

THE AVIFAUNA OF THE PODOCARPUS NATIONAL PARK – THE “ANDEAN JEWEL IN THE CROWN” OF ECUADOR’S PROTECTED AREAS

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Resumen. El Ecuador es uno de los países que más esfuerzos dedica a la conservación de la biodiversidad. En los Andes, al sur del país, donde confluyen las áreas de distribución de diversas especies endémicas de aves, el Parque Nacional Podocarpus (PNP) es la única zona protegida (1642 km²). En el presente trabajo se discute la importancia nacional y global que el parque representa para la aves. Hasta ahora, solamente una mínima parte del PNP ha sido estudiada, como se aprecia en un mapa adjunto donde también se puede ver el número de especies en cada área con referencia a la intensidad del muestreo. Pese a que una sola localidad ha sido estudiada con profundidad, se han registrado un total de 552 especies en una zona de alta montaña. Varias especies amenazadas habitan esta región, la cual es de suma importancia debido a que el bosque andino desaparece a un ritmo alarmante. El PNP es también muy importante para la conservación de un elevado número de taxones forestales. La mitad de las especies de tangaras (Thraupidae) y de colibríes (Trochilidae) que habitan en el Ecuador, se encuentran en el PNP ubicado en las proximidades de dos capitales de provincia. El parque está amenazado por la tala ilegal del bosque, la construcción de carreteras y las explotaciones mineras. El bosque primario del PNP no solo es importante para la conservación de la biodiversidad, sino también para el bienestar de la población humana, que habita en sus alrededores. Finalmente, se argumenta que el futuro del parque depende del apoyo internacional de las ONG's y que las necesidades de la población local no pueden ser olvidadas, si se quiere conservar toda la riqueza del Parque Nacional Podocarpus.

Abstract. Ecuador is among the most important countries with regard to preservation of biodiversity. In the Andes of southern Ecuador, where several endemic bird areas adjoin, Podocarpus National Park (PNP) is the only protected area (1462 km²). The national and global importance of Podocarpus National Park for birds are discussed. Today only a few minor areas of PNP (illustrated by map) have been surveyed, and numbers of species are given by area with indications of thoroughness of survey. Although only one locality, situated in the upper-montane zone, has been surveyed thoroughly, 552 bird species have been recorded. Several globally threatened species occur in the area - maybe depending on it for their long-term survival. Because Andean forests disappear at an alarming rate, PNP is also of decisive importance for a high number of specialized Andean forest taxa, that are yet to become threatened. For example, half of Ecuador's species of tanagers (Thraupidae) and hummingbirds (Trochilidae) occur in PNP. Situated next to two provincial capitals the park is threatened by illegal clearing of forest, plans of road building, and mining. The primary forest of PNP is not only important for the conservation of biodiversity, but also for the welfare of the human population inhabiting the surrounding rainshadowed valleys as a provider of ecosystem services. Finally, it is argued that the future of the park depends on international support through local NGO's (Non Governmental Organizations), and that the needs of local people cannot be neglected if we want to preserve the richness of Podocarpus National Park. *Accepted 10. October 1995.*

Key words: Ecuador, Podocarpus National Park, avifauna, endemism, biodiversity, conservation, ecosystem services.

INTRODUCTION

Ecuador has approximately 1500 bird species (Ridgely, pers. com.), and is one of the ten countries in the world with the highest number of threatened bird species (Collar *et al.* 1994). It is number five on the list of countries in the world that have the highest number of threatened restricted-range bird species (Bibby *et al.* 1992). The diversity within most other groups

of organisms in Ecuador is probably just as immense as it is for birds, and their status is probably just as threatened by the same factor, habitat destruction. Ecuador must therefore rank high in any global strategy for preservation of biodiversity. This species richness, however, is severely threatened by an alarming annual loss of 2.4 percent of the total forest cover - the second-highest rate in South America (Whitmore & Sayer 1992).

In this paper we draw the attention of readers to Podocarpus National Park in southern Ecuador. This area represents a "hot-spot" of biodiversity, and still has large areas of diverse natural habitats. For birds, it is the Andean jewel in the crown of Ecuador's protected areas, and competes with the legendary Manu National Park in Peru in terms of number of recorded bird species.

