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Sustainable use of caiman in Argentina: An analysis from the perspective of the stakeholders involved

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ABSTRACT

Commercial use of wildlife is considered a potential tool of conservation and sustainable development, under the ideological assumption that the economic valuation of them generates incentives for conservation, as well as the ecosystems they inhabit, while benefiting local communities. However, many authors question the scope of these initiatives. The reptiles represent 61% of the value of this trade. Two species of Caiman genus inhabit Argentina. In 1997, a ranching farm was developed in Santa Fe province; between 1997 and 2004, more ranching farms were developed in other four Argentinean provinces. This paper aims to develop a conceptual model of the production system and its influence on sustainability trajectory in commercial use of caiman in Argentina based on the stakeholders` perception. The information obtained from interviews was organized into two results: 1) a conceptual model representing the caiman production system, and 2) a stakeholder network. This paper provided insights about the caiman production system and its articulation with the stakeholders involved. Throughout the qualitative analyses here implemented, we have obtained a diagnostic tool which could be converted into a planning tool incorporating quantitative information.

1. Introduction

Commercial use of wildlife is considered a potential tool of conservation and sustainable development, under the ideological assumption that the economic valuation of wildlife generates incentives for conservation, as well as the ecosystems they inhabit, while benefiting local communities (WCED, 1987; IUCN/UNEP/WWF, 1980; Robinson and Redford, 1991; CDB, 1992; Ojasti and Dallmeier, 2002; Larriera, 2011). Therefore productions based on wildlife are promoted as an alternative land use to traditional agriculture. However, many authors question the scope of these initiatives (Robinson, 1993; Ludwig et al., 1993; Costanza and Patten, 1995; Hansen, 1996; Larriera, 2011), because is not enough to assess the intensity of extraction, the effect of the removal of individuals on the biological community and ecosystem function, but it is also necessary to determine the needs, aspirations and rights of the different groups using the resources (e.g. local communities, entrepreneurs, institutions). A systematic approach is required to analyze these variables together (Checkland, 1981, Senge, 1990, Meadows and Wright, 2009, Ostrom, 2009) in order to account the complex relationships established in production systems. It is important to recognize the socio-economic drivers that may influence the trajectory of the production system (Rivas, 2007) and therefore its effectiveness in the conservation of species and those ecosystems where they inhabit.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) estimated that wild fauna products are legally sold for between 350 and 530 million dollars per year (CITES, 2012). The reptiles (live and skins) are the most significant taxonomic group between the five that are sold, representing 61% of the value of this trade. In the international leather market, three of the five species that are being the most traded are crocodilian. This market has recorded 13 species from more than 35 countries. They are divided into two groups, in relation to size and leather quality: 1) *Caiman* genus and 2) *Crocodylus* and *Alligator* genus.

Two species of *Caiman* genus inhabit in Argentina: the broad-snouted caiman *(Caiman latirostris)* and the yacare caiman *(Caiman*

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yacare), belonging to Alligatoridae family of Crocodylia order (Ross, 1995). They are sympatric in Chaco, Corrientes, Formosa and Santa Fe. *Caiman latirostris* also inhabits in Entre Ríos, Misiones, Salta and Jujuy (Waller and Micucci, 1993; Larriera and Imhof, 2006). In other South American countries, broad-snouted caiman could be found in marshy and lacustrine regions of Bolivia, Brasil, Paraguay and Uruguay, and yacare caiman could be found in the southwestern of Brasil, eastern of Bolivia and Paraguay. Under the "National Program Management and Sustainable Use of Wildlife", coordinated by the Department of Wildlife - Ministry of Environment and Sustainable Development, 5 ranching farms were developed. The ranching technique consists of harvesting wild eggs for captive rearing (for more details, see Larriera, 1990, 1991, 2011). Through the Argentine experience in the commercial use of caiman, this paper aims to develop a conceptual model of this production system and its influence on sustainability trajectory based on stakeholders` perceptions in order to develop a diagnostic tool that tends to visualize the magnitude of the intervention in nature, according to the social interests that underlie, and assess the impact of the intervention on the conservation of the species used.

This paper is a qualitative assessment and, as a consequence, it is considered interpretative, inductive, multimethodic and reflexive. The methodology used is flexible and sensitive to the social context where data were obtained. This work tries to provide new perspectives about what is known, described and explained (Vasilachis de Gialdino, 2006) on the sustainable use of wildlife species.

