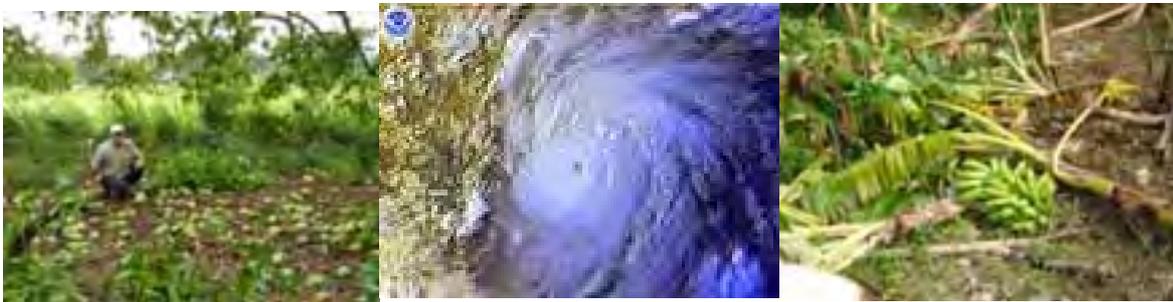




TCP/RLA/3101

---

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



**Good practice examples for disaster risk reduction in  
Cuban Agriculture**

**Final project report**

**April 2008**

**Submitted by:**



---

The Food and Agriculture Organization of the United Nations

TCP/RLA/3101

---

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

**Good practice examples for disaster risk reduction in  
Cuban Agriculture**

**Final Report**

**Consolidated by  
Ministry of Agriculture**

---

**Technical guidance: Disaster Risk Management Group, FAO, Rome**

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Opinions expressed in this publication are those of the authors and do not imply any opinion whatsoever on the part of FAO.

## ACKNOWLEDGEMENTS

The successful completion in Cuba of this project has been possible thanks to kind support, coordination and technical leadership provided by the Ministry of Agriculture (MINAG). Several individuals contributed significantly to the successful completion of the project whose contribution the authors wish to acknowledge.

Special thanks to Mr Julio González González, head of Minister of Agriculture's Civil Defence arm (EMNDC), who led the project sub team in Cuba; he contributed substantially to both regional workshops implemented under the project, and coordinated the consolidation of the material for this report.

Special appreciation is due to the national project task force composed of representatives from drawn from EMNDC, the Ministry for Foreign Investment and Economic Cooperation (MINVEC), the Food and Agriculture Organization of the United Nations (FAO), the Institute for Plant Health Research (INISAV), the Institute of Veterinary Medicine (IMV) and MINAG's national authorities Mr. Marcelin, lead national consultant during project phase I, who conducted the field work and consolidated the material for this report.

Technical backstopping, overall supervision and operational support to the project were provided by FAO Headquarters staff, led by Dr. Stephan Baas, Ms. Micaela Rossello and Ms. Maria Ruiz-Villar. Technical backstopping support for the project subcomponent in Cuba was provided by Mr. Javier Escobedo, FAO Emergency Coordinator for the Caribbean, and Mr Tomas Lindemann.

The FAO Representation in Cuba is thanked for the coordination, administrative and logistic support provided on behalf of FAO to the project component in Cuba, and specifically for the excellent support to the preparations of the regional workshop held in Havana.

## CONTENTS

<b>ACKNOWLEDGEMENTS .....</b>	<b>4</b>
<b>CONTENTS .....</b>	<b>5</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>6</b>
<b>LIST OF ACRONYMS .....</b>	<b>7</b>
<b>1 INTRODUCTION .....</b>	<b>8</b>
1.1 Main Goal and Outputs envisaged by the regional project .....	8
1.2 Project Implementation Strategy in Cuba.....	9
<b>2 NATIONAL CONTEXT OF DRM IN CUBA .....</b>	<b>10</b>
2.1 Geographical Location .....	10
2.2 Background.....	12
2.3 Current situation .....	16
<b>3 CONSOLIDATION OF GOOD PRACTICES ADOPTED IN CUBA .....</b>	<b>19</b>
<b>REFERENCES .....</b>	<b>48</b>

## EXECUTIVE SUMMARY

The vulnerability of the Caribbean region to hydro- meteorological hazards such as hurricanes, floods, drought, high magnitude rainfall and related hazards such as landslides is underscored. The recurrent impacts of these events have wreaked havoc on environment, economy and society throughout the region. Although the contribution of agriculture to Caribbean regional Gross Domestic Product (GDP) has steadily declined over the last two decades, this sector has remained a major employer of labour and as such a main player in the livelihood profile of the region. The extreme vulnerability of the agricultural sector to a variety of hazards/disaster has been a perpetual focus of hazard/disaster management and interventions in the Caribbean. Over the past decade, the FAO has regularly responded to the relief/rehabilitation/reconstruction needs of the sector in the aftermath of hurricane-related disasters. While such response and rehabilitation interventions are important, the extent of devastation caused to the agricultural sector by the 2004-2005 hurricane seasons stresses the need to move from a reactive to a proactive mode in order to facilitate more long term and sustainable benefits from interventions. It is in recognition of the immense negative impact of the 2004 hurricane season on the agricultural landscape of the Caribbean region and in response to the urgent call for assistance from regional policy makers, that the FAO funded the regional project Assistance to improve local agricultural emergency preparedness in Caribbean countries highly prone to hydro-meteorological hazards/disasters.

Jamaica, Haiti, Cuba and Grenada were among the worst affected countries by hurricane-related disasters during 2004-2005, hence the urgent need to emphasize preparedness as a mitigation strategy for the impacts of these events. While the aforementioned countries, in particular Cuba, have advanced Disaster and Risk Management (DRM) frameworks that address preparedness and mitigation issues to different extent and involve a wide cross-section of stakeholders, there are still weaknesses in linking long-term development planning within the agricultural sector with the realities and projections of recurrent natural hazards/disasters and improving preparedness and mitigation measures. Over the last decade the Caribbean region has been experiencing a paradigm shift in this regard, with increased recognition of the importance and advantages of community-based disaster management planning. It is this approach to DRM which was advocated and promoted in the FAO regional TCP project.

Given the limited time horizon and budget available per country under this project in the context of this TCP, Cuba decided to focus the Cuba contributions to the project on the documentation and sharing of good practice examples for disaster risk management in agriculture, including regional level sharing of experience. Cuba organized and hosted the second regional workshop implemented under this project.

This report provides the summary of examples of good practices adopted in Cuba in various agricultural sectors, which contribute to mitigating the damage caused by hurricanes and similar events. Each practice includes its name, the event to which it applies, whether traditional or introduced (if the latter, the year of introduction), a summary of the practice, the benefits reported, the material requirements and the prospects for replicating it in other regions of the area, with photographs.

## LIST OF ACRONYMS

CARICOM	Caribbean Community
CENSA	Nacional Center for Health in Agricultura
CITMA	Ministry of Science, Technology & the Environment
DRM	Disaster Risk Management
EMNDC	National Civil Defence agency
GDP	Gross Domestic Product
IMV	Institute for Veterinary Medicine
INISAV	Institute for Plant Health Research
FAO	Food and Agricultura Organization of the United Nations
GDP	Gross Domestic Product
MINAG	Ministry of Agriculture
MINVEC	Ministry for Foreign Investment and Economic Cooperation
SLSs	Severe Local Storms
TCP	Technical Cooperation Program

# 1 INTRODUCTION

The vulnerability of the Caribbean region to hydro-meteorological hazards such as hurricanes, floods, drought, high magnitude rainfall and related hazards such as landslides is underscored. The recurrent impacts of these events have wreaked havoc on environment, economy and society throughout the region.

Although the contribution of agriculture to Caribbean regional GDP has steadily declined over the last two decades, this sector has remained a major employer of labour and as such a main player in the livelihood profile of the region. The extreme vulnerability of the agricultural sector to a variety of hazards/disaster has been a perpetual focus of hazard/disaster management and interventions in the Caribbean. Over the past decade, the FAO has regularly responded to the relief/rehabilitation/reconstruction needs of the sector in the aftermath of hurricane-related disasters. While such response and rehabilitation interventions are important, the extent of devastation caused to the agricultural sector by the 2004-2005 hurricane seasons stresses the need to move from a reactive to a proactive mode in order to facilitate more long term and sustainable benefits from interventions.

