Colegio de Postgraduados

Perception of inhabitants from the Laguna Santiaguillo Basin: natural resources and livelihoods

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ABSTRACT

Objective: To learn about the state of the natural resources and productive systems in the Laguna Santiaguillo Basin from the viewpoint of the inhabitants.

Methodology: The approach was qualitative, by means of a focus group.

Results: The problems perceived are related to: access to water both because of its low availability and due to the inequity in its distribution which generates low productivity and conflicts over the use of this resource; low prices for agricultural products; conflicts arising from the use of wildlife; and the degradation of grasslands as a result of overgrazing.

Limitations on study/implications: The Mennonite group, which is an important actor within the basin, was not represented in the focus group.

Conclusions: The participants in the group perceive the basin's problem in an integrated manner, linking components of natural, economic, social and political resources, which lead them to actions adapted to their context to solve this problem.

Keywords: Socioenvironmental conflicts, perception, focus group, ecosystem degradation, endorheic basin.

Citation: Morales de Casas, M., Sánchez-Ortiz, E., & Márquez-Linares, M. (2023). Perception of inhabitants from the Laguna Santiaguillo Basin: natural resources and livelihoods. *Agro Productividad*. https://doi.org/10.32854/agrop.v16i3.2433

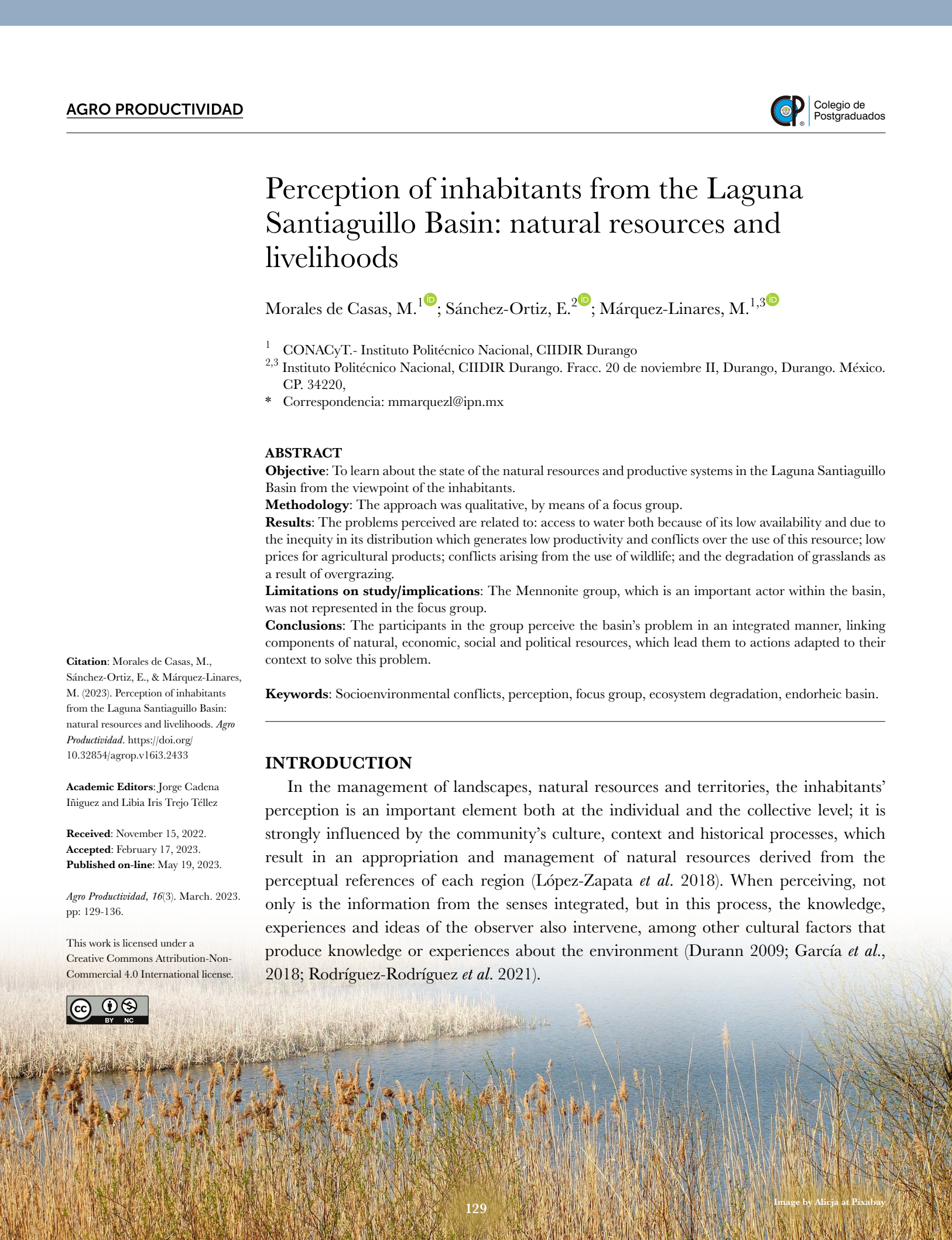
Academic Editors: Jorge Cadena Iñiguez and Libia Iris Trejo Téllez

