

**PREVENTING NATURAL DISASTERS ON EXPERIMENTAL TEACHING
FARM «LA MARGARITA» IN HOLGUÍN MUNICIPALITY**

**LA PREVENCIÓN DE DESASTRES NATURALES EN LA FINCA DOCENTE
EXPERIMENTAL «LA MARGARITA» DEL MUNICIPIO HOLGUÍN**

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ABSTRACT

Prevention activity related to disastrology was diagnosed on «La Margarita» farm. It is part of the Agrarian System in the urban area of San Rafael, in Holguín municipality by using theoretical methods such as historical-logical and analysis-synthesis. As a solution for the identified problem, an action plan is proposed, based on activities for preventing management against disasters to contribute to the conservation of natural resources and, consequently, to food sustainability, based on extension activities with agro ecological approaches.

KEYWORDS: disasters; health events; agricultural practices; sustainable agricultural production

RESUMEN

Se realizó un diagnóstico sobre la actividad de prevención ante la desastrología en la finca «La Margarita» perteneciente al Sistema Agrario de la zona urbana San Rafael del municipio Holguín. Se emplearon métodos del nivel teórico como histórico-lógico y análisis-síntesis. Como solución al

problema detectado se propone un plan de acción, basado en actividades para el manejo preventivo ante desastrosología para contribuir a la conservación de los recursos naturales y con ello a la sostenibilidad alimentaria, basado en actividades extensionistas con enfoques agroecológicos, en función de lograr la protección de los recursos disponible para la producción agropecuaria.

PALABRAS CLAVE: desastrosología; eventos sanitarios; prácticas agrícolas; producciones agrícolas sostenibles

INTRODUCTION

In Cuba, the capacity-building program for natural disaster preparedness has been a government priority, decisively influencing the avoidance of loss of life and collateral damage.

Throughout our country's history of phenomena causing natural disasters, a political will for the prevention and mitigation of damages can be observed, particularly since 1959 with the arrival of the Revolution and the implementation of mechanisms and bodies to organize the people in disaster situations, which were the genesis of Civil Defense in Cuba (Beceiro, 2012).

Disasters result from the combination of two factors: first, natural phenomena triggering processes that cause physical damage, loss of human life, and capital; second, they disrupt the lives of communities and individuals, and the economic activity of the affected territories.

Some originate from violent phenomena without prior warning: earthquakes; others, from slow-evolving events, such as droughts, with negative effects on society and the economy; due to their intensity and duration, they can even affect essential services, as population food supply.

There are impacts that demand the search for new alternatives to mitigate damage to natural resources. This ensures the sustainability of agricultural production, through actions that contribute to preventing and mitigating the effects of natural disasters on production systems.

Food security is a requirement stemming from the respect for human rights contemplated in all legislation (Zeledón, 2008); it is a real problem for everyone and constitutes a necessary and essential objective for humanity (Bequer & Legón, 2022). It is necessary to promote sustainable agriculture that accounts for a greater utilization of all production factors (Álvarez & Cruz, 2020).

Achieving greater productive yields in local agricultural systems to satisfy the growing food demands of the population is endorsed in the Republic Constitution and in the Guidelines of the Economic and Social Policy of the Party and the Revolution.

Also, it constitutes part of the National Economic and Social Development Plan until 2030, which establishes as a guiding principle ensuring the conservation, protection, and rational use of natural resources, as well as adaptation (including risk prevention) and mitigation actions for the impacts of climate change, so that the relationship with nature and the environment becomes a factor contributing to prosperous and sustainable economic and social development.

Considering these elements, a diagnostic study was carried out using empirical research methods at «La Margarita» farm, located east of Holguín University, José de la Luz y Caballero campus, within the Agrarian System of the San Rafael urban area in Holguín municipality. The identified problem was: inadequacies in the agroecological management of production systems with a preventive character to mitigate the effects of natural disasters.

Consequently, based on these considerations, this research aimed to: conduct a diagnosis on disaster prevention activities at «La Margarita» farm belonging to the Agrarian System of the San Rafael urban area in Holguín municipality.

DEVELOPMENT

Disaster prevention: a necessity in productive areas to guarantee food sovereignty and nutritional security

Climate change in recent years has represented a threat and concern for the world (Mejía et al., 2022). Research and new knowledge about climate, climate change, and its impacts have been a prioritized subject of study for several decades. Our condition as an archipelago and geographical location in the Caribbean Sea makes us highly vulnerable to events associated with climate variability, with significant incidence in economic sectors like agriculture (Bonilla & Brenes, 2009).