The Podocarpus National Park is situated within the Central and Eastern Andes Endemic centers (as defined by Bibby *et al.* 1992). However, in the extreme western part of the park, some species belonging to the Ecuadorian Dry Forests Endemic Center of southwestern Ecuador (as defined by Bibby *et al.* 1992) can be found (Rasmussen *et al.*, in press). The national park comprises an area of 1462 km² (ca one tenth of the size of Manu National Park, Peru), and has a very irregular topography covering altitudes from 950 m to 3700 m, i.e., from lower-montane forest in the east through mid-montane forest, upper-montane forest, elfin forest and páramo and down again through elfin forest and upper-montane forest on the western side of the main Andean cordillera which traverses the national park. These two factors, the placement within a center of endemism and at the border of another center, and the wide altitudinal range, are the main reasons why the Podocarpus National Park is so rich in species and so important to preserve.

HOW MANY BIRD SPECIES?

Until 1989 little ornithological work had been carried out in Podocarpus National Park, where 238 species were known (D. Platt, pers. com.). Based on our own survey during the first half of 1989 and on additional information gathered from other ornithologists who had visited the area briefly, a species-list for the park was published (Bloch *et al.* 1991). This list comprises 490 species. Sixty-one of these species are based solely on old records from the Zamora and Sabanilla areas (Chapman 1926). As no exact information on collection sites of these 61 species exists, it cannot be ruled out that some of the specimens may have been collected at another place than what is now the Podocarpus National Park. Considering the lack of surveys in the mid-altitude range of the park, and poor coverage of its lower part, and given what we know about

the geographical and altitudinal ranges of South American birds, we suggested that Podocarpus National Park might harbor as many as 600-800 species of birds (Bloch *et al.* 1991). A survey from October 1991 to January 1992 of some less well surveyed or unsurveyed areas of Podocarpus National Park added many new species to the list. Thus, with these new observations and others from different sources (see Rasmussen & Rahbek 1994), the list now contains 552 species, including 45 species recorded only by Chapman (1926) (Rasmussen & Rahbek 1994). The number of species on the list is expected to continue to rise as new visits are made at different times of the year and in different parts of the park.

The national park can be divided into six "sectors" for which bird data exist (Fig. 1). Of these, the Cajanuma Valley is the only area that we regard as reasonably well surveyed for birds. The rest of the national park's avifauna is poorly known, with Río Bombuscara as the second best surveyed place. Table 1 lists the number of bird species known from each of the six areas shown on figure 1. Not surprisingly, the Loja-Zamora Road and adjacent areas, covering the largest elevational range (from the lower-montane to upper-montane zone), is the most species rich "sector", with 362 species (including 8 only from Chapman 1926). However, only smaller sub-samples of the area have been surveyed so far, and several more species must be expected to be found in this northern part of the national park. Also the Río Bombuscara area, representing the lowest part of the national park, has a large list with 292 species (including 52 species from Chapman 1926). Although much better surveyed than the Loja-Zamora Road area, several additional species can be expected to be found in this area. The known elevational distribution of birds in Podocarpus National Park is shown in Table 2.

The Cajanuma area, which has been the focus of the most intense investigation in Podocarpus National Park (see Bloch *et al.* 1991), clearly shows how rich in bird species the national park is. The development of the Cajanuma species-list nicely illustrates how the species-list seems to continue to grow when new surveys are carried out. In 1988 Platt (pers. com.) made a list on the basis of her fieldwork in the Cajanuma area. Although inexperienced, she found 130 species du-

ring a couple of years of more or less regular visits to the area. During our 107 person-days (a day's field work by one person equals one person-day) at Cajanuma in the first half of 1989, we found 139 species (Bloch *et al.* 1991), of which 35 were new to the area. The total list for the Cajanuma area in September 1991 was 179 species, including observations other than Platt's and ours (Bloch *et al.* 1991). Considering the small area (10 km²) of this "sector", and the thoroughness of surveys so far (Table 1), we had hardly expected the number to rise much more with further fieldwork. Nonetheless, new species continue to be added to the list. The total list for Cajanuma had by June 1992 reached an impressive 210 species (Rasmussen & Rahbek 1994). This increase is primarily a result of eight visits made by us in 1991 at a different time of the year from our 1989 work, and a few records by others. This locality appears, so far, to be richest in species of any cloud forest and elfin forest/páramo ecotone in the world.