Jamaica, Haiti, Cuba and Grenada were among the worst affected countries by hurricane-related disasters during 2004-2005, hence the urgent need to emphasize preparedness as a mitigation strategy for the impacts of these events. While the aforementioned countries, in particular Cuba have advanced DRM frameworks that address preparedness and mitigation issues to different extent and involve a wide cross-section of stakeholders, there are still weaknesses in linking long-term development planning within the agricultural sector with the realities and projections of recurrent natural hazards/disasters and improving preparedness and mitigation measures. Over the last decade the Caribbean region has been experiencing a paradigm shift in this regard, with increased recognition of the importance and advantages of community-based disaster management planning. It is this approach to DRM which was advocated in the FAO project being implemented.

## 1.1 Main Goal and Outputs envisaged by the regional project

The goal of the project was to contribute to community-based disaster management planning and community level risk management within the agricultural sector.

The regional project had three target-audience specific expected outputs:

- i) Local communities/small scale farmers: identification, demonstration and replication of locally adapted good practices for response preparedness and assessment of demand responsive training related to innovative preparedness activities.
- ii) Local Government Departments: inputs to local action plans for timely, efficient and demand responsive emergency operations to minimize adverse effects of hurricane-related disasters on the agricultural sector and integration of agricultural issues into local contingency planning.

- iii) Government and relevant ministries (rural and agricultural ministries) and international community: recommendations and best practices examples to enhance national and local preparedness in national and international post-emergency agricultural rehabilitation programs.

Given the limited budget available per country under this regional TCP, Cuba decided to focus its activities and give highest emphasis on the third above project output, including regional level sharing of experience in the context of the regional workshops implemented in the context of the project .

## **1.2 Project Implementation Strategy in Cuba**

The regional project adopted an iterative, participatory implementation process to identify and compare lessons learned and good practice examples of disaster preparedness for emergency response and preparedness in the agricultural (including livestock) sector with special emphasis on the local institution and farm levels. Thereafter, this information was valued in order to promote replication in selected pilot sites of techniques which would add value to existing systems. Key recommendations for improving agricultural disaster preparedness aspects of the national/local DRM systems in place, and for the impacts of preparedness activities (or the lack of them) on immediate emergency relief and rehabilitation operations, were analyzed and shared at regional level. Close collaboration with government DRM programmes and other agriculture and livelihood development work was established at the onset of the project in each country to avoid possible duplications and establish a platform for mutual learning and action. Operational linkages were also established with FAO Emergency Coordinators and other FAO development projects in the region.

The first project phase focused on the in-depth situation analysis. It also encompassed research activities to identify existing good practices for DRM in agriculture, to analyze the existing institutional set up and approaches for DRM in agriculture, and to understand the vulnerability context in selected pilot sites caused by natural hazards. National Workshops were organized in each of the participating countries in order to evaluate and prioritize the identified good practices in view of their impacts and potential for replication as well as a Regional Technical Workshop held in January 2007 which provided a platform for technical exchange among the four country teams about the good practices identified, and to discuss their replication potential across the region. Mr Julio González González, head of MINAG's civil defence arm, gave a detailed presentation at the Kingston workshop on Cuba's experience gained in performing tasks responding to natural disasters affecting Cuban agriculture.

In follow up to the Kingston workshop a technical working group was set up in Cuba in April 2007 to guide national level project activities. It was drawn from EMNDC, MINVEC, FAO, INISAV, IMV and MINAG's national authorities. The working group decided to focus project activities in Cuba mainly on the documentation and sharing with partners of good practice examples, of which there are many in Cuba, to enhance national and local preparedness in national and international projects and programs.

In June 2007 the working group conducted a national workshop on disaster response, with the cooperation of various agricultural institutions. Other participants included centres belonging to Cuba's Academy of Science, to the Ministry of Education (National Centre for Agricultural Health) and Civil Defence specialists in agriculture in the provinces. The national workshop led to the consolidation of examples of good practices adopted in Cuba in various agricultural sectors, which contribute to mitigating the damage caused by hurricanes and similar events.

Finally, in order to discuss and conclude the results and outcomes of the regional project a second Regional Synthesis Workshop organized and hosted by the government of Cuba was held in Havana in October 2007. Representatives from local government and civil societies from Cuba, Grenada, Haiti and Jamaica and other CARICOM countries were invited to share lessons learned, good practices and recommendations. Other representatives from the international community currently working on hurricane disaster relief and preparedness in the region were also invited. Workshop findings and recommendations have been documented in a separate report.

## **2 NATIONAL CONTEXT OF DRM IN CUBA**

The national context of the project implementation relates to the geographical location of Cuba in relation to hydro-meteorological hazards such as hurricanes, floods and drought, the dualistic structure of the agricultural economy which results in extreme vulnerability of most farmers and the social and economic impact of recent hydro-meteorological hazards that undermine attempts towards sustainable development.

### **2.1 Geographical Location**

The Cuban Archipelago lies in the Caribbean basin, between  $19^{\circ} 49' 36''$  and  $23^{\circ} 17' 09''$  North and  $74^{\circ} 07' 52''$  and  $84^{\circ} 54' 57''$  East, the most easterly of the Greater Antilles (Fig.1) with a surface area of 110,860 square kilometres, of which the mainland accounts for 96.6% and cays and islets (of which there are 1,600) account for 3.4%. It has a long, narrow outline, with a maximum width of 191 km in the eastern region and a minimum width of 31 km in the west. It is 1,200 km long.

Fig 1. Geographical location of Cuba



The climate is tropical, seasonally humid with marine influence and semi-continental features. Average temperatures on the plains are between 24 and 26°C - higher in the east and below 20°C in the mountains. Rainfall is variable throughout, greater in the west with a gradual west-east diminution. The annual average is 1,300 mm. There are two recognized seasons: the wet (summer), from May to October, and the dry (winter) from November to April. The differences between the west and east reflect the frequency and intensity of storms, the effects of hurricanes, frontal systems and other meteorological factors responsible for complex processes of formation and distribution of rainfall closely related to the nature of the underlying surface.

Thunderstorms, characterized by dangerous electrical discharges in the Cuban countryside, straight-line winds and heavy rain in short bursts account for a substantial proportion of the strongest wind and heaviest rain recorded in Cuba. They are most frequent in inland areas and under specific weather conditions; they are a common occurrence from June to mid-October and rare during the rest of the year (the 'winter').

Active tropical depressions, cold upper lows, prefrontal squall lines and tropical cyclones are weather phenomena that lead to severe local storms (SLSs), which can develop at any time of year. A storm is classified as an SLS when one or more of the following apply: heavy rain exceeding 100 mm; winds gusting to speeds over 60 mph, tornado, waterspout, hail.

Hurricanes are among the most important meteorological events affecting Cuba between June and November; the diameter and strength of their wind systems make them dangerous

phenomena that affect large areas for a certain period, as well as bringing substantial volumes of rain. The winds tend to spread the reproductive material of crop pests, while the associated high levels of humidity favour the development of fungal diseases. August, September and October are the months with the highest incidence of hurricanes and cyclonic disturbances generally; these originate in the Caribbean Sea, Gulf of Mexico and South Atlantic. The probability of occurrence in the western half of the island is about double that for the eastern half.

Another meteorological phenomenon that has a disastrous impact on agriculture is drought. This is a silent event whose beginning and end generally go unnoticed. Apart from the damage to crops, it also increases the risk of fires in woodlands and other rural areas and favours the emergence of insect plagues and viral infections associated with vectors. An important element of the work so far is management of water, with a dual purpose - in case of drought and of the opposite (when rainfall is extremely heavy). This involves weirs, dams, windmills and drinkers for poultry and pig farms.

Records of recent years show an increase in the frequency of hurricanes affecting the Cuban archipelago and neighbouring countries, as well as larger-diameter hurricanes with stronger winds, reflecting the effects on the Caribbean area of global climate change.

## 2.2 Background

Various weather phenomena involving precipitation, as well as hurricanes, cause considerable damage to Cuban agriculture. Strong winds and torrential rains destroy outbuildings and other facilities on cattle farms (Fig.2), poultry farms (Fig.3), apiaries (Fig.4), pig farms (Fig.5) and greenhouses (Fig.6), as well as irrigation equipment (Fig.7). They damage crops and production (Fig.8) as well as plantations (Fig.9). Hurricane winds spread the reproductive material of crop pests (Figs. 10 & 11) in such a way that over the time, at the beginning as an initiative coming from the producers, technical workers, managers, specialists and researchers, and with the political will of the Cuban government, work has been done on searching for solutions using the existing resources, to minimize the impact of the largest and severest hurricanes of the last 10 years and the most frequent SLSs, reflecting the influence on the Caribbean area of global climate change.



