

## **Progress Report: Biodiversity of Sierras Grandes**

### **HABITAT LOSS AND ITS IMPACT ON AVIAN DIVERSITY OF HIGHLAND MOUNTAINS OF CORDOBA, ARGENTINA**

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#### **Habitat problem**

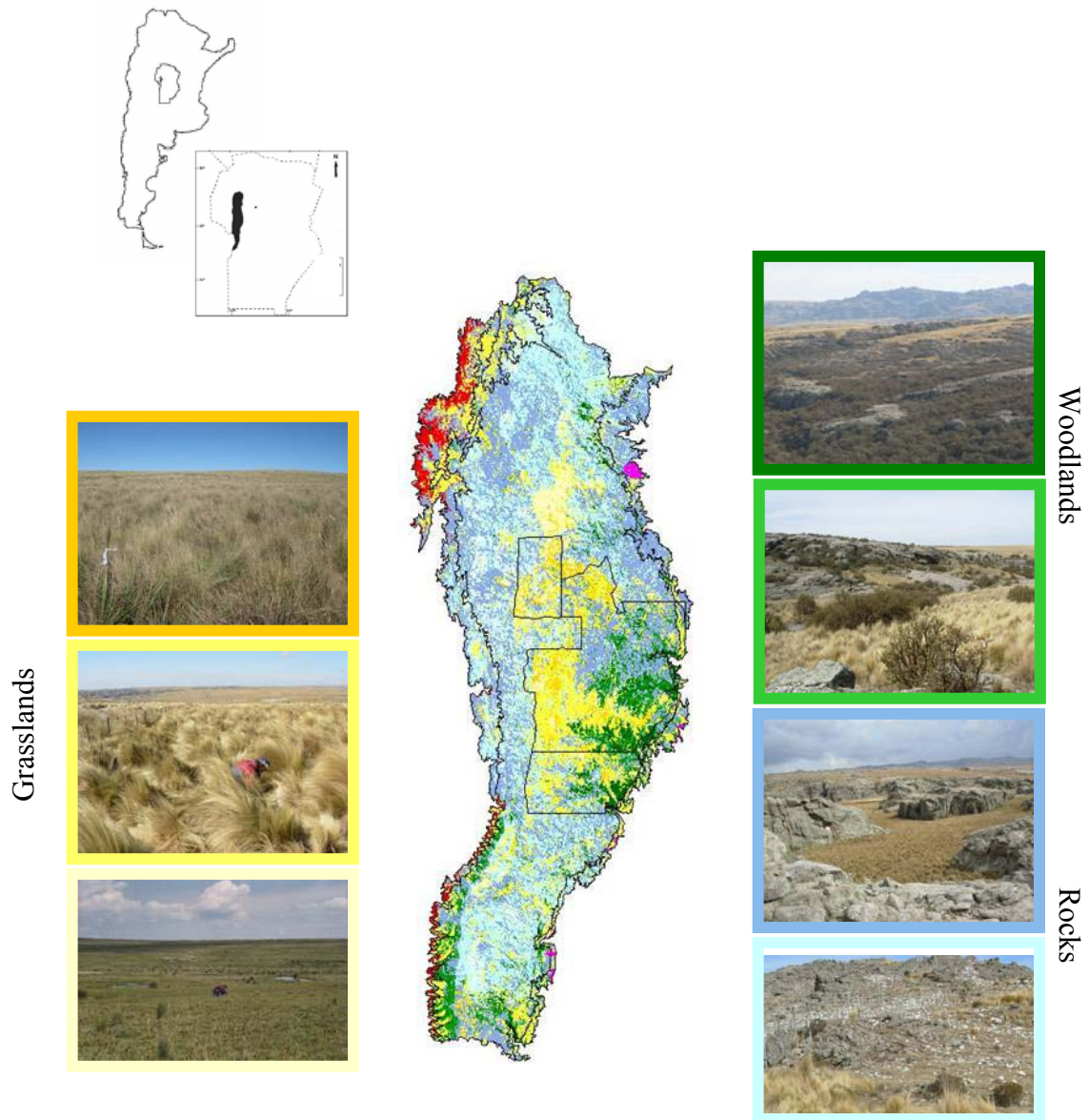
In the highland mountains of central Argentina four centuries of domestic grazing and anthropogenic fires have caused serious erosion problems and woodland degradation. At present, vegetation cover and soils are completely degraded in ~ 20% of the area leaving behind bare rock (Cingolani et al. 2004, 2008, Renison et al. 2006). These problems are especially alarming since the area constitutes a biogeographical island and because rivers formed there provide the lowlands with water. Consequently, there is an urgent need to study the impact of grazing on biodiversity. Due to the impossibility to perform complete species inventories, here we propose birds as ‘bio-indicators’ given that they are easy to quantify, have large area requirements and specialised habitat needs, and their distribution

