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Classification of Dairy Farms and Identification of their Weaknesses by the PRAGACC System

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ABSTRACT

Fourteen dairy farms from the Basic Unit of Cooperative Production (UBPC) *Patria o Muerte* in Camagüey, Cuba, were classified by the PRAGACC system and their principal weaknesses were detected in order to implement mitigation measures. In all farms, deficiencies concerning management of ecosystem elements were detected (subsystem I, natural resources); out of them, five farms were impaired in two variables, six in three variables, and three in four variables. Among the principal deficiencies identified for this subsystem, water availability and its inadequate use, lack of trees on grasslands, and insufficient endogenous sources as alternatives for cattle feeding were the most evident. Regarding subsystem II (others resources), six farms showed an inefficient production process mainly associated with absence of initiatives in finding energy sources and the non-utilization of certain materials for biofertilizers manufacturing. Two other farms were identified as the most affected, thus demanding a higher priority in measures implementation. PRAGACC also increased the likelihood of a priority arrangement for the remaining farms.

Key Words: *vulnerabilidades, fincas ganaderas, cambios climáticos y adaptación*

INTRODUCTION

Cattle farm vulnerability awareness is fundamental when deciding on taking proper measures for ecosystem improvement and general management (Acosta, 2008).

It is also advisable to group similar entities, as behavior awareness, analysis of potentials and production arrangement can be more easily carried out (García-Trujillo, 1983; Senra, 1992; Guevara, 2005 and Acosta, 2008).

PRAGACC (classification of entities based on their vulnerabilities) was used for dairies from UBPC *Patria o Muerte*, which will allow setting strategies as a guaranty for sustainability and priority in the application of mitigation and adaptability measures to face climate changes in the area.

MATERIALS AND METHODS

Dairies (UPLs) from UBPC *Patria o Muerte*, are located in the municipality of Jimaguayú, province of Camagüey, Cuba, between coordinates 296 000 and 276 000 north, and 387 000 and 397 000 east, Conical Projection Lambert Cuba South (Fig. 1).

The area is blanketed by Inceptisole soils, covering approximately 496.4 km^2. Of them 225.4 km^2 have different degradation processes, mainly erosion, compaction and acidification. The main factors unchaining these processes, beside climatic ones, are overgrazing and deforestation (Acosta and Reyes, 2002).

Plains are dominant, whereas vegetation is secondary, characterized by clusters from the original vegetation. Native or introduced grass is abundant (Capote and Berazaín, 1984).

According to statistical data from the Weather Station in the province, the means of the main weather variables for the period 1981-2009 are 24.7^oC for wind temperatures (July is the warmest and January the coolest); 30.7^oC for maximum temperatures (August with the top and December with the least values); 20.0^oC, for minimum air temperatures, mainly in the low-rain season (January has the lowest values).

The rainfall mean in the area is 1 353.3 mm (June has the highest values, May ranking as second high; December and January show the minimum values). Rainfall in the low-rain season accounts for 18.4 % of the yearly overall, with 249.3 mm . The other 81.6 % corresponds to the rainy season, with 1 104.0 mm . Evaporation-transpiration processes reach an an-

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nual mean of 1 421.3 mm, with top values in July and August.

RESULTS AND DISCUSSION

UPL analysis brought about generalized problems of natural resources availability (subsystem I). Five units only had two variables affected in the subsystem; six units have three; and three have four variables affected.

The most critical variables are A, C, D and E. Variable A is related to microclimate, its most affected components were A1 and A2, linked to temperature and soil humidity, respectively (Table 1), which may be dependent on climatic variations and changes in the area (Rivero *et al.,* 2005), and the lack of trees in their grasslands, causing marked effects on the soil (Urquiza, 2002).

Component C2 —water use— was the most affected within the variable related to hydrology (C); whereas the variable representing flora and vegetation in the system (D) owes its difficulties to poor arborescent stratum (D5), and pressure from grazing (D6). The animal behavior variable (E) produced the greatest vulnerabilities, regarding scarce alternatives for animal nutrition (E1) and cattle reproductive behavior.

Obviously, all these possibilities identified at the UPLs effect on milk production, so the application of corrective measures on the farms affected should mitigate such effects and improve results to achieve sustainability in the face of climate change.

One sample of such effects is revealed on the UBPC statistics, where feed concentrates in 2005-2010 was incremented at a rate of 1.6 times (from 674.9 to 1 086.4 t/year^{-1}), whereas molasses-urea was increased 9.8 times (from 10.4 to 102.2 t/year^{-1}), which accounted for an animal increase of barely 1.3 times (from 1 914 to 2 580). Insufficiencies are clearly observed in the system, as a disproportionate rise in the use of external sources for animal nutrition.