Fig. 2. Damage to cowsheds



Fig. 3. Destruction of battery henhouses.



Fig. 4. Impact on beekeeping



Fig. 5. Pigsties



Fig. 6. Greenhouses



Fig. 7. Damaged irrigation equipment



Fig. 8. Wind-damaged fruit trees



Fig. 9. Hurricane damage: banana plantation

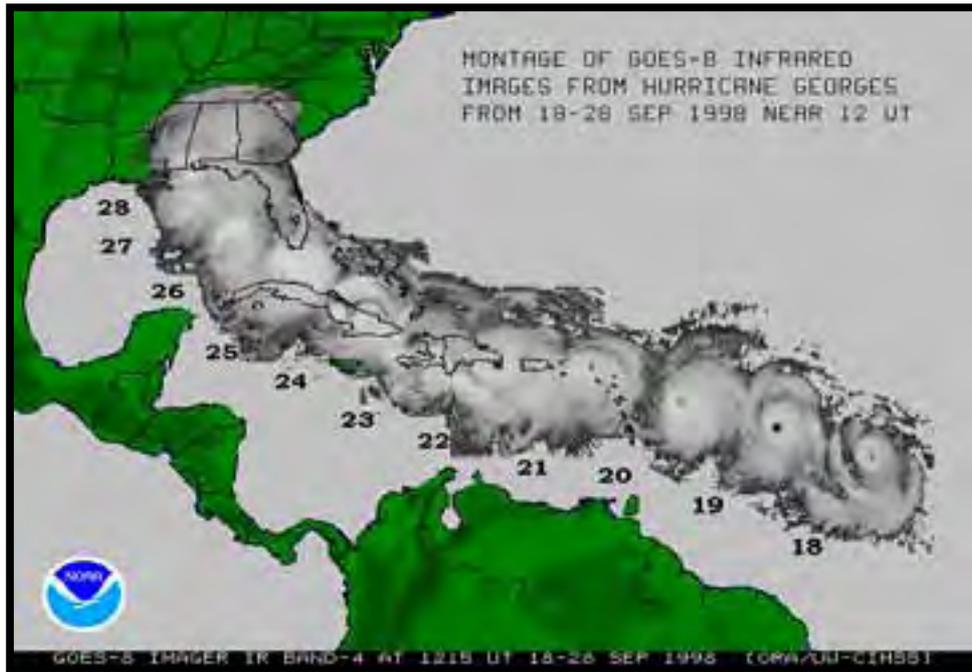


Figure 10. Path of Hurricane Georges, which spread *Paracoccus marginatus*.

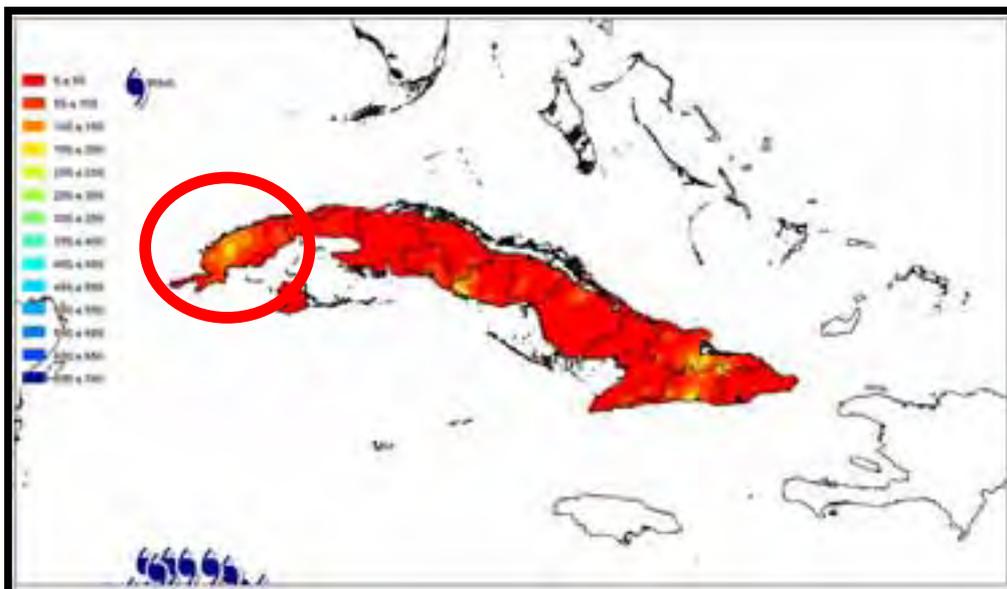


Figure 11. Dissemination of *Peronospora hyoscyami* in Pinar del Río by Hurricane Mitch.

To cite a specific example, when in August 2004 Hurricane Charley struck at a specialist poultry firm's site, roofs were destroyed (Fig.12), as were the chick nurseries (Fig.13), warehouses (Fig.14), avenues, and administration areas. Bio-security was compromised, with 800,000 birds in the open (Fig.15), substantial losses of stock (animals killed or destroyed for sanitary reasons) (Fig.16), outbreak of respiratory and enteric diseases. Also, damage was caused to electrical and water-supply networks, coverings, nursery equipment, fences and other sanitary barriers; serious disruption of flock movements and of the technological flow.



Fig. 12. Damage to roofs      Fig. 13 Damage to chick nurseries      Fig. 14. Damage at warehouses



Figure 15. Disruption of bio-security

Figure 16. Death and slaughter for sanitary reasons

Thousands of birds and eggs were lost. It took six months for the farm to recover (Table 1).

Table 1. Comparison of the production indicators at the specialized poultry farm before and after Hurricane Charley (August 2004).

Indicator	Units	July 2004	August 2004	February 2005
<b>Birds (average)</b>	000s	649.3	398.2	602.5
<b>Egg production</b>	000s	17,745.3	8,662.2	14,527.4
<b>Layers</b>	000s	14,610.5	5,580.8	12,191.2
<b>Eggs per bird</b>	Ratio	22.5	14.77	20.24
<b>Eggs</b>	%	72.57	47.64	72.27

More recently, between October and early November, eastern Cuba experienced several days of rain caused by the tropical depression that became Tropical Storm Noel, creating a series of problems for agriculture. Persistent torrential rain was the primary result of the phenomenon, and caused flooding and damage to crops.

An important factor is the training, from production to the highest level, that is being carried out on a regular basis and in all cases supported by research centres, universities and national, provincial and district authorities. It is an activity that provides valuable feedback for all concerned.

### 2.3 Current situation

A detailed study was carried out by the MINAG, guided and coordinated by the EMNDC and based on organized effort at all levels of government from national institutions to the People's Councils, taking account of economic objectives but prioritizing humanitarian aims. This led to the introduction of a series of measures - political-ideological, socio-economic, public order, judicial, foreign relations, computing and communications - during the disaster reduction cycle, with emphasis on the **planning stage**; this is permanent and the most effective - it includes measures aimed at reducing vulnerability and enhancing the monitoring and forecasting systems (Fig.15).

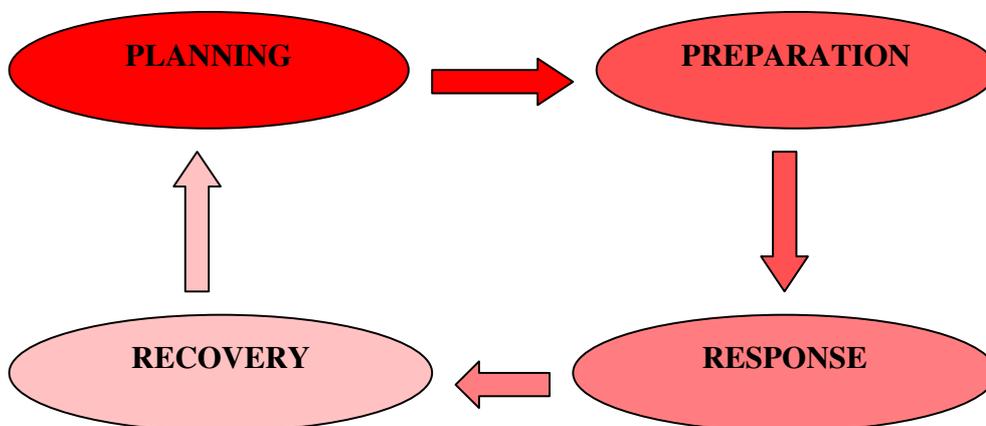


Figure 15. Organizational diagram of the disaster reduction cycle.

