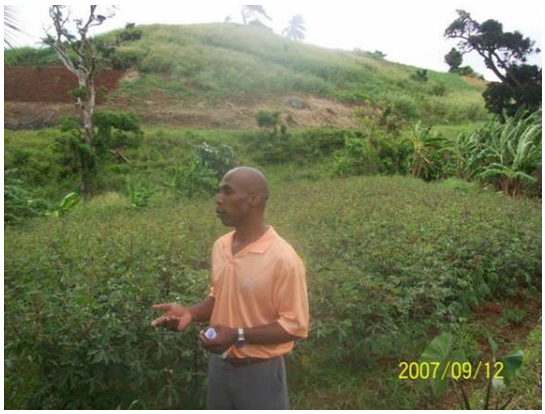


Photo 2: Aden Forteau, Forestry Officer highlighting the importance of agro-forestry in risk reduction

Photo 3: Snap shot of strip cropping system of corn and sweet potato

Photo 4: FAO National Consultant, and Demonstration Farmer

Farmers were also trained in the areas of financial management and group dynamics as part of the overall strategy of improving their resilience to natural disasters.[48]

6.2 LESSONS LEARNT: DEMONSTRATIONS AND REPLICATION OF GOOD DRM PRACTICES AT FARMERS LEVEL

Implementation of the demonstration plan in Table 5 revealed a number of lessons as listed below:

1. Use of a participatory approach was very effective in supporting project implementation due to the following observed benefits:

    - Farmers claimed ownership of the process, resulting in full cooperation of most farmers throughout all stages of the demonstration cycle;
    - Technical advice from agriculture support services (e.g. Extension, Forestry, farm mechanization, Land Use etc.) was incorporated into project planning and implementation;
    - Avoided conflict, and wastage of resources between different support services;
    - Similarly, the potential for conflict between farmer and Extension/technical officers were reduced and in most cases avoided.

2. The process used to select the demonstration farmer is critical – it must be transparent and validated by farmers.

3. Choice of the demonstration farmer is very important in promoting involvement of other farmers – demonstration farmer must be one deemed by other farmers as approachable, easy to work with and actively involved in the farming community.

4. Farmers are more willing to consider the adoption of good practices that are:

    - Culturally relevant;
    - Affordable and easy to implement;
    - Adopted by other farmers in their league;
    - Observed to be effective in withstanding the effects of tropical systems - seeing is believing.

5. Farmers are unwilling to invest in mitigation if land tenure is uncertain.

6. Demonstration activities build camaraderie among farmers, and increased their willingness to established farmers groups/cooperatives.

7. Financial disbursement must be facilitated to limit lapses in the implementation process, which could negatively impact stakeholders' morale.

[48] This was well received by farmers who indicated the need for follow up sessions in the areas addressed.

Wider replication of good practices identified through the FAO funded project is critical for project sustainability and increase impact. The following tasks are recommended for achieving greater adoption of practices among farmers at the national level.[49]

- Provide support in implementing good practices through organized field days.
- Sensitize farmers of the direct benefits of practices to their livelihood.
- Provide incentives to adopting farmers to participate in demonstrations (e.g. fertilizers, planting material, machinery services etc).
- Document and disseminate information on good practices to all key stakeholders including the education system for integration in their line of work.
- Facilitate ongoing publicity of the usefulness of good practices in mitigation. More importantly, have strategic partners (e.g. National Disaster Management Agency, Departments of Forestry and Land Use, and Commodity Boards) endorse practices to create spread effect.
- Implement training in DRM for support services e.g. Extension, Agronomy, farm mechanization etc.
- Include "integration of mitigation practices in farming system" as one criterion for selecting farmer of the year.

[49] The assumption is made by the Project Team that the recent passage of hurricanes Ivan and Emily and other less destructive tropical system has instilled a certain degree of awareness among farmers of the need for mitigation.