Within the most recommended practices to mitigate this problem is the establishment of forest-grazing systems in different forms. Productivity and ecological rehabilitation of cattle landscapes can be improved (Ibrahim *et al.,* 2007); and more soil laboring is performed (Crespo, 2008). They also provide cattle with an alternative for nutrition, especially during the low-rain season, in which the reproductive behavior will surely be favored (Alonso, 2012).

Subsystem (II) had six units with insufficiencies in the productive process (G), owed to the lack of initiatives to generate new power sources (G1), and improper use of organic materials for bio fertilizers (G2).

Remarkably enough, in terms of milk production, the UBPC has encouraging productive results, around 2 000 132 l at the end of 2010 (MINAG, 2010). However, the results were improved by 2009 (2 010 566 l), with fewer cows in reproduction (1 506 in 2009 and 1 635 en 2010). All the previous points to the need of rethinking the role played by producers, and the implementation of measures as a guarantee of sustainability.

The use of bio fertilizers in cattle raising offers a solution for the generation of solid wastes, the improvement of pasture lands and animal production (Sánchez *et al.*, 2011). This practice is another choice for UPLs with management problems and use of renewable sources of energy that provide entities with acknowledged economic advantages (Casimiro and Casimiro, 2007).

Generally, entities (12-8 and 12-15) were found to have the worst management, so they have a priority in the application of mitigation measures. In that same order are dairies (12-14; 12-1; 12-2; 12-12; 12-3; 12-6; 12-9; 12-17; 12-4; 12-5; 12-11 and 12-16) in Table 1.

CONCLUSIONS

The application of PRAGACC in UPLs from UBPC *Patria o Muerte*, allowed the researchers to identify the main vulnerabilities of their ecosystems and set up an order of priority in the application of mitigation actions, to keep sustainability and adaptability to climate change.

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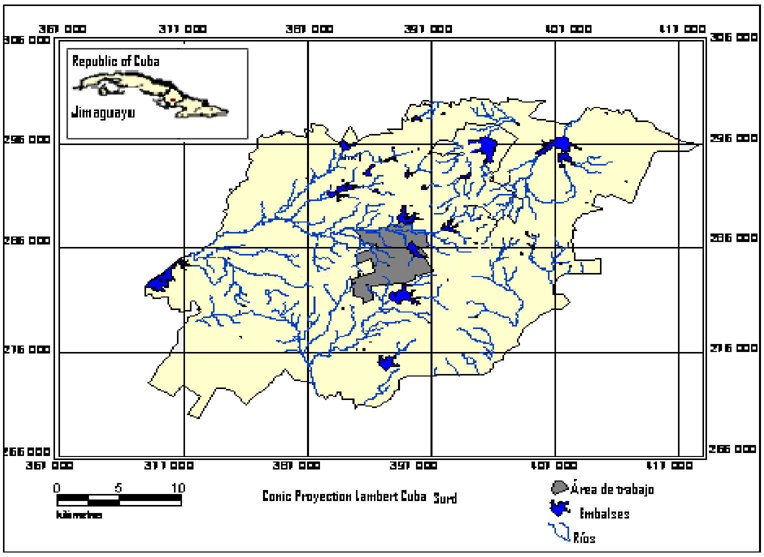

Fig. 1. Location of working areas

Table 1. Classification of UBPC production units from UBPC Patria o Muerte

Dairies	Components and variables per subsystem, indicating problems		Classification
	Subsystem I	Subsystem II	
12-1	A1; A2, D5; E1 y E5	G1 y G2	I_3II_1
12-2	A1; A2, D5; D6; E1 y E5	G1 y G2	I_3II_1
12-3	A1; A2, D5 y E1	-	I_3II_0
12-4	A1; A2 y D5	-	I_2II_0
12-5	A1; A2 y D5	-	I_2II_0
12-6	A1, A2; C2 y D5	-	I_3II_0
12-8	A1, A2; C2; D5 y E1	G1 y G3	I_4II_1
12-9	A1;A2;A3:D5 y E1	-	I_3II_0
12-11	A1; A2 y D5	-	I_2II_0
12-12	A1; A2, D5; D6; E1 y E5	G1 y G7	I_3II_1
12-14	A1;A2;C2;D5 y E7	-	I_4II_0
12-15	A1;A2;C2;D5; E1;E6 y E7	G1	I_4II_1
12-16	A1;A2;A3 y D5	-	I_2II_0
12-17	A1;A2;A3 y D5	G3	I_2II_1