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Birds community of "Cerro El Potosí" in Galeana, Nuevo León, México

Blanca Lizeth Gaspar Rodríguez*, Armando Jesús Contreras Balderas and Juan Antonio García Salas

Laboratorio de Ornitología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Ave. Pedro de Alba S/N, San Nicolás de los Garza, Nuevo León, México

Corresponding author

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A B S T R A C T

The Cerro El Potosí is located within the Sierra Madre Oriental, being part of the Gran Sierra Plegada Province. It has an elevation of 3 750 meters above sea level. This high elevation restricts biota development, resulting in selection of habitant species, which has lead to endemic flora and fauna of this particular area (García, 1996). In the present study, 24 field trips were conducted during 2006-2008 periods, where seven selected stations were sampled according to their topography and floristic characteristics, 1) 2 000-2 120m area of disturbance, 2) 2 120-2 475m *Pinus pseudostrobus* - *Pinus cembroides*, 3) 2 475-2 900m *Quercus* sp. - *Arbutus xalapensis*, 4) 2 900 to 3 160m *Pinus hartwegii*, 5) 3 160-3 300m *Pinus strobiformis* - *Pinus hartwegii*, 6) 3 300-3 750m *Pinus hartwegii* - *Pinus stobiformis*, 7) 3 750m alpine meadows - *Pinus culminicola*. For birds observation, the method transect line without bandwidth (Hilden 1991) was used. For each transect, field data including date, location and altitude were taken. For species richness determination, we recorded the number of species present during the two years of monitoring. The information collected in the field was applied in order to calculate the Jaccard similarity index. We compared the list of species found for the years 2006-2008 with the list by Guzmán-Velasco (1998), to distinguish which species were present on the "Cerro El Potosí" after the fire riots that occurred in 1998. The data record of the ecological distribution of species in the sampled communities was used to determine qualitatively the presence/absence of species to calculate the Jaccard similarity index. For the global index value was obtained following 0.2652. Registered for the Mexican norm (NOM-059-SEMARNAT-2010), eight species under one category, divided into subject to special protection and threatened.

Introduction

The "Cerro El Potosi" was recognized by the federal government as a conservation priority region (CONABIO, 2010), particularly for birds (Arizmendi and

Marquez, 2000). Formal studies have been conducted in the "Cerro El Potosi", where Leopold (1946) first reported the *Nucifraga columbiana* specie, detailing that its presence was related to the flora movements during the glacial period, especially with the existing boreal vegetation above 3 600 meters above sea level. Martín del Campo (1959) reported 169 bird species within Nuevo León state, from them, 53 were located in the Galeana town and five were reported at "Cerro El Potosi": *Rhynchopsitta terrisi* was found between 2000 and 2500 m, *Calothorax lucifer* and *Archilocus colubris* at 2500m, and *Aphelocoma ultramarina* and *N. columbiana* at 2 135m. Phillips (1986) reported that *N. columbiana* was a resident in El Potosi along with the wild bird population. Contreras-Balderas (1992a) established that the population of *N. columbiana* in this studied area was a relict resident species, which represents the most southern distribution. Contreras-Balderas (1992b) also reported *Otus flammeolus* on the Potosi region. Finally, Contreras-Balderas and Gaspar-Rodríguez (2010) reported *Loxia curvirostra* species at the same location.

The Cerro El Potosí is located within the Sierra Madre Oriental, being part of the Gran Sierra Plegada Province. It has an elevation of 3 750 meters above sea level. This high elevation restricts biota development, resulting in selection of habitant species, which has lead to endemic flora and fauna of this particular area (García, 1996).