7.0 CONSTRAINTS AND RECOMMENDATIONS TO AUGMENT EXISTING AGRICULTURE DISASTER RISK MANAGEMENT FRAMEWORKS

Throughout the implementation process, in particular during the national workshops, effort was made by key stakeholders to assess the strengths, weaknesses and opportunities for enhanced disaster risk management in agriculture sector in Grenada. This section highlights areas of concern with respect to the current DRM framework, and proposes strategies for strengthening the current system.

7.1 PRIMARY CONSTRAINTS

- Reactive and response focused approach to disaster management at all decision making levels.
- Inadequate representation of the sector at the National Disaster Management Advisory Council (NaDMAC).
- Unavailability of a disaster management plan for the agriculture sector.
- Inadequate commitment to disaster management from some individuals representing the interests of the agricultural sector at the various NaDMA subcommittees.[50]
- Limited training among agricultural officials in disaster management.
- Lack of incentives provided to volunteers in disaster management at national and community levels.
- Unstable strategic policy directives of the Ministry of Agriculture.[51]
- The adhoc involvement of the District Agriculture Offices in the affairs of the District Disaster Committees.
- The unavailability of a structured emergency food storage program prior to the commencement of the hurricane season.
- Overwhelming responsibilities of the chairpersons of the various management committees.
- Lack of risk diversion mechanisms for the agriculture sector.
- The politicize approach used in some cases to select representatives to participate in disaster management at national and community levels.

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50 A number of informants accredited this challenge inadequate understanding of disaster risk reduction, selection of the wrong person and lack of incentives.

51 Two key informants reported that the strategic policy directions of the Ministry of Agriculture sometimes changes with permanent secretaries and new governments, restricting long term development.

7.2 PROPOSED RECOMMENDATIONS

The project case study contributed to raising awareness of the importance of DRM frameworks in the overall socio-economic development of Grenada. The following points were extracted among farmers, technicians and other informants as critical elements that should be in place to inform and catalyze the development of an enhanced DRM framework.

- Facilitate a major paradigm shift from response and recovery to comprehensive disaster management in all productive sectors, and mainstream DRM in development planning at the national level.
- Develop a Disaster Risk Management Plan for the agriculture sector. *This was prioritized as the most critical intervention needed to support comprehensive disaster risk reduction in the agriculture sector.* The following issues were recommended for inclusion in the sector plan:
  - Ensure adequate representation of the agriculture sub-sectors at all decision making levels pertaining to disaster management – from policy to implementation.
  - Establish and routinely update an agricultural database that is easily accessible. This can be implemented in collaboration with the NaDMA, the Grenada Red Cross Society or other appropriate institutions.
  - Develop and implement a plan to train all officers attached to the Ministry of Agriculture in disaster management.
  - Augment the managerial capacity of the chairpersons of the Disaster Management and other committees to ensure effective implementation of responsibilities.
  - Establish a National Agriculture Committee on disaster management. Hire a Disaster Management Officer to assist in the development and implementation of the disaster plan.
  - Depoliticize disaster management. Specifically select volunteers based on competence, interest and time available to execute duties, and not solely on political affiliation.
  - Establish a mechanism to ensure the availability and equitable disposal of emergency agricultural inputs.
  - Collaborate with regional institutions (e.g. IIAC) and countries in establishing a risk diversion program for the agriculture sector.
  - Foster more effective coordination within the Ministry of Agriculture.
- Lobby with government to prioritize agriculture as a major sector for national development - marketing agriculture as a primary productive sector to policy makers.

- Improve research capacities and skills, and principles for integrated/collaborative management within the sector.
- Invest in appropriate technology as part of a larger strategy to promote soil and water conservation.

7.3 CONCLUSION

Although no formal evaluation was conducted of the project *Assistance to Improve Local Agricultural Emergency Preparedness in Caribbean Countries Highly Prone to Hurricane Related Disasters*, it can be viewed as a *critical first step* in changing the paradigm of disaster management among Caribbean agricultural sectors. Specifically, the following principles became much more relevant and important to stakeholders as a result of this project.

1. The need for proactive disaster planning that addresses *all phases of the disaster cycle,* and not limited exclusively to the response and recovery components of the disaster.