The species-lists for the Romerillos area, the area east of San Pedro and Quebrada Honda are still based on a limited fieldwork. Thus, the number of species recorded in these areas should be taken as a minimum. The Romerillos area, where 182 species have been recorded based on limited fieldwork, might well harbor over 300 species.

As described, the species list for Cajanuma has continued to grow whenever additional field surveys have been conducted in the area. This pattern is unlikely to be unique, therefore we expect to see the list for the other less surveyed areas of Podocarpus National Park (see Table 1) and the total list to continue to grow at a considerable rate when further ornithological sur-

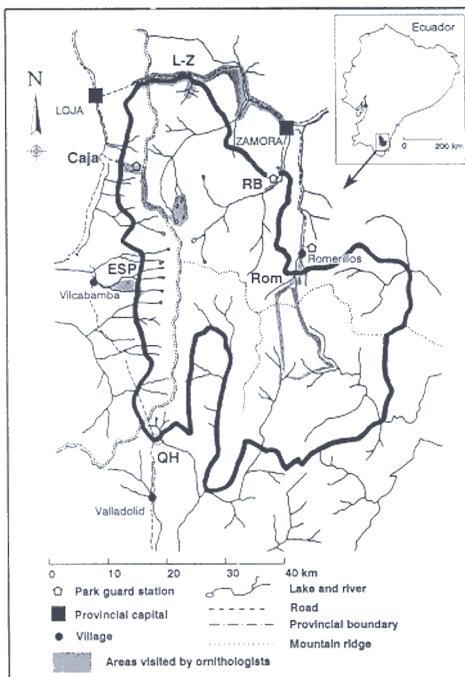


FIG. 1. Map of Podocarpus National Park. Grey shading indicates the six areas surveyed so far. ROM: the Romerillos area, which includes the trail from the village of Romerillos to Quebrada Avioneta, at 1550–2000 m (mid-montane zone), and a briefly surveyed area at 2000–2800 m (mid- to upper-montane zone) south of the main area; RB: the Río Bombuscará area around the National Park Administrative Center, 950–1300 m (lower-montane zone); L-Z: the Loja-Zamora Road and adjacent areas, 1000–2800 m (lower- to upper-montane zone); Caja: the Cajanuma area from the entrance to the national park up to adjacent páramo and lakes, 2500–3700 m (upper-montane zone); ESP: the area east of San Pedro de Vilcabamba, 1900–3300 m (mid- to upper-montane zone); QH: the Quebrada Honda area, 1800–2550 m (mid-montane zone).

TABLE 1. Number of bird species known from the six surveyed areas of Podocarpus National Park (data compiled from Rasmussen & Rahbek 1994). Figures in brackets show the number of species recorded only by Chapman (1926). TI indicates the thoroughness (arbitrarily judged) of investigation for each area: 1 = superficially investigated areas; 2 = reasonably well-surveyed areas that presumably still harbor several unrecorded species; 3 = well-surveyed localities with nearly complete species-lists.

Locality	Altitude	Number of species	TI
Romerillos area			1
Río Bombuscará area			2
Loja-Zamora Road area			2
Cajanuma area			3
East of San Pedro area			1
Quebrada Honda area			1

TABLE 2. The number of bird species in Podocarpus National Park found in the lower-montane zone, mid-montane zone, and upper-montane zone, defined respectively as 950–1500 m, 1500–2500 m and 2500–3700 m (data compiled from Rasmussen & Rahbek 1994). Figures in parentheses show number of species that have been found in the park, but not yet in the specific elevation zone, although they probably occur here.

Life zone	Number of species
Low-montane zone	300 (54)
Mid-montane zone	317 (69)
Upper-montane zone	209 (29)

veys in these areas hopefully are carried out. A "true" figure for the total number of species in Podocarpus National Park may well be 600–800 species.

