Journal of Animal Production, 30 (3), 1-6, 2018

Integration of Environmental Management Tools to Reduce Vulnerabilities in Livestock Areas

Zoe G. Acosta Gutiérrez, Jorge Pereda Mouso** and José M. Plasencia Fraga**

Center for Environmental Research, Camagüey, Cuba.

****Center for Animal Production Studies, Faculty of Agricultural Sciences, University of Camagüey, Cuba**

jorge.pereda@reduc.edu.cu

ABSTRACT

The aim of this research was to integrate environmental management tools to reduce vulnerabilities on farms chosen as intervention sites, as part of the Environmental Bases for Local Food Sustainability (BASAL) project, in the municipality of Jimaguayú, Camagüey, Cuba. The tools studied were, environmental arrangement model (MOA) and studies of hydro-meteorological hazards, vulnerabilities, and risks of droughts, rural fires, and sanitary conditions due to epizooties. Four dairy farms (UPL) from the *Patria o Muerte* Basic Production Cooperative (UBPC) were evaluated. The units were located on the digital maps of MOA environmental units (EU), to analyze the guidelines of each of them. The measures to be adopted depending on the type of hazard were reviewed and integrated by unit. As a result, the four dairy farms were established within the EU limits for which the principal recommended environmental use was livestock raising. Accordingly, four measures were identified for implementation in order to achieve integrated environmental management, which will be added to adaptation measures tackling climate change, following BASAL´s recommendations for those sites. It was concluded that the integration of the tools described improved the portfolio of measures for adaptation to climate change recommended at the UPLs of the *Patria o Muerte* UBPC. It will contribute to the integration of environmental management aiming to achieve sustainable dairy production.

Key words: *environmental management, dairy production, livestock raising, environment*

INTRODUCTION

Considering the need to reduce vulnerabilities in local agriculture posed by climate change, project Environmental Bases for Local Food Sustainability (BASAL) in the municipality of Jimaguayú first included a diagnostic of the main components involved in the production systems of selected intervention sites to be used as the groundwork for adaptation measures.

Previous studies revealed that livestock raising had several vulnerable points, including devaluation of facilities, organizational problems and technological malpractice, soil deterioration, infestation of weeds, insufficient water availability, and poor conditions of the livestock food base (Acosta *et al.*, 2017).

In the framework of BASAL (Environmental Bases for Local Food Sustainability) as a tool for decision-making, the Environmental Arrangement Model (MOA) was designed in the municipality. Environmental policies, guidelines, and standards were suggested for inclusion in the local arrangement plans (MOA, 2014), and the location was segmented in local environmental units.

A national program to confront climate change is based on several studies: threats, vulnerability and hydro-meteorological hazards, droughts, rural fires, and sanitary conditions due to epizooties (PVR). Also studied, were the periodic inventories of greenhouse gases and the application of science and technology (Planos, Vega and Guevara, 2013).

The aim of this research was to integrate environmental management tools to reduce vulnerabilities in livestock areas chosen as intervention sites of project BASAL, in the municipality of Jimaguayú, Camagüey, Cuba.

MATERIALS AND METHODS

The environmental management tools were integrated for the four intervention sites of the project, located at the *Patria o Muerte* Basic Cooperative Unit (UBPC), which corresponded to dairy farms 12-15, 12-11, 12-4, and 12-2. The location of the UBPC is shown in Fig. 1, and it belongs to the Agricultural Company of Jimaguayú, in the municipality with the same name, province of Camagüey, Cuba, between coordinates 296 000 and 276 000 north, and 387 000 and 397 000 east; Lambert conic projection, South Cuba (SIG, 2015).

The analysis was made by placing the dairy farms on the map, within each environmental unit of MOA (2014). Then the environmentally recommended use for each of them was established, along with guideline correspondence of the environmental units that hosted them, and the local economic activity, with particular recommendations for each of them.