2. The importance of mainstreaming disaster planning and management in national development planning.

3. The urgent need for a well developed and managed agriculture sector disaster plan.

4. The importance of providing mechanisms for integrating the needs and views of the agriculture sector at all decision making levels.

5. The importance of building accountability and responsibility among the farming community for their own disaster management, particular their responsibility for mitigation, recovery and rehabilitation of their farming units.

6. The need to enhance the capacity of local non governmental organizations and community based groups to access resources for disaster planning and recovery.

7. The role of the Extension Department in supporting the adopting of mitigation practices and technologies among the farming community.

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ANNEX 1

DUTIES OF DISASTER MANAGEMENT COMMITTEES

1. Damage and Needs Assessment

- Design a specific damage and needs assessment plan.
- Ensure the committee and its members are prepared to assess damage and needs at the national and local levels if a disaster occurs.
- Assign specific responsibilities to committee members to assess damage and needs to different sectors: housing, health services, agriculture, utilities, etc.
- If a hazard strikes, co-coordinating assessments in disaster areas to determine number of deaths, casualties, damages to property and relief requirements (food, shelter, medical attention).
- Conducting assessment of damages to public utilities (water-supplies, sewage and drainage facilities, telephone electricity, cable) and assisting where possible with the other utilities.
- Coordinating assessment of damages to agriculture and livestock.
- Coordination surveys of roads, bridges, ports and other infrastructure to determine extent of damage.
- Supplying information to the Emergency Operations Centre and to the Disaster Relief Management and the Public Utilities and Rehabilitation and Reconstruction Committees, as necessary, and providing initial financial evaluations and estimates to the relevant ministries and departments as required.
- Conduct assessments of damages to private sector including tourism, distribution, retailers, etc.
- Co-ordinate, within the EOC, with regional and international organizations conducting damage and needs assessment in the case of a disaster.
- Up-date assessments periodically until the disaster is finished.

2. Disaster Relief Management

- Design a specific disaster relief management plan and mechanisms.
- Arranging for suitable buildings for the storage of food, clothing, building material and other emergency supplies.
- Arranging for other safe areas for storage of non-perishable emergency supplies.
- Establishing distribution centres for bulk distribution of emergency supplies.
- Arranging for staff to package and distribute emergency supplies.
- Arranging for the transportation of emergency supplies to storage at all predetermined points.
- Arranging for security of areas where emergency supplies are stored.
- Determining the quantity and type of assistance required with information of the damage and needs assessment committee.
- Maintaining proper records of emergency supplies received and distributed.
- To co-ordinate NGOs supplies from arrival to distribution.

3. Public Utilities, Rehabilitation and Reconstruction

- Design specific plans for the rehabilitation of public utilities after a disaster.
- Maintenance of alternative backup services for use in disaster situations.
- To identify damage to public utilities including information from the damage and needs assessment.
- Restoring services as soon as possible after disaster.
- To co-ordinate supply of labour - local and external.
- Repair and reconstruction of buildings and infrastructure to permit population to revert to normal activity in the shortest possible time.
- Determining suitability for resettlement in formerly hazardous areas.
- Determining the need for land use/ownership policy.
- To procure and subsequently availability of building supplies.
- Transfer of population from high-risk areas.
- Identification of hazardous industries before the disaster.
- To adhere to building codes and maintain prices.
- Liaise with the NaDMA.
- Plan/co-ordinate/liaise with external assistance for rehabilitation and reconstruction.

4. Earthquake Volcanic Eruptions, Floods and Landslide

- To maintain contact with academic and research institutions that studies these specific natural hazards.
- To ensure hazard, vulnerability and risk assessments are conducted to determine the possible magnitude, cope of impact and probability of occurrence of these hazards.
- To promote the design of specific disaster scenarios for specific hazards and specific vulnerable areas.
- To ensure dissemination of information to persons in the danger areas.

5. Hazardous material and Hazardous Wastes and Fires

- To identify hazardous materials used in the country.
- To identify the method of storage, handling, transfer, movement, transportation and disposal of such materials.
- Training of personnel to identify, handle and dispose of hazardous material and toxic waste.
- To design specific regulations for the management of hazardous materials.
- To design specific hazardous materials emergency plan for the response to specific types of accidents involving hazardous materials.

