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Habitat use and social structure of an isolated population of guanacos (*Lama guanicoe*) in the Monte Desert, Argentina

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Abstract We studied abundance, habitat use and social structure of an isolated population of guanacos in the Lihue Calel National Park in central Argentina, based on data from foot surveys during 1998–2000. Based on topography and vegetation characteristics we distinguished three types of habitat: hills, valleys and piedmonts, and lowlands. Three types of social groups were observed: solitary males, family groups and male groups. The guanacos used hills preferentially, followed by valley and piedmont. The guanacos avoided the lowlands where the vegetation is dense. Habitat selection, both on a coarse and a fine scale, could be explained by habitat quality and possibly also predator avoidance behaviour. Abundance of guanacos increased by 21% over the 3-year-study period. However, the specificity of habitat requirements of guanacos and the susceptibility of the study area to wildfires could cause guanacos to move into sub-optimal areas were they are more vulnerable to predation and human persecution.

Keywords Camelids · Conservation · Natural areas · Wild populations

Introduction

At the end of nineteenth century the guanaco (*Lama guanicoe*) was present in almost all phytogeographic regions of Argentina, occupying open habitats, shrubland, and open forest communities (Cajal 1980). Presently, they are abundant only in Patagonian steppe and in the foothills of the Andean Mountains (Cajal 1980;

Cunazza et al. 1995). The causes of the species range reduction are not well documented, but include hunting, competition with livestock (sheep and beef-cattle), habitat loss and habitat fragmentation due to agricultural development (Cunazza et al. 1995). Today few relict and isolated populations remain in small, mostly protected areas in central and northern Argentina with suitable and undisturbed habitats. The landscape of these areas is characterized by sierras and low high mountains, surrounded by farmlands or cattle ranches.

Guanaco populations from steppe, pre-cordillera, cordillera and transition zone between cordillera and steppe zones have been well studied with regard to food habits (Raedecke 1980; Ortega and Franklin 1988; Raedecke and Simonetti 1988; Puig 1995; Puig et al. 1996, 2001). Features such as social behaviour, population dynamics and habitat use of guanacos in these sites are, however, unknown.

The strongest ecological contrast between these isolated populations and those of the Andean and Patagonian regions is perhaps the sedentary habits of the relict populations in central Argentina. In the former, spatial isolation does not allow migration between neighbouring populations located thousand of kilometres apart. Thus, the abundance of guanacos in such sites is regulated only by local factors (e.g. predation and hunting) and studies of such isolated populations are of special importance for conservation and management. In this paper, we describe the social structure, abundance, distribution, and habitat selection of a guanaco population in a protected area of the Monte Desert of Central Argentina. We also discuss current trends in the abundance of guanacos in the Lihue Calel National Park, Argentina.

Materials and methods

Study area and habitat classification

The study was conducted in Lihue Calel National Park (9910 ha), La Pampa, Argentina (38°00'S, 65°35'W)

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between 1998 and 2000 (Fig. 1). The area is located in the Monte Desert biome (Cabrera 1976) and is characterized by hot summers (from December to March: mean 35.9 ; SD 0.96°C), cool winters (June to August mean -4.33 ; SD 2.08°C), and low annual rainfall (567 ± 214 mm). The park is comprised of sierras and rolling hills (47% of the area, 300–589 m above sea level) that cross the park in NW-SE direction and flats (63% of the area) of shrubs and open areas of grasses and forbs. Common shrubs include *Larrea divaricata*, *Acantholippia seriphoides* and *Cassia aphila*. Numerous grasses occur in the park, but the dominant species are *Stipa* spp. (Cano et al. 1980). The park area is surrounded by large cattle ranches.

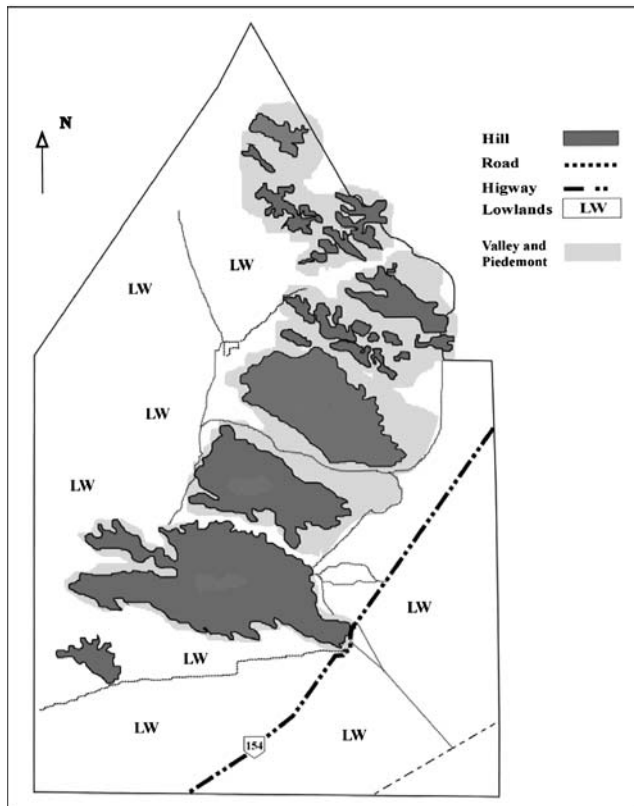
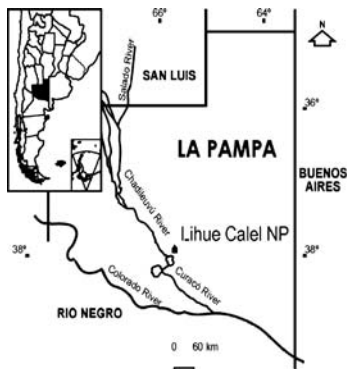