In a second analysis, the hydro-meteorological PVR studies (CITMA, 2011), drought (CITMA, 2012), fires (CITMA, 2013), and sanitary condition due to epizooties (CITMA, 2014), were reviewed, in order to standardize and particularize the measures to be implemented by BASAL, which can contribute to the adaptation of these sites to climate variations and changes.

RESULTS AND DISCUSSION

Overlapping of the intervention sites on the map of environmental units of MOA, Jimaguayú, revealed that such areas were located in second-order zones, for which the environmentally recommended use is livestock raising (Table 1).

Since the intervention sites within the project were mainly used for livestock raising, the economic success of the activity was anticipated, whenever proper measures and friendly practices to available natural resources were implemented.

After MOA consultation, it was determined that most areas of dairy farms 12-15 and 12-11 were in environmental unit (EU) 2.1 (Table 1). Therefore, it was necessary to call for obstacle (rocks) removal in areas for pastures and forages, as an essential task for sustainable preparation and use of soils (Urquiza *et al*., 2011).

Generally, the local soils are brown, without carbonates, in different manifestations, with little effective depth. The presence of thick elements on their surface, like gravel, stones, and rocks, had a negative effect on livestock production (LPS, 2014).

Another measure included for these UPLs was in relation to the application of organic matter to the soil. Ramírez-López; Désirée and Velasco-Misael (2013) said that one of the advantages of conservation agriculture is that higher levels of organic matter in the soil improve biological activity and porosity, leading to more water infiltration in the soil and water availability to the plant.

Accordingly, soil preparation and management was recommended as an alternative for preservation and improvement. In that sense, Lau, Jarvis and Ramírez (2011), suggested the application of the same procedure on trails to adapt to variations caused by climate change to agriculture.

One of the limitations found in the UPL was the high percentage of invasive plants. The predominant species are *Dichrostachys cinerea* (L) Wight et Arm. (sickle bush), *Acacia farnesiana* (L.) Willd. (needle bush), *Malva alcea* L. (greater musk-mallow), *Paspalum virgatum* L. (paspalum), and *Sporobolus indicus* (L.) R.Br. (smut grass).

As a result, some of the measures to be taken are the application of recovery programs of idle lands, which will increase the areas for grazing and/or forage production. According to Muñoz *et al*. (2013), the presence of invasive species in important areas affects grassland productivity and quality. Besides, these species compete over water, light, and nutrients, which are essential to guarantee the efficiency and sustainability of livestock systems.

The poor biodiversity observed in these ecosystems is another consequence derived from weed infestation, also present on the dairy farms. Hence, other recommendations are the establishment of forest-grazing systems, and the incorporation of smaller areas with a potential for various crops production, particularly short-cycle crops. Pereda *et al*. (2017), after characterizing various cooperative farms in terms of diversification in the same region, found that more than 75% were pooled in low or middle levels, which is a vulnerability in face of the climatic changes and their economic and productive stability.

Therefore, the adaptation measures recommended for these areas were reforestation and establishment of intensive forest-grazing systems, which according to Murgueitio *et al*. (2013), is a good example of intensification in agriculture using natural means, which also help mitigate the effects of climate change.

Water quality was another issue; therefore, actions should be taken to protect both surface and ground waters available in the livestock areas (Table 2). These aspects were included in the MOA guidelines for EU 2.1, 2.2 and 2.3.

Dairy farms 12-4 and 12-2 have areas with deficient draining and therefore very vulnerable to floods (commonly observed in EU 2.3); hence, some of the environmental guidelines included

the establishment of networks to collect and use the surface waters and evaluate the feasibility of wells where possible.

As a complement to the MOA measures, upon a meteorological event, the flood-vulnerable areas will follow the PVR instructions, in order to save the livestock potential (CITMA, 2011).

In that sense Meza and Gonzáles (2012), noted that adaptation to climate change requires the implementation of measures directed to infrastructure, policies, creation of capacities and best practices, that foster sustainable procedures and technologies for preservation and utilization of water, soil, and biodiversity (animals and plants) that improve resilience of these systems.

The application of preventive measures on all the dairy farms was suggested as a way to deal with sanitary hazards due to epizooties, rural fires, and droughts (Table 2).