ANNEX 2

GUIDE FOR IMPLEMENTING GOOD PRACTICES

Appendix 2 outlines a guide for implementing each of the five (5) good practices presented at the national workshop in Jamaica.

1. STRIP CROPPING

- Mark out contour lines along the plot of land to be cultivated using an A Frame, Abney Level or other suitable technology.

- Establish strips of equal distances along the contour or across the general slope if sheet or rill erosion is a concern or perpendicular to the prevailing wind to limit wind erosion.

- Arrange crops so that strips requiring intense cultivation with less protective cover are alternated with more permanent crops offering greater protective cover.

- A variety of vegetables, fruit trees, tree crops and tubers/cover crops can be grown depending on farmers needs.

- For example the following two options can be cultivated as part of a strip cropping system:

    - Strip 1: corn (protective cover); Strip 2: vegetables e.g. hot peppers - beans can also be integrated into this system by allowing to run on mature corn stalks.

    - Strip 1: Fruit trees (protective cover); Strip 2: Vegetables.

- This practice can be augmented by integrating grass barriers or field borders such as hedgerows of Angelica Fence, fruit trees or tree crops to further reduce the velocity of ground and upper altitude wind. These additional windbreakers can be placed approximately 30-40 on the plot of land.

- It is important to note also that strip cropping is most effective when used as part of a planned conservation system that integrates crop rotation, minimum tillage etc.

2. EROSION CONTROL STRUCTURES AND PRACTICES

A. Grass Barriers

- Identify areas along the contour that needs stabilization to reduce soil erosion.
- Select an appropriate species of grass based on farmers needs (e.g. Vetiver and Lemon grass).
- Optimal species should meet the following minimum criteria:
  - ✓ form an erect, stiff and uniformly dense hedge;
  - ✓ should be able to survive stress with quick secondary growth;
  - ✓ should not proliferate as a weed; and must require only a narrow width to be effective (The Australian Society of Agronomy, 1999);
  - ✓ should have a very narrow leaf base that prevents insects from lodging (very important in disease prevention).
- Patches of grass should be planted approximately 1-1½ feet apart along the contour depending on species used.
- To maximize the soil conservation effects of this practice, establish barriers approximately 30-40 feet apart from top to bottom of the plot.
- If livestock is integrated into the farming system, farmers could consider using a high protein grass such as elephant grass which can be used as fodder. It is important to note though that this species of grass must be carefully monitored and harvested.
- Grass barriers can be utilized as an economic crop, thus contributing to farmers' income. To maximize the economic value of grass barriers the following is recommended:
  - o Plant species that can be used for a range of purposes outside the farm e.g. domestic, medicinal or raw material for manufacturing.
  - o Working in collaboration with Extension Division or relevant entities, establish partnership with manufacturers, supermarkets or other clientele to ensure quick absorption of harvested product.

B. Contour Farming

- Mark out contour lines along the plot of land to be cultivated using an A Frame, Abney Level or other suitable technology.

- Cut contour drains using contour lines as a guide.

- Using a trained machine operator, plough at right angles to the natural slope of the land to create a series of stepped ridges/beds above each contour drain. Contour beds can also be constructed manually using tools such as hoe, fork and spade.

- Ensure that the edge of each contour bed is made with a slight slope about 5° to prevent unnecessary soil erosion.

- The edges of contour beds can be further strengthen by using one or more of the following methods:

    - Plant grass barriers along alternating beds or at least 30-40 feet between beds.

    - Construct a stone embankment on the front edge of each bed using large stones at the bottom with smaller stones at the top.

- The principals of strip cropping can be integrated into any contour farming practice to augment soil conservation.

- This practice can be augmented by integrating hedgerows or boundary planting to reduce the velocity of ground and upper altitude depending upon farmers needs.

- It is important to note that this practice is most effective when used as part of a planned conservation system that integrates crop rotation, minimum tillage etc.

3. TREE MANAGEMENT

A. Pruning

- Identify all unwanted branches (e.g. dry or infected) and suckers on the targeted tree.

