



# PARKS WATCH

Strengthening Parks to Safeguard Biodiversity

## Park Profile - Argentina

# Lago Puelo National Park

**Date of latest field assessment:** April 23, 2005

**Date of publishing:** July 2005

**Location:** Northeastern area of Chubut, 19 Km from El Bolsón.

**Year of creation:** In 1937, as an annex of Los Alerces National Park; in 1971 as an independent Park and National Reserve

**Area:** 27674 ha (of which 9600 are National Reserve)

**Eco-region:** Valdivian or Valdivian Temperate Forests

**Habitats:** Temperate Cypress, Austral Beech, and Valdivian forests



*View of Puelo Lake and the "Tres Picos" Mountain (photo © Felix Vidoz)*

**Autors:** Monjeau, Adrian; Nazar Anchorena, Sofia; Montoni, Victoria Fernandez; Marquez, Jorge; Alcalde, Daniel; D'Iorio, Ana; Galván, Hernán; Denholm, Cristian; Di Vincenzo, Andrés; Gonzalez, Fabián.

## Summary

### *Description*

Lago Puelo National Park was created with the purpose of preserving the breathtaking landscape that awed the first surveyors that arrived in the area. Later it was discovered that the area harbors some species once thought exclusive of the Trans-Andean Valdivian Rainforest that had not been found in any other Andean-Patagonian National Parks. The World Wildlife Fund (WWF) has determined that the Valdivian Eco-region and the Valdivian Temperate Rainforests of Argentina and Chile are among the priority sites for conservation of global diversity (Dinerstein et al. 1998). Lago Puelo is the smallest of the Andean-Patagonian Parks that form part of the corridor (excluding Los Arrayanes National Park, which is part of the Nahuel Huapi National Park, a larger unit).

### *Biodiversity*

The Puelo area harbors unique Argentinean flora specimens that thrive regardless of the scant rainfall and the negligible elevation of the area (200 m ASL). Notable examples are the Valdivian elements that co-exist with specimens unique to the transition forest between the rainforest and the Patagonian steppe. Species such as Chilean Hazelnut (*Gevuina avellana*), ulmo (*Eucryphia cordifolia*), tique, and lingue (*Persea lingue*) make up the most extensive native flora patches of the Andean Patagonia, as well as Mountain Cypress or “alerce” (*Fitzroya cupresoides*), coihue (*N. dombeyi*), radial, arrayán (*Luma apiculata*), lenga (*N. pumilio*), and shrubs and smaller trees such as pañil (*Buddleja globosa*), pitra (*Myrceugenia Exsucca*), espino azul (*Acacia cavenia*), maqui (*Aristotelia chilensis*), calafate, tiaca (*Caldcluvia paniculada*), tepú (*Tepualia stipularis*), etc. The park, however, does not harbor any relevant fauna, because the resident species also thrive in other parks of the region. A few areas have outstanding huemul (*Hippocamelus bisulcus*) and pudú (*Pudu puda*) deer populations, as well as one endemic amphibian. The northern branch of the Puelo Lake is the wealthiest site, with many individual conservation values, especially the relictual hygrophilous forests near the Melo River, in the Cuevas Hill area.

### *Threats*

Forest fires and cattle herding, the increase of visitors to the northern area of the lake and the population increase of the surrounding populations, both in Argentina and Chile, are the most worrisome threats to the park's natural heritage. Exotic bushes creep upon already disturbed areas, and sweet briar, an exotic bush, has proliferated throughout the Park and invaded territory formerly used for cattle herding, which increases the epidemiological risk of Hantavirus. Several other herbaceous plants and fruit species have also been introduced, for example blackberry, willow, acacia, Jerusalem thorn, maple, juniper, birch, and Monterey cypress. The uncontrolled dissemination of exotic evergreen species inside the native forests is worrisome, because they have even overtaken formerly pristine areas. The presence of introduced mink, wild boar, and salmon has been of detriment to the native biological diversity. Population growth and illegal and legal land occupation in the Turbio area does not comply with the National Reserve's sustainability objectives. The basin of the Puelo Lake relies mainly on the massive ice beds at the headwaters of the Turbio River, and for this reason the global climactic changes might directly affect the hydrological balance of the system, making it almost exclusively reliant on rainfall. The zones that surround the

Park have been totally deforested and cause the water to flow without permeating the forests. The fact that the basin is too large for a very small collector makes the problems worse. This feature and deforestation cause heavy rainfall to increase the dramatic seasonal elevation of the lake waters. The Azul River carries sewage from the Lago Puelo and El Bolsón districts and other surrounding settlements and pollutes Lake Puelo, although the current rapid renovation of the waters (1,1 years) of the lake has taken care of this. The exponential demographic increase throughout the basin, plus the natural increase of the resident population and the intense internal migration due to residents wishing to abandon the large cities may increase the intensity of the impact. There are plans to build important highways that will run across Paso Puelo, which would greatly endanger the most important and already scarce natural areas with Valdivian features. Solid waste scattered throughout the park, especially along the beach, and the solid refuse from cities and towns, that is transported by the rivers, have permanently marred the coastal landscape.

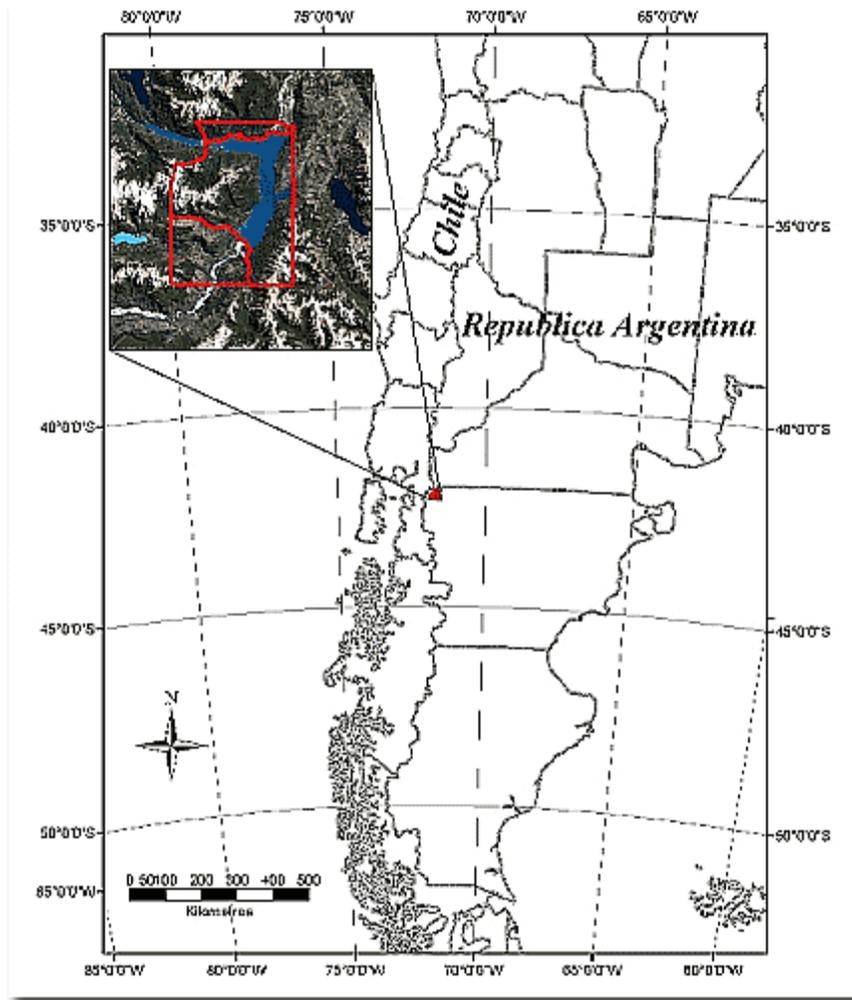


*View of the Puelo Lake and the Aguja and Los Hitos Norte Mountains on the Chilean border  
(photo © Felix Vidoz)*

## **Description**

### *Geography*

Lago Puelo National Park was created in 1937 as an Annex of Los Alerces National Park and was declared an independent National Park and Reserve in 1971. It is located in the northeastern area of the Chubut province, on the Chilean border. The Park covers 27,674 hectares, of which 9,600 correspond to the National Reserve. The Administrative Offices are located 3 Km from Lago Puelo. The Park is located 19 Km south of El Bolsón, 120 Km from Bariloche, and 160 Km from Esquel (Map 1).



Map 1: Location of Lago Puelo National Park

## Climate

The climate is humid-temperate and the seasons are clearly marked: winters are fresh and rainy (average temperature  $+5^{\circ}\text{C}$ ), summers are dry (average temperature between  $16^{\circ}\text{C}$  and  $18^{\circ}\text{C}$ ,  $37^{\circ}\text{C}$  max). The average annual temperature is  $11^{\circ}\text{C}$ . The climate is more benign than that of the surrounding landscape due to the negligible elevation ASL and the lake's moderating effect. The recreational area closes down during the coldest four months, frost kills off Antarctic beech (*Nothofagus Antarctica*). It generally rains between May and October. Average rainfall is approximately 500 mm in the western boundary of the basin, and 2,000 mm in the international boundary. Winds are scarce and do not surpass an average of 15 Km/h at the meteorological station. At the northern shore of the lake, however, winds can reach 60 Km/h or more, which cause "short" waves which are difficult to navigate. Summer evenings are quite windy, especially in January. The daily wind speed average is 4.5 Km/h (18 Km/h/day at the shore.)

The central part of the lake and the Turbio River valley are protected by elevated mountains and are therefore not affected by the cyclic winds that blow through the Puelo pass, which

elevates the temperature (+35°C.) The surface temperature of the lake during the summer is very pleasant, with an average of 18°C; the first thermocline is at approximately 2 m from the surface, which creates an exceptional natural wading site. The temperature at the small shore of the recreational area has been reported at 23 °C in the evening<sup>1</sup> (information from the Patagonia Technical Delegation).

## Geology and Geomorphology

Granite rocks are plentiful throughout the park. Glaciers used to cover almost the total surface of the park during the Pleistocene and, in consequence, glacial erosion formations abound in the park as well as “U” shaped vast valleys, whose unstable hillsides are constantly altered by landslides. A secondary moray forms the lake, which is a natural ditch. The most recent fluvial deposits have had an important role in fashioning the present landscape. The important fluvial platforms of the Azul and Turbio Rivers and the large alluvial fans of the deltas of the Aguja, Melo, Bravo, Los Hitos and Las Lágrimas Rivers are some of the most notable features of the zone. Because the park is located very close to the delta of the lake at the Puelo River, the very strong currents of the alluvial fan of the Los Hitos River accumulates large clasts that form a natural dam for the lake, which in turn narrows the natural drainage of the Puelo River.

Clear granite rocks form most of the mountains<sup>2</sup> and the fluvial-glacier activity gives way to sand and clay deposits.

## Hydrology

The area of the park is mostly inside the basin of the Puelo River, which drains into the Pacific Ocean. The Puelo Lake and the Manso River and Ventisquero Rivers sub-basins form the main basin (Vidoz 2000). The headwaters of the three main basins, with highly developed glaciers that supply the Puelo Lake, are outside the park's boundaries. Two basin headwaters that are of less importance than the aforementioned are Cuevas Hill, which feeds several streams, and Cordón Derrumbe, both inside the park.

Lake Puelo's maximum depth is 185 m. It is of medium size (4,500 hectares) and feeds off three important hydrographic basins (Turbio, Azul, and Epuyén Rivers), and/or heavy rainfall and constant ice melting and at times its level increases (approximately 15 cm/hour), which causes maximum overflows of some 5 meters above average. This characteristic sometimes causes floods that damage the tourist facilities in the shore of the Recreational Area. The flood line can be seen from afar when the waters of the lake are shallow, a phenomenon frequent in manmade dams. The turquoise hue of some areas of the lake is caused by clay dissolving into the colloidal solutions that seep from the glaciers.