The threat of global climate change has caused concern among scientists, as key climatic variables for crop growth, such as precipitation and temperature are altered and will impact agricultural production (Altieri & Nicholls, 2009).

Although the effects of climate variations on crop production vary widely from one region to another, changes are expected to have major effects, primarily in tropical areas of developing countries with precipitation regimes ranging from semi-arid to humid (Gonzalez, 2016).

These impacts are already being faced by countries worldwide, and Cuba is not exempt from them. Among the most frequent disasters is the increase in Tropical Cyclones, which are occurring with greater intensity and recurrence, causing losses and damage to agriculture.

In accordance with the above and in order to mitigate these effects to favor the quality of life of our population, the National Assembly of People's Power (2022) approved Law 148 on Food Sovereignty and Food and Nutritional Security (SSAEN). Article 58.1 outlines potential risks for local food systems, referring to extreme hydrometeorological events.

The Ministry of Agriculture (MINAG), guided and coordinated by the National Civil Defense State (EMNDC), issues political-ideological, socioeconomic, internal order, legal, foreign relations, and informatics and communications

measures during the Disaster Reduction Cycle (DRC), with emphasis on the Preventive Stage, which is permanent and the most effective. It includes measures related to reducing vulnerability and strengthening surveillance and forecasting systems.

Worldwide, agriculture is increasingly at risk due to multiple hazards and threats, such as floods, water scarcity, drought, declining agricultural yields and fishery resources, loss of biological diversity, and environmental degradation.

According to this organization, understanding the scope and degree to which meteorological anomalies and extreme phenomena affect agriculture is the first step in developing disaster risk reduction strategies and climate adaptation.

The pre-disaster phase involves activities corresponding to the stages of prevention, mitigation, preparation, and alert (Ponvert-Delisle et al., 2007).

In agriculture, the following stages are developed:

Prevention: conservation of watersheds to prevent erosion and slope instability, floods, landslides, and avalanches; irrigation and water channeling systems to prevent droughts; policies and legislation aimed at planning the country's agrarian development at a socio-spatial level; programs for vector, pest, and disease control; fire prevention and combat programs, control of chemical or radioactive materials in strategic sites; methods for the conservation and use of natural resources; education and training programs on the topic of disasters aimed at agricultural entrepreneurs, specialists, farm workers, and the rural population in general.

Mitigation: vulnerability studies: physical, social, economic, cultural, and ecological; land use planning to delimit areas of threat influence; programs for the location and relocation of rural human settlements to lower-risk zones; reinforcement of agricultural facilities; surveillance and control in the application of agricultural health standards; construction of dikes and dams

in areas exposed to floods or river overflows; soil conservation works, such as slope stabilization, natural barriers, drains, ditches for avalanche and flood control in high-gradient basins; and construction of windbreaks for the protection of agricultural crops.

Preparation: development of emergency plans; training to inform the rural community about the threats in the area and how to act in case of disaster; conducting simulation exercises and drills; training for personnel involved in emergency response.

Disasters destroy livelihoods, reduce food production, and increase food insecurity. They reverse development achievements and compromise the attainment of the SDGs.

These elements justify the need to propose strategic actions to adapt agricultural activities to current and future climate changes, promoting variants in land use as a consequence of rising sea levels and drought, improving soil conditions, developing resistant varieties, and directing reforestation towards the maximum protection of soils and waters. All this to guarantee food production in quantity and quality, without jeopardizing present and future generations.

«La Margarita» farm is located east of Holguín University, José de la Luz y Caballero campus, within the Agrarian System of the San Rafael urban area; it borders the buildings of the mentioned campus to the northwest, the Holguín-Mayarí highway to the north, and the Holguín city encirclement to the southeast, specifically the Holguín-Mayarí highway up to the central highway towards Las Tunas.

Using Locus Pro software, the different points of the farm were digitized, numbered after activating the GPS sensor and the spatial object category 'points'. The farm was traversed across its entire perimeter, and once more than three satellites were visualized, the collection of marks (points) and geographic coordinates began.

Subsequently, the record was named, and the points were exported to KML and GPX formats. Using DNRGPS software, which allows loading the points

onto the computer, they were registered in a format compatible with Mapinfo software. Conversion was done using ArcGIS software ver. 10.5 from 2016 to shapefile format; this software enabled editing, resulting in the creation of the farm map. By overlaying the farm map onto the Holguín municipality soil classification map using ArcGIS software, soil classification and its characteristics were achieved, allowing information acquisition from the associated database.