- Using appropriate pruning tools (e.g. pruning knife, saw or rollant) remove all unwanted branches and suckers working from the top centre of the plant. This increases the amount of sunlight entering the tree.

- Balanced the tree by carefully removing unwanted branches on both sides. This is critical in improving the resilience of the tree of hurricane strength winds.

- Branches must be cut close to the trunk as possible. This encourages quick healing of wound and helps to prevent entry of insects (e.g. termites and ants) and pathogenic organisms.

- Pruning should be done once per year before blossoming period.

B. Top working

- Identify the terminal shoot in the targeted tree.

- Using saw or other appropriate tool cut the terminal shoot at the desired height.

- Apply a small amount of tar on the cut surface and cover with a plastic or other water resistant container to prevent rotting and entry of pests and pathogenic organisms.

- Maintain height of tree about 15-25 feet by routinely toping of terminal shoot allowing auxiliary branches to expand.

4. INTEGRATE AGRO-FORESTRY PRACTICES

Agro-forestry is a dynamic, ecologically based, natural resources management system that, through the integration of trees in farmland and rangeland, diversifies and sustains production for increased social, economic and environmental benefits.

A. Windbreaks and shelter belts

- Conduct an assessment of the plot of land to be protected to determine which group of trees would be best suited for establishing windbreaks. This activity can be conducted with assistance from Extension Division and/or Forestry Department or other suitable entity.

- Assessment should be focused on the following issues inter alia:

    - Agro-climatic zone of farming area (tress must be suited to the agro-ecosystem).
    - Trees that have historically grown in the area.
    - Farming system used on plot of land.
    - Identify direction of prevailing wind.
    - Specific objectives of the windbreaks (e.g. reduce wind velocity or to obtain economic returns from system planted).

- Use the above information as a guide for establishing windbreak system.

- Plant selected trees in lines at appropriate distances across the direction of the prevailing wind to reduce wind velocity and crop damage. Examples of good windbreak species include mahogany, white cedar, citrus, bamboo, mango, casuarinas, mahoe and galba.

B. Boundary Planting:

- Plant permanent trees such as fruit trees, tree crops or other non-economic trees along the field boundaries.
- This is critical in especially is vegetable farming dominates the cropping system.

C. Trees on erosion control structures:

- Select trees based on cropping system and farmers needs that can be integrated into structures employed for soil and water conservation such as terraces and grass barriers.

D. Hedgerow intercropping:

- Hedges are planted as parallel rows, with plants closely spaced, and crops are grown in the alleys between them (e.g. citrus).

5. CONSTRUCTING A STORM AND FLOOD RESISTANT POULTRY PEN

- Build concrete walls at least two feet under-ground and 8 inches above the floor area, with post (4x4 rgh) cast 1ft. down into concrete wall and studded with galvanize nails.

- Post 8 feet tall on long sides and 10 feet plus on gable side or (short side) and be planted 5 feet apart. Higher gable is better for ventilation.

- Gable roof is ideal for houses and not flat or shed (better heat control).

- Rafters should be placed 3feet apart and bolted down to post or laths with hurricane straps.

- Galvanize sheets should be screwed down to laths but if drive screws are to be used, each protruding nail must be bent underneath.

- The floor area should preferably be of concrete slab 2 ½ - 3inches thick so as to allow for easy cleaning and disinfecting.

- A floor depth of 8-10 inches is recommended for good litter airflow.

- Sixteen gauge(16 g) ½ x 1inch or ½ x ½ in sq. are the recommended wire mesh for poultry houses and it should be attached from the side of the floor up to the galvanize, so as to keep out wild birds and rodents.

- Curtains should always be attached from the bottom of the pen so as to facilitate better natural elements control (sun, wind, rain).

ANNEX 3

NATIONAL WORKSHOP - LIST OF PARTICIPANTS

NO	NAME OF PARTICIPANT	ORGANIZATION	CONTACT
1	Maximus Lazarus	Agriculture/ Extension	442- 7249
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14	Christopher Holas	Farmer	442-6672
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