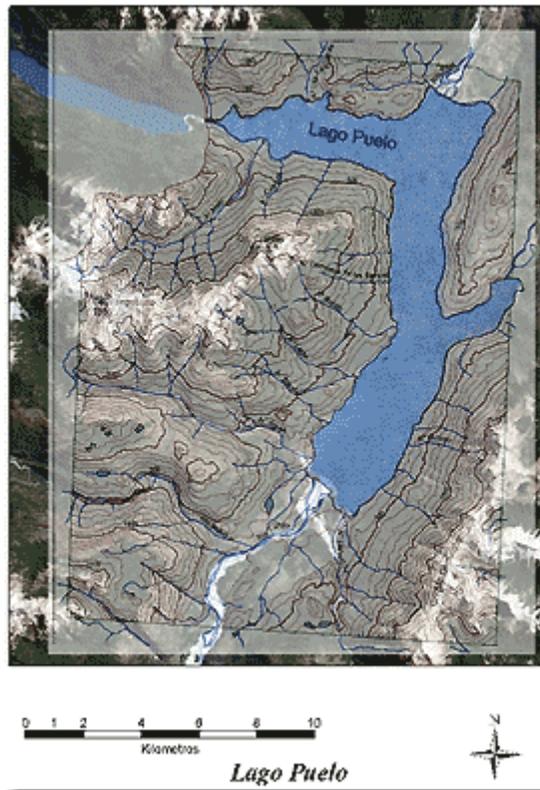
---

<sup>1</sup> The photic zone is approximately 25 meters deep. Thermocline is at approximately 33 meters in late summer; this depth varies throughout the lake. The nutrient and chlorophyll values indicate a state of oligotrophy.

<sup>2</sup> From an average age of 100 million years (but fluctuates between 14 and 317 m.a.– Lizuain, A. op cit.)



*Map 2: Topographic map showing the most important internal rivers*



*Map 3: Headwaters of the basins inside the protected area*

## Access

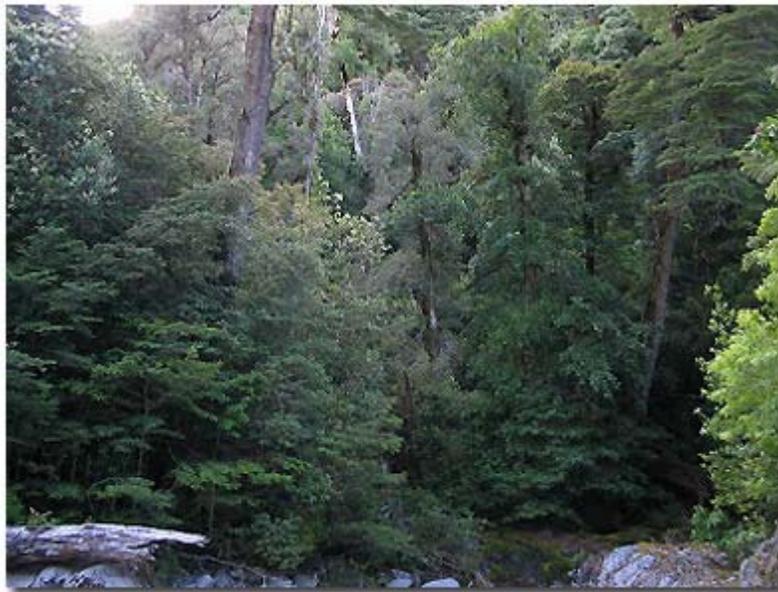
National Highway 258, which is completely paved, links Bariloche and Esquel. This road runs 14 Km from the north of the park and facilitates access into it. The closest population center is Lago Puelo, with 5,500 inhabitants. The suburbs and tourist villas are 1,500 m from the lakeshore.

Former National Highway 258 (currently part of National Highway 40) runs 135 Km from San Carlos de Bariloche to the city of El Bolsón. From here, province route 16 takes the traveler directly to the Lago Puelo town; the road is paved up to the lakeshore, inside the National Park. From Esquel, the trip is done through 155 Km of paved road on former National Highway 258 (currently part of National Highway 40) up to Lago Puelo.

Medium- and long-distance bus companies travel to Lago Puelo. Some of these companies are El Valle, Vía Bariloche, Don Otto, Mar y Valle, Crucero del Norte, etc. (Vidoz 2000).

## *Biodiversity*

### Flora



*Coihue forest (photo © Lago Puelo N.P. Felix Vidoz)*



*Lenga forest (photo © P.N.Felix Vidoz)*



*Valdivian forest in the Melo River (photo © Felix Vidoz)*

The most prevalent forests are those typical of the Andean North-Patagonian region, which are characterized by the presence of southern beech (*Nothofagus dombeyi*) and cypress (*Austrocedrus chilensis*) in the lower areas of the valleys of up to 1,000 meters of altitude, and lenga forests, between 1000 and 1500 meters. Mixed cypress and coihue forests are most prevalent in hillsides from lake level to 1,000 meters. This type of vegetation is characteristic of a more closed superior stratum, from 15 to 30 meters of altitude, where coihue trees predominate. A second more open 8-meter stratum is mostly populated by cypress, *Guevina avellana*, *Lomatia hirsuta*, and other species. There is also a shrub stratum and a rich multi-species moss stratum. Cypress forests and those with cypress and

palo piche (*Fabiana imbricata*) develop mostly on very rocky substrates. Some hillsides, especially those under 1,100 meters, develop radial and notro mixed forests, which flourish after forest fires. The superior stratum is from 2 to 4 meters high, closed, mostly populated by radial and the secondary species maqui (*Aristotelia chilensis*) and notro. These forests harbor the highest number of reported species (91 spp.).

Temperate hillsides under 600 m ASL and the continuity of the Paso Puelo valley foster the presence of several species typical of the Chilean Valdivian forest, such as Chilean hazelnut (*Gevuina avellana*), lingue, *Aextoxicon punctatum*, ulmo, and ñipa (*Escallonia leucantha*) that do not survive at higher altitudes. These species are present in Argentina almost exclusively in the area of Puelo, and for this reason the park is of capital importance for the preservation of the species in the country. The forest of mixed Valdivian species is especially prevalent in the northeast of the park. Coihue is the dominant species of this type of vegetation, and the secondary tree stratum is wealthy in cypress, hazelnut, tineo, lingue, olivillo, tiaca (*Caldecluvia paniculata*), palo santo (*Dasyphyllum diacanthoides*), and laurels (*Laureliopsis philippiana*), depending on the shade and humidity conditions. An abundant moss stratum can also be found in the most humid areas. Above 500 meters of altitude, olivillo, lingue, and ulmo dwindle, and hazelnuts are absent above 700 meters.



Chilean hazelnut (*Gevuina avellana*) with fruit (photo © Felix Vidoz)



*Chaura* (*Pernettya furians*) (photo © Felix Vidoz)



*Ulmo* flowers (*Eucryphia cordifolia*) (Photo © Felix Vidoz)

The valley of the Melo River has special features. Although having been under heavy herding activity and being burned for agricultural purposes until the park was created, a handful of very humid areas escaped the fire. Some of these include the upper river basin, which has a dense coihue, *Fitzroya cupressoides*, *Saxegothaea conspicua*, *Weinmania trichosperma*, and *Laureliopsis philippiana* forest, and small areas on the shore above 460 meters, with a forest of coihue, tineo, and laurel, and a secondary stratum of “picha picha” (*Myrceugenia planipes*), which is the most exuberant flora landscape of the protected area, with healthy populations of *Hydrangea serratifolia* and “pil pil voqui” (*Campsidium valdivianum*) ivies, large ferns (*Losophoria quadripinnata*) and *Blechnum magellanicum*, and epiphyte moss (*Camptochaete orbiculata*).

Shrubs and pastures abound in the deep valleys of the Azul and Turbio Rivers, along with small arrayán (*Luma apiculata*) and pitra (*Myrceugenia exsucca*) forests, as well as forests populated by exotic willow (*Salix fragilis*), which invades the few beaches of the river, or a handful of spots of ñire and radial that mix with pastures. Total pitra forests, adapted to flooded and poorly drained environments, form a beautiful community. There are several pitra communities in the park, with individuals of great size.

Forest fires have had great incidence upon the actual flora composition of the park. During the present century, fires of varied intensities and magnitudes have affected an important percentage of the surface of the protected area. The current flora corresponds to successive post-fire stages of the original forests. In general terms, coihue and cypress are doing very well and many young individuals have started to cover the hillsides. Young hazelnut trees are also thriving and attest to early successive stages. (Vidoz 2000).



*Burnt hillside in recuperation (photo © Felix Vidoz)*



*Forest recuperating after a fire (photo © Felix Vidoz)*

## Fauna

The fauna of the park is characteristic of the Sub-Antarctic province. A complete list of birds and amphibians has been developed, but information regarding other groups is yet to be finalized. The completion of the roster is an important task to accomplish for the better understanding of the park's biodiversity.

Before being declared a national park, several exotic and sports-worthy fish species had been introduced to the lake, such as Rainbow, Brown, and River Trout. Currently, Pacific

and Atlantic salmon have been introduced from Chilean fisheries located at the delta of the Puelo River, in the seashore.

The *Eupsophus emiliopugini* amphibian was just recently discovered (March 1998). This species had not been reported for Argentina, and seems to thrive in the very humid cohicue/tiaca forests of the mid-valley of the Melo River, very close to the Chilean border<sup>3</sup>. Significant *Bufo rubropunctatus* toad populations have been reported in semi-open environments in the eastern zone of the park (Vidoz 2000).



*Eupsophus emiliopugini*, an endemic frog (Photo © Felix Vidoz)

There have not been any specific discoveries of reptiles in the National Park, and the only data are reports of sporadic encounters with some species (*Liolaemus pictus*, *Tachymenis chilensis*, *Diplolaemus* sp.) (Vidoz 2000).

The National Park has the typical aquatic habitats of the Andean-Patagonian lake area, such as rock shores, streams and rivers, lakes, and areas prone to flooding. However, there are notable aspects and environments suitable for birds: the deltas of the Turbio and Azul Rivers, in the north and south headwaters of the lake, respectively. Among the species reported, variable numbers of *Cygnus melancoryphus* can be seen almost every year, as well as *Anas georgica* and *Fulica armillata*, although the numbers of the latter species are quite uneven. *Merganetta armata*, considered “rare” in Argentina (Úbeda y Grigera, 1995), has been reported in Paso del Puelo and the Alerzal and Derrumbe Rivers. Some species common to the area (*Nycticorax nycticorax*, *Anas georgica*, *A. flavirostris*) nest in very humid and periodically flooded pitra forests. Some sea bird species visit Lake Puelo once in a while, like *Oceanites oceanicus*, *Sterna hirundo*, *Calidris alba*, *Calidris melanotos*, and *Phalacrocorax atriceps*<sup>4</sup>.



*Tachymenis chilensis* snake (Photo © Felix Vidoz)

<sup>3</sup> This species was described for the first time in 1989 in Chile, where its distribution is somewhat restricted, from the Termas de Puyehue to Caleta Vidal (Aisén province). This discovery is perhaps related to Puelo’s characteristic altitude, climate, and flora.

<sup>4</sup> A group of fishermen reported sightings of the *Pelicanus thagus* pelican in Lago Puelo, in the “Desemboque” (delta) area outside of the National Park, and in 1962 a *Pelecanoides magellani* individual was captured in El Bolsón (Daciuk 1977).

The Brazo Epuyén branch, the only part of Puelo Lake that lies outside the jurisdiction of the National Park, harbors a highly different environment and biodiversity than the rest of the region. The Desemboque area has the longest arm of the lake and it attracts some species that are not frequently seen in the Andean-Patagonian area. This is the case of *Tachuris rubrigastra* and *Agelaius thilius*, which are birds that highly depend on reeds for survival. Although some areas inside the National Park are indeed populated by reeds, they are not large enough to be used by those species.

Many Andean-Patagonian land bird species reside inside the National Park. Among the most notable, *Columba araucana*, a pigeon that has been classified as "rare" (CARPFS, 1995) and is endemic to the region, exhibits healthy numbers of winter metapopulations in the pitra forests of the north area. This species nests in the area. Park ranger Félix Vidoz has seen other interesting species such as *Eugralla paradoxa*, *Buteo ventralis*, and *B. albigula*<sup>5</sup>. Remarkably, it has been confirmed that *Colomba araucana* nests in the National Park, because there is very limited information regarding its nesting habits in both Argentina and Chile.



*Condor* (Photo © Felix Vidoz)



*Colomba araucana* (Photo © Felix Vidoz)

---

<sup>5</sup> Vidoz et al, op. cit.