The **preparation stage**, which takes account of actions that ensure an optimal response, includes the formulation of disaster-reduction decisions and plans, as well as the updating of these, preparation of personnel, activities to take place before the impact of the danger with the aim of reducing damage.

The **response stage** should take account of measures that start when the impact of a potentially-destructive threat is imminent or in progress; it is the exercise of management of steps based on the approved disaster-reduction decisions and plan; their planning naturally takes account of the stages assumed for each type of disaster.

The **recovery** stage starts when the danger is perceived to have passed and is no longer a threat, or when the situation that evoked the response is under control. It includes two sub-stages: **rehabilitation**, aimed at restoring key services (water supply, food preparation, medical care, electricity supply), damage assessment and aid for the victims; and **reconstruction**, involving construction and repair of buildings, installations and infrastructure. The time this takes depends on the scale of the losses and damage suffered and on the country's economic resources available for such purposes.

At the various levels of the MINAG infrastructure (national, provincial, municipal, production unit) there are multidisciplinary groups that study, analyze and formulate recommendations on threats, vulnerabilities and risks; they are also in contact with the Municipal Risk Centres, where present.

Between December of each year and May of the next, directives and guidelines are received from the EMNDC which are studied and adapted to MINAG's specific characteristics, while those of the agriculture and forestry sector are also included. The guidelines for preparing the annual national plan of disaster-reduction activities are then formulated. This plan is circulated to intermediate levels: national authorities and provincial delegations on agriculture; the civil defence chief (the president of the provincial government) proceeds on a similar basis to that adopted in MINAG, incorporating the particular features of the territory concerned. The procedure at the lower levels (municipal delegation, production unit and municipal firm), in response to the guidelines and provincial plan received, is similar; in the production units, the plan is drawn up and agreed in detail with the People's Defence Council. At all levels, the plans are reconciled with Civil Defence. Following approval, the process operates in reverse: the returns go to MINAG in April, are analyzed during May in the course of the national meteorological review, which also involves validation of the plans drawn up. The work proceeds systematically to ensure effective mitigation of disasters in each agriculture-related unit in Cuba.

Of primordial importance in the annual plans for disaster-reduction activities is the planning stage, which actions are associated to deadlines for implementation and are usually funded. Each unit draws up a prioritized list of actions needed to solve problems that increase vulnerability, with the aim of including its solution in the plan so as to eliminate the risk, in accordance with the resources available. Top priority is accorded to training all personnel in disaster reduction at every level of MINAG's structure, to make all the workers aware and prepared for minimizing the damage arising in such emergencies.

The difficulties deriving from the economic embargo imposed on Cuba since 1959 and those associated with the collapse of the socialist camp in 1989 have meant that the nation has fewer resources for coping with extreme weather conditions, which have become more

frequent and severe in recent years. Droughts, hurricanes and torrential rainstorms, strong winds and flooding are prime examples. The socio-political and climatic mishaps, in the latter case related to global climate change, have stimulated inventiveness among the public in general and farm workers in particular, who have responded to the lack of supplies mentioned with a variety of homespun, traditional or local solutions, which crudely but efficiently replace their missing modern-technology counterparts. This has led to the creation of new jobs in Cuba's countryside, as well as better management of natural resources, and has enhanced the capacity of the public at large to cope with these emergencies. Examples include the use of an excavator-shovel part to clean out the overflow channels of small, local reservoirs, of ploughing equipment to clear sediment from these reservoirs and from drainage channels, of biogas instead of conventional fuel for lighting farmhouses and milking parlours and for cooking, of sewage for organic fertilization of crops.

### 3 CONSOLIDATION OF GOOD PRACTICES ADOPTED IN CUBA

#### SOIL PREPARATION AND CONTOUR SOWING (Traditional, applied intensively since 1980) Against hurricanes or torrential rain



To prepare the soil for contour cultivation, guidelines are marked out with a ridge plough, placing small stakes that are subsequently adjusted to leave them aligned with the contours. All the work is done following these lines using a traditional plough and animal traction. After marking out the guidelines, the first furrow is ploughed, from top to bottom or vice versa, continuing until the whole area has been tilled. If the plan is to put in fences or hedges, the guidelines should be maintained so as to place them along or within these. In the case of contour sowing, planting follows the curve, more or less, so that master guidelines should be marked out, the longest middle part taken, as many guidelines as necessary (above and below) marked out, keeping a basic distance so that the furrows can be ploughed until the field, parcel or plot has been completed, in accordance with the sowing area chosen. The guidelines should not be too far apart, to avoid the appearance of detour. On steeper slopes, the lines should be closer together, while the space between rows should be a multiple of the width of the road to be used. Working from the edges of the field, then the stakes, which should be visible, are put in; finally, the lines are adjusted and the furrows for sowing are established. The irrigation system is set up after the field has been marked out.

It is a means of agronomic/plant-based conservation of the soil; it enables land to be protected and erosion reduced. Its application benefits agriculture, in the form of higher crop and woodland yields; it maintains the fertility of the soil, makes better use of run-off water, protects the land and contributes to environmental improvement

Manpower of the farm concerned is used, formed into teams of manual workers tasked with controlling soil erosion. Other, partly mechanized teams are set up to control soil erosion and perform soil-improvement tasks. Equipment required includes tractors, trailers, front loader, bulldozer, and dump trucks. The cost is of \$200 per hectare.

It can be adopted in flat and hilly areas, for coffee, cocoa, woodland and fruit-growing areas, mixed crops; in a variety of climatic zones, river basins. Also in small farmers' fields, land worked by cooperatives or firms.

**USE OF LIVING COVERINGS  
(Traditional)  
Against hurricanes and torrential rain**



This is sowing with species such as bugle, inch plant, shiny bush and other fast-growing species, to cover soils of hillsides, footpaths border and tracks, bridges, rills or gullies, areas or parts of fields with steep slopes, bends in rivers and streams, to protect the soil from flooding and/or slippage caused by rainwater running downhill. Dual-purpose species can also be used, such as marrow, sweet potato, beans and melon. All these species should be planted in wet periods if they are to establish themselves quickly. The areas should be free of other grasses; some can be scattered at random in the field or sown in trenches with a separation of 20-30 cm.

These are important for fruit-, coffee- and cocoa-growing and woodland areas. It protects soils from the effects of torrential rain.

Specifically indicated are sugarcane seed, plantain, maize, sorghum, sesbania, corn, jack bean, pineapple and bamboo, among others. The time for sowing them, in the case of a living barrier of vetiver, plantain, sugarcane, pineapple, king grass, leucaena, live oak or other material, around 100m long, is 20-35 days; the construction of 12 planting holes takes 36 days; cutting of 10 living stakes is done over 16 days. Maintenance is annual. The cost is \$150 per hectare.

This practice can be used in areas with slopes of any kind, in various agro-climatic zones and for small producers, cooperatives or firms.

**USE OF NON-LIVING COVERINGS  
(Introduced)  
Against hurricanes and torrential rain**



These can be permanent or temporary. The materials used include cuttings, straw, branches, leaves, stones and any plant material that can be gathered. It is placed in the rows between the crops or on slopes. If the material is very bulky, it is cut using machetes. In arid areas lacking vegetation, stones can be used.

This method conserves the humidity of the soil, contributes organic material, and protects the soil from erosion. It also increases microflora activity and improves the physical, chemical and biological properties of the soil.

It is easy to do; the farmer can carry it out with materials at hand. The time required depends on the area to be protected. Maintenance is regular, in line with the life-cycle of the crop concerned and the material used.

It can be adopted with different types of soil relief and agro-climatic zones. It is practical for small producers, cooperatives and farms growing various crops.