This region has been also subjected to anthropogenic impact due to human activities. As a result, in some places, much of the native vegetation has disappeared and replaced by secondary vegetation. In addition, climate change, agriculture, livestock overgrazing, the construction of road and trails, mineral extraction and fires that occur in the area on a recurring basis, have negatively impacted the flora and fauna of this particular mountain and accelerated changes in the appearance of the area. In 1998, this area was affected by the largest forest fire ever recorded. After that, serial flora and fauna cyclic evaluations to detect its effect on the mountain were recommended. The biological values of the species that inhabit it, whether scientific, cultural, and/or economic (ornamental and hunting), justify the need to conduct studies leading to have more accurate data related to the floristic inventories, wildlife, and status of the species. Altogether, results may be useful to enforce national or international protection of the endemic species, which over the time will allow presenting the most appropriate strategies for conservation and utilization of native flora and fauna. The objective of this study was to compare changes in birds diversity related to a previous study conducted in 1995 (García-Salas *et al.*, 2010), where the sampling took place between 2006 and 2008 period.

Materials and Methods

This work was conducted at the "Cerro El Potosí" which is a natural protected area from the Sierra Madre Oriental, located south central of Nuevo Leon, 15km West of Galeana municipality. The study area is located: 24°42'04"-100°01'12" N and 25°47'57"-100°52'01" W.

Physiography

The "Cerro El Potosí" has a semicircular direction West-East-Southeast, and an altitude between 2 000 on the eastern slopes and 3 200m west (Altiplano), and a maximum altitude of 3 750m with steep slopes (INEGI, 1986).

Soil

The predominant soil is combined with rendzina Litosol, with smaller proportions of lithosols and rendzina and castañozem, regosol and feozem on the western slopes, thin soils, dark, and with high amount of organic matter.

According to the analysis based on the charter pedological (INEGI, 1975) on the Cerro "El Potosí", the main type of soil in the area rendzina (E) reaching 68% coverage of the area, mainly distributed in a strip the hill between 2000 and 3400m, Litosol (I) covers19.3% of the area, the hilltop and other low areas luvisol (L) with 4.1% in low areas surrounding the valley, feozem (H) with 8.6% present in low exposure areas southeast.

Weather

INEGI (1986) describes this area with a climate type BSohW (e)W, recording low rainfall throughout the year and more than 18% rainfall in the winter. Total annual precipitation ranges from 400 to 600mm.

Vegetation

García (1989) and García and González (1991), cited that the relatively rich flora of the area has been considerably reduced mainly by anthropogenic disturbances and fires.

In the present study, a 24 field trips were conducted during 2006–2008 periods, where seven selected stations were sampled according to their topography and floristic characteristics, recording the different bird-plant associations, their location coordinates, altitude and topoforms of the location peak. For birds observation, the transect method on line without bandwidth was used (Hilden, 1991). For each transect, field data including date, location and altitude were taken. For each bird observed, recorded data included species, number of individuals and geographic coordinate variables. With this information an Excel database was elaborated, arranging data phylogenetically (AOU 1983; Banks, 2003). Collected field data for the ecological distribution of species was performed according to altitude and floristic gradients. Data were collected in the following layers: 1) 2000–2120m disturbance zone, 2) 2120–2475m *Pinus pseudostrobus* - *Pinus cembroides*, 3) 2475–2900m *Quercus* sp. - *Arbutus xalapensis*, 4) 2900–3160m *Pinus hartwegii*, 5) 3160–3300m *Pinus strobiformis* - *Pinus hartwegii*, 6) 3300–3750m *Pinus hartwegii* - *Pinus stobiformis*, 7) 3750m alpine meadows - *Pinus culminicola* (Figure 1). For species richness determination, we recorded the number of species present during the two years of monitoring. The information collected in the field was applied in order to calculate the Jaccard similarity index.

This system measures how similar a number of communities are present or absent by qualitative species. This index was designed to be equal to 1 in case of complete similarity and equal to 0 in communities with no species in common.

The information collected in the field was applied the following analysis:

The equation is: Ij = c / a + b-c.

Where:
a= number of species present in 1995
b = number of species present in 2006-2008
c = number of species in both studies

Result and Discussion

We compared the list of species found for the years 2006-2008 with the list by

Guzman-Velazco in 1995, to distinguish which species were present on the "Cerro El Potosí" after the fire riots that occurred in 1998 (Figure 2).