Regarding small mammals (rodents and marsupials), some Hantavirus hosts have been captured in the eastern area of the Park. Existing records of the species are very limited<sup>6</sup>. The Park harbors the medium and large mammals typical of the region and similar to the populations reported for other neighboring National Parks. More studies are necessary to acquire information about bats and to determine what large felines reside in the area (whether it is *Oncifelis guigna*, *Oncifelis geoffroyi*, or both). The huemul is often seen in the mountainside of the Cuevas Hill and other areas of the park<sup>7</sup>, as well as in surrounding protected areas: "La Esperanza" Wildlife Refuge (Fundación Vida Silvestre Argentina, FVSA) and the Río Turbio Province Park and Multiple Use Reserve). It has been confirmed that this species wanders from one area to the other<sup>8</sup>.



*Huemul in Cuevas Hill (Photo © Felix Vidoz)*

Pudú has been confirmed in the north end of the National Park, especially close to the Police Station and the recreational area, as well as other areas of the National Park<sup>9</sup>. Pudús have also been seen in the "La Esperanza" Wildlife Refuge and it is presumed that there is a healthy population of the species in the area.

Park rangers and residents have reported that *Lontra provocax* disappeared from the park some 30 years ago (Chehébar et al, 1984)<sup>10</sup>.

Although the macro crustaceans *Aegla abtaoriolimayana* and *Sammastacus spinifrons* are very abundant and vital links of the trophic network of the lakes and rivers of Lanín and Nahuel Huapi and the nearby basin of Chubut River, they do not exist in Lago Puelo and Los Alerces National Parks (Chehébar et al., 1984). The aquatic communities therein are

---

<sup>6</sup> More intense studies are still of the essence, particularly in the western area. Due to the peculiar climactic and flora characteristics of the area, the results might be surprising, i.e., it might be confirmed that the marsupial *Rhyncholestes raphanurus*, does indeed exist in Argentina; so far, it has only been reported by two persons.

<sup>7</sup> The existing records of the Cordón Derrumbe area, on the eastern boundary of Lago Puelo, particularly in the headwaters of the Ocinao, Silva, and La Escalera Rivers, suggest the presence of at least one family group. These animals might be in contact with other groups of huemules in the east (Alto Epuyén River and Cholila Range) and south (Derrumbe River and Cubridor Range) inside the limits of the National Park.

<sup>8</sup> Vidoz et al, op. Cit

<sup>9</sup> Due perhaps to more reports from visitors than the actual pudú population of the Park.

<sup>10</sup> The freshwater environments of Northwestern Patagonia seem to be quite important for southern river otters and macro-crustaceans that do not thrive in the Puelo basin. This fact leads us to suppose that the Park is not the ideal habitat for southern river otters and that the individuals reported might have been passing by or that very limited populations live in the park (Vidoz et al., op. cit.).

very different from those of the other Nor-Andean-Patagonian National Parks, perhaps due to glacier formations, a peculiarity that should be preserved.

### *Management*

One person is in charge of the management and administration of the area. The park has three permanent employees. Seven park rangers patrol the north area of the park and one is in charge of the Turbio River area. The fire brigade is outsourced; during the low forest fire season, there are four employees (they weed, post signs, etc.) During the summer, the park hires 10 more persons to extinguish every fire before they spread. In the case of fires that surpass the park brigade's capacity, The Coordinación de Lucha Contra Incendios Forestales (Forest Fire Combat Coordination), with headquarters in San Carlos de Bariloche and formed by representatives of the Dirección de Bosques y Parques del Chubut (*Chubut Parks and Forests Directorate*) and the Plan Nacional de Manejo del Fuego (*National Plan for Fire Management*) (Vidoz 2000), is readily available to lend staff and additional fire-fighting equipment, including a helicopter.

Persons interviewed believe that the staff is adequate to accomplish the protected area's objectives. ParksWatch has noted that all the park rangers, except one (in charge of the Turbio area) patrol the public bathing area, which is not a priority area for conservation but where very many visitors concentrate and presents urban complications. The manager of the park helps the park rangers to patrol the north area.

Interviews reveal that the park rangers and the administrative staff lack motivation; there is hardly any growth potential inside the park. The staff is very much underemployed, they lack training, and are not motivated. ParksWatch noted that the staff is assigned tasks that do not correspond to their areas of expertise (management, general information to visitors, and other time-consuming tasks that could be assigned to less specialized workers, as the park rangers). The most submissive workers are assigned way too many duties.

Ninety-five percent of the man-hours available in Lago Puelo National Park during the summer are invested in receiving the massive number of visitors to the public bathing area. Visitors have complained that this conveys an image that is not becoming to a National Park. Most of the future important facilities have been planned for this area.

- **Administrative Staff:** some administrative workers live in Lago Puelo. The Police Station is inside the park and it is believed that the administrative staff covers approximately 80% of the needs.
- **Technical Staff:** the technical support staff does not live in the park, but in Bariloche, more than 200 Km away (Patagonia Regional Delegation). The general opinion is that the protected area does not have any technical personnel.
- **Infrastructure and services:** the Park does not have any infrastructure, but the Reserve has one rustic and three camping sites, an interpretation trail, four mini trekking trails, two one-day trekking trails, a temporary information center in the main port area and another in the Administration Office. Both zones have produced

brochures and maps, have posted signs, and provide guide services and public transportation, which the Administration Office also does.

- **Equipment and materials:** The Park and the Reserve have control and surveillance vehicles, boats, riding gear, communications equipment, fire-fighting gear and tools (chainsaws, weed-whackers), and office supplies, although it appears that only between 60 and 80% of the needs are covered.
- **Financing:** The protected areas make use of permanent funds and the persons interviewed consider that those funds cover approximately 60% of the financial needs. The funds are not sufficient due to poor planning, unforeseen events that affect planned activities, and the inadequate and untimely transference of the necessary monies. At times, the park has been granted external funds that barely amount to a very low percentage of the main budget.
- **Budget:** We were informed that the preliminary budget for the 2005 payroll was \$217,100 (actual figures); \$264,709 for all other expenses (although, we were told, this total amount is not always obligated); Park admission fees from the beginning of the season until our next visit were calculated at \$100,000. This figure is expected to increase to \$120,000 at the end of the season. Tourist operators pay approximately \$18,000 for permits<sup>11</sup>. The fire brigade members earn \$900/month, which is almost the same as the salary of a park ranger with limited studies and no tenure.
- **Design/zoning:** Besides the division between the Park and the National Reserve, there is a Strict National Reserve area and two Wildlife Reserves, as well as areas for intense visitation. The Northern Reserve does not effectively buffer the Park due to design shortcomings. The Southern Zone's boundary overlaps with the Río Turbio Province Reserve. According to the staff interviewed, the management of the park fully coincides with the zoning categories.

According to the conservation value analysis carried out by ParksWatch<sup>12</sup>, there is an important difference between the conservation values ("green index" or NDVI, in tele-detection jargon, see Map 4) of the Park and the Reserve; the latter's is much lower. Inside the Park, the Strict National Reserve is precisely the one that protects more land with high conservation value. There are subtle variations regarding the accumulation of conservation values between the areas inside and outside the Reserve's boundaries. This is due to the conservation of pitra forests and other woodlands inside the western area. The Turbio area, however, does not exhibit any plausible differences between the areas inside and outside its limits. Both areas are quite deteriorated.

---

<sup>11</sup> The US dollar/Argentinean peso rate of exchange was 1/ 2.80-2.90 when this report was prepared, which means that Lago Puelo National Park's budget amounts to US\$220,000/month.

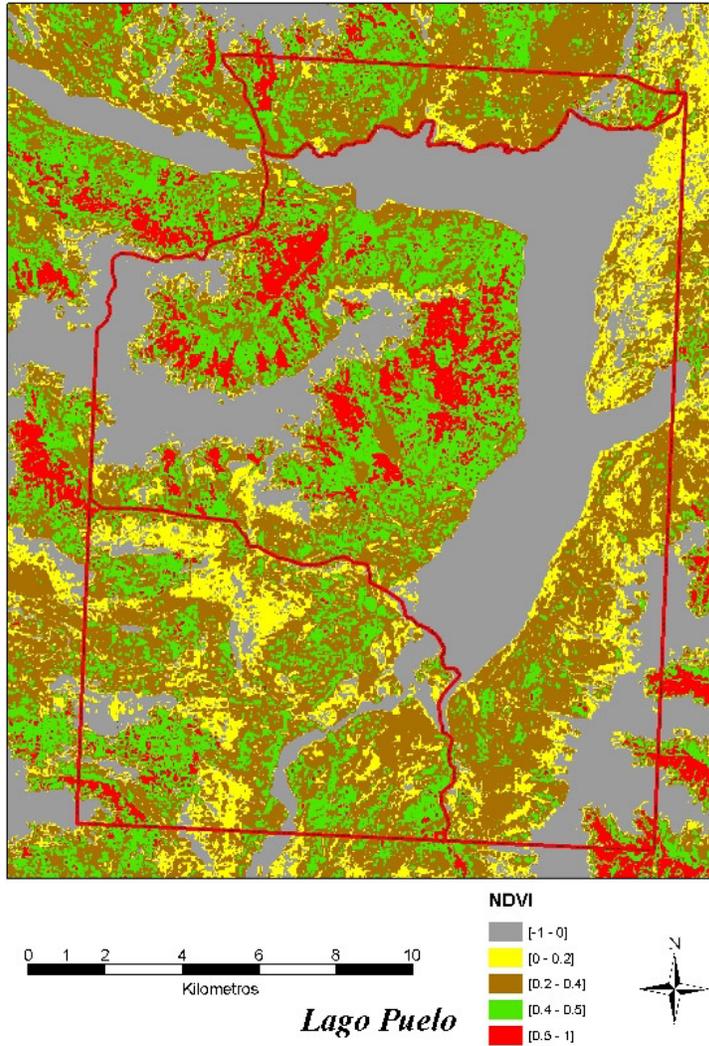
<sup>12</sup> The Green Index (Normalized Difference Vegetation Index or NDVI) was used as a remote surrogate to compare the conservation values of the areas inside and outside the Park's boundaries because it proved effective during the exploration of the park carried out by ParksWatch. The green index is a combination of remote sensor bands, which indicate a combination of environmental features that are directly related to the photosynthetic activity.

- **Planning:** The areas do not have approved management plans<sup>13</sup> and although their activities are based on Annual Operation Plans, they have barely accomplished 50% of the objectives.
- **Political context:** The opinions expressed by the interviewees regarding this issue vary greatly: some consider that political support is adequate, whereas others deem that it is not sufficient. Currently, the municipality of Lago Puelo no longer requests that the Chubut Province relinquish the Northern Reserve (the total north area of the lake), although it has been a long-standing appeal that stems from families established many years ago that do not agree with the new ecological current –namely, the Lemú Project– that pursues stricter conservation and the creation of a conservation corridor that will benefit the lakes<sup>14</sup>.
- **Data/research and data management:** information available includes base data; topographic, soils, use, and forest maps; aerial photography, and flora, mammal, amphibian, reptile, bird, and climate and hydrological information data. The random research that is carried out is for academic purposes and is not oriented to management.
- **Monitoring and evaluation:** Random monitoring of several resource conservation and management is carried out and the results are incorporated into management or conservation efforts.
- **Environmental education/extension/diffusion:** unplanned and random environmental education, diffusion, and/or extension activities are presented to residents, neighbors, and/or surrounding populated centers.
- **Boundaries:** just narrative and physically partial (Rusch 2002).

---

<sup>13</sup> ParksWatch has taken due notice that there is a preliminary Management Plan drafted by the former manager. The draft is at present being assessed by the park staff and other stakeholders.

<sup>14</sup> The Gondwana Project pursues the conservation of Austral Beech forests throughout the Southern Hemisphere (Argentina, Chile, Australia, New Zealand.)



Map 4: Distribution of the NDVI (Normalized Difference Vegetation Index) within Lago Puelo National Park and Reserve and the surrounding areas

### Human Influence

The human influence history of Lago Puelo dates to the pre-European hunters and gatherers that populated parts of the forests and tended their main source of income: guanaco (*Lama guanicoe*) and choique (*Pterocnemia pennata* – a small ñandú) herds in the adjacent steppes. One thousand year-old Paleolithic paintings can be seen throughout the shores of the Turbio River<sup>15</sup>. According to accounts from explorers and travelers of the XIX century, the zone of Parallel 42° was used by different ethnic groups that would travel from North to South or from East to West (Vidoz 2000).

