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Primates, Lots and Forest Fragments: Ecological Planning and Conservation in the Sierra de Santa Marta, Mexico

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Introduction

Rain forest fragmentation is of particular concern where entire regions are threatened by agriculture and other human activities, constituting as they do some of the most rapidly disappearing habitat on earth. An understanding of processes allowing specific taxa to persist in fragmented habitat is of great importance to conservation programs (Silva-López, 1996; Silva-López *et al.*, 1993a). Resources from forest fragments may play a key role in the domestic economies of local communities (Silva-López *et al.*, 1993b), and community work is as important as research when considering specific conservation measures (Portilla-Ochoa, in press). The management of forest fragments within systems where public land is divided into lots needs to be carefully incorporated into regional and local development plans, and requires a knowledge of the political decisions and socio-economic factors that determine their permanence or state of conservation.

In 1983, recognizing the need to create a balance between primate conservation and the development of rural areas, the Charles A. and Anne Morrow Lindbergh Fund, Inc., decided to support GSL's project "Rainforest exploitation and efforts to protect the endangered spider and howler monkeys at Sierra de Santa Marta, Mexico." The study´s results not only helped to promote new research and initiatives on behalf of primate conservation in the area but, most importantly, it stimulated the participation of biological and social scientists alike to design new approaches to support the conservation of the Sierra. This paper comments on one such approach and represents a new stage in our research program's vision of the problem. It deals with the fact that *campesinos* have long recognized the agricultural relevance of forest fragments, and examines some of the ways they use these fragments in their daily lives.

The Sierra

Each portion of the Sierra has unique geographic, cultural and biological characteristics. The eastern and southern slopes exemplify this situation, which is closely linked to the presence of the local, Zoque-popoluca people inhabiting the area. This indigenous group is the fourth largest in Veracruz, with about 29,000 people, of which about 60% (some 23,000) inhabit the Sierra and neighboring areas. Most of the Sierra and its area of influence is located in the municipality of Soteapan, where the population density, estimated at 52 inhabitants/km², is nearly half of the 95.4 inhabitants/km² average for the entire state (INEGI, 2000). However, the annual population growth rate in Soteapan has been estimated at 4.47%, almost twice that of the state. Soteapan has more than 40 *ejidos* (public lands) and agricultural communities, which combined represent about 98% of the municipality. Clearly, the Sierra´s portion of Soteapan, with its hilly relief marked by streams and small valleys, its Zoque-popoluca population inhabiting *ejidos* and its flora and fauna largely restricted to small forest fragments, is an example of a unique environment.

Forest Fragmentation

The problems associated with, and derived from, forest fragmentation have been studied by a number of authors (Silva-López, 1995; Kattan, 1993; Robinson, 1993; Kellman, 1993; Murcia, 1993; Harris and Silva-López, 1992) and are not discussed here. However, although we sometimes suggest that the clearing and fragmentation of a rain forest is an irrational act, from the point of view of the stakeholders involved, it is in fact only rarely so (Schelhas, 1993). Only with an understanding of the basis on which an *ejidatario* (a family head of the *ejido*) makes decisions on land use is it possible to change and influence the conditions promoting destructive uses and create incentives to promote sustainable uses.

An *ejidatario* who leaves one or more intact forest fragments in his lot is not being irrational. Our joint study of 67 *ejidal* lots and approximately 50 fragments suggests that these forest remnants are a refuge for the impoverished flora and fauna, including numerous tree species, palms, and spider and howler monkeys, while also providing a number of products for the local economy. A detailed study of the trees in a 10-ha forest revealed that locals use some 12 species for food, 15 as a source of medicinal products, 10 as a source of construction materials and at least 20 for firewood. Combined, they represent about 30% of the species, 40% of the families and approximately 60% of the trees with a diameter of 20 cm or larger in the fragment (Jiménez-Huerta *et al.*, 1993; Silva-López *et al.*, 1993). Fragments also provide ecological services such as windbreaks, the reduction of erosion levels in areas adjacent to cultivations and protection of streams. More than 90% of these fragments are next to rivers and streams on the Sierra´s eastern slope.

There are severe land use restrictions in a hilly terrain such as that prevailing in the Sierra. One of these is related to climate. The strong winds from the south, locally known as *suradas* (Portilla-Ochoa, 1995), are characteristic of the dry season and can be extremely damaging. They may cause fires started by cattle-ranchers to run out of control, resulting in severe and extensive forest fires. These runaway fires are one of the main causes of forest destruction. The loss of

trees in forest remnants eliminates a natural barrier to these fires and eventually promotes new fires which affect cultivations, firewood and timber reserves alike, as well as the settlements themselves in the Sierra´s upper portions. The *suradas* have also caused the disappearance of the *tapachol* practice (maize cultivation in the winter) and the cultivation of chili, one of the area's few marketable products.