CONCLUSIONS

The integration of tools of the environmental arrangement model (MOA), and studies of threats, vulnerability and hydro-meteorological hazards, droughts, rural fires, and sanitary hazards by epizooties (PVR), in the municipality of Jimaguayú, was part of the portfolio proposed for climate change adaptation, recommended by the BASAL Project on the dairy farms of the *Patria o Muerte* Cooperative. This will contribute to integrated environmental management for sustainable production of milk.

REFERENCES

ACOSTA, Z.; PEREDA, J.; PRIMELLES, J.; REYES, G. y CRUZ, M. (2017). Ordenamiento del potencial pecuario, para su adaptación al cambio climático en Jimaguayú, Camagüey, Cuba. *Revista de Producción Animal, 29* (3), 6-11.

CITMA (2011). *Estudios de peligro, vulnerabilidad y riesgo de inundaciones por intensas lluvias, inundaciones por penetración del mar y afectaciones por fuertes vientos en la provincia de Camagüey*. Camagüey, Cuba: CITMA.

CITMA (2012). *Estudios de peligro, vulnerabilidad y riesgos por intensa sequía, Municipio Jimaguayú, Camagüey*. Camagüey, Cuba: CITMA.

CITMA (2013). *Estudios de peligro, vulnerabilidad y riesgos por incendios en áreas rurales en la provincia Camagüey*. Camagüey, Cuba: CITMA.

CITMA (2014). *Estudio de peligro, vulnerabilidad y riesgo sanitario para los animales en la provincia de Camagüey*. Camagüey, Cuba: CITMA.

LAU, C.; JARVIS, A.; RAMÍREZ, J. (2011). *Agricultura colombiana: Adaptación al cambio climático*. Cali, Colombia: Centro Internacional de Agricultura Tropical (CIAT).

LPS (2014). *Suelos representativos para la región Jimaguayú-Camagüey*. Camagüey, Cuba: Laboratorio Provincial de Suelos.

MEZA, L. y GONZÁLES, M. (2012). *Herramientas para la adaptación y mitigación del cambio climático en el sector agropecuario. Resultados de taller práctico*. Roma, Italia: Ed. FAO.

MOA (2014). *Modelo de Ordenamiento Ambiental. Municipio Jimaguayú*. Camagüey, Cuba: Proyecto Bases Ambientales para la Sostenibilidad Alimentaria Local (BASAL).

MUÑOZ, D.; PONCE, M.; PEREDA, J.; MORGADO, C.; MUÑOZ, L.; MUÑOZ, D.; CRUZ, M. y RIVERO, L. E. (2013). *Impacto de la generalización de la tecnología de control del marabú sin utilización de productos químicos en la Agricultura Suburbana de la Provincia Camagüey*. IV Congreso Internacional de Producción Animal Tropical, La Habana, Cuba.

MURGUEITIO, E.; CHARÁ, J. D.; SOLARTE, A.; URIBE, F.; ZAPATA, C.; RIVERA, J. (2013). Agroforestería Pecuaria y Sistemas Silvopastoriles Intensivos (SSPi) para la adaptación ganadera al cambio climático con sostenibilidad. *Revista Colombiana de Ciencias Pecuarias, 26* (1), 313-316.

PEREDA, J.; CURBELO, L.; PARDO, G.; VÁZQUEZ, y FIGUEREDO, R. (2017). Clasificación de fincas lecheras según dimensiones de la intensificación productiva en un nuevo modelo de gestión. *Rev. prod. anim., 29* (2), 50-56.

PLANOS, E.; VEGA, R. y GUEVARA, A. (2013). *Impacto del cambio climático y medidas de adaptación en Cuba*. La Habana, Cuba: Instituto de Meteorología, Agencia de Medio Ambiente, Ministerio de Ciencia Tecnología y Medio Ambiente.

RAMÍREZ, A.; BEUCHELT, T.; MELCHOR VELASCO, M. (2013). Factores de adopción y abandono del sistema de agricultura de conservación en los valles altos de México. *Agricultura, Sociedad y Desarrollo, 10* (1), 195-214.