The data record of the ecological distribution of species in the sampled communities was used to determine qualitatively the presence/absence of species to calculate the Jaccard similarity index. These comparative data allowed us to determine whether there were changes in species composition after disturbance in the study area, based on data from studies conducted in 1995 and from 2006-08, as shown in Table 1. The relationship of species richness in different altitudinal levels and comparable studies is shown in the chart below. It was noted that the stratum with higher species richness has changed among the studies (Figure 3). Registered for the NOM-059-SEMARNAT-2010, eight species under one category, divided into subject to special protection and threatened, are shown in Table 2.

The richness of bird species reported for the "Cerro El Potosi", Guzman-Velasco (1995) is 80, but after the records collected during this study (2006-2008) showed that has been increased to 87 species. In addition, a change in the composition of species of birds located in the town was observed, with a Jaccard similarity index of 0.2652.

This increasing value in the species richness the changes in its composition, might be attributed to the high environmental pressure that occurs in this area. The appellants' environmental fires, for the changes exerted by anthropogenic activities, such as livestock on ranches within the Protected Natural Area, agriculture in the foothills of the "Cerro El Potosi", and timber harvesting of pine species found at the scene, triggered the observed changes.

Similarly, some studies have reported that species richness and structure of plant communities are often augmented after a fire riot.

Because the fires do not burn evenly, and that species are affected differently by these, both the number of species and diversity tend to increase (Apfelbaum and Haney 1981).

May be the establishment of species that are favored by the disturbance is quite common. Now we increase the avifauna of the El Potosi with 26 new records for the mountain: *Meleagris gallopavo*, *Cyrtonyx montezumae*, *Circus cyaneus*, *Buteo swainsoni*, *B. regalis*, *Falco peregrinus*, *Geococcyx californianus*, *Tyto alba*, *Glaucidium gnome*, *Bubo virginianus*, *Eugene fulgens*, *Sayornis saya*, *S. Phoebe*, *Vireo huttoni*, *Aphelocoma californica*, *Tachycineta thalassina*, *Stelgidopteryx serripennis*, *Catherpes mexicanus*, *Catharus occidentalis*, *C.guttatus*, *Wood Thrush*, *Parula sp.*, *Dendroica virens*, *Myioborus miniatus*, *Pipilo maculates* and *Icterus graduacauda.*

The presence of *Geococcyx californianus* had already been reported by Guzmán-Velasco (1995), who mentions that at the end of their work, after fires events have occurred, it was observed this bird species at the site. This is a sample of species that exploit these opportunities, because after the fire, most vegetation is removed, increasing the extension of the affected areas needed for the species. During this study years, this event was observed repeatedly between 2184-3636 meters, from the thicket of *Quercus sp.*, which is the habitat where they expect to be found for the pine forests *P. culminicola* and alpine meadows, serving as disturbance species indicator.

Table.1 Jaccard index variation at different altitudinal gradients of the bird community in "Cerro el Potosí", México

	Meters above see level					
	2000-2200	2200-2500	2500-3500	2900-3000	3500-3650	3600-3715
Jaccard Index	0.0895	0.2812	0.3214	0.1957	0.2863	0.2162

For the global index value was obtained following 0.2652

Table.2 Status of the birds in the "Cerro El Potosí" according to the Mexican legislation (NOM-059-Semarnat-2010)

Taxa	**Status**
ORDER FALCONIFORMES	
FAMILY ACCIPITRIDAE	
Accipiter cooperii	PR
Buteo regalis	PR
Parabuteo unicinctus	PR
FAMILY FALCONIDAE	
Falco peregrinus	PR
ORDER GALLIFORMES	
FAMILY ODONTOPHORIDAE	
Cyrtonyx montezumae	PR
FAMILY PHASIANIDAE	
Meleagris gallopavo	PR
ORDER PASSERIFORMES	
FAMILY PARULIDAE	
Vermivora crissalis	PR
ORDER PSITTACIFORMES	
FAMILY PSITTACIDAE	
Rhynchopsitta terrisi	P