Received: November 15, 2022.
Accepted: February 17, 2023.
Published on-line: May 19, 2023.

Agro Productividad, 16(3). March. 2023. pp: 129-136.

INTRODUCTION

In the management of landscapes, natural resources and territories, the inhabitants' perception is an important element both at the individual and the collective level; it is strongly influenced by the community's culture, context and historical processes, which result in an appropriation and management of natural resources derived from the perceptual references of each region (López-Zapata *et al.* 2018). When perceiving, not only is the information from the senses integrated, but in this process, the knowledge, experiences and ideas of the observer also intervene, among other cultural factors that produce knowledge or experiences about the environment (Durann 2009; García *et al.*, 2018; Rodríguez-Rodríguez *et al.* 2021).



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Presently, the perception of natural resources is an issue that has acquired greater relevance (Amin *et al.*, 2015; Frank *et al.*, 2017; Baffoe and Matsuda 2018) because the way in which resources are used for the satisfaction of needs and the procurement of livelihoods depends to a large extent on the perception, and as a result of pressures that they suffer or which have been aggravated, among other things, by climate change and the lack of sustainable practices that allow their conservation (Orellana Salas and Lalvay Portilla 2018). Therefore, the diversity of ideas, cultures, appropriations and thoughts which lead to perception become essential to agree on actions to revert situations of degradation of the territory and the productive systems (Courage and Saarinen, 2020).

The Laguna Santiaguillo Basin, located in Durango, Mexico, is presented as case study. The main economic activities of the primary sector are irrigation and rainfed agriculture, extensive livestock production and forestry (SRNyMA, 2018). However, some of the lands devoted to these activities suffer deterioration due to an inadequate historical management. The basin is endorheic and within it there is a wetland of international importance designated in 2012 as a Ramsar 2046 site (SEMARNAT, 2021). In this study, the status of the natural resources was analyzed through the inhabitants' perception about them, supported by studies that have been conducted in the basin, which will allow establishing strategies for its sustainable management and conservation.

MATERIALS AND METHODS

A focus group was established as a technique through group discussion, with the aim of identifying the feelings, thoughts and experiences of participants in relation to the theme of interest, and of obtaining qualitative data (Mena and Méndez 2009). The group was held in October, 2018, with inhabitants from the different regions of the basin represented by the so-called Active Committee of the Santiaguillo Basin, whose mission is to generate mechanisms for environmental governance and to unleash local development processes (Cassio and Sánchez 2017).

Twenty-three members of the Committee attended the group, as well as four service providers and five trainers. The profile of the participants was the following: agriculture, livestock or forestry producers who live and have their productive activities within the basin; the service providers carry out their activities within the basin. An image of the basin on a blackboard was used to understand the participants' perception regarding their resources and problems, and the main types of soil coverage in the basin around it, which are: forest (including pine, pine-oak and oak forests), grasslands, agricultural fields, scrubland, lagoon and towns. Relation lines were established between each type of coverage, and finally there were questions about the perception of the status of each of the territorial elements (resources or spaces), with the response categories being: the same as 10 years ago, decreased since 10 years ago, and increased since 10 years ago. In a third phase, the assistants were grouped into work tables from each sector (agriculture, livestock production, forestry, towns and lagoon) to see the perception of the problems of each with greater detail.

Study area. The Laguna Santiaguillo Basin is located in the center of the state of Durango, Mexico, in the municipalities of Nuevo Ideal, Santiago Papasquiaro, Canatlán,

San Juan del Río, Coneto de Comonfort and Santa María del Oro, of which the first concentrates most of the populations and productive activities that are developed in the basin. The basin has a surface of 254,000 hectares and it is endorheic (Figure 1). Laguna Santiaguillo has been declared a RAMSAR wetland with the label 2046 due to the importance it has for migratory birds, especially goose, ducks and cranes that spend the winter in this body of water, and from this that its management, protection and conservation has international relevance (RAMSAR 2012).