THE AVIFAUNA IN A REGIONAL AND INTERNATIONAL PERSPECTIVE

Podocarpus National Park is the only area of southern Ecuador under park protection. Furthermore, it is the only area in the Andes of southern Ecuador which still has undisturbed continuous habitats that might be large enough to support viable populations of many Andean species. Seven of the 43 threatened bird species of mainland Ecuador occur in Podocarpus National Park (Bloch *et al.* 1991, following the new IUCN criteria used in Collar *et al.* 1994). This includes 3 of the 10 species of parrots which occur in the park, namely, the endangered *Haplospittaca pyrrhops*, the vulnerable *Leptosittaca branickii*, and the vulnerable *Pyrrhura albipectus* (Bloch *et al.* 1991). In "Threatened birds of the Americas" (Collar *et al.* 1992) it is suggested that to secure the survival of *Pyrrhura albipectus*, an Ecuadorian endemic, the major task is perhaps to assure the long-term future of Podocarpus National Park (see also Bloch *et al.* 1991, Toyne & Jeffcote 1992, Toyne *et al.* 1992). This is the only protected area in which the species occurs. Also the vulnerable *Penelope barbata*, endemic to southernmost Ecuador and northern Peru, and the vulnerable *Galbula pastazae*, endemic to the east slope of the Andes throughout Ecuador (with one locality in Colombia), have important strongholds in Podocarpus National Park (Bloch *et al.* 1991, Collar *et al.* 1992, Poulsen & Wege

1994). The newly described *Doliornis remseni* (Robbins *et al.* 1994), first found in Podocarpus National Park in 1989 (Bloch *et al.* 1991), is also listed as vulnerable (Collar *et al.* 1994), and only known from four localities (Robbins *et al.* 1994, Rasmussen *et al.*, in press).

Fifty-eight species of hummingbirds, approximately half of the 121 species known from Ecuador, have been recorded in the park. One of these is the near-threatened *Metallura odomae* (Bloch *et al.* 1991), which is only known from three sites in Ecuador and one in Peru (Collar *et al.* 1992), of which Podocarpus National Park is the only protected area. Other hummingbirds worth mentioning are *Lophornis stictolopha*, *Phlogophilus hemileucurus*, *Heliodoxa rubinoides*, *Coeligena iris*, *Heliangelus viola*, and *Opisthoprora euryptera*.

More than half (81) of Ecuador's 138 species of tanagers have been recorded in Podocarpus National Park. Among these, the vulnerable *Buthraupis wetmorei* (Bloch *et al.* 1991) known from only six localities in southern Colombia, Ecuador and northernmost Peru (Collar *et al.* 1992) appears to be fairly common in bushy páramo habitat. Other tanagers include *Chlorophonia pyrrhophrys*, *Piranga rubriceps*, *Chlorotraupis carmioli* (in Ecuador known only from this area), *Sericossypha albocristata*, and *Chlorospingus parvirostris*.

Other species that can be regarded as rare or local comprise *Harpyhaliaetus solitarius*, *Oroaetus isidorei*, *Gallinago imperialis*, *Bolborhynchus lineola*, *Otus petersoni*, *Asio stygius*, *Aegolius harrisii*, *Steatornis caripensis*, *Micromonacha lanceolata*, *Andigena nigrivestris*, *Campylorhamphus pucheranii*, *Siptornis striaticollis*, *Grallaricula peruviana*, *Myiophobus lintoni*, *Knipolegus poecilurus*, *Ampelion rufaxilla*, *Notiochelidon flavipes*, *Turdus fulviventris*, and *Saltator cinctus*.

In recent years, the focus of international concern and conservation politics has shifted from single species toward biodiversity (Bibby *et al.* 1992), including the overall diversity of all groups of organisms. In this respect the park is unique with its extreme diversity of birdlife.

Podocarpus National Park is globally important, not only because the existence of the park is probably crucial for the global survival of several globally threatened and near-threatened species, but also because it contains a high number of specialized Andean forest taxa. The lower

slopes of the Andes from about 1000 m to about 2500 m, especially in Ecuador, are seriously affected by colonists and the forest is disappearing at an alarming rate. In southern Ecuador, where in some regions less than 5% of the original forest remains (Bloch *et al.* 1991), Podocarpus National Park is the only Andean area with large areas of continuous forest. If nothing changes, we might in the future witness a landscape in which most of the forest outside the national parks in Ecuador (and throughout the Andes) has been cut, or is heavily disturbed. Even though most of the species that occur in the Podocarpus National Park are not threatened at the moment, the survival of many forest-dependent Andean species that are not currently threatened, may in a longer time perspective depend on preservation of such areas. The function of national parks is not only to secure the future of the threatened species of today, but also to secure the long time survival of the remarkable diverse life of the Ecuadorian Andes.