is well known. The main aim of this project is to investigate the impact of human activities on avian diversity in Sierras Grandes of Córdoba, Argentina. This project is focused on the study of avian communities in habitats with different intensities of livestock grazing.

### **Activities performed**

Fieldwork was carried out in the Sierras Grandes of Cordoba (SGC, 1200–2800 m a.s.l.) in central Argentina. This region has three different habitat types: woodlands, grasslands, and rock habitats (Figure 1). In each habitat types sample sites were randomly located in zones under different grazing situations: (1) traditional grazing: livestock management within privately owned lands (129,000 ha) where livestock activities have been fairly intense during the last 400 years and effective stocking rate generally ranges from 0.4 to more than 1.5; (2) grazing exclusion: traditional grazing until 1998 when the National Park administration took over 26,000 ha of land and livestock was completely excluded four years before our field surveys and (3) moderate grazing: livestock is maintained at low stocking densities.

So far 126 widely distributed sampling points were located in each of sampling sites, 14 points per environmental condition which is defined as a combination among different habitat types and grazing situations. Each point was surveyed for 10 min to maximize count efficiency and efforts were made to avoid double-counting of individuals moving among points (Sutherland 2004). Points were visited twice in the spring-summer (September-March) seasons 2007-2008 and bird richness and abundance was assessed. The location of each sample point was recorded with a GPS.



**Figure 1.** Sierras Grandes of Cordoba, Argentina. Each picture represents the different vegetation units included in the three habitat types of the region. Dark line shows the location of Quebrada del Condorito National Park. (Map adapted from GIS of Sierras Grandes; Cingolani et al. 2003a).

## Results obtained

### 1. Traditional grazing situation:

Table 1 shows the avian richness (as a list of bird species) and the total abundance recorded in each habitat types under high densities of livestock.