<sup>15</sup> More information about the region will be available in the next few years, when the Archaeology of the Andean Province of Parallel 42° is finalized.

Populations of German-Chilean origin settled systematically and permanently in the area. These populations outgrew their boundaries and spilled into the Puelo area. The residents carried out mostly agricultural and cattle activities and traded most of their products in Chile<sup>16</sup> and, to a lesser extent, in the El Maitén and Ñorquincó areas of Argentina. Beginning in the 1940s, forests, fruits, and hops (*Humulus lupulus*) were added to the trade roster, and although trade and tourism began to blossom, cattle herding was the main activity.

Based on this historical analysis (of the Chilean-German colonization), the notion that Lago Puelo National Park was created for nature purposes only seems to lose credibility. Documental evidence proves that a large surface of the landscape we enjoy today was totally razed when the area was appointed as a National Park<sup>17</sup>. We believe that the park was created to better define the boundaries of Argentina.

As a matter of fact, several settlers (most of them of Chilean origin) lived inside the park, in environments suitable for agricultural activities<sup>18</sup>.

The first manager of the then Puelo Annex, Mr. Raúl Sosa (who was later appointed Manager of the Institution) forcefully evicted several of the settlers and stories about Sosa's nefarious practices and nepotism persist to this date. The current park authorities are very different, very cordial, but the unfortunate beginnings of the park sowed ill will among the neighbors<sup>19</sup>.



*Remains of former settlements evicted from the park (Photo © Felix Vidoz)*

---

<sup>16</sup> Denis P., 1987 from the original of 1920:183-186

<sup>17</sup> There is no information about the landscape in the mid 1930s, but Bailey Willis states that forest fires burned approximately 20,000 hectares of the Lago Puelo basin area, and for 1914 (op. cit.). The average age of the forests of the north area of the western branch and of Currumahuida hill would confirm that these areas had been burned before the Park was created, and would therefore not have been part of a spectacular forest landscape that would justify the creation of a protected area.

<sup>18</sup> Some last names such as Rietman, Viguera, Solari, Bahamonde, Rubilar, Fernández, Muñoz, Melo, and Vargas are well known.

<sup>19</sup> “Yes, yes, the park ranger, he was so evil, my child! He would hang out with Commissioner Benavente and the Ferrari guys [...]. When the Parks service arrived, we were living in peace, we tended our cattle, sheep, cows, mares, horses, pigs, ducks, turkeys [...] and this man Sosa once came on horseback and began to run after the cows from one end of the plot to the other, hitting them with a whip, so one of the cows crashed into the fence and one of the sticks burrowed into its stomach. We would yell to my father to come, but he took a long time and when he finally arrived, Sosa came down of the horse and wanted to hit my father. My father told him that he had to pay for the dead cow and Sosa treated us like we were Indians. He and my father yelled at each other and my father told him to leave, “because if I catch you here again, I will hit you.” Fragments of Florencia Perata’s interview with Manuela Rubilar, resident (Argentina, 1924).

## Current populated centers around the park

At present, four urban communities are closely linked to the area: Lago Puelo, El Bolsón, Epuyén, and El Hoyo. Although there are no populated centers inside the National Park, some farmers have been granted a permit for occupation and grazing (PPOP) for inside the National Reserve and one illegal settler that the authorities have been trying to evict for the past 20 years, along with security personnel, the staff of a school, and the staff of a camping ground. These settlements are collectively called the “Andean province of parallel 42” and are actively involved in ecological issues along with many closely-linked NGOs that wish to ban mining, hydroelectric, forestry, and nuclear energy testing in the area. Lago Puelo celebrates the feast of the forest and the surrounding areas with a handicraft fair that is set up in the performances area.

The small township of Lago Puelo has been a municipality since 1928. In the last few years, it has undergone major development mostly due to several families that migrated to the area, wishing to be closer to nature. Many institutions have settled in the area and the major sources of income are public and tourist services, production and processing of fine fruits, nurseries (flowers and plants), dry flowers, hops and handicrafts. The Lago Puelo Municipality includes Planta Urbana, Villa del Lago, los Parajes Entre Ríos, Las Golondrinas, and Isla Norte and Sur. The town is especially important because of its proximity (4 Km) to Lago Puelo National Park. There are more than 5,000 inhabitants in the Lago Puelo town, which could very well become an external buffer zone of the homonymous National Park.



*View of the north end of the National Park, with the Lago Puelo town in the background  
(Photo © Felix Vidoz)*

El Bolsón, the most important city of the province, is 16 Km away from Río Negro. The area offers several tourist activities, treks, and the like. The rich soils and climate are very adequate for agricultural and cattle activities, just like the surrounding areas.

The landscape of the great Hoyo de Epuyén basin, 14 Km away, on National Highway 258, is breathtaking, especially the easily reached 80 meter tall cascade called “La Catarata”. The road then drops 140 m into the deep Epuyén River gorge, which has very steep hillsides. From the hills, the landscape includes a magnificent view of the Epuyén Lake and town.

## Public Opinion

A local survey was carried out by Internet to find out what the residents and visitors think. Seventy-seven percent believe that admission fees should not be charged to enter the Park; 23% think that it is necessary to charge admission<sup>20</sup>.

Community participation is very heterogeneous. Some residents, especially the ones born in the area, believe that the area should not be a part of the National Protected Areas. Some groups new to the area, NGOs and tourists, think that it should be kept under that prescription. Then again, the visitors to the Park damage the existing infrastructure and the areas of intense recreational use, such as the northern shore of the lake, which needs maintenance (but this is a general occurrence throughout the area and should not be interpreted as an “anti-park” action.) Additional proposals for improved education and control might help solve the problem. The current administration is striving to reinstate the local assessment commission, which might provide solutions to the most pressing issues regarding the management of the park.

“La Playita”, regularly used as a bathing area, is completely abandoned; solid waste is strewn along the shore because no garbage cans are available for the tourists. The infrastructure is badly damaged and the internal roads and trails that lead to the several tourist facilities are in disrepair, which has caused many visitors’ vehicles to become damaged. Visitors become disoriented and confused because very few signs are posted throughout the park. The sanitary facilities are not enough for the many visitors to the park, and the few available are notably unclean<sup>21</sup>. Note: The current status is quite different; 22 large signs have been commissioned and the aforementioned problems might soon become a thing of the past; the task for 2005 is to place more garbage cans throughout the area, and the roads are in good conditions.

---

<sup>20</sup> Source: park rangers.

<sup>21</sup> From ParksWatch observations and tourist surveys. This problem is caused by lack of personnel to take care of the waste in the public beach and because the users do not even bother to walk up to the garbage bins to deposit their waste.



*Public bathing area in the Lago Puelo National Park (Photo © Felix Vidoz)*

## Human settlements

Some conflicts have risen among neighbors of the National Park because the boundaries have not been well defined.

- All of the plots inside the protected area are property of the municipality (there are no private properties), and are divided into the following management categories: National Reserve, Natural Wildlife Reserve, National Park, and Strict Natural Reserve (some overlap in several areas.)
- Residents of the Recreational Area: four park rangers, one fire brigadier, and one general purpose worker; a staff of four at the Argentine Navy Prefecture; one caretaker of the organized camping area, and the person in charge of the shop-bar of the main dock that is part of the Lago Puelo Camping Area.
- In the Las Lágrimas valley: From three to six members of the National Police of the Lago Puelo Group.
- In Río Turbio: One sub-ranger post; Elementary School for children that live inside and outside the park, with two teachers and staff hired in site, and 5 resident families that have been granted special permits to carry out productive activities.

The park receives many foreign and national visitors during the summer.

## Residents

Five families live inside the National Reserve. They have been granted Residence and Herding Permits (“permiso de ocupación y pastaje” – PPOP) and each has a farm-style set-up. The regulations establish that, upon the demise of the original resident, the family loses all rights to the special permit, but the National Park Authority does not enforce the regulation and the special permits are handed down to the surviving family members. Most of the residents arrived from Chile before the area was appointed a National Park. Today,

the descendants have built homes and even their children have erected their own. They survive on cattle herding and private orchards.



*Boats of the residents at the Turbio dock (Photo © Sofia Nazar Anchorena)*

Each family tends to cattle inside common fenced area. The cows are sold in groups, through the “Desemboque” (delta) or they are sometimes sold individually and illegally transported by boats. Most of the residents have one motorboat that they use to go to the hospital or to go shopping to Lago Puelo.

The residents say that they do not harvest mushrooms or ferns, and that they do not make cypress eaves. However, Parkswatch witnessed a resident packing such eaves<sup>22</sup>. They tend sheep, cows, horses, pigs, chicken, turkeys, fruit trees, and orchards. The grazing lands are covered with sweet briar.



*The Fernandez resident shop at the Turbio Section (Photo © Sofia Nazar Anchorena)*

---

<sup>22</sup> The resident said that they come from outside the park, which is very difficult to prove because of the proximity if the boundary.



*Grazing areas in the Turbio Section (Photo © Sofia Nasar Anchorena)*

They all travel on horseback, car, or by foot. The ones closer to the lake have power plants with internal combustion engines. There is no electricity, but they use flashlights. They cannot build any infrastructure or repair the existing infrastructure without a permit from the National Park. They can only use wood or firewood to repair infrastructure if they have a permit.



*Trunks and eaves inside the Turbio Section (Photo © Sofia Nasar Anchorena)*

There is one rural school-hospice inside the Park area. Eighteen students attend the school, which is under the responsibility of 2 teachers. School operates during 10 continuous days and rests four. The school has one hydroelectric turbine and orchards. It is located at a one-hour walking distance from the lake. Children attend the El Bolsón High School (almost every resident owns a house in Lago Puelo or El Bolsón, or have family members

that lodge them). Children come and go, according to work opportunities available inside the Protected Area. Residents do not want to leave and are not in any way pressured by the National Protected Area to do so. However, the information provided by the park rangers greatly varies from what the residents stated.

Some children of the residents that move outside the Protected Area come back years later to El Turbio, to live in the family homestead or claim tenure to prevent losing the property (cousins and others) in the National Park.

The residents of the Province reserve use the Turbio River as their means of transportation (approximately 6 families). The Forest Authority of Chubut has given them permission to use fallen cypress trees and cypress eaves. The Forest Authority representative enters the reserve to mark the trees that can be used by the residents, who float the trees down the Turbio River and then on the lake.

The last forest fire was caused by a boundary dispute between two residents of the Province reserve. One lit the other's plot and burned down 3,000 hectares. The Province reserve forest is very deteriorated. Only the owners may use wood. Wild hogs are hunted inside the area. The Turbio residents ask their friends for permission to hunt inside the reserve. The Morchella mushrooms, which proliferate after a forest fire, are exported to Europe, where they reach very high prices and greatly benefit the residents. Perhaps this is the main cause of deliberate forest fires throughout the region.

### ***Tourist use***

El Bolsón, a populated center located 16 Km from the Park, offers tourist and lodging services in cabins and hostels. Along the way from El Bolsón to Lago Puelo there are many bungalow and cabin complexes.

The Park has two camping sites on the recreational area on the shore: one is organized and the other one is rustic, with inferior quality services. In the recreational area there is an information post, barbeque facilities, camping sites, sanitary facilities, a dock, a ramp for boats, and the park and national police offices, as well as recreational activity areas. Water sports lovers will encounter a wide selection of activities, from excursions on the lake on motor vessels, to kayaks. There are many alternatives: trips to the Chilean boundary, trips to the Turbio River delta, a short trek on the shore, sports fishing, or transportation to the camping areas or the beginnings of trails. The north beach floods during winter and spring, when the ice melts. Besides the lake, the most interesting tourist sites are the headwaters of the Puelo River and the Turbio River valley, "Hito 10", Aguja Sur Mountain, and the Las River.

"La Playita" is close to the recreational area and is used as a public bathing site because its waters achieve very pleasant temperatures and the lake is very shallow there. The Park is adequate for trekking, rappel, and mountain bikes ([www.argentinaexplora.com](http://www.argentinaexplora.com)).