RESULTS AND DISCUSSION

The results from the discussion group are shown in Figure 2, which shows the existing relationships between the territorial components, the products, and the problems perceived in the focus. The territorial resources are shown in brown, the products that are obtained from each in green, the aquifer in blue, and the perceived problems in purple. In the same way, the arrows indicate the resources which, in agreement with the participants' perception, increased, decreased or maintained their quality or surface.

The agreements on perceptions of each of the territorial resources are presented in Table 1. In it, the consensual contributions on the problems, attributions and characteristics of each of the territorial resources can be observed.

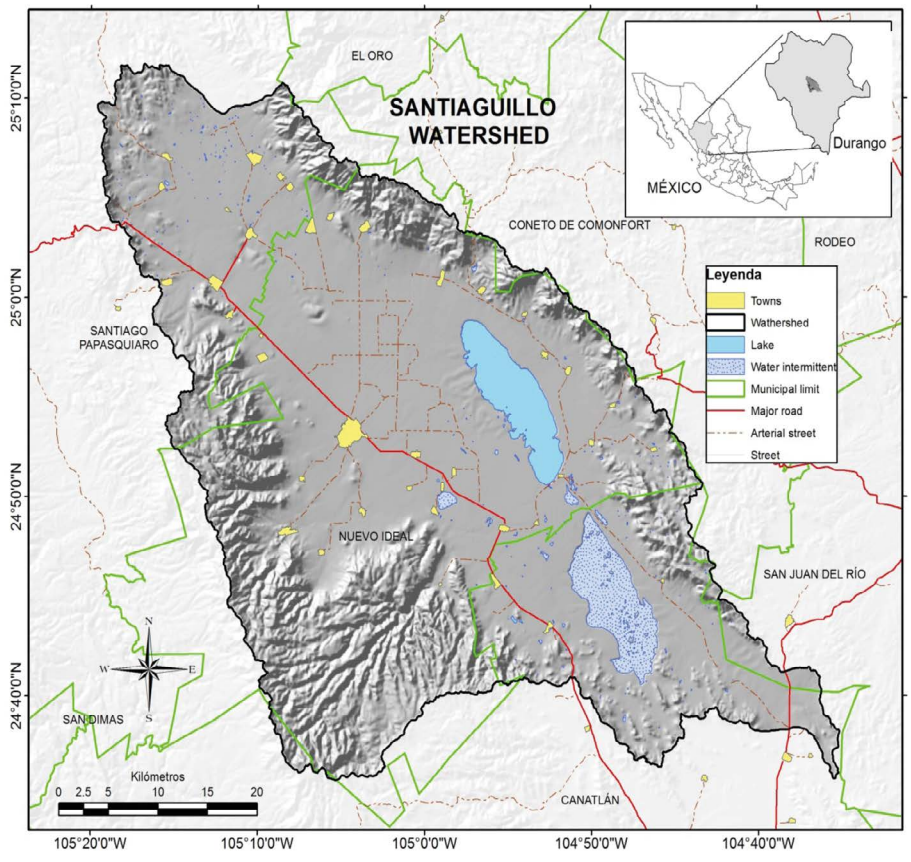

Figure 1. Location of the study area. Prepared by the authors with data from INEGI.