OTHER GROUPS

Unfortunately, birds are the only group of organisms for which the national park has been thoroughly surveyed. Some botanical surveys have, however, been conducted, primarily in the western part of the park. The number of vascular plant species has been estimated to be between 3000-4000 (Madsen 1989), and the numbers of tree species recorded in one hectare plots at 2700-2800 m vary from 75 (Cajanuma) to 90 (south of the Yangana Pass) (J. Madsen, pers. com.). This makes the cloud forest of Podocarpus National Park the richest in tree species known in Ecuador (J. Madsen, pers. com.). Since birds are easier to survey than vascular plants for a larger area, this (rough) correlation suggests that birds has a potential use as indicators of overall biodiversity (see Bibby *et al.* 1992, but see also discussion in Bloch *et al.* 1991).

No thorough survey of the park's mammals has yet been conducted. Yet, a high richness in mammalian species may be indicated by the known occurrence of rare mammals such as the Mountain Tapir *Tapirus pinchaque*, Giant Armadillo *Priodontes maximus*, Northern Pudu *Pudu mephistophiles*, Spectacled Bear *Tremarctos ornatus*, Jaguar *Panthera onca*, and Woolly Monkey *Lagothrix lagotricha* (Bloch *et al.* 1991, Toyne

& Jeffcote 1992). Podocarpus National Park is perhaps the world stronghold of the Mountain Tapir and is probably extremely important for the survival of the Spectacled Bear. Preliminary data on butterflies (P. Toyne, *in litt.*) indicate a similar high level of richness of Andean species as in birds, plants, and possibly mammals.

ECOSYSTEM SERVICES

Podocarpus National Park is not only important for the conservation of biodiversity, it also provides important ecosystem services to local people. The forested slopes play a key role in preventing soil erosion and maintaining the moisture balance of the region.

Access to clean water is already a major critical problem around the world. Podocarpus National Park is the principal water source for large urban and rural populations (two provincial capitals are situated near the park). These water sources are the start of several large rivers and are essential for agriculture in the area.

Fog condensation contributes substantially to water storing capacity, especially in the cloud zone where large mats of epiphytic bryophytes can intercept large amounts of water (Pócs 1980, 1990; Gradstein & Pócs 1989). An undisturbed cloud forest with a natural, heavy load of epiphytes is capable of holding more water than a degraded forest with a lesser amount of epiphytes.

If the forest of Podocarpus National Park is removed, nothing will hold the water from being drained more rapidly by the many streams and rivers in the area, and the thin layer of topsoil will be washed away with the water. This will result in an irregular and seasonal water supply, something undesirable for the inhabited valleys surrounding the park. The preservation of the natural forest of Podocarpus National Park is thus crucial for the welfare of the human populations inhabiting the rainshadow areas in the valleys around it.

Because of the rapidly growing population in Ecuador, one of the most important natural resources will be access to permanent, clean, and abundant water, all-year round. An unimpaired mountain forest system with its complex structure and high biodiversity is the best guarantee to have stable water resources in the future.

THREATS TO THE PARK

The park was designated as such in December 1982. But its protected status is poorly respected, and the area is under severe pressure due to several different illegal and semi-legal activities. These threats to Podocarpus National Park are caused primarily by the continuous impact of the human population on the park and by activities that have a brutal impact on the national park, such as gold mining and road building.

Podocarpus National Park is situated very close to the cities of Loja (pop. 96000) and Zamora (pop. 8000), provincial capitals in Loja (9930 km²) and Zamora-Chinchipec provinces (22000 km²), respectively. Illegal colonization and pseudo-colonization (colonists clearing lands for future sale) are severe problems in the Río Sabanilla area, Río Bombuscara area, the Romerillos area, the Loyola area, and the southern part of the park (personal observations; D. Espinosa, pers. com.; R. Tapia, pers. com.; Calderón, undated in Toyne & Jeffcote 1992). Other problems are private land within the park boundary, illegal logging, illegal hunting, fishing with dynamite, illegal collection of orchids, and uncontrolled fires (see Bloch *et al.* 1991 and Toyne & Jeffcote 1992 for further information). Although illegal hunting, fishing, and orchid collecting have a negative, and obvious impact on the national park, the major problem resulting from human activities in the area is deforestation. This is associated with colonization, but is also one of the negative results of mining inside the park.