2. Materials and methods

2.1. Determination of the assessment unit and its sample

Social actors involved in the development of Argentinean ranching farms for caiman production are the assessment unit.

The assessment unit was sampled based on stakeholders´ type, in relation to their role within the production system. Number and type of social actors were increased with the snowball sampling technique (Guber, 2001), asking first informants to identify other people with knowledge about the system analyzed. This technique allowed the access to those social actors that could not be easily identified (e.g. nests identifiers, egg collectors). Two factors were considered in order to obtain an adequate sample: 1) time, relative to the variation of productive activities throughout the year; and 2) place and context, the meeting with each social actor was performed in places where they work. Sampling was completed by data saturation; i.e. this happens when no new information is obtained from the addition of more informants or becomes redundant (Taylor and Bogdan, 1987).

The final sample consisted on nineteen stakeholders: 1) owners and/or managers of ranching farms (6 respondents), 2) representatives of government institutions (2 respondents), 3) nests identifiers and egg collectors (6 respondents), 4) technical consultants (2 respondents), and 5) researchers (3 respondents). Considering that these stakeholders prefer confidentiality, their names could not be displayed.

2.2. Field work and data collection

With the aim of preparing the field work, a historical review of caiman use in Argentina and the development of conservation strategies was made. Scientific publications and outreach material were used (Guber, 2001). Between 2009 and 2012, four trips were made to visit five ranching farms present in Argentina. These ranching farms were located in Formosa, Chaco, Corrientes, Santa Fe and Entre Rios provinces (Fig. 1).

During field work, data were collected using two ethnographic techniques: 1) semi-structured interviews, and 2) participant observation. A semi-structured interview consists of open questions listed a priori defining a thematic guide. This is based on the research objective and the particularities of stakeholders that make up the production system. During the interview, these questions were reformulated or extended from the information provided by the interviewee (Guber, 1994; Taylor and Bogdan, 1987). Data were collected using recorder when the interviewee allowed it or alternatively in a fieldbook. Nineteen interviews were conducted; i.e. an interview per stakeholder.

Regarding the use of participant observation technique, two simultaneous activities were carried out: a) everything that happened in the environment was systematically observed, and b) one of the authors participated in productive activities with the interviewees (Taylor and Bogdan, 1987; Guber, 2001). Records arising from this technique were used to amplify, supplement and/or validate the information collected through semi-structured interviews.

2.3. Data analysis and techniques used

Information obtained from interviews was transcripted in order to be codified with Atlas Ti software (Chernobilsky, 2006). The encoding consists on putting conceptual names or categories to different observations, texts or interviews in order to make an abstraction. This abstraction is a conceptual categorization with its own properties and variations. The information revealed from interviews and participant observation was coded. The encoding considers whether information obtained is a) supplemented, b) affirmed or c) opposed within stakeholders interviewed. After encoding, the information was organized into two main results: 1) a conceptual model for the caiman production system, and 2) a stakeholder network. This second result consists on a social network; i.e. a graphical representation of the relationships established among social actors.

Finally, the relationships established by different stakeholders involved in the caiman production system were analyzed. In order to do this, the UCINET software was used (Borgatti et al., 2002), which allows setting the link of relationships established among different actors within a network. The temporal periods of the network structure were obtained from the interviews. The network structure was analyzed based on two indicators:

1) Density: this indicator presents the number of observed relationships out of the total number of possible relationships, allowing determining the extent to which it is connected the general conceptual network. Density is calculated as follows:

$$D = \frac{1}{n(n-1)} \sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij} \quad (1)$$

where a_{ij} is the relational component between the node i and the node j, and n is the number of nodes within the network.

2) Centralization: the degree of centralization of a network indicates how close the network behaves as a star network, in which a stakeholder plays a central role in controlling the entire network; or how far is from that behavior, which is more favorable because it speaks of a well-connected network. The centralization index (CD) of a graph (G) is calculated as follows:

$$C_D(G) = \frac{\sum_{i=1}^{|V|} [C_D(v^*) - C_D(v_i)]}{H} \quad (2)$$

where v_i is a particular node; v^* is the node with the highest degree centrality in G; $|V|$ are the vertices of the graph; H is maximized when the graph contains one central node to which all other nodes are connected.

2.4. Study restrictions

Qualitative researchers observe, interact with, transform and are transformed by their informants (in our case study, stakeholders). Their activity is based on relationships and the phenomenon under study could modify their point of view. Even though the methodology is