Procedures used:

Work team preparation: the methodology of the Project for Support to the Agrarian Extension System (Marzin et al., 2014) was used, from which elements were adapted to the site's and team's characteristics. This team was formed by professors from the Faculty of Natural and Agricultural Sciences and researchers from the Center for Studies on Arid Agroecosystems.

Sensitization: the work's objective was agreed upon, consisting of improving production strategies with an emphasis on natural disaster prevention and thereby the farm's profitability. An exchange of knowledge and consolidation of mutual understanding among family members and participants in the process took place.

Diagnosis: a semi-structured interview was applied based on experiences gained in the Project for Support to the Agrarian Extension System, proposed by Marzin et al. (2014). The questions were developed by a member of the work team; other support tasks included recording the interview, note-taking, and photography. Following the interview, a tour of the farm areas was conducted, explanations were listened to, and other observations were made.

Report drafting: it was prepared based on the interview results, using the methodology's indicators for its analysis. It places the farm in perspective with a systemic vision focused on disaster prevention.

Restitution of results: this was presented in two versions, the first with the main results and the second more extensive to analyze the vulnerability and risk elements affecting the production system under study.

Definition of actions: this allowed, based on the results, the identification of actions, which were socialized within the team and with the producer. This proposal is made concretely based on demand. It addresses aspects of the farm (resources, production systems, vulnerability and risks to natural disasters, technical and economic aspects). It links other institutions in supporting the actions.

Prioritization and execution of actions: the execution of the proposed actions was carried out with the consent of the farm producer, who, as the owner, had the responsibility and authority to decide what was most appropriate to mitigate the effects of natural disasters and achieve transformations in their production system.

Evaluation of actions: they were evaluated considering elements, such as:

- ✓ Vulnerability and risk.
- ✓ Implementation of preventive measures of an agroecological nature.
- ✓ Increased capacities for preventing natural disasters and the sustainability of the production system.

RESULTS

The site diagnosis provided the following:

Location and access routes

The farm is located in the peri-urban zone of Holguín city and lies within the areas of Holguín University, José de la Luz y Caballero campus. It is distant from the cluster of farms belonging to the Credit and Services Cooperative to which it is affiliated. Houses are quite distant, with the closest proximity being the residential buildings of the campus with its students and the rest of the workers from the university's administrative facilities.

The nearest access routes are to the east of the farm, adjacent to the encirclement covering the stretch between the Holguín-Mayari highway and the Central Highway Holguín-Las Tunas, and to the north, the Holguín-Mayari highway.

The relationships established with the usufructuary are diverse: with the teaching and research areas of the university and the other producers in the area belonging to the CCS with which it is associated. Given the proximity to the city, even without being in a populated area, and due to the diversity of activities carried out by the farmer, who is atypical compared to other peasants or farmers in the area, he has facilities for social management.

Labor force

The labor force is familial, formed by a producer with experience in agricultural activity, having been linked to the countryside since childhood with his grandfather. The other members participate in animal care, and other tasks such as weeding and applying organic matter to the fruit trees. Generally, everyone is involved in the farm's productive activities.

Animal traction and several implements and machines for agricultural work are available. Hydraulic resources on the farm are acceptable, with two artisanal wells having good potential and water quality. Only one is exploited for the household and the water supply for domestic animals.

Production system

The production area of the farm is a slightly flat zone with a slope running from northwest to southwest and a height difference between the highest and lowest parts of around four meters (Digital Terrain Model Cuba 1:25000). It is crossed by a very narrow stream, contaminated waters from nearby institutions and communities, plus several sewage pipes. A large part of the area is flooded during intense rains and is easily saturated. These aspects affect the crops, which is why it is identified as vulnerable to natural disasters.

The soil is classified as brownish-red fersialitic ferromagnesian type with a marked anthropogenic influence, showing construction material waste. The most notable characteristics identified for this soil are: medium erosion (loss of horizon A between 25-75%); effective depth of 20cm; almost flat slope (1.1-2.0%); limiting factors being the presence of stones and the effective depth (Jiménez et al., 2015). It classifies as Category IV soil, very low productivity.

In this context, it is stated that there are many alternatives for soil improvement; for their selection and implementation, they must be analyzed taking as the main indicator the farmer's possibilities regarding economic resources, available means, and access to sources of organic matter, seeds, sewer and channel cleaning, among others, for which the environment where the farm is located must also be taken into account.

The possibilities for preventing soil degradation are diverse: establishment of live and dead barriers, live fences, planting along and perpendicular to the slope, minimum tillage; tilling the soil according to its effective depth and the type of crop. Furthermore, it can be favored by applying organic matter, green manures, production and application of worm humus, compost production from residuals obtained in the area, use of biofertilizers, such as mycorrhiza, and production and application of effective microorganisms.