Woodlands	Grasslands	Rock habitat
<i>Aeronautes andecolus</i>	<i>Anairetes flavirostris</i>	<i>Aeronautes andecolus</i>
<i>Anairetes flavirostris</i>	<i>Anthus furcatus</i>	<i>Anthus hellmayri</i>
<i>Anairetes parulus</i>	<i>Anthus hellmayri</i>	<i>Asthenes modesta cordobae</i>
<i>Asthenes modesta cordobae</i>	<i>Asthenes modesta cordobae</i>	<i>Asthenes sclateri sclateri</i>
<i>Asthenes sclateri sclateri</i>	<i>Asthenes sclateri sclateri</i>	<i>Cinclodes comechingonus</i>
<i>Bolborhynchus aymara</i>	<i>Cinclodes fuscus</i>	<i>Cinclodes fuscus</i>
<i>Carduelis magellanica</i>	<i>Cincodes oustaleti olrogi</i>	<i>Hymenops perspicillata</i>
<i>Cinclodes atacamensis schocolatinus</i>	<i>Cistothorus platensis</i>	<i>Muscisaxicola rufivertex achalensis</i>
<i>Cinclodes comechingonus</i>	<i>Colaptes campestris</i>	<i>Nothiochelidon cyanoleuca</i>
<i>Cincodes oustaleti olrogi</i>	<i>Hymenops perspicillata</i>	<i>Phrygilus unicolor cyaneus</i>
<i>Cistothorus platensis</i>	<i>Idiopsar brachyurus</i>	<i>Sturnella loica obscura</i>
<i>Colaptes melanolaimus</i>	<i>Nothiochelidon cyanoleuca</i>	<i>Vanellus Chilensis</i>
<i>Leptasthenura fuliginiceps</i>	<i>Phrygilus plebejus naroskyi</i>	<i>Zonotrichia capensis</i>
<i>Muscisaxicola rufivertex achalensis</i>	<i>Phrygilus unicolor cyaneus</i>	
<i>Turdus chiguanco</i>	<i>Sturnella loica obscura</i>	Number of individuals 55
	<i>Theristicus caudatus</i>	Richness: 13
Number of Individuals: 87 Richness: 15	<i>Turdus chiguanco</i>	
	<i>Vanellus chilensis</i>	
	<i>Zonotrichia capensis</i>	
	Number of individuals: 85 Richness: 19	

### 2. Moderate grazing situation:

Table 2 shows the avian richness and total abundance recorded in each habitat types under moderate densities of livestock.

Woodlands	Grasslands	Rock habitat
<i>Agriornis montana fumosus</i>	<i>Anthus furcatus</i>	<i>Agriornis montana fumosus</i>

<i>Anairetes parulus</i>	<i>Anthus hellmayri</i>	<i>Anthus furcatus</i>
<i>Asthenes sclateri sclateri</i>	<i>Asthenes modesta cordobae</i>	<i>Anthus hellmayri</i>
<i>Buteo albicaudatus</i>	<i>Asthenes sclateri sclateri</i>	<i>Asthenes modesta cordobae</i>
	<i>Cinclodes atacamensis</i>	
<i>Falco sparverius</i>	<i>schocolatinus</i>	<i>Asthenes sclateri sclateri</i>
<i>Turdus chiguanco</i>	<i>Cinclodes comechingonus</i>	<i>Cinclodes fuscus</i>
<i>Zonotrichia capensis</i>	<i>Cinclodes fuscus</i>	<i>Cincodes oustaleti olrogi</i>
	<i>Cincodes oustaleti olrogi</i>	<i>Cistothorus platensis</i>
Number of individuals: 12	<i>Cistothorus platensis</i>	<i>Falco sparverius</i>
Richness: 7	<i>Hymenops perspicillata</i>	<i>Geranoaetus melanoleucus</i>
	<i>Phrygilus alaudinus</i>	<i>Hymenops perspicillata</i>
	<i>Polyborus plancus</i>	<i>Phrygilus unicolor cyaneus</i>
	<i>Sturnella loica obscura</i>	<i>Sturnella loica obscura</i>
	<i>Turdus chiguanco</i>	<i>Zonotrichia capensis</i>
	<i>Vanellus chilensis</i>	
	<i>Zonotrichia capensis</i>	Number of individuals: 46
		Richness: 14
	Number of individuals: 71	
	Richness: 16	

### 3. Exclusion grazing situation:

Table 3 shows the avian richness and total abundance recorded in each habitat types under livestock exclusion.