Fig. 1 Location of the study area in Argentina and detailed map of the Lihue Calel National Park showing the three different habitat types considered in the study

Based in topographic and geomorphological features of the area, we determined three types of habitat on a fine-scale: (a) hills, (b) valleys and piedmont and (c) lowlands (Fig. 1).

Field surveys

Field work was conducted during June, July and September 1998, May 1999, and March 2000. Surveys were carried out by foot along and across the sierras. Two observers surveyed with binoculars and a spotting scope and recorded the location of guanacos on a TM Landsat Satellite Image (1:30,000 scale) divided into grid of 400 plots (500×500 m).

For each sighting we determined group size and composition (juveniles and adults), and age and sex of adult individuals (Franklin and Fritz 1991). When distance from the observer to the guanaco did not allow the differentiation between male and female, individuals were classified as undetermined. The homogeneity G -test (Zar 1996) was used to evaluate habitat selection by guanacos for each social category at the scale of the 500×500 m plots.

Results

We identified three categories in the social structure of guanaco population in our study area: family groups, male groups, and solitary males. Mean group size (\pm SD) was 3.77 ± 1.09 individuals for male groups and 8.07 ± 4.05 individuals for family groups. Observed habitat utilization differed from expected utilization based on habitat availability for all social groups, hills being the preferred habitat for all groups: family groups ($G_2 = 92.1$; $P < 0.01$); male groups ($G_2 = 14.6$; $P < 0.01$), solitary males ($G_2 = 24.5$; $P < 0.01$).

Considering survey results on a year-to-year basis, the abundance of guanacos increased 21% during the study period (June–September 1998, 148.3 ± 3.78 (mean \pm SD); May 1999, 166; March 2000, 180 guanacos).

Discussion

The social organization exhibited by the guanacos in the Lihue Calel National Park was similar to that described by Franklin (1982) in Torres del Paine (Chile), except that groups of females were not recorded in our study site. However, demographic studies are needed to understand the population dynamics of guanacos in the area.

Most of sightings of solitary individuals and groups were made in areas of irregular topography. The analysis of habitat selection at a fine scale revealed the elevated and grass covered areas as the sites preferred by guanacos, as was also reported by Cajal (1989) and Puig et al. (2003) for the Andean precordillera of northern

Argentina. Although, the most plausible explanation for such habitat selection is differences in habitat quality (i.e. food supply and availability), predator avoidance behaviour could also be acting in habitat selection both at a broad (sub-areas of the sierra system) and a finer scale (topography and vegetation structure). Guanacos were almost absent in the diet of their main predator in the area, the puma (*Puma concolor*) (Branch et al. 1996; Pessino et al. 2001), even though guanacos constitute one of the most common prey items of pumas in other areas such as Torres del Paine, Chile (Wilson 1984; Iriarte et al. 1991; Bank et al. 2003). Guanacos remained almost negligible in the diet of pumas even when the main prey (the plain vizcacha, *Lagostomus maximus*) declined approximately 90%, and exotic large-ungulates such as wild boar (*Sus scrofa*) and red deer (*Cervus elaphus*) were consumed (Branch et al. 1996; Pessino et al. 2001).

We recorded a positive trend in the abundance of guanacos in the Lihue Calel National Park during the study period. Cunazza et al. (1995) pointed out that this species has a small to medium population size in the biogeographic regions of Monte, Espinal, and Pampas, due to habitat alteration fragmentation and subsequent change in land use: agriculture and cattle ranching, and hunting. Most of the guanacos killed by humans in the Park are shot near the limits of the protected area (Milne, personal communication). In our case, the absence of floating groups of immature individuals and the low predation pressure by pumas suggest that the population of guanacos in Lihue Calel National Park is growing with few natural limitations and that it may be below the carrying capacity of the habitat. However, the strong relationship observed between guanacos and a particular habitat type, only represented in this small area (i.e. the hill tops) make this population vulnerable to catastrophic events of habitat alteration. For example, wildfires during summer could affect guanacos by direct mortality but also, and more probably, by causing guanacos to move towards habitats in surrounding areas of the Park where predation risk and human persecution could exercise a negative impact on the population.

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