**USE OF EARTHWORM HUMUS; CREATION OF RESERVES  
(Traditional)  
Against hurricanes, torrential rain and flooding**



Worm-farming is a technology for converting solid organic residues out of the soil, working directly with the earthworm, to obtain humus and animal protein. It is the best fertilizer known, containing all the macro- and micro-nutrients plants need, a high biological charge and substances that stimulate plant growth, making it a product of reference in farming practice.

Its main benefits include a healthy environmental impact, since the technology destroys pollutants. Also, its use encourages the creation of new sources of employment.

Worm farms are of various sizes, small, medium and large. Medium-sized units measure 60-96 square metres; and the biggest ones measure over 3,200 square metres. The local workforce is used. Equipment required includes tractors, trailers, front loader, bulldozers, dump trucks, organic fertilizer applicators, oxen for transporting materials such as harvest waste, cuttings, solid waste, and manure. Also required are a tractor with front shovel, a cart, shovels, 3-prong forks, hoes, trucks, machetes, sieving equipment, mill, plastic bags, polythene sacks, sealant, irrigation system, protective clothing, over 270 cubic metres of manure according to the size, at least 2,145 15-inch blocks,  $\frac{3}{4}$  plastic pipework,  $\frac{1}{2}$  or  $\frac{3}{4}$  hoses. A basic farm based on organic material can be set up in about 120 days. Maintenance is carried out annually. The cost is over \$5,000 per farm.

It can be replicated on any slope and any agro-ecological region, for producers, cooperatives or provincial or national firms.

**USE OF COMPOST; CREATION OF RESERVES  
(Traditional)  
Against hurricanes, torrential rain and flooding**



This is an organic fertilizer obtained through a natural process of transformation of solid organic residues (agricultural, agro-industrial, urban waste or manure). The process is aerobic, with the action of micro-organisms in the right conditions of temperature, humidity, pH and type of compost. It releases substantial amounts of carbon dioxide, water vapour and energy, so that the tank or silo of organic material heats up. Thereafter it cools and matures until reaching the final stage. There are many ways of making compost; in a hole in the ground, in receptacles or on the surface.

The benefits include the certainty of obtaining a natural fertilizer of excellent quality. Its application results in healthy crops and contributes to the development of eminently ecological farming. It helps maintain the nutritional balance of the soil and, hence, its natural fertility.

The workforce of the farm concerned is used. Species adapted to living within large quantities of organic material, not rambling, should be used. They can be fed with any solid organic substance, the manure of any animal, solid organic industrial waste, harvest waste, urban garbage. Prior preparation of this food is essential. Equipment required includes tractors, trailer, front loader, bulldozer, dump trucks, organic fertilizer applicators, and oxen for transporting materials such as harvest waste, cuttings, solid waste, and manure. Also required are a tractor with front shovel, a cart, shovels, 3-prong forks, hoes, trucks, machetes, sieving equipment, mill, plastic bags, polythene sacks, sealant, irrigation system, protective clothing, over 270 cubic metres of manure according to the size, at least 2,145 15-inch blocks,  $\frac{3}{4}$  plastic pipework,  $\frac{1}{2}$  or  $\frac{3}{4}$  hoses. A basic farm based on organic material can be set up in about 120 days. Maintenance is carried out annually. The cost is over \$5,000 per farm.

It can be replicated on any slope in any agro-ecological region, for producers, cooperatives or provincial or national firms.

## CONTROL AND ADAPTATION OF RILLS (Traditional)

**Against hurricanes (Category 2 and above), torrential rain and flooding**



A topographical survey is conducted to define the area affected by the presence of the rill, followed by works upstream. Given that the axis is the central area and that in or into which the run-off water flows, strong, durable structures are established here, able to reduce the speed of flow and maintain a blocking effect. Any kind of obstruction (locks, weirs) is suitable for this operation, although various types that can be temporary or permanent, according to the material used in their construction, are preferable; these serve to slow the run-off water, deposit part of the material upstream, forming a sediment layer. Under favourable conditions, these enable a cover of vegetation to become established, which completely stabilizes the rill bed.

Rills represent the last and most damaging stage of the soil-erosion process, undermining crops, roads, paths, bridges. They are regarded as river basins in miniature, formed by tributaries. They are classified by depth and drainage area, being categorized as deep (depth of over 5 metres), medium-deep (1-5 metres) and shallow (less than a metre); and as regards the drainage area involved, as small (under 2 hectares), medium (2-5 hectares) and large (over 5 hectares).

It avoids the spread of rills, landslips, destruction of houses, paths of communication and crops.

Weirs or locks, dams of branches, trunks, stones, masonry slabs etc. need to be put in place. Equipment and materials required include tractor with trailer, pairs of oxen with cart, dump truck, A-type trestle, machete, hoe, ropes, wire, stones, posts, grass seed, tree (including fruit-tree) supports, living stakes, disposable tyres. The time required is over 30 days.

Maintenance is annual. The estimated cost for a small rill-control project is of \$560, for medium-sized it is of \$3,728.30 and for large one it amounts to \$8651.82.

It can be created in any kind of topography, from near-flat to hilly, in most agro-ecological areas and in most Cuban soils.

**EXTRA-DENSE PLANTAIN TECHNOLOGY**  
**(Introduced, since 2001)**  
**Against the threat of hurricanes**



This involves high-density sowing in a single crop cycle, which boosts the yields by a factor of two or three and cuts hurricane damage by 70%. It is based on an advanced-technology package, organic concepts and benefits the farm-worker in pay terms. With intensive use of the soil and irrigation, planting (vitroplants, seedlings in bags from nurseries), no replanting, no cuttings, no crop rotation, minimum farm work, organic fertilization at the base and foliage level, avoidance of pesticides.

It results in high production, greatly increased yields, high returns, reduced vulnerability of the plantations to hurricanes, and it is environment-friendly.

Labour requirement is one man per hectare; a sure supply of seedlings, organic material, humus and hoes are also needed. The job takes 10-12 months or 12-14 months according to the variety of plantain used. Maintenance does not require soil preparation, planting is continuous. The estimated cost is \$38,932.59 per hectare.

It adapts itself to any type of soil, topography or agro-ecological region, provided there is irrigation, and can be used on patios, smallholdings, at cooperatives or firms.

## **MONITORING SYSTEM FOR EARLY DETECTION OF FOREIGN AND EMERGING PESTS**

**(Introduced, since 1977)**

**Against hurricanes, torrential rain, flooding, drought, south winds etc.**



Monitoring of crops and other plants to detect symptoms of foreign or emerging pests is carried out by Plant Health department specialists and field workers from the people's councils, small producers, cooperatives, firms, territorial plant-protection stations and provincial plant-health laboratories. The Plant Health Research Institute, the Central Plant Quarantine Laboratory and other research agencies within MINAG and other ministries, study and establish methodologies for diagnosis and other activities concerned with early detection and with introducing and establishing natural enemies that minimize the damage caused by pests.

This practice is decisive in preventing the arrival and/or spread of foreign pests potentially capable of causing agricultural disasters, found in neighbouring countries or in distant lands that are trading partners, as well as in the case of biological threats to farm crops, which cause plant-disease disasters in the country.

Requirements include monitoring methodologies, activists and trained producers, notebooks, pencils, magnifying glasses, plastic bags, plastic or glass jars for sample-taking and sending to the laboratory in cases of doubtful identification. The scientific/technical training of the personnel (producers, businessmen, experts, officials) should be kept up to date on a regular basis.

Knowing which foreign pests may appear and having or designing monitoring methodologies, as well as training the technical personnel, it can be applied to any farm crop in any agro-climatic region. It is best used by small producers and cooperatives, but is also used by specialists from provincial and national firms, according to the pest or plant-disease problem to be highlighted.

**PLANT-HEALTH MONITORING AND ISSUE OF EARLY WARNINGS**  
**(Introduced, since 1977)**  
**Against hurricanes, torrential rain, flooding, drought, south winds etc.**



The producers monitor their crops to detect signs of infectious and non-infectious diseases, damage by insects and other pests, in the wake of hurricanes, torrential rain, flooding, drought, south winds, high concentrations of ozone and other climatic threats. Monitoring is performed on the basis of the pest reporting and forecasting methodologies, crop-management regulations, crop-protection programmes and integrated pest-management programmes.

Early detection of pests and/or non-infectious diseases enables decisions to be taken promptly to forestall plant-disease and pest epidemics among farm crops, optimizing the number of chemical and/or biological treatments and hence raising yields and curbing environmental pollution.