Woodlands	Grasslands	Rock habitat
<i>Aeronautes andecolus</i>	<i>Anthus furcatus</i>	<i>Agriornis montana fumosus</i>
<i>Agriornis montana fumosus</i>	<i>Anthus hellmayri</i>	<i>Aimophila strigiceps</i>
<i>Aimophila strigiceps</i>	<i>Asthenes modesta cordobae</i>	<i>Anthus furcatus</i>
<i>Anairetes flavirostris</i>	<i>Asthenes sclateri sclateri</i>	<i>Anthus hellmayri</i>
<i>Anairetes parulus</i>	<i>Buteo polyosoma</i>	<i>Asthenes modesta cordobae</i>
<i>Asthenes sclateri sclateri</i>	<i>Carduelis magellanica</i>	<i>Asthenes sclateri sclateri</i>
<i>Bolborhynchus aymara</i>	<i>Catamenia inornata cordobensis</i>	<i>Bolborhynchus aymara</i>
<i>Carduelis magellanica</i>	<i>Cinclodes comechingonus</i>	<i>Carduelis magellanica</i>
<i>Cathartes aura</i>	<i>Cistothorus platensis</i>	<i>Cinclodes comechingonus</i>
<i>Cistothorus platensis</i>	<i>Embernagra platensis</i>	<i>Cinclodes fuscus</i>
<i>Colaptes melanolaimus</i>	<i>Geositta cunicularia contrerasi</i>	<i>Cistothorus platensis</i>
<i>Columba maculosa</i>	<i>Hymenops perspicillata</i>	<i>Geositta cunicularia contrerasi</i>
<i>Coragyps atratus</i>	<i>Leptasthenura fuliginiceps</i>	<i>Hymenops perspicillata</i>
<i>Falco sparverius</i>	<i>Nothoprocta pentlandii</i>	<i>Leptasthenura fuliginiceps</i>
<i>Geranoaetus melanoleucus</i>		<i>Muscisaxicola rufivertex achalensis</i>
<i>Leptasthenura</i>	<i>Phrygilus plebejus naroskyi</i>	<i>Nothura maculosa</i>
	<i>Phrygilus unicolor cyaneus</i>	

*fuliginiceps*

*Myioborus bruniceps*  
*Pheucticus aureoventris*  
*Sappho sparganura*  
*Troglodytes aedon*  
*Turdus chiguanco*  
*Zonotrichia capensis*

Number of individuals: 92  
Richness: 22

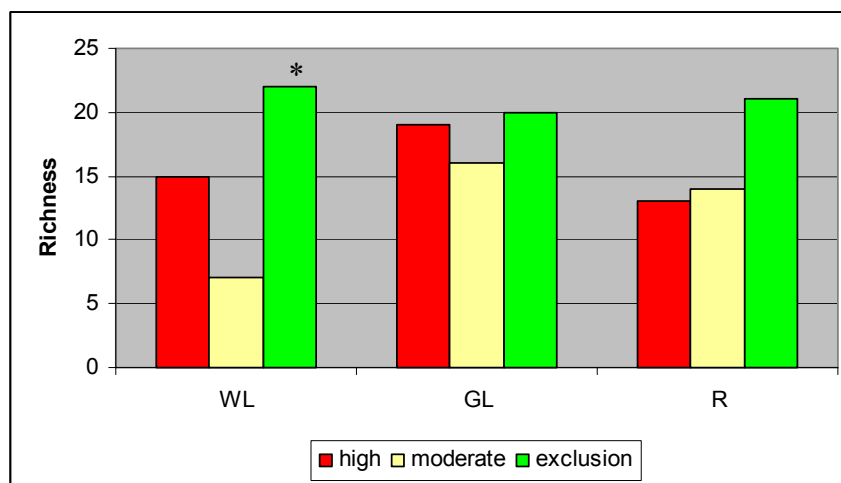
*Sturnella loica obscura*  
*Turdus chiguanco*  
*Vultur gryphus*  
*Zonotrichia capensis*

Number of individuals: 99  
Richness: 20

*Phrygilus plebejus naroskyi*  
*Phrygilus unicolor cyaneus*  
*Sturnella loica obscura*  
*Turdus chiguanco*  
*Zonotrichia capensis*

Number of individuals: 92  
Richness: 21

Preliminary comparisons among different environmental conditions (Figure 2) showed that woodlands with grazing exclusion have significant more richness of birds that high and moderate situation.