There are activities of different difficulty for everyone. Varied length trails offer the possibility of enjoying amazing landscape. Some of them are:

- Trail to Los Hitos: Nine hours are required to trek and return. The trail is not easy, so it is recommended that the visitor camp out in a site close to the Police facilities. The trail is of moderate difficulty. The Puelo River rapids can be seen from some spots in the trail and short walks can be done inside Chilean territory.
- Trail to Turbio River through the El Derrumbe Mountain: Seven and a half hours are required from El Desemboque. There are places to camp and light fires close to the Park Rangers station.
- Trail to Plataforma Mountain: Ten hours from the Park Rangers station at Turbio River.
- Trail to Mirador del Lago: it is 800 m long and offers panoramic lookouts at 130 m above lake level.
- Las Sombras Forest: 400 meters on a bridge made of narrow coihue wood planks from where the permanently flooded pitra and arrayán forest seems to float.

At the southern end of the lake there is a small dock for boats and a rustic camping site called “El Turbio”. It can be reached by boat from the Park’s Office or through a trail that starts at El Hoyo (Trail to Turbio from Derrumbe).

Fishing is plentiful in the main branches: Azul, Turbio, and Epuyén Rivers, and Puelo River, which is the delta of the latter.

#### Visitor admission

The data reported below were taken from admissions recorded from December to March:

1995: 16.000  
 1996: 15.000  
 1997: 1.500<sup>23</sup>  
 1998: 30.000  
 1999: 27.000  
 2000: 32.700  
 2003: 31.072  
 2004: 45.069

During the last years, more visitors have arrived at the lake. Visitation is purely seasonal, and the highest indexes (80%) are recorded during the summer. Most of the visitors are tourists that lodge in the city of San Carlos de Bariloche, and take day trips to visit Puelo Lake. An important percentage of the visitors are residents and tourists that lodge in the surrounding towns.

Most tourist services are concentrated in the north area, close to the lake’s headwaters. There is one public restroom, a parking lot, an information booth, a dock, and two camping areas of different categories (“Organized” and “Rustic”). The Argentinean Navy has a navigation safety post. The lake is also used to practice sports fishing of exotic salmon

---

<sup>23</sup> Perhaps this decrease is due to news about the appearance of Hantavirus in the area during that year and the decrease of tourist visitation throughout the Andean region.

and for recreational navigation. Sport fishing is regulated through specific bylaws that establish several general regulations and sets individual restrictions for each environment. Only fly-fishing is permitted in the Azul River. The most prevalent species of Lago Puelo are “percas” (*Percichthys trucha*), an autoctonous fish whose fishing is strictly banned.

The commercial tourist activity of the lake is limited to a 36-passenger boat and three smaller vessels (rapid semi-rigids) that are used for fishing excursions or day trips, and the watercraft operate at random times. The most sought-after lake trip is transportation to Los Hitos, in the north end of the lake. There are several trails for walks and trekking. The shortest (30-40 minutes) are the Pitranto Grande and Mirador del Lago trails, which begin at the recreational area. The 10-Km Los Hitos trail is used for trekking and is of moderate difficulty. The trek can be accomplished in one day, with an overnight stay in the area close to the Police Station, located some 3 Km from the Chilean boundary. Close to the boundary there is also an area that looks out to Lago Puelo and Inferior, and the Puelo River, that links them (Vidoz 2000).

### ***Rural use***

Several populations that survived on agriculture and cattle herding once occupied the Azul and Turbio River valleys, inside the park. Several groves of exotic species scattered throughout the area attest to past settlements. The rural use of the protected area is limited to the activities carried out in the Puelo-Turbio zone National Reserve, in four settlements (Juan Viguerras, Juan Fernández, Carlos Fernández, and Bucci), although the latter has not obtained a permit and there are plans for its eviction (since 1987!). The principal activity of these settlements is extensive cattle herding, but the management of the animals is very poor and they are kept inside vast, unfenced areas.

Although the settlements are few, there are 230 cows, 60 horses, and 180 sheep in the area. The number of cattle has notably increased in the last few years and they roam throughout the entire Turbio zone reserve and in some sectors of the national park that are adjacent to the reserve, mainly because of the lack of fences. Illegal cattle enter the park through the north area and the hillsides of the Currumahuida range. Close to the Melo River there is also a passageway for animals from Chile (Vidoz 2000). Cattle herding is not compatible with the conservation objectives of the protected area.

### ***Forest use***

Several forest fires, mainly between the 1940s and the 1960s, ravaged the park's forests. Usually after the fires the national parks agency would give authorization to use the wood from dead trees, which was also used to build the facilities of the institution during a phase of infrastructure development. The wood from burnt cypresses and “alerces” (*Fitzroya cupressoides*) was generally used.

The extraction of firewood from the two reserves is the only forest use authorized inside the protected area. The firewood is for the use of residents and the institutions inside the park,

as well as for the poorest residents of the Lago Puelo municipality. The extraction of wood from the Turbio area is also authorized, mainly for the residents to use for building. The wood extracted from the north area originates from the floodings of the lake during the peak season. Natural gas was made available in the Lago Puelo town and in the park administrative offices in 1996, which helped decrease the extraction of firewood from the north zone.

There are no heavy demands on the park's forest because the adjacent areas have many forests of the same kind (Vidoz 2000).

### *Conservation and research*

#### Distribution of the Conservation Value of the Lago Puelo National Park

A map of the conservation value of Lago Puelo NP was developed per Monjeau et al's (2002)<sup>24</sup> approach. The map profited from existing information provided by the park administration (e.g., distribution of critical flora and fauna species<sup>25</sup>), and available field information (e.g., location of most pristine sites) and teledetection (e.g., classification of green index sites similar to the most pristine sites, definition of basin headwaters). There are examples about the theme layers:

Each theme layer was assigned a numerical priority value for conservation. A GIS was used to total the layers, pixel by pixel, to develop the park's conservation value map (Map 5).

The most pristine sites have been deemed the *fatal flaws*<sup>26</sup> of the park<sup>27</sup>.

***Fatal flaws***—Let's pretend we must face a massive threat that is capable of destroying every conservation object of the park, for example, a huge fire. Let's also suppose that we have very limited capability of mitigating the damage and that we can only save a few places<sup>28</sup>. Which are these places? Where are they located? The purpose of the conservation

---

<sup>24</sup> Monjeau, J.A.; M. Lilienfeld, J. Marquez, E. Corrales, J. Coello, C. De Ugarte, J. Tort, E. Rapoport, F.O. Kravetz, J.P. Ramos, I. Oetting, M. Mariscal, L. Del Río, M. Ghiglione, M. Jager, G. Martín and C. Danklmeier. 2002. Sistema de Monitoreo para las Areas Protegidas. Volumen I. SERNAP - GEF II. Primer Informe para el Banco Mundial. 106 pp.

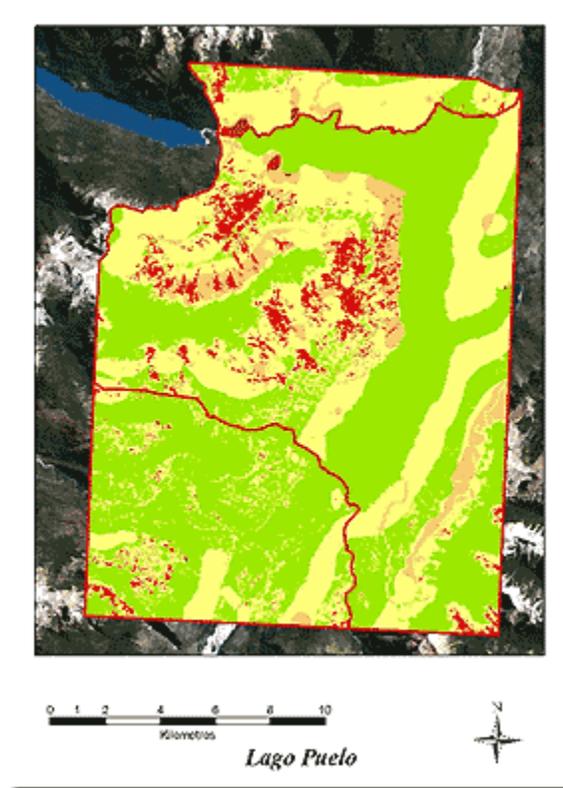
<sup>25</sup> The maps provided by Puelo NP were rectified by IARN to make them compatible with the GIS database.

<sup>26</sup> The engineering World has lent us the "fatal flaw" concept; it was adopted by Monjeau et al (2002) to name the sites of exceptional conservation value inside the protected area, whether they are threatened or not. In the first case, the fatal flaw concept would be almost similar to the hotspot concept, but the former is applied locally. In the case of Lago Puelo, whose main conservation objects are its particular Valdivian flora, park ranger Félix Vidoz led us to a pristine area that we then located with a GPS. At IARN's geomatics laboratory, Ing. Jorge Márquez classified the image and found other sites with similar spectral responses, using the NDVI. We assumed that every pixel with an NDVI larger than 0.5 would be considered a fatal flaw. The maps show this distribution.

<sup>27</sup> Regarding species of special conservation value, we used those that had been located inside the park. Some others could be added to the roster, especially those that have a special conservation value according to the criteria established in Article 31 of the Wild Fauna Protection and Management Bylaws. The list includes some species whose presence has not been confirmed, but that are more than likely present: Velvet catfish (*Diplomystes viedmensis*), green-golden frog (*Hylorina sylvatica*), Andean condor (*Vultur gryphus*), Arauca pigeon (*Columba araucana*), torrent duck (*Merganeta armata*), ochre-flanked Tapaculo (*Eugralla paradoxa*), "monito de monte" (opossum – *Dromiciops australis*), pudú, huemul, huiña cat (*Felis gigna*), cougar or puma (*Felis concolor*), small grey fox (*Dusicyon griseus*), and "Huillín" (*Lontra provocax*). Regarding flora, there is also a list of critical species that includes Olivillo, tiaca, ulmo, alerce, avellano, lingue, *Myrceugenia planipes* in the tree stratum; *Baccharis elaeoides*, *Escallonia leucantha* in the bush stratum; *Agrostis philippiana*, *Brachystele unilateralis*, *Chevreulia pusilla*, *Hymenophyllum fuciforme* in the shrub stratum, and the *Cissus striata*, *Cynanchum diemii* ivies (Vidoz 2000).

<sup>28</sup> A fire in a library is the usual metaphor used to explain fatal flaws: which 10 books would you save? If this is the case, a very important aspect would be the exact location of each book.

value map with *fatal flaws* (red spots) is to reply to these questions to help orient the management.



*Map 5: Distribution of the conservation values of the Lago Puelo National Park. The conservation values equal the sum of the conservation values of each feature layer: Red: fatal flaws, sites with the highest conservation values of the park, determined by their pristine status; orange: high conservation value; yellow: moderate conservation value; green: from moderate to low.*



*Fatal Flaw—hygrophilous forest that survived the Melo River fires (Photo © Felix Vidoz)*



*Fatal Flaw—Diversity of high conservation value flora in the Melo River (Photo © Felix Vidoz)*



*Fatal Flaw—The highest conservation value forests of Lago Puelo N.P. (Photo © Felix Vidoz)*

If we analyze the map that shows NDVI distribution inside and outside the limits of the park and the reserve (Map 4), we will be able to see that there are places outside of Lago Puelo NP that might have conservation importance.

#### Conservation status

The conservation value map (Map 5) shows that the area of the park that is not suitable for public use (National park and Strict National Reserve) is in good conservation (reds, oranges and yellows). Coincidentally, around 80% of the park maintains the original vegetation coverage. However, the reserve's conservation values go from moderate to low

(yellows and greens), except for some patches on the western branch of the Los Hitos trail and extremely fragmented areas in the Turbio section.

The low conservation value of some areas of the Reserve are due to historical disturbances and not because natural conservation is not likely. On the other hand, the Reserve has conservation values similar to the park. The Reserve has restricted endemism, is wealthy in species, it includes threatened species, individual genetic populations, ecological services (basin and shore protection, soil stability), breathtaking landscapes and many recreational and touristic opportunities (Rusch 2002). The lost conservation value might be recuperated through previous restoration efforts of the major impacts.

#### Conservation status of archaeological sites<sup>29</sup>

The archaeological sites of the Lago Puelo National Park are located in areas that are not easily accessed due to the surrounding vegetation and the distance from the beaten path. Most of the sites are very deteriorated. The cave paintings of five of the sites are exposed to the natural elements, which further deteriorate them. Only two sites are in good conditions. The natural elements that damage the paintings are water, sunlight, wind, and fire (Vidoz 2000).

#### Research projects

Several research projects have requested authorization to work in Lago Puelo<sup>30</sup> National Park because many universities and research institutes carry out studies in the Andean-Patagonian region. For references to some of these studies click [here](#).