Requirements include: a suitably-trained producer or a specialist who dedicates the necessary minimum time to monitoring the cultivated areas; notebooks and pencils or biros, magnifying glasses, plastic bags or plastic or glass jars for sample-taking and sending to the provincial plant-health laboratory (LAPROSAV) in cases of doubtful identification. The scientific/technical training of the personnel (producers, businessmen, experts, and officials) should be kept up to date on a regular basis, as well as the consumables needed for carrying out the monitoring.

It is applied to any farm crop in any agro-climatic region. It is best used by small producers and cooperatives, but is also used by specialists from provincial and national firms, according to the pest or plant-disease problem to be focused on.

## USE OF INSECTIVORES FOR CONTROLLING PESTS AND SAFEGUARDING RESERVES

(Introduced, since 1990)

Against hurricanes, torrential rain, flooding, drought, south winds etc.



This is the control of pests by using their natural enemies, in the wake of conditions strongly favouring the development of plagues. The natural enemies are reared using traditional methods at centres ("CREEs") for the reproduction of insectivores and animals that cause diseases among insects, where reserves are accumulated for emergencies resulting from natural disasters that can trigger insect plagues. Another focus is that of maintaining an appropriate balance among the agro-ecosystems, to enable conservation of these insects that are so useful to agriculture. Conservation is a basic biological control strategy of sustainable agriculture and is central to ecological pest-management programmes. The emphasis is on managing the agro-ecosystem and the aim is to create an environment favouring the activity, survival and reproduction of the natural enemies inhabiting the region concerned.

They are effective in keeping the numbers of insectivores within bounds. They do not pollute the environment and are not injurious to man or to animals.

Requirements include knowing which natural enemies are present in the various crops, how to protect them and learning to rear them. They can be used in any agro-climatic region, for any kind of crop and are generally used by small producers, cooperatives or businessmen.

**USE OF *TRICHODERMA* AMONG CROPS FOR BIOLOGICAL CONTROL OF DISEASES CAUSED BY SOIL PHYTOPATHOGENS FOLLOWING TORRENTIAL RAIN; SAFEGUARDING OF RESERVES**

**(Introduced, since 1990)**

**Against hurricanes, torrential rain and floods**



This is the use of the TRICOSAVE bio-product based on *Trichoderma harzianum* A-34 (antagonistic micro organism) for controlling soil fungi that attack plants (*Phytophthora*, *Fusarium*, *Pythium*, *Rhizoctonia*), as well as nematodes that cause diseases (black shank, damping off) in the wake of torrential rain, which facilitates their penetration of plants. The bio-product is produced using traditional methods in the centres ("CREEs") for the reproduction of insectivores and animals that cause diseases among insects, in various parts of the country; these keep reserves for use in the event of torrential rainstorms. Control can be carried out at the various sites affected by the pathogens; the method of application also takes account of the location of the damage to the plant. Treatments are performed on seeds, the soil, leaves, flowers and fruits.

It is very effective for controlling the diseases that always appear after torrential rain. It is an organic product and, unlike chemicals, poses no pollution risk to humans, animals or the environment.

It requires minimum technical knowledge of application techniques. It is applied like any other fungicide with the specific requirements of the product, obtainable from the nearest CREE.

It can be used in any agro-climatic region, on any affected crop and by small producers, cooperatives or businessmen.

**INTEGRATED PEST-MANAGEMENT PROGRAMMES**  
**(Introduced, since 1989)**  
**Against hurricanes, torrential rain, flooding, drought, south winds etc.**



This is a system of pest methodologies which, in the context of the related environment and the population dynamics of the damaging species, uses all the appropriate techniques and methods in the most compatible way possible and contains the pest population to levels below which it would cause economic damage. The basic aspects to be considered include the agro-ecosystem, natural control, biology and ecology of the organisms, cultivation as a central approach, sampling and use of critical levels, use of compatible tactics, integration of disciplines and secondary effects of photoprotection. Integrated pest-management tactics include management and encouragement of natural enemies, importing and establishing foreign natural enemies, use of microbiological agents, phylogenetic control, cultural practices, mechanical and physical controls, legal measures, employment of autocidal techniques and use of pesticides.

Integrated pest management optimizes crop yields and ensures their long-term productivity, protects human health and the quality of the environment.

The techniques are employed at national, provincial and local level, by businesses, small producers, with results of practical studies. The time required depends on the crop and the information collected. They are systematically updated or improved with the emergence of new scientific/technical results.

They can be used in various agro-climatic regions, by small producers, cooperatives and firms.

**ACTIVATION OF MONITORING, SURVEILLANCE, COMMUNICATION AND  
INFORMATION FOR EARLY-WARNING SYSTEMS OF PEST & DISEASE  
AMONG FARM CROPS AND ANIMALS  
(Introduced, since 1977)  
Against drought**



In the event of severe drought, monitoring, surveillance and communication for early-warning systems of pests among farm crops is activated, based on the signalling and forecasting methodologies used in the territorial plant-protection stations by plant health specialists or activists, as well as the diagnostic methods for early detection of harmful agents. The information is processed by bio-statistics experts and sent to the provincial authority for processing and forwarding to the national plant-health centre and the central plant quarantine laboratory. In the case of animals, the work is similar to that relating to crops.

Implementation contributes to preventing plagues among plants and animals consequent on severe droughts.

Requirements include the availability or formulation of methodologies for reporting and forecasting various plagues among farm crops, methods for diagnosis of pests and diseases among animals.

It can be applied in any agro-climatic region, at local, provincial and national levels.

## **EVACUATION CENTRES FOR FARM ANIMALS AND PETS FOR THEIR PROTECTION AND FOR DISEASE PREVENTION**

**(Introduced, since 2002)**

**Against hurricanes, torrential rain and inland and coastal flooding**



Use of evacuation centres for farm animals and pets to ensure their protection and animal wellbeing, as well as prevention of diseases which can be transmitted to humans (zoonoses). The centres are independent of the places where people gather in the event of hurricanes, torrential rain and inland and coastal flooding. The practice reflects Directive No.1 for the planning, organization and preparation of the country for disaster situations, and the plan for mitigating community disasters regarding animal protection and its economics.

The primary benefits include full satisfaction on the part of the population since its animals are cared for and protected and zoonoses are prevented. Better control for veterinary work, enables the creation of a reserve of livestock for feeding the population in case of need and better preparation and organization of evacuation, whether of people or of the animals, consolidating the community orientation group.

Requirements include a specialist studying the community and its locality full-time, to locate these centres according to the vulnerabilities and the number of animals concerned, as well as to monitor the diseases to which they are susceptible there. It requires using paper, pencils or biros for notes, identification of buildings suitable for holding animals, veterinary medicines, personnel trained in animal care, feed, water, scientific/technical training of personnel (producers, members of the public, specialists, officials).

It is applied to coastal communities, those close to rivers or in low-lying areas or tropical or subtropical regions. It is best employed in the communities, but is also used by producers, cooperatives, according to the natural disaster to which they are exposed.

**INSTALLATION OF LOMBARDINI DIESEL PLANTS TO ENSURE  
CONTINUITY OF MILKING AT DAIRY FARMS  
(Introduced, since 1983)  
Against cyclones, hurricanes, torrential rain, flooding**



It consists in using Lombardini diesel plants at farms to maintain the continuity of milking in the event of power failure during the passage of a cyclone, hurricane or torrential rainstorm. The installation and operation of the plant is governed by the manufacturer's instructions.

It avoids loss of milk production in the event of power failure and stabilizes the milking routine. It avoids stress among the animals and diseases of the mammary glands.

Requirements include personal qualified to install and maintain the plant. Training of the personal working at the dairy where the plants are installed, in their use and care.

<u>Equipment to be used</u>	<u>Cost</u>
Lombardini diesel plant	\$1,290.00
Consumption: 1.2 litres per plant per hour	

It can be used at any farm but is best employed at cooperative, firm level, at borough and district level.

**EVACUATION OR MOVEMENT OF CATTLE TO SAFE HIGH GROUND**  
**(Traditional practice)**  
**Against hurricanes, torrential rain, inland and coastal flooding**



This practice is implicit in the culture created by cattle farmers over the years, in response to various natural phenomena, as a means of protection. It needs to take account of the topography of the locality, access roads and the availability of feed and water at the place where the stock would be concentrated. The species to be moved are basically those able to travel on foot, such as cattle, horses, sheep and goats. However, pigs and poultry are moved only in the private sector, since in the state sector they are protected in their ordinary accommodation.