This usufruct area was delivered with the social purpose dedicated to various crops, which limits the development of the production system, as the existing soils are not suitable for crop development; they are used for forestry, fruit trees, and most of the areas are dedicated to pastures, over 50%. Therefore, the application of soil improvement measures is required.

Crops, such as sweet potato, cassava, plantains, and fruit trees are established for self-consumption, and the residues are used as animal feed. The fruit trees have specific functions in animal production by providing shade for the different species and constitute a vital element for achieving the agroecological equilibrium of the production system, deteriorated by human action.

According to Altieri & Nichols (2007), most biological control programs have been developed in fruit orchards because they are considered more stable and permanent ecosystems than annual crop agroecosystems. The same author points out that planting legumes under fruit trees brings different benefits, including soil improvement and moisture retention; this can be considered in the farm under study.

It is significant to note that the fruit trees constitute a protective barrier for the rest of the crops against strong winds and prevent soil degradation from runoff during heavy rains.

Main limitations and potentialities identified on the farm

Limitations

- ✓ Excessive saturation of soil moisture in the lower part during the rainy season.
- ✓ Flooding of 50% of the areas during heavy rains.
- ✓ Poor soil quality, disturbed, debris in some areas.
- ✓ Frequent theft.
- ✓ Time dedicated to the farm is shared with other tasks related to the profession.
- ✓ Scarce labor force.
- ✓ Lack of an irrigation system.

Potentialities

- ✓ Geographical location of the farm.
- ✓ Number of fruit plants.
- ✓ Relationships with institutional actors for development purposes.
- ✓ High educational level in the family.

- ✓ Training in agronomy.
- ✓ Peasant tradition.
- ✓ The family possesses knowledge for the development of the farm.

Proposed actions

The presented action plan is elaborated based on the diagnostic results, aimed at preventing impacts from natural disasters.

It constitutes a working tool for the producer, including: technical, organizational, economic training, field visits with specialists, exchanges with other production units, experiments, demonstrations, and meetings with key personnel in the area for agricultural processes.

- ✓ Develop preventive capacities among producers and family members regarding disaster management in agricultural production systems.

Objective: to equip the producer and their family with knowledge to prevent disasters.

- ✓ Promote the establishment of commercial fruit tree plantations in areas prone to flooding.

Objective: to avoid economic losses due to flooding.

- ✓ Promote agro-fruit systems with fruit tree species in association with other crops of agricultural interest.

Objective: to improve productivity and decrease soil deterioration.

- ✓ Promote silvopastoral systems that allow increased use of multi-purpose fruit tree species to obtain forage, firewood, timber, fruits, and livestock protection.

Objective: to reduce soil deterioration from overgrazing in critical areas to achieve sustainability.

- ✓ Implement integrated fruit tree management techniques, under the principle of sustainability, for obtaining food products.

Objective: To ensure the conservation and continuity of biological processes, contributing to climate change adaptation.

- ✓ Apply fire prevention measures through the dissemination and implementation of prevention and control activities.

Objective: To decrease the occurrence level of fires in pasture areas during the drought period.

- ✓ Perform sustainable management of watersheds through reforestation with fruit trees and other long-cycle crops, cleaning natural drains, and establishing live fences.

Objective: To preserve soil, vegetation, and water.

- ✓ Employ less aggressive tillage modalities, minimum tillage, use of low-impact machinery.

Objective: To reduce risks of soil compaction and degradation.

- ✓ Establish live and dead barriers, small dams, contour tillage, protection of natural collectors, and work against the steepest slope.

Objective: To decrease soil erosion.

- ✓ Establish a stratified windbreak with fruit tree plantations on the farm perimeter.

Objective: To guarantee sustainability in productions during droughts and floods.

These actions serve as a guide to prevent the effects of natural disasters and enhance the development of the farm. Also, as they are put into practice, the family's level of knowledge regarding disaster prevention, soil

characteristics, preventive agroecological practices, and implementation possibilities on the farm increases.

This allowed for progressive soil improvement, the establishment of a greater variety of fruit trees with intercropped cultivation, and better management influencing yields; as well as a decrease in collateral damages.

CONCLUSIONS

The diagnostic study conducted at the «La Margarita» peasant experimental teaching farm confirms the existence of a production system whose dynamics do not always consider the spaces and potentialities offered by the farm for preventing natural disasters for its sustainability. An action plan for disaster prevention was developed, breaking with the traditional dynamics established on the farm under study; this plan prepares the family to achieve the protection of the resources available for agricultural production.

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