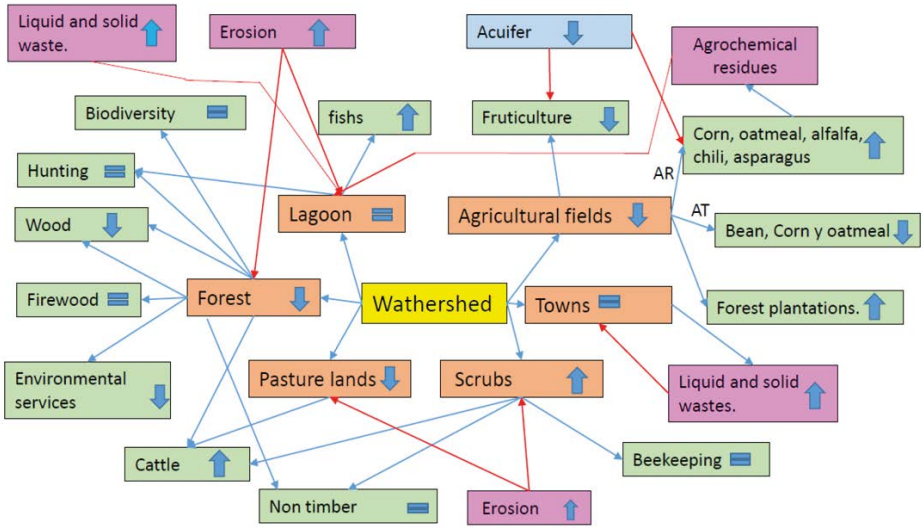

Figure 2. Conceptual diagram of the relationships between the soil coverage, the products obtained based on the perceptions of participants from the discussion group, the signs indicate if the status of the resource remains the same (=), has increased (↑) or has decreased (↓). (AR: Irrigation agriculture; AT: Rainfed agriculture). Source: Prepared by the authors.

According to Table 1, the water problem is of greatest relevance to them, since agriculture and livestock production depend on this resource, and because it is a limiting factor, it causes conflicts with the authority since the opening of more wells is restricted by the condition of the overexploitation of the aquifer and due to an agreement published in the *Diario Oficial de la Federación* from April 5, 2013, which provisionally prohibits the perforation of new wells. Likewise, there are conflicts with the Mennonite population over water since they have clandestine wells or some that are not regulated by the authority, as a result of the Mexican agreement signed in 1921 by which it is established that this group is not subject to the regulations imposed by Mexican Laws (Hansen 2005).

The participants of the focus group perceive that water from the aquifer ought to be extracted from deeper (Table 1), which agrees with the studies carried out by Corral-Bermúdez *et al.* (2019), who reported a negative water balance. However, as was mentioned before, this is an issue of social, productive and political conflict due to the need of all the rural actors involved for this essential resource used in every productive activity. The water balance indicates that only two of the 11 micro-basins have a positive balance, and most have catastrophically low balances (Corral-Bermúdez *et al.*, 2019a), which is why it is necessary and urgent to modernize its use.

When it comes to rainfed agriculture, participants indicated that there are low yields due to the lack of rain and the high cost of inputs which have led to ceasing to farm land and with that to the decrease of surface planted year after year (Table 1). However, as it happens in other places of the state of Durango and the basin, this activity continues to be conducted because it is a traditional way of life and of peasant identity for the farmers, particularly the older ones (Morales-De Casas *et al.*, 2021). The participants also mention that supports or subsidies given by the government are insufficient to make this activity

Table 1. Participants' perception of the focus groups with regards to the status or condition of the territorial resources of the Santiaguillo Basin.

RESOURCES	PARTICIPANTS' PERCEPTION
RAINFED AGRICULTURE	It has decreased in area because it is not very profitable. It has decreased in area because it is not very profitable.
	Corn, beans, oats and apple orchards are planted.
	Most of the apple trees are old and of low productivity.
	Lack of rainwater does not allow to ensure harvests, so groundwater is required to reduce this risk factor.
	The cost of fertilizers and herbicides is very high, so they are hardly used.
	SAGARPA and SAGDR support is insufficient. SAGARPA and SAGDR support is insufficient.
	Some rainfed agricultural fields changed their use to make plantations of Pinus gregűi although it is necessary to wait at least 15 years to harvest and obtain some income.
IRRIGATED AGRICULTURE	Corn, oats, alfalfa, chili and, on a very small scale, asparagus are planted.
	More and more land is being planted with clandestine wells.
	There are no permits to extract more water legally.
	Mennonite Group has greater facilities to extract water legally.
	Everyone wants more water for agriculture.
PASTIZALES	They have decreased in quality and quantity
	Erosion is present
	There is an invasion of inedible plants for livestock due to people putting more and more cattle in the pastures to maintain production.
	The Secretaría de Agricultura, Ganadería y Desarrollo Rural (SAGDR) only intervenes to regulate the sale of livestock in terms of health.
MATORRALS	Have increased in surface area and are subject to erosion
	They obtain firewood, pasture for cattle and some people have apiaries.
	Low production due to increase of non-edible plants
	Erosion is a consequence of the increase in livestock, as there is no regulation of the number of cattle entering these fields.
	There has been support for erosion control from CONAFOR.
FOREST	They have decreased in surface area.
	Timber is extracted and in some ejidos there is hunting of wild turkeys and wild boars.
	They provide environmental services..
	They have erosion problems.
	There are ejidos with forest management programs.
SANTIAGUILLO LAGOON	It remains the same as it was ten years ago.
	Fish are caught in the northern part.
	Annual and temporal variations,
	Migratory birds continue to arrive at the lagoon.
	Sediment on the banks when the water level drops.
	Mennonites and villagers use the lagoon for picnics and celebrations.
	Problems with hunters leaving gates open and cattle leaving the grazing fields
AQUIFER	Year after year, water is obtained at greater depths.
	The authority does not allow any more wells to be drilled.
	There are many illegal wells.
	Mennonites have many wells and it is believed that they are not legal.
	More wells are required to increase production.
CYNEGETIC USE	This is done through the Management Units for the Conservation and Use of Wildlife (UMAS).
	The UMAS have leases with hunting organizers from the states of Jalisco and Monterrey.
	There is a lack of local regulation of UMAs
	There are few or no benefits from these activities for local residents.
	Hunters are not responsible for crop damage, litter left behind and opening of fences.
TOWNS	The population has decreased due to migration to the USA.
	There are no public services such as sewage and garbage collection.
	There are clandestine dumps near the villages that cause bad odors, flies and rats.
	Cattle die from ingestion of plastics.