The Management of Lots

In order to ameliorate these kinds of problems, a relatively large number of *ejidatarios* from the *ejido* of Magallanes have requested a management strategy for their lots (Portilla-Ochoa, 1995), based on the consideration of physiographic conditions limiting land-use. The *ejidatarios* use the "lomos de las colinas" (hilltops) for pasture, precisely in the places where the effects of *suradas* can be most harmful. They use the "bajadas-contra" (leeward slopes, or slopes oriented against the direction of the *suradas*) to cultivate maize and other mixed cultivations, which include beans, yucca, sweet potato, string beans and squash. Finally, they use the "planos" (small valleys between the hills) to cultivate maize and some of the 10 banana varieties and/or to maintain forest remnants. The exact system may vary somewhat, but the general pattern is consistent.

Considerations for Ecological Planning at the Level of Lots

We propose that a management strategy based on lots can be used as a preliminary approach for the Sierra's ecological planning. Land use patterns are not static, however. They change in degree or characteristics from time to time due to social, economic and political factors at local, state and national levels. These changes require immediate actions on behalf of the long-term conservation of landscape elements as dynamic as forest fragments.

Forest fragments cannot be perceived as isolated elements of the landscape. Ultimately, they have been, and are, social spaces in the Sierra's rural environment. That is why, in the application of any conservation measure, it is necessary to distinguish the effects of fragmentation *per se* from the effects of man upon fragments, which in most cases are more deleterious and permanent in character. The products and ecological services provided by fragments cannot be guaranteed in the long-term unless the fragments themselves are the object of intensive management.

The immediate protection of fragments can be very cheap but, in spite of the potential management costs, they must form part of an integrated conservation strategy for the Sierra. The key is to identify the most convenient type of projects for management, which of necessity must involve the participation of the locals, with the multiple use of forest remnants as an end-product.

The establishment of general goals in these projects must be carefully planned. Initially, projects may come from a number of different organizations and approaches but, in order to make them viable, they must contribute to a balance which combines the role fragments play for the conservation of forest diversity with an improvement in the Zoque-popolucas' subsistence level in accordance with local environmental conditions. From our point of view, the achievement of this balance, to diversify the economic base in the shortest period of time, is of critical importance.

To summarize, the preservation of forest fragments is only one part of the conservation actions necessary in the Sierra. The area's management must be oriented toward ecological planning at the level of the lots, including traditional or alternative cultivations, the grasslands, and the maintenance and management of forest fragments offering products and ecological services to the *ejidatario* and habitat for the native flora and fauna. In the scheme of a biosphere reserve, this type of ecological planning will be critical to prescribe actions for the buffer zone.

At present, a regional zonation has been made to define the "Los Tuxtlas" Biosphere Reserve, including a nuclear and a buffer zone, of which Santa Marta forms an integral part. Four sub-zones have been distinguished inside the buffer zone: (1) traditional use, (2) recovery, (3) sustainable use of agroecosystems and (4) sustainable use of natural resources (Portilla-Ochoa, 1999). By using this management strategy, the approach to the management of lots is better defined because, for each sub-zone, it has now become possible to establish specific management guidelines combining conservation and the rational use of natural resources.

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Estudio del Patrón de Actividad General de Monos Aulladores (*Alouatta palliata*) en el Parque Yumká, Tabasco, México

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Introducción

Los monos aulladores (*Alouatta* spp.) se han caracterizado por presentar patrones de baja actividad, descansando más de la mitad de su tiempo diurno, lo cual se atribuye a la necesidad de procesar grandes cantidades de fibra vegetal como resultado de una dieta rica en hojas (Milton, 1980). Las variaciones en los patrones de actividad de este primate parecen estar relacionados con el grado de dispersión del alimento en el tiempo y espacio (Crockett y Eisenberg, 1987), con su densidad, y con variables abióticas como el clima (Chivers, 1969; Glander, 1979; Ortíz-Martínez *et al.*, 1999), así como también con la edad y sexo de los aulladores (Bicca-Marques y Calegaro-Marques, 1994). La perturbación antropogénica de los hábitats naturales de este primate también tiene una influencia importante sobre la estrategia de asignación de tiempo y energía a las diferentes actividades vitales (crecimiento, mantenimiento y reproducción), pero hasta el momento existe poca información al respecto (Juan *et al.*, 1999; Estrada *et al.*, 1999).

El estado de Tabasco en el sur de México resguarda poblaciones representantes de las tres especies de primates que existen en México: *Alouatta palliata, A. pigra y Ateles geoffroyi* (Smith, 1970; Horwich y Johnson, 1986; Rylands *et al.,* 1995). Tabasco es el único estado de México, y la única zona de la región Mesoamericana, en donde podemos encontrar representantes de las tres especies de primates y resguarda la zona de transición entre *A. palliata y A. pigra* en algunas localidades (Smith, 1970). Cerca del 60% de la superficie del estado estaba originalmente cubierta por selvas, pero como resultado de la actividad humana en Tabasco, cerca del 80% de esta vegetación ha desaparecido a una tasa de 600 km² ó más al año, siendo las tierras bajas en donde ha ocurrido la mayor transformación de la selva a pastizales y otros agrosistemas (Masera, 1996; SEMARNAP, 1999; INEGI, 1996).