RAMÍREZ-LÓPEZ, A.; DÉSIRÉE BEUCHELT, T. y VELASCO-MISAEL, M. (2013). Factores de adopción y abandono del sistema de agricultura de conservación en los valles altos de México. *Agricultura, sociedad y desarrollo, 10* (2), 195-214.

SIG (2015). *Sistema de Información Geográfica. Plataforma del MOA de Jimaguayú*. Camagüey, Cuba: Centro de Investigaciones de Medio Ambiente de Camagüey.

URQUIZA, M. N.; ALEMÁN, C.; FLORES, L.; RICARDO, M. P. y AGUILAR, Y. (2011). *Manual de procedimientos para manejo sostenible de tierras*. La Habana, Cuba: Ministerio de la Agricultura.

.

Received: 3-10-2018
Accepted: 3-16-2018

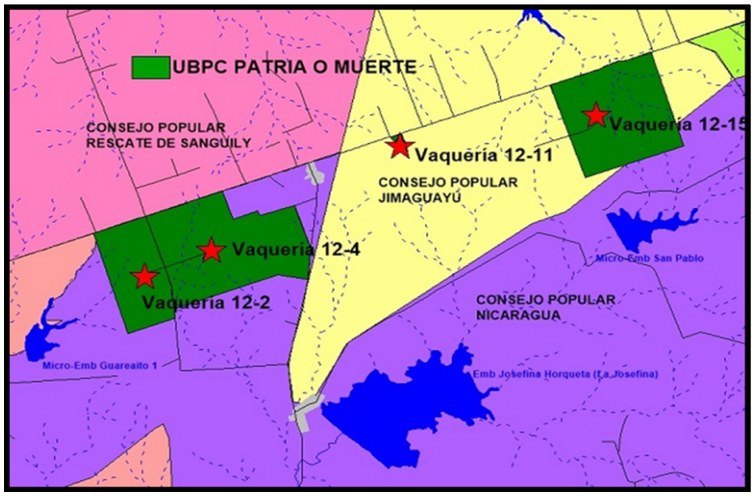

Fig. 1. Location of intervention sites of the BASAL Project in the *Patria o Muerte* UBPC (dairy farms 12-2, 12-4, 12-11, and 12-15)

Table 1. Environmental units which hosted the BASAL intervention sites at the *Patria o Muerte* UBPC, municipality of Jimaguayú, Camagüey, Cuba

UPL (intervention sites BASAL Project)	Local People's Council	MOA environmental unit with UPL areas
Dairy farm 12-15	Jimaguayú	2.1 and 2.2
Dairy farm 12-11	Jimaguayú	2.1
Dairy farm 12-4	Nicaragua	2.2 and 2.3
Dairy farm 12-2	Nicaragua	2.2 and 2.3

Table 2. Measures to be included, according to MOA guidelines in Jimaguayú (*) and PVR studies of droughts, hydrometeorology, rural fires, and sanitary hazards caused by epizooties (**)

Measures	Intervention sites of BASAL Project, at *Patria o Muerte* UBPC			
	Dairy farm 12-15	Dairy farm 12-11	Dairy farm 12-4	Dairy farm 12-2
Application of the program for idle land recovery (*).	x	x	x	x
Collection of obstacles to increase the vital area of pastures, forage, and tree roots, and to facilitate mechanization.	x	x		

Application of integrated management that ensures soil improvement and preservation (*).	x	x	x	x
Implementation of legal actions that help prevent water pollution and meet the consumption demands with standard quality parameters (*).	x	x	x	x
Implementation of draining systems capable of removing excess water from forage areas (**).			x	x
Application of measures established in PVR upon the occurrence of hydrometeorological events, in order to save the livestock potential (**).			x	x
Regularization of surveillance actions of both endemic and exotic diseases (**).	x	x	x	x
Regular follow up of measures to mitigate disaster by severe droughts and fires, to secure livestock population (**).	x	x	x	x