Approximately 99 % of the national park was until recently given away in mining concessions by the Instituto Ecuatoriano de Minería (Calderón, undated in Toyne & Jeffcote 1992). Mining activities occurred primarily along the Río Sabanilla, Río Bombuscara and especially along the Río San Luis and around Loyola (Toyne & Jeffcote 1992, Toyne & Kapila 1993). Alarming high levels of mercury contamination (ranging from 4.51 to 61.2 µg/g) have been measured recently in the river sediment at Río San Luis (Toyne & Kapila 1993). Fortunately, commercial mining as well as the activities by hundreds of illegal goldminers that followed the opening up of trails into the park by the mining company seemed to have been stopped during 1993 due to local and international pressure from conserva-

tionists and scientists (see Anonymous 1993 and Grylls 1993 for more details).

Plans to build roads from Romerillos to Loyola through the national park and from Yangana to Numbala have been suspended recently. However, both mining and road-building plans may well resume, if the current political situation changes. Either or both of these activities will result in major deforestation. Furthermore, the Romerillos-Loyola road will divide the park into two halves and open it up for exploitation. With time such a road will lead to a conspicuous reduction in species richness of Podocarpus National Park.

THE FUTURE OF THE PARK

Several measures must be taken to insure that the diversity of natural habitats and the species richness of Podocarpus National Park remain secure. A comprehensive, up-to-date management plan should not only be worked out, but mostly implemented, and the needs of local communities should be further studied in detail before a sound management plan can be proposed. High priority should be given to an evaluation of the role of human impact on the vital services of the water catchment forests of the park, in order to incorporate knowledge from such studies in future socio-economic development plans for the area. In addition, the area's high potential for ecotourism should be carefully developed, so that the local population receives a fair share of the economic benefits. Finally, it goes without saying that continued faunistic research should be carried out (see Bloch *et al.* 1991, Toyne & Jeffcote 1992 for more details).

In recognition of Ecuador's importance for maintaining the Earth's biodiversity and because Ecuador can expect only a limited economic return from its impressive biodiversity, a World-bank Global Environmental Facility (GEF) project for preservation of Ecuador's biodiversity has been proposed (Anonymous 1992). The aim of the 36 million US\$ project is to develop management plans for Ecuadorian national parks, including Podocarpus National Park, and for their areas of influence, including urban areas. The project is innovative in that it would "promote establishment of an efficient fiscal system to collect revenues from resource use and to redistribu-

bute those revenues to support the protection of biodiversity" (Anonymous 1992). The objective is "to establish a management, financial and institutional framework in which the national parks system generate [*sic*] revenues on a scale to defray a large part of their management costs" (Anonymous 1992). It is our sincere hope and strong recommendation that the proposed GEF project will be implemented, so that Podocarpus National Park with its unique and diverse flora and fauna can be preserved. However, in such large internationally controlled projects, it is important not to forget or neglect the role of Non Governmental Organizations (NGO's), i.e., local environmental groups such as Fundación Ecológica "ARCOIRIS" (meaning rainbow) in Loja. ARCOIRIS is working hard to protect the park and promoting it at a local level. They were, for example, the initiators of the local campaigns that lead to an end of the road-building plans and mining activities in the park.

NGO's are often more successful than governmental institutions and thus should be more involved in development in human resources, local organization and motivation aspect. If possible, this should be conducted in an effective collaboration between NGO's and government agencies. ARCOIRIS has often been successful in promoting environmental matters regarding Podocarpus National Park by establishing a climate of confidence with the local communities. NGO's often can promote work with less "red tape" than governmental departments (including the local national park administration). With external funds ARCOIRIS has since 1991 conducted information and education programs with the aim of creating public awareness about issues regarding Podocarpus National Park. These awareness-raising programs have been carried out successfully primarily in schools, but also for the general public, and include excursions to the visiting centers of the national park. Support of such local engagement is vital for the survival of the park.

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