It avoids death among the livestock and the consequent economic loss (since not only the animal but its produce would otherwise also be lost).

The sites to which the livestock is to be transferred should be chosen in advance so as to minimize the risk of losses. Also needed are workers or producers familiar with the species involved. Also, in the place to which they are moved, a grazing area must be created (according to the number of animals involved) while natural reservoirs should be present and veterinary care available. Also needed are skilled personnel (rural cattle inspectors), average pay \$280, as well as a veterinary surgeon and veterinary auxiliary, average pay \$375 and \$335 respectively, and a stock of medicines and instruments needed for attending the species concerned.

It is applied to coastal communities, those close to rivers or in low-lying areas or tropical or subtropical regions. It is best employed in the communities, but is also used by producers, cooperatives, firms, according to the natural disaster to which they are exposed.

**USE OF COVERINGS ON OUTBUILDINGS TO PROTECT  
SMALLER SPECIES AND YOUNG ANIMALS  
(Traditional practice)  
Against cyclones, hurricanes, torrential rain, drought**



The use of covering materials on farm installations or outbuildings is designed to preserve the health and wellbeing of smaller livestock species and young animals (calves, poultry, pigs, rabbits, lambs and kids). The coverings are placed at the sides of open-sided structures as shelter against rain, strong winds and the sun.

The practice preserves the health and wellbeing of the livestock kept in these structures, avoids mortality among the species and reduces expenditure on medicines for treating sick animals.

Requirements include personnel experienced in livestock care. Either natural or man-made materials can be used, as indicated below:

<u><i>Natural materials</i></u>	<u><i>Unit</i></u>	<u><i>Cost per unit</i></u>
- Palm fronds	1 frond	1.00
- Royal palm	doz.	6.00
- Stalks	uno	0.65
<u><i>Man-made materials</i></u>		
- Nylon sheeting	metre	4.00
- Polythene sheeting	metre	6.80
- Jute sack sheeting	sack	0.25
- Canvas	metre	7.20
- Corrugated iron	sheet	17.50

Quantities depend on the size of the outbuilding etc.

It can be used in any structure where animals are reared. Best used at family, cooperative, firm level, at borough and district level.

## TRADITIONAL CHEESE-MAKING AS AN ALTERNATIVE MEANS OF SAVING MILK

(Traditional)

Relevant risks: hurricanes, torrential rain, floods



Production of cheese under traditional methods is used as an alternative means of avoiding losses of litres of milk at farms in the event of breakdown of the refrigeration system or because of bad weather and non-availability of milk stabilizers as well as the inability to distribute the milk immediately and directly to the consumer.

This practice reduces economic losses in that the milk is not lost. It is a method of conservation that results in a product of high nutritional value which lasts for 10 days at room temperature.

Requirements include personnel trained in this type of traditional production and a specialist (veterinary surgeon) to check and certify the safety of the finished product. The following materials are needed:

	<u>Unit</u>	<u>Cost/unit</u>	<u>Quantity</u>	<u>Total</u>
* Mould	1	12.00	40	480.00
* Salt	kg	0.10	1 Kg.	0.10
* Gauze	m	1.95	1 m	1.95
* Boiler (20-litre)	1	142.80	2	285.60

Estimated total cost: \$767.65

It can be used at any dairy farm, small milking parlour or anywhere dairy cattle are kept. It is best used at cooperative, firm level at borough and district level.

**SECURING OF ROOFS AT ANIMAL-REARING INSTALLATIONS  
(Traditional)  
Against hurricanes, high winds associated with severe local storms**



This traditional practice is designed to avoid losses of roofs at poultry, pig and other cattle farms, warehousing and administrative facilities etc., with the resulting cost of replacing coverings and the loss of livestock, products, equipment and materials kept in such places.

It avoids losses of material resources at the installation and of roofing components. It avoids accidental death of livestock of the various species kept. This kind of securing is easy and cheap, so that this practice is adopted in the various sectors of the national economy.

Requirements include the training of personnel. The material needed depends on the size of the structure to be secured.

<u>Materials</u>	<u>Unit</u>	<u>Cost</u>
- Wooden poles	1 m <sup>3</sup>	\$43.50
- Smooth wire	1 roll	\$62.00

It can be used on any lightly-roofed farm building, warehouse, dwelling. Best employed at family, cooperative, firm, borough or district level.

In the case of an average battery henhouse, securing its roofs would cost \$10,527.72.

## TRAINING AT THE CAMILO CIENFUEGOS TRAINING CENTRE



A technical training centre has been built at the Camilo Cienfuegos genetic agriculture firm ("EPG") in Consolación del Sur, Pinar del Río province, which is used for the preparation of all the firm's personnel in training activities under the disaster-reduction plans. In classrooms or centres similar to this, the agriculture-sector workers are trained and updated annually on disasters in agriculture. In 2007 various seminars, courses and conferences were held at the EPG, including the following:

- Seminar on use of biogas.
- Conference on disaster reduction.
- Course on installing and operating windmills.
- Conference on mitigation of disaster effects on cattle.
- Seminar on installing solar panels as a renewable-energy alternative.
- Disaster reduction: protection of irrigation machinery and equipment.
- Disaster reduction at plant nurseries.
- Seminars on locating solar heaters for warming milk for calves in fattening centres.

**USE OF 'STABILAK' MILK STABILIZERS AND IMMEDIATE DISTRIBUTION  
(Introduced as from 2000)  
Against hurricanes, torrential rain and flooding**



STABILAK is used to preserve raw, fresh cows', goats', buffalo and other mammalian milk, for 8-72 hours according to the starting quality and temperature of the milk. This product and immediate distribution of the milk are alternatives for avoiding deterioration or loss of milk quality and production, whether caused by interruption of electricity supply, blockage of farm access roads or delay in collecting the milk in the wake of a hurricane or torrential rain. They also apply where the refrigeration equipment at the unit breaks down and in units without refrigeration.

It preserves the quality of the milk, which retains the appropriate parameters at the time of its use by the consumer. It avoids the loss of litres of daily milk at a unit; this could amount to 1000 litres which at 90 cents per litre implies loss of revenue amounting to \$900.00, affecting delivery to the dairy industry and to the consumer. Without STABILAK 200 kg of imported powdered milk should be used to produce the 1,000 litres of lost milk, with a cost amounting to \$830.00. Stabilak is harmless to human health and does not affect the taste, smell or colour of the milk or produce lactic derivatives.

Requirements include competent cattle-farming personnel, training of producers in its use and handling and of the public in the hygienic measures to be taken for consumption of this milk.

In the case of immediate delivery to consumers, the state of health of the milking stock must be taken into account, to avoid the incidence of zoonoses.

The unit price of a packet is \$4.96 and two packets (the 1 and the 2) come in boxes of 50-litre doses, 500-litre doses and 5,000-litre doses of milk which reactivates 8 hours after the treatment, prolonging protection of the milk for a similar period to that of the first activation.

It can be used at any dairy farm, small milking parlour or anywhere dairy cattle are kept. It is best used at cooperative, firm level at borough and district level.

**SINKING WELLS AND BUILDING DAMS FOR WATER SUPPLY  
TO CATTLE FARMS  
(Introduced, since 1991)  
Against drought**



This practice of creating natural or artificial reservoirs, whether dams or wells, is used to store this precious liquid for livestock and crops. It is carried out taking account of the local topography, method of reservoir water supply and the location and dimensions of the aquifer where the well is to be sunk.

It enables the storage of water for supply to cattle farms and crops in the dry season. Moreover, dams enable enrichment of the aquifer and regulate the flow in streams and rills.

Requirements include personnel skilled and qualified in the creation of these reservoirs, as well as a study and analysis to determine their location and construction method (which can be manual or mechanized). Building a dam costs 7,884.26 pesos, while sinking a well costs 1,755.00 pesos.

Its construction can extend to rural and semi rural areas, in any topography. It is best employed in communities, but they are also used by producers and cooperatives.

**BEEHIVE FEEDING**  
**(Introduced during the 1970s)**  
**Against drought, impact on vegetation of hurricanes, floods and fires**



The hives are fed with moistened sugar, left on a tray or in a receptacle inside the hive.