profitable and, instead, they work as a subsidy to the family economy rather than to increase agricultural productivity.

Concerning the grasslands and scrublands in the basin, the consensus was focused on the decrease in the quality of the rangelands due to overgrazing because the load capacity is constantly exceeded, which results in a lower weight and even mortality of the animals (Table 1). Overgrazing is a factor that unleashes various processes which decrease the quality of the pastureland and provoke erosion (De Villalobos 2013). For the inhabitants of the basin this is particularly important since the livestock represents an important source of income for their family economy. It was also exposed that government agencies do not regulate the number of heads within the rangelands, which is a factor that favors overgrazing and with that the increase in erosion and they only focus on the livestock's health for their sale.

Regarding the forests, the perception is that they are important for the production of timber, firewood and other environmental services, and that they present erosion problems and a reduction in the forest limit due to the increase in areas used for livestock production (Table 1). However, given that most of the forest zones have forestry management programs authorized by SEMARNAT, and backing from CONAFOR, this resource is not perceived as a serious problem.

When it comes to the use for hunting (Table 1), the participants' perception indicates that the benefits derived from this activity do not reach the *ejido* owners, but rather that they remain with the hunt organizers, in addition to them not assuming the responsibility for damages produced in the fields where hunting takes place. This is a cause for dissatisfaction since the owners of the concessions are unknown, or where the benefits of this activity remain. Participants perceive the need to regulate the way of operating Wildlife Management Units (*Unidades de Manejo de Vida Silvestre*, UMAs), since according to what is established in the General Wildlife Law, monitoring the hunt should be done through reports about the use of the UMAs which must be presented annually and shared with the inhabitants.

Because of this, the members of the focus group perceive clearly the problems that there are in the basin, which agree to a greater or lesser extent with the information generated by disciplinary studies. However, the problems that are perceived continue to worsen (Figure 2), due to the lack of institutional presence, on the one hand, as is the case of water distribution and degradation of rangelands, but also because of external problems such as the low prices of agricultural products and the dependency on rainfall, which generates low productivity of the rainfed lands. On the other hand, the fact that the perception of the problem is clearer has given rise to local initiatives through the "Active Committee of the Santiaguillo Basin", which has carried out various actions since its formation with different institutions such as PRONATURA and DUMAC; however, this requires not only of the committee's activity, but also of the government institutions that support politically and economically the initiatives of the population to improve their living conditions, at the same time that they improve and increase their natural capital.

Thus, the focus group's participants perceive the quandary of their natural resources and how these problems affect the productive systems, which at the same time has a

direct effect on their economy. As was mentioned at the start of this study, perception is an element of utmost importance to establish mechanisms for governance and local development, which lead to assertive actions for the sustainable management of the basin.

CONCLUSIONS

According to the results obtained from the focus group, the participants perceive and recognize the quandary of the natural resources of Laguna Santiaguillo Basin related to their livelihoods, as well as the economic, social and political aspects that are a hindrance for their solution, for which it is necessary to generate strategies for sustainable management that emerge from local agreements supported by state and federal government agencies.

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