#### Threats

- Fires
- Over-herding
- Exotic invader species
- Extractive activities
- Population increase
- Uncontrolled tourism/visitation
- Epidemiological risk
- Construction of new routes
- Impacts on the hydrography and aquatic environments
- General threats

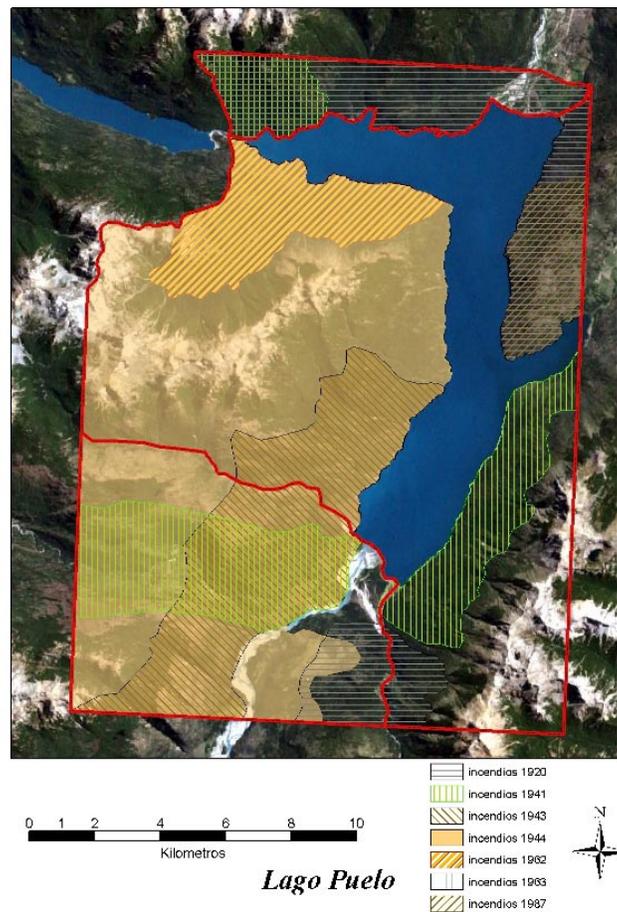
---

<sup>29</sup> The resolution of the maps did not allow adding the layer corresponding to the conservation value of archaeological sites.

<sup>30</sup> If you need to know more about these projects, don't hesitate to contact us.

## *Fires*

Map 6 shows the most recent fires that have affected Lago Puelo National Park. The fires, which are frequent and fierce, ravage the forests and are therefore the most serious threat affecting the park. The size of the protected area is almost equal to the area devastated by the largest fires, such as the one of 1944, which indicates that one fire might burn down the total area of the park<sup>31</sup>.



*Map 6: History of the most recent fires in Lago Puelo National Park*

Although scientists have been able to prove that fires were a natural occurrence in the Andean-Patagonian forests, more fires occurred after the arrival of the settlers of European origin. Many important fires have destroyed the park since the beginning of the century. The most important occurred during the 1940s and 1960s (1941, 1943, 1944, 1962, and 1963). From the 1970s, the areas affected by fires decreased.

<sup>31</sup> A meta-analysis of the fires in the protected areas of the world concluded that the ideal relationship between a protected habitat and its FIRE regime is from 10 to 1. When the ratio is lower, recuperation is partial and fragmented (Meeffe and Carroll, 1994). In other words, a protected forest should ideally be 10 times larger than the largest historical fire-ravaged area.

The flora we see today is a product of past fires. The forests of some zones prone to recurrent fires or the hillsides do not yet evidence recuperation and are still covered by “notro” and “radal” shrubs, reeds, and exotic bushes.



*Burnt forest in Lago Puelo (Photo © Felix Vidoz)*

However, most of the area is covered with vegetation in the early stages, and the regeneration of coihue and cypress is becoming more evident. If new disturbances are prevented, those areas might fully recuperate.

The fires that occurred in the early part of the century affected some of the populations of alerces (*Fitzroya cupressoides*), and some areas still have singed individuals and hardly any sign of regeneration. Apparently, the lenga (*N. pumilio*) forests do not recuperate adequately after the fires. As a matter of fact, the areas once covered with such forests are today filled with pastures and shrubs, and the remaining lenga woods are very small and isolated (Vidoz 2000).

The conservation valoration map developed by ParksWatch (Map 5) shows, among the *fatal flaws* (red spots), patches of vegetation with a very high green index that might have not been affected by the fires maybe because the shores they live in buffered the effects of the fires. Very pristine hygrophilous forests thrive in such spots, with individuals whose age might be in the hundreds.

**Socioeconomic implications of forest fires** – The rudimentary economy of the early 20<sup>th</sup> Century that still thrives in the Turbio River valley (which has been a province protected area since 1994) has indirectly provoked repeated forest fires in the area shared by both parks (national and province) since 1989. The fires that have devastated this area, one of the most beautiful in the Andean-North Patagonian region, are the result of conflicts arising from the lack of employment, the advance of the forest on the pastures, disagreements between the residents<sup>32</sup>, population increase, territory and forest claims of third parties,

---

<sup>32</sup> There is evidence that the fire that destroyed 10,000 hectares in 2002 started in the Turbio Provincial Reserve after a heated and long dispute between neighbors (one of them burned down the other's plot.) These disagreements are hard to assuage and will probably keep causing more environmental problems in the future. Increased conservation actions might also cause further upheaval among the residents.

informal land tenure (fiscal residents), the boom of the cypress mushroom (*Morchella* spp.).



*Cypress mushroom (Morchella spp). The high price paid in Europe for this delicacy is one of the most prevalent causes of deliberate forest fires, because the first post-fire succession gives way to huge amounts of the mushroom (Photo © Felix Vidoz)*

One of the most worrisome aspects for ParksWatch is that some residents might light fires to take revenge if the park authorities penalize them. As a matter of fact, this was the cause of many fires during the past century. There is resident in the north end of the park that lets his cows graze every night inside the park and gathers them in the morning. The park manager does not want any problems with this night intruder, because he might initiate a fire if pressured.

### ***Overherding***

Cattle herding is one of the most worrisome problem faced by Lago Puelo National Park, second only to forest fires, although the latter do not constantly occur. Herding, on the other hand, is a permanent disturbance that results in substantial changes of the natural operation of the ecosystems. Beyond the consequences of trampling and the obliteration of the flora, cows are major scatterers of invader exotic species. As an example, park rangers recently visited an area of the Cuevas hill, a favorite place of huemules, and found cows, rather than the deer.

Cattle are brought in illegally to the park from the northern area. The Turbio, Derrumbe, and Alerzar River valleys suffer major impacts from the herding activities of the residents of the reserve. Large areas of the Turbio valley, west of the river, have been severely depleted by cattle; exotic vegetation and bare, eroded areas are all that remains. Cattle roll in the bare ground, which increases the erosive effect of the wind. Due to the magnitude of the impact (a combination of change, duration, and extension), ParksWatch believes that cattle herding is not compatible with the aims of the protected area and that there are many environmentally sustainable alternatives for economic development that can be done in smaller areas.



*Neighbor of the National Park taking his cattle to graze inside the park  
(Photo © Sofia Nasar Anchorena)*



*Cows property of neighbors grazing inside the North Reserve  
(Photo © Sofia Nasar Anchorena)*



*Illegal herding in the north end of the Lago Puelo National Park (Photo © Sofia Nazar Anchorena)*

### ***Invasion of exotic species***

Voluntary and involuntary introduction of exotic species is considered, after the loss of habitat, the most critical threat on the biological diversity. When some species are introduced into areas where they did not exist previously, they compete with the resident species for space and food and might even feed on other species, degrade or destroy the habitat and increase the epidemiological risk.

#### Flora

In modern times, the lowlands surrounding the Park's administration, which had been under intense agricultural and herding use, were almost abandoned due to new ecological prescriptions. Some European species, such as sweet briar (*Rosa rubiginosa*) and blackberry (*Rubus ulmifolius*)<sup>33</sup>, took over the abandoned areas. A past effort to eradicate the invader species included agrochemicals<sup>34</sup>, but currently the plants are removed by mechanical means from the areas of intense tourist use.

The flora succession begins with sweet briar, which have taken over every available open space thanks to the efficient dispersal of the seeds by cattle and horses. The ensuing phases, maitén (Maiten tree – *Maytenus boaria*) and cypress, thrive in the native forest and provide protection to cattle herds without excessive shade, replacing the role that the native bushes perform in non-altered areas. In many areas, the residents carry out permanent control of sweet briar and reserve large areas for the grasses that cattle prefer (Vidoz 2000).

---

<sup>33</sup> Locally called "murra" (*Rubus ulmifolius*), which found the ideal conditions for rapid proliferation. By 1980 they were already considered noxious weeds.

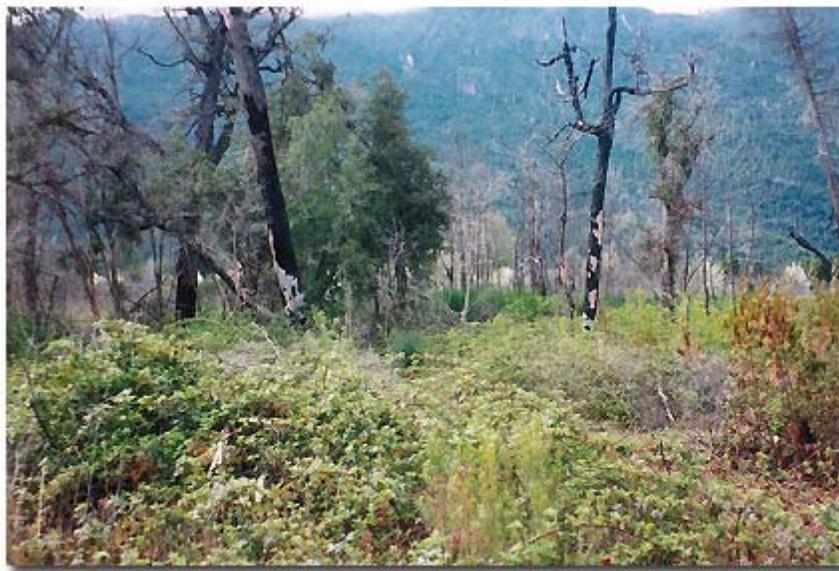
<sup>34</sup> The failure of these experiments and time permitted the park rangers to notice that some weeds protected the seedlings of autochthonous trees (especially from the actions of the cattle brought in from outside the Park) and became tutors of future maitenes and cypress bushes.



*Disturbed environment invaded by Sweet briar in Turbio pastures  
(Photo © Sofia Nazar Anchorena)*



*Native forest with incipient  
invasion of exotic species in  
the shore of the Puelo Lake  
(Photo © Felix Vidoz)*



*Post-fire succession: invasion of exotic thorny bushes dispersed by cattle. They provide an adequate environment for the proliferation of Hantavirus-fostering rodents (Photo © Sofia Nazar Anchorena)*

Several exotic herbaceous species common to the North-Patagonian region can be seen throughout the Park: cocksfoot (*Dactylis glomerata*), Kentucky bluegrass (*Poa pratensis*), dandelion (*Taraxacum officinale*), Dallas grass (*Paspalum dilatatum*), white clover (*Melilotus albus*), yellow wood sorrel (*Oxalis corniculata*), and others<sup>35</sup>, which are generally associated with areas disturbed by cattle, fires, or tourist use. The fact that these species are not plentiful in pristine sites, which proves the statement above, indicates that they can be kept under control if the activity that causes them is eradicated. Sweet briar and blackberry shrubs are quite abundant. Blackberry shrubs are very exuberant and impede the growth of the native flora.

The Spanish broom (*Spartium junceum*) is another very aggressive and high-impact invader that, like blackberry, grows thick shrubs under which the native vegetation cannot mature. After the fire of 2002 in the Recreational Area, retama took over the areas previously covered by sweet briar and the species is today uncontrolled and presents a short-term problem. There are also several exotic trees generally associated to old and current settlements. There are several poplar and pine species, as well as other exotic evergreens, and a handful of fruit trees. Poplars are taking over the area surrounding the shore and the Turbio River sector, where they compete with cypress trees. Oregon and Ensign thrive in the area, but the areas covered by them are still negligible.