It avoids death of bees and hives from starvation, and ensures the retention of hives for continuing the production process.

Requirements include the services of beekeepers. Materials needed include feeders, water, sugar, suitable receptacles. The minimum time needed for carrying it out is one day, preferably two days. Maintenance consists in verifying availability of food in the hives, deciding whether further feeding is needed or whether the vegetation has recovered sufficiently to provide food, or whether the hive should be relocated to another area. Cost estimates depend on the number of hives to be fed (around 4-5 kg per hive) and the distances to be travelled. The main items of expense are sugar, fuel and transport.

It is applicable in any region exposed to the extremes that can cause starvation among the hives and at any level in terms of the number of hives, although it is especially applied in cooperatives and among producers with a large number of hives (over 50-100 up to 1,000 or more).

## **TRANSHUMANCE OF HIVES** **(Introduced during the 1970s)**

Against cyclones, hurricanes, rain, flooding, fires



The hives are closed at the bee entrance, preferably at night, their parts (hive body, roof and supporting platform) are secured with strips of wood or are fastened so that they cannot become detached, and are transported to high ground, where the entrances are cleared to permit the bees to fly.

With this practice, death by drowning of bees and hives is avoided; the possibility of retaining strong, healthy hives to continue the production process is ensured.

Requirements include the services of beekeepers. Materials needed include nails, wooden strips or ropes. The minimum time needed for the job is one day, preferably two days. The hives should be examined when the rain stops, to determine whether they should be moved again or fed. Cost estimates depend on the number of hives to be moved and the distances to be travelled. The main items of expense are fuel and transport.

It is applicable in any region exposed to the risk of hurricanes or low-lying areas at risk of flooding and at any level in terms of the number of hives, although it is especially applied in cooperatives and among producers with a large number of hives (over 50-100 up to 1,000 or more).

**CONSTRUCTION AND USE OF REFUGES ON FARMLAND  
(Traditional)  
Against hurricanes**



This is a hut constructed of wooden posts secured at their joints with screws, a roof thatched to the ground with dry royal palm fronds, wooden slats in front and at the base. It is in frequent use during the hurricane season, typical of the Cuban countryside, able to withstand strong winds and occupied in the critical stages of hurricanes by people, domestic animals, trays of seedlings and seeds, for their preservation until the hurricane has moved on.

It protects people, domestic animals, seedlings, from hurricane-force winds, from rain, without risk of collapse, loss of roofs or other damage.

Requirements include 800 palm fronds (roof), 400 palm petiole tops, 3 cubic meters of wooden poles, 2 cubic metres of sawn timber, 5 kg 5" heavy-gauge nails, 5 kg 2.5" heavy-gauge nails, 5 kg 5" standard-gauge nails.

It can be used in various agro-climatic areas, basically by families, cooperatives and firms.

**INSTALLATION OF LIGHTNING RODS**  
**(Introduced, since 1975)**  
**Against thunderstorms**

**Ante sequías, Ciclones Tropicales, intensas lluvias, inundaciones**

It consists in the installation of lightning rods on the various cattle farm outbuildings, to reduce the damage caused by lightning during thunderstorms.

It avoids accidents with lightning to livestock or workers, reduces damage to premises from the same cause as well as the incidence of fires, thereby contributing to the wellbeing of the livestock.

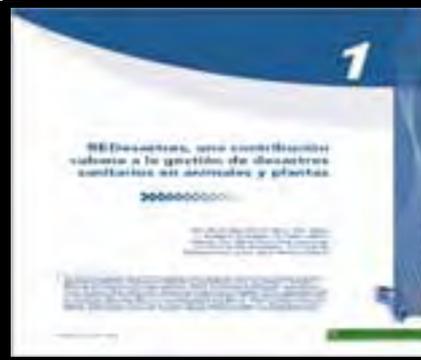
Requirements include personnel trained in installation of these devices, training of personnel at the unit in their functioning and the safeguards to be adopted on the occurrence of thunderstorms.

Its implementation can be extended to any structure dedicated to livestock rearing. It is used in the cooperatives' tobacco curing houses.

**'REDesastres': multi-institutional network operated by the Centre for Training in the Reduction of Animal & Plant Health Disasters (CEDESAP) (Introduced in 2005)**

**Against drought, hurricanes, torrential rain, flooding.**

**Ante sequías, Ciclones Tropicales, intensas lluvias, inundaciones**



Developed to strengthen inter-sector, multidisciplinary cooperation (see <http://www.censa.edu.cu/cedesap> , REDesastres-L@censa.edu.cu), which is key to coping with disasters and a pillar of national strategy. Sponsored by the National Centre for Health in Agriculture (CENSA), the Ministry of Higher Education and EMNDC, it covers the whole country and has 403 members, between institutions, researchers, professors, specialists and executives at various levels in the ministries. It enables real-time interconnection between professionals in a variety of disciplines, notably across all the universities and agricultural research centres, technical and administrative agencies and diagnostic laboratories belonging to the official veterinary and plant health services, as well as all the production sectors. 750 messages have been circulated with salient, updated information and related commentary, obtained from public health bodies and international news agencies, scientific journals, regarding prevention, diagnosis and control of cross-border diseases and especially public-health disaster situations following extreme weather, emphasizing those possibly attributable to climate change. It is endorsed by MINAG, EMNDC and the Ministry of Science, Technology & the Environment (CITMA). It was singled out by INFOTEC as a successful example of the use of information and communication technology for agricultural research and technological innovation in Latin America & the Caribbean. It stimulates multi-sector and interdisciplinary cooperation, opens an additional channel for communication on risk, facilitates preparation of personnel,

enables distance learning, increases the chances of contact and exchange of experience and contributes to optimized use of human resources.

It requires teamwork on a part-time basis, involving close relations with the other members of the network, to optimize the benefits of cooperation, a microprocessor, and connection to a server and to the Internet. Set up a web page and create an E-mail distribution list, a necessary complement for lending dynamism to the network's operations and as a solution for problems accessing the Internet. The operating costs are minimal. It can be replicated by academic institutions, service organizations, industry and research agencies, public and private, in the agriculture sector in any other country.

## **LESSONS LEARNED**

- Good practices have been identified in the various activities and at different levels of the MINAG's infrastructure, which are applied in the stages of the Disaster Reduction Cycle.
- There are many good practices which should be generalized across the various areas of the country and the Caribbean region.
- More work is needed on improving good practices at the various levels of Agriculture & Forestry Sector decision-making and activity
- Work should continue on identifying good practices in the country's various agro-climatic regions.
- Training of personnel engaged in agriculture is one of the most important activities in preparing for disasters.
- Documentation of the good practices identified will contribute to improving training in and organization of this activity in Cuba and elsewhere in the region
- The good practices at grassroots level using traditional, homespun, rough-and ready and similar means have proved efficient in terms of preparation for disasters, have created demand for additional employment in Cuba's fields and have enhanced the public's ability to cope with the effects of extreme weather.
- Management water during droughts also contributes to management of emergencies caused by torrential rain associated with hurricanes and other types of extreme weather.

## REFERENCES

**Centella, Abel et al.** *Primera comunicación Nacional a la Convención Marco de las Naciones Unidas sobre Cambio Climático*. Grupo Nacional de Cambio Climático. INSMET, 169 pp., ISBN 959-02-0333-7, Cuba, 2001.

**Consejo de Defensa Nacional.** *Directiva No. 1 del Vicepresidente del Consejo de Defensa Nacional. Para la Planificación, organización y preparación del país para situaciones de desastres*. Republic of Cuba, 74 pp., Havana, 1 June 2005.

**Gómez, Guadalupe et al.** *Relatoría del Taller Nacional sobre Asistencia para mejorar la capacidad local de prevención ante emergencias agrícolas en los países del Caribe propensos a los huracanes TCP/RLA/3101*. Havana, June 2007.

**Lecha, B., Luís et al.** *El clima de Cuba*. Editorial Academia, 186 pp., Havana, 1994.

**Mendoza, M. et al.** *Análisis y cartografía de la vulnerabilidad a la inseguridad alimentaria en Cuba*. PMA, IPF, 139 pp., 2001.

**Pérez, H., María del Carmen & Julio González.** *Indicaciones para la preparación de la Defensa Civil en el Sistema del Ministerio de la Agricultura en el año 2007*. MINAG, 13 pp., January 2007.