**Figure 2.** Bird richness comparisons among the different environmental conditions (i.e. the combination of habitat types and grazing situations). WL: woodlands, GL: grasslands R: rock habitats. Colors show the 3 grazing situations. (\*) shows significant differences of Chi square test (7.68;  $P < 0.05$ ).

## Deliverables for Phase 2

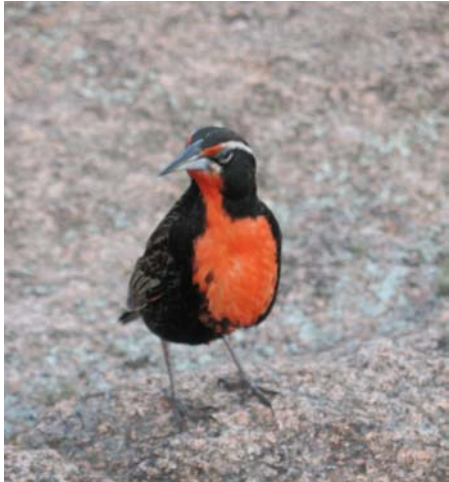
During the spring-summer seasons 2008-2009 we will perform a new fieldwork to reinforce bird survey and to improve our data. Additionally, in each sample site we will measure the

accumulated grazing impact at local scale by means of : (a) % of vegetation cover soil and (b) % bare rock exposed by erosion (Renison et al. 2006). In the Cordoba Mountains bare rock exposed by erosion should be a good indicator of long-term grazing pressure, because grazing and cover of bare soil on vertical surfaces where erosion is active are highly correlated (Cingolani et al. 2003b). Finally, we will analyze the data set to identify the intensities of grazing pressure that most affect the natural habitats and to determine which bird species are more vulnerable to disturbance. Also, we expect to detect some species that may be used as ‘umbrella species’ if their habitat requirements are useful in setting targets for conservation planning.

## References

- CINGOLANI A. M., RENISON D., SCHINNER D., CABIDO M., ENRICO L., GALLI E., FALCZUK V., ZAK M. & RENISON R. 2003a. Sistema de Información Geográfica de la Reserva Hídrica Provincial de Achala y Parque Nacional Quebrada del Condorito. En: Flores A. y Cabido D. (eds.). Primer Congreso Nacional de Áreas Naturales Protegidas. Resumen de presentaciones pp 104-105. Córdoba: Agencia Cordoba DACyT, Dirección de Ambiente, Administración de Parques Nacionales.
- CINGOLANI A. M., M. R. CABIDO, D. RENISON & V. SOLÍS NEFFA. 2003b. Combined effects of environment and grazing on vegetation structure in Argentine granite grasslands. *Journal of Vegetation Science* 14: 223-232.
- CINGOLANI A. M., D. RENISON, M. R. ZAK & M. R. CABIDO. 2004. Mapping vegetation in a heterogeneous mountain rangeland using Landsat data: an alternative method to define and classify land-cover units. *Remote Sensing of Environment* 92: 84-97.
- CINGOLANI A. M., D. RENISON, P. TECCO, D. GURVICH, & M. CABIDO. 2008. Predicting cover types in a mountain range with long evolutionary grazing history: a GIS approach. *Journal of Biogeography*, 35: 538-551.

- RENISON D., HENSEN I., SUAREZ R. & CINGOLANI A. 2006. Cover and Growth Habit of *Polylepis* Woodlands and Shrublands in the Mountains of Central Argentina: Human or Environmental Influence? *Journal of Biogeography* 33: 876-887.
- SUTHERLAND, W.J., 2004. Ecological Census Techniques. A Handbook. Cambridge University Press, Cambridge.



*Sturnella loyca obscura*  
(subspecies endemic of the region)



*Anthus hellmayri*



*Muscisaxicola rufivertex achalensis*  
(subspecies endemic of the region)



*Hymenops perspicillatus*

**Figure 3.** Birds of the study area.