Figure.1 Selected stations for the sampling method in the "Cerro el Potosí", Nuevo León, México

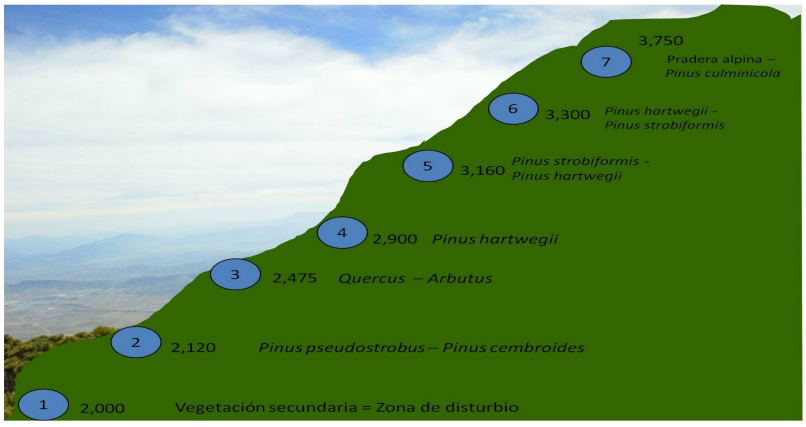


Figure.2 Comparison of birds species richness detected in 1995 and 2006-2008 on the "Cerro El Potosí", Galeana, Nuevo León, using the transect method online without bandwidth