Native pine species are taking over the native flora of the northeast boundary of the park; there are commercial plantations in the surrounding areas. The wind is greatly contributing to the worrisome dispersal of *Pinus contorta*, and some individuals reach beyond the timberline. Maple trees are also disseminating rapidly and there are some important nuclear patches close to the dock and the administration. Throughout the delta of the Azul River, *Salix fragilis* is causing severe conservation problems and is depleting important sites of recreational value and interfering with the hydrological and basin balance of the river, which might suffer from the invasion of the trees and might prefer flowing into the Recreational Area, where there are several tourist services. This species is rapidly dispersing throughout the few beaches of the lake and is overtaking the areas for the visitor's use while simultaneously providing shade. Many removal methods have been essayed, with mechanical means (Vidoz 2000)

---

<sup>35</sup> It would be beneficial to explore Eduardo Rapoport's proposal about edible weeds, which shows the surprising amount and quality of food available in one hectare.



*Exotic trees (mainly poplars and willows) have overtaken the landscape of the North area of the Lago Puelo N.P. (Photo © modified from the Lago Puelo N.P. Administration /Felix Vidoz)*

## Fauna

The most prevalent vertebrates are wild boar, mink, and European hare, and the Californian quail, since 2000. Rainbow and River Trout have taken over the bodies of water and their management is difficult, because they influence changes in affected communities.

Salmons feed on native fish and other components of the aquatic fauna, and present a potential threat because they feed on amphibian larvae and adults, which impedes that these aquatic animals re-populate the areas from they have disappeared due to depredation or other causes, and might also isolate the many different amphibian populations of the sub-basins if the main courses are threatened. Salmons have a high economic value and are of regional importance, aspects that must be taken into account when defining management strategies (Vidoz 2000).

The residents illegally hunt wild boar, and hunting dogs might kill pudú, foxes, ferrets, and huemules. There is no information available about the impact of wild boar, but their effects on the flora and the ground are very evident in some areas.

It has become evident, in several places of the Patagonian region, that aquatic bird populations dwindle when minks invade the water bodies. The latter also have an effect on otters (*Myocastor coipus*). There are no systematic data yet, but it seems that the autoctonous fauna has been able to recuperate a few years after minks have invaded a body of water.

There is evidence of populations of Red deer (*Cervus elaphus*) in an area very close to the park, so it is highly that these animals might inhabit the Park in the short or medium term.

An invasion of German yellowjacket wasps (*Vespula germanica*) causes problems in the main recreational center of the park, especially between mid-February and March. Large swarms jeopardize the bathing area and disturb the visitors. The effects of the wasps on the native communities have not been studied, but they have been seen feeding on native insects.

### ***Extraction activities***

Park rangers estimate that 50% of the regular low-impact illegal entries to the park are controlled, but Park Management believes that only a handful of sporadic entries are of importance.

In late September, the pollen clouds from cypresses announce the eclosion of mushrooms of the *Morchella* genus, which are highly coveted by European gourmands and can therefore be sold at very attractive prices, whether dried or fresh. The spring after the cypress forests have burned down, for one time only, there is an exceptional eclosion of these mushrooms, which is the cause of many intentional fires. After the edible mushrooms are reaped, the mycelium cannot produce any more, so the extraction is final.

The Leatherleaf fern (*Ruhmora* or *Polystichum adiantiformis*), which thrives at half shade in these forests, has been commercially exploited since 1995 in the areas surrounding the Park and are sold to flower shops in the big cities. This has caused a dramatic decrease of the species and very intense illegal harvesting in the Park boundaries, which has forced the park rangers to constantly patrol the area to hamper illegal harvesters<sup>36</sup> (information from the Patagonia Technical Delegation).



*Ornamental ferns in Lago Puelo N.P. (Photo © Sofia Nazar Anchorena)*

---

<sup>36</sup> The illegal extraction of ferns increases when the Chubut province authorizes harvesting for ornamental purposes. The harvests are intense and unsustainable in the countryside and the species are quickly disappearing; illegal harvests are frequently the culprits.

Just recently, an inordinate harvest of “murta” (Chilean Guava – *Ugni molinae*) has been noticed. These fruits mature in late summer and are used to produce sweets and liquors that are sold in regional fairs. This fruit must be managed, because of the high demand among the residents (Vidoz 2000).

Another recent problem is that cypresses, both dry and green, have been cut down to produce eaves *in situ*. The eaves are of higher added value than raw wood and are easily transported. The main pressure has been noticed in the Desemboque area in the last year.

### ***Population Increase***

ParksWatch is concerned about the demographic increase trend of the families that reside in the Turbio area. The residents must be offered alternative economic alternatives, which is an objective compatible with the environmentally sustainable economic development of the National Reserve areas. Some park rangers interviewed, however, believe that the improvement of the quality of life of the residents will only translate in more residents, because the family members move in with them to enjoy the improvements and will, in turn, deplete the natural resources even further.

### ***Uncontrolled tourism/visitation***

Without a doubt, tourism is the best ally of the national parks, more than any other economic development activity. This is because tourism permits to satisfy the economic demands without taking up too much space, in a timely manner, and producing low and medium intensity disturbances that are generally reversible. After the devaluation of the Argentine peso, there has been an explosion of foreign and national tourism. Ecotourism and adventure tourism are the most sought after activities in the country.

National parks are one of the most important places where the activities can take place. This is an important opportunity for the federal system of protected areas.

However, the sector is growing too fast and no national guidelines have been issued for the purpose. National Parks has very complete rules regarding tourism and the guides that operate in the protected areas must do extensive tests, but the number of park rangers might soon be too few to control and monitor the activities.

### **Waste**

The main problem results from waste management. The beaches used by the tourists are strewn with garbage, which is picked up by the rangers (not in their job description!), young volunteers, and maintenance personnel. Although signs have been posted, the amount of garbage left by visitors during peak periods is too much for the Park administration to handle. The major impact of this action is indirect: since garbage is the most obvious disturbance and evident to non-environmentally aware visitors, most of the complaints to park rangers and the park’s administration have to do with the unkempt grounds. The complaints have resulted in 5 of the 6 park rangers of the Lago Puelo N.P. devoting 90% of their time to control a low conservation value public bathing spot and therefore not caring for more critical areas.

## Vandalism

Tourists usually carve the barks of the arrayán trees (*Myrceugenella apiculata*) of the Bosque de las Sombras trail. Most carve names and dates (E.g., Tito, 12/01/2004) perhaps wishing to preserve their “art” for eternity. Immortality, alas, deserves more merit and talent.

## Fire

Bonfires are highly controlled in the camping areas. However, ParksWatch witnessed one of the many events with which the park rangers have to deal with frequently: a camper was brandishing a lit branch close to his tent<sup>37</sup>.

## Traffic

More visitors mean more vehicles. In 2004, a car hit a pudú inside the park. After the animal recovered, a veterinarian who collaborates with the National park liberated it inside the strict Reserve. This type of accidents might occur more frequently if the traffic increases.

## ***Epidemiological risk***

### Cypress disease

Some cypress trees of the Turbio River area exhibit signs of a fungus infection called “cypress disease” that makes the leaves fall and eventually kills of the tree.

### Hantavirus

The long-tailed pygmy rice rat (*Oligoryzomys longicaudatus*) is the principal Hantavirus host. In 1997, there was a population boom of this rodent in the Turbio area, mostly due to the proliferation of sweet briar, which are this species’ favorite habitat and food. Neither the trails that cross the natural forests of Lago Puelo N.P. nor the open and well-aired spaces are prone to any epidemiological risk.

## ***Construction of new roads***

The most troublesome project inside the reserve is the opening of an international highway that will end in Chile.

---

<sup>37</sup> It was almost midnight, on a Sunday, when a park ranger suddenly appeared and suggested to the camper, “if you want to play with fire, do it somewhere else.” The camper apologized and said that he was using the branch to find his way in the darkness. This example shows that our protected areas are in jeopardy if the public is not environmentally aware. Apparently, flashlights and common sense are not abundant in the region.



*Los Hitos sector of Lago Puelo N.P. The narrow space to the left of the picture is the Chilean boundary, where the Chilean highway ends. One of the project's alternatives strives to continue the road into Argentina, through National Reserve forests that can be seen in the lakeshore (Modified photo by the Lago Puelo N.P. Administration /Felix Vidoz)*

The opening of a controlled frontier post between Argentina and Chile is of major importance for the development and integration of the Los Lagos region. The post would increase Chilean visitation to Lago Puelo N.P. Regardless of the obvious benefits, the highway project proposes a direct environmental impact and collateral impacts that are not in synch with the conservation objectives of the protected area.

The conservation value map shows that the highway would interfere with areas with moderate to high conservation values, including some areas of very high conservation value and a patch that is considered a *fatal flaw*.

### ***Impact on hydrography and aquatic environments***

In general terms, the deforestation caused by fires and overherding has a major impact upon the natural hydrography of the Puelo system, because it increases the drainage speed which brings about an excessive sedimentation of eroded materials and fosters uncontrolled flow<sup>38</sup>. The lack of vegetation in the areas surrounding the Park, which are almost totally deforested, causes uncontrolled flow and the forests don't retain any water. For this reason, heavy rainfall elevates the level of the Puelo Lake waters. The lake is growing more dependent on the melting of ice at the headwaters of the Turbio river basin, which will cause that the level of the water and stratification change be more evident in the future.

Occasional floods after heavy rains and the overflow of the lake destroy shore infrastructure (dock, information booth, tables and chairs.)

---

<sup>38</sup> This is very evident in the western shore of the lake, which was very affected by the 1987 fire.



*Overflow of Lago Puelo. The picture shows how the overflow of the lake can flood the entire north area and can affect the Park Administration building (Modified photo by the Administration of Lago Puelo N.P. / Felix Vidoz)*

### ***Pollution of aquatic environments***

Lake Puelo is located mid-basin, downstream from water bodies and courses that are outside the protected areas. There are relatively important human settlements in the shore of the lake, the populations of which have grown in the last few years. The lake drains into a basin that has a growing population of 22,350 residents and that is visited by more than 20,000 tourists during the summer. Regardless of the quick renewal of the water, there is evidence of eutrophication, which brought about the need to build the sewage purifying plant in El Bolsón. The clarity of the water is gradual from the headwaters of the Turbio River to the delta, with an average value of 9 meters.

The Turbio, Epuyén, and Azul Rivers are the most important affluents. The National Parks does not have authority on any of the three. An important sub-basin that belongs to the Province Park and the Turbio multiple use reserve drains into the Turbio River, where regulated productive activities are permitted. The Epuyén River drains the Epuyén Lake into the Puelo Lake; it receives the sewage of the shore villages of Epuyén and Hoyo (previously treated in the El Salamín lagoon.) The important agricultural and cattle activities in the valley cause fertilizer and agrochemical contamination. Another affluent of the Azul River is the Quemquemtreu, which carries the sewage waters from El Bolson. Those waters only receive first-phase treatment.

The preliminary studies performed to date have not discovered any pollution in the lake. Lake Puelo is the final link of the sub-basin, which makes it very vulnerable (Vidoz 2000). However, it has been confirmed that the Azul River is contaminated.

In the future, as the upriver population grows, the contamination of the lake and rivers might become a problem, as well as the changes in land use and the loss of the buffer areas around the National Park due to tourist development and the growth of the surrounding populations. ParksWatch is concerned about a small land plots project initiated by the Municipality of Lago Puelo. This project might bring about an inordinate growth of the

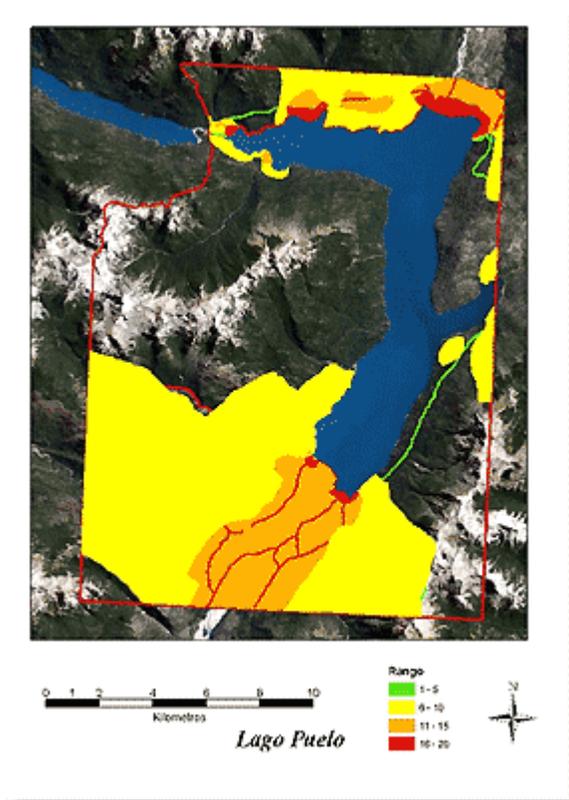
population, which will translate into heavier pressure upon the hydric system of the Lago Puelo N.P.