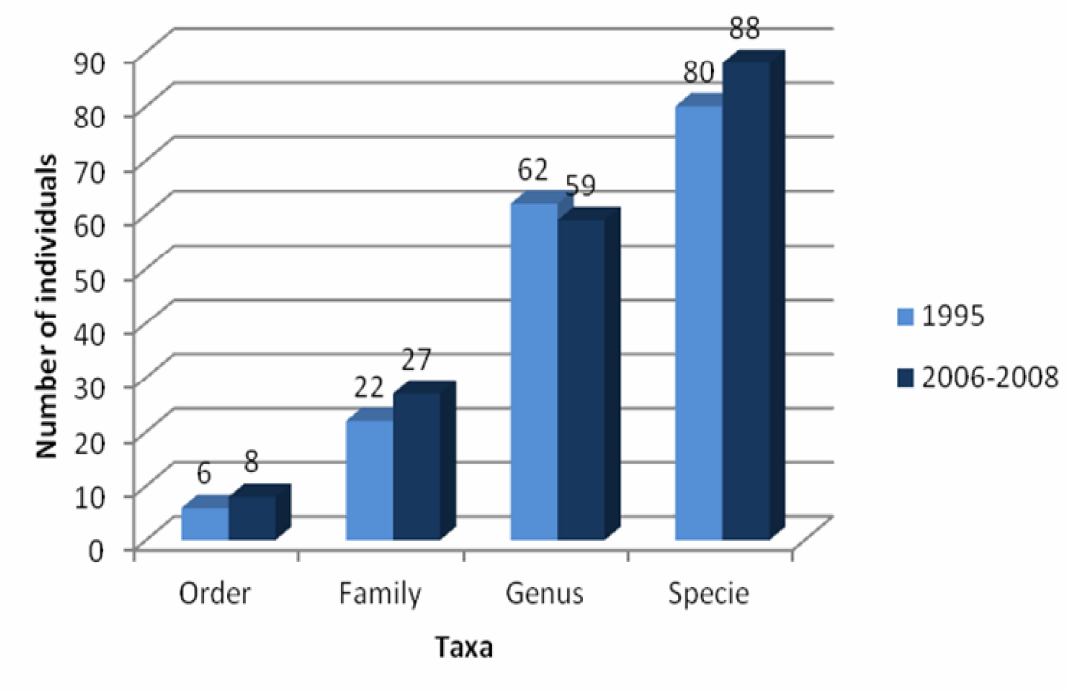
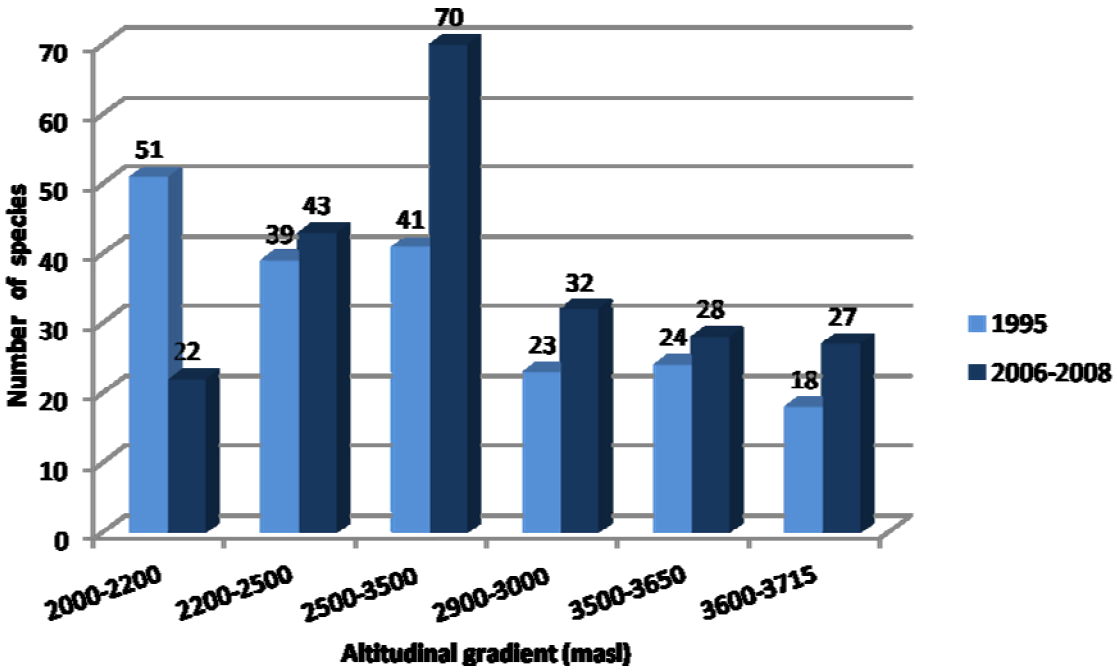


Figure.3 Relationship of species richness at different altitudinal gradients of the "Cerro El Potosí", Nuevo León, México



Since different species were found outside their normal altitudinal range, as *Toxostoma curvirostra* which was recorded at 3339 meters, a height greater than that found in the literature (1000–3000m according to Howell and Webb, 1995), and the pine forest community, its presence there could be because they are observed near a canyon that is connected to scrubland, which is their habitat, and may be induced to move to higher ground, along with other plant communities.

The presence of the migratory species reported for the locality, *Falco sparverius*, was confirmed by Guzman-Velasco (1998), contrary to that what was previously reported by Contreras-Balderas *et al.* (1995).

Conclusions

Analyzing the ecological distribution of birds, we were able to confirm that the plant community that supports the greatest wealth of species is the pine forest, conformed by *Pinus strobiformis* - *P. hartwegii*, distributed at a high of 2500–3500 meters. This observation may be as result that this community is the least affected and the one with more coverage, if the "Cerro El Potosi" is studied as a unit.

This result discerns to the common reference, that bird species decreases while altitude increases.

In this regard, species richness may also be endure among areas lower of 2000-2500m, where a major disturbance area are located among the pine-oak associations, including *Pinus pseudostrobus*, *P. cembroides* and *Quercus sp*., as well as an area where it dominates the chaparral succession to *Quercus sp*. and *Arbutus xalapensis*.

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