### ***General threats, total analysis***

The most worrisome threats to the natural heritage of the park are forest fires and cattle herding, because they alter the environment during long periods. In third place, invader exotic flora is slowly creeping upon the park and has invaded former cattle grazing areas. The intrusive sweet briar shrubs have disseminated throughout several areas of the Park and have overtaken former cattle grazing areas, which increases the epidemiological risk of Hantavirus. Blackberries, willows, acacia, Spanish broom, oak, and several fruit trees and herbaceous plants have also been introduced. The dissemination of exotic evergreens inside the forest is worrisome because they have overtaken the native forest and former pristine sites. Minks, wild boars, and salmon jeopardize the native biological diversity. The increase of legal and illegal population in the Turbio area hinders the sustainability objectives of the National Reserve. The Puelo basin relies mostly on the melting of the ice in the headwaters of the Turbio River, which might unbalance the hydrological system if it becomes completely dependent on rainfall. Waters flow uncontrolled throughout the park because many areas are severely deforested. For this reason, heavy rainfall might dramatically increase the level of Lake Puelo. The park faces other threats: hydric pollution of the Puelo Lake waters by the Azul River, that carries sewage from the Lago Puelo village and surrounding towns; the urbanization of small parcels, an initiative of the Lago Puelo municipality, might increase this impact; the opening of an international highway running from the protected area of Paso Puelo in Argentina to Los Hitos, Chile; the weak law enforcement by the very few park rangers, inadequate funding, and garbage disposal in the beach area.

The global threat map (Map 7) shows that all of the National Reserve is under moderate and wide threats. The map does not include fires because they are treated differently (because they are occasional and not permanent). The fires are considered a high-probability threat, especially during the dry months of summer because the combustibility of the forest increases, endangering the total area of the National Park (see fire history, Map 6).

Considering the total threats, no area of Lago Puelo N.P. can be considered safe.

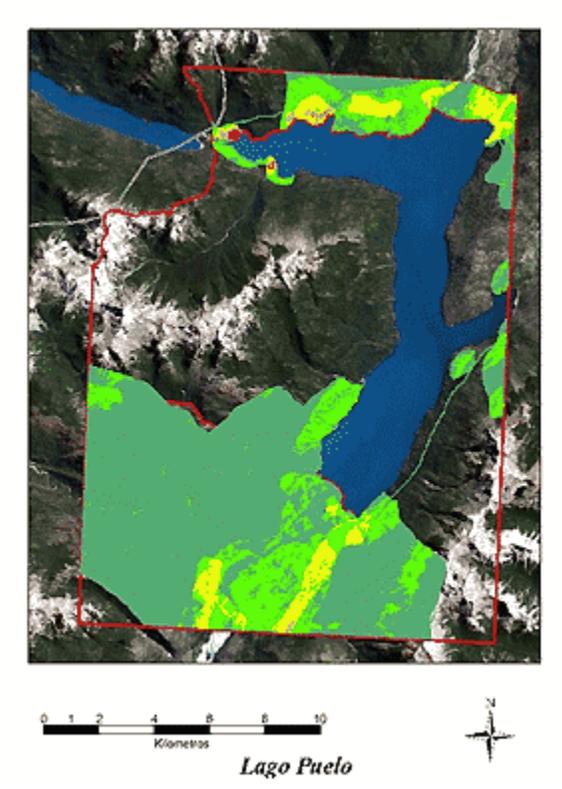


*Map 7: Layers of threats faced by Lago Puelo N.P. This image is the result of the overlaying the pixels that represent the magnitude values of each theme map. This map does not include forest fires because there is a specific map for this subject.*

## Recommended Solutions

The objective of ParksWatch's recommendations is to help the Park's Administration prioritize their conservation efforts and to *re-orient the internal and external funding* to the actions, works, and projects that justify the protected area as such<sup>39</sup>.

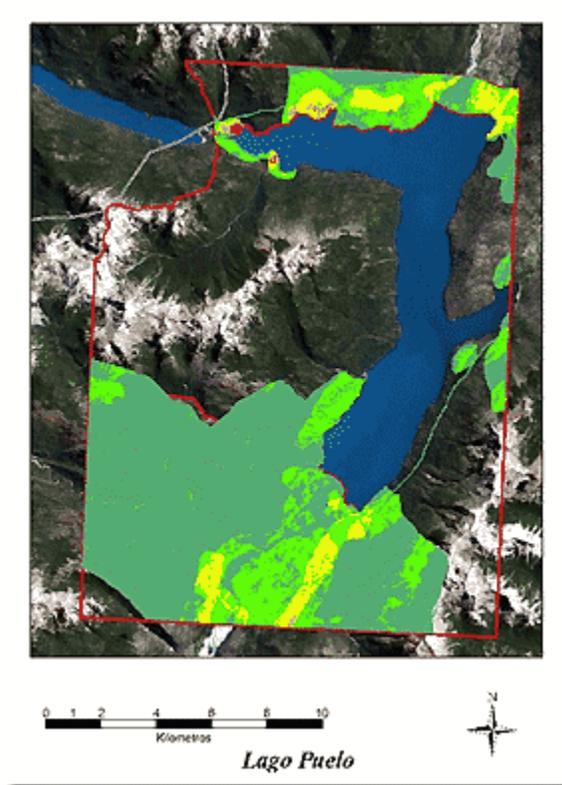
Since the total surface of the protected area is prone to some threat level and the park's rangers and the annual budget are not sufficient to care for all the areas, a decision-making process must be implemented. For this purpose, ParksWatch has developed a vulnerability (v) map of Lago Puelo N.P. (Maps 8 and 9), which superposes the conservation or sensibility (s) values over the threat magnitude (M) values<sup>40</sup>. Since fires occur seldom (mostly in summer) and the other threats are permanent, two vulnerability maps have been developed. The maps will be used to prioritize the decision-making process.



*Map 8: Map of winter vulnerability (not including fires). The stoplight pattern applies. Red is the maximum priority for decision-making, after orange; yellow is alert, and green is low priority for decision-making.*

<sup>39</sup> “Whatever their purpose, protected area assessments must be regarded as a tool to aid the decision-making process and not as a system to denounce and penalize park managers. Assessment is a normal part of the management process” (World Commission on Protected Areas, IUCN: Hockings, M.; Stolton, S. y Dudley, N. (2000) Evaluating Effectiveness. A framework for Assessing the Management of Protected Areas. IUCN, Gland Switzerland and Cambridge, UK, x + 121 pp.

<sup>40</sup>  $V = M.s$ . The most vulnerable pixel is the one where a high conservation value coincides with a high threat magnitude, and should be a priority in the decision-making process. An area might have a very high conservation value but is not vulnerable if it is not threatened. Time, efforts, and funding for the latter cases should be re-oriented to other priority sites (de Monjeau et al., 2002)



*Map 9: Summer vulnerability (includes fires). The stoplight pattern applies. Red is the maximum priority for decision-making, after orange; yellow is alert, and green is low priority for decision-making. This map includes fatal flaws, which should be considered the maximum priority.*

Ideally, the park administration should direct its efforts to diminish the red areas from the map. The ideal national park should be all green, i.e., with zero vulnerability. We understand that this is the best-case scenario, very hard to achieve, but these maps help us determine our progress throughout the years. Following are some recommendations that we hope can improve the park's management.

### ***Fires***

#### Priority areas

Regarding the conservation value *per se*, the priority areas to defend against a fire are indicated in the summer vulnerability fatal flaws map (Map 9). Among these (if one had to prioritize), the core area is the Valdivian forest of the Melo River and surrounding areas. The second would be the basic Valdivian woods of Del Fuinque River, between the Police Station and Los Hitos.

### ***Overherding***

Eradicate the cattle.

The Cattle and their grazing areas have depleted the north and (especially) south (Turbio delta) reserve areas. The satellite image for NDVI analysis shows that the areas of the

Turbio River delta are highly disturbed (green, which signals changes). The national reserve area exhibits as much or perhaps more alteration than the surrounding area, upriver from the delta of that river. Ideally, the reserve should be inclined to conservation or should be an example of sustainable development, regardless of the human activities therein. We recommend banishing all cattle herding activities and replace them with ecologically friendly activities such as sustainable tourism (ecotourism, adventure tourism) and less-intruding agricultural actions.

ParksWatch understands the social, economic, and political implications of this recommendation. Lessons learned from past experiences (e.g., manager Sosa, see footnote # 19), indicate that all procedures should be politically correct, should be guaranteed by the law, and should be dealt with in a socially fair manner.

Wild cattle hunting agreements can be subscribed with the residents, who will benefit from the sale of such animals.

A very limited cattle herd can be kept to satisfy the milk and meat needs of the residents. The areas would then be able to recuperate and alternative sustainable activities could be pursued. Support should be provided to the residents, to substantially increase their life quality with other means of income.

We have been informed that some residents would like to support conservation in exchange for a government stipend. Some others would gladly sell their plots (to dedicate them to conservation) and use the money to purchase a farm or a plot in a place better than El Turbio. These solutions would please many actors. ParksWatch invites all persons interested to come forward and state that they support the recuperation of the Puelo National Park.

### ***Exotic species***

Eliminate all sweet briar, blackberry, and Spanish Broom bushes and willows and pines, especially Murrayana and other invader evergreens that compete with the renewable native species. Willows are invading the shores of the north area and are altering the coastal landscape's structure. Spanish Broom bushes grow very close to each other and impede the growth of the forest. Although sweet briar bushes nourish the renewable forest species, they also increase the risk of fires during the summer and elevate the epidemiological risk of Hantavirus, because they are the most important habitats of the host. National and international volunteers may remove the bushes.

Actively combat wild boars and minks.

### ***Restoration of degraded areas***

Restore with native flora all areas previously used for cattle purposes and occupied by exotic plants. National and international volunteers may be sought to help out. The park (or at least the Andean-Patagonian region) could have a botanical garden with a native plant nursery to be used as restoration sources.

### *Stricter management*

#### **Increase the number of park rangers**

Lago Puelo needs at least two more park rangers.

**Obtain more equipment:** Especially two new vehicles and one boat, and one tractor equipped with a weeder. In general terms, all equipment necessary to improve the specific role of the park.

**Relocation of activities according to conservation priorities:** The park rangers are almost 100% devoted to providing customer service to the tourists and to patrol the public bathing area in an area that does not have an elevated conservation value (except the pitra woods and other spots defined in the conservation value map) and only very seldom patrol the natural areas. A group of tourist guides could take charge of visitors' services and other tasks and therefore permit the rangers to carry out the work they were hired to do. As an example, the Los Hitos area will need more care if the Chilean highway is built. Perhaps the entire north area should become a concession, and therefore liberate the park administration from tasks that consume almost 95% of their time.

**Changing the protection categories-** ParksWatch visited the north area of Lago Puelo with the rangers. This is the only place in Argentina where the unique Chilean Valdivian flora has been able to thrive, especially in the very few areas that have never been ravaged by the forest fires. These areas should be put under a strict reserve prescription. The Melo River secluded valley has spectacular landscapes that cannot be seen elsewhere in the park. Félix Vidoz, park ranger, believes that the secluded valley should be set aside for moderate visitation (for trekking without camping, with capable guides.) Certainly, Lago Puelo would greatly benefit from this prescription because there are very few sites with such breathtaking scenarios comparable to the ones of the adjacent Nahuel Huapi and Los Alerces parks. ParksWatch visited the future trail, which includes sites previously ravaged by fires, and we consider that the conservation impact would be minimal if the regulations are enforced. In other words, only the Melo secluded valley should not be a strict reserve and remain under the "national park" prescription, which would allow the aforementioned activities.

### *Environmental Education*

Lago Puelo N.P. should follow Nahuel Huapi National Park's example and implement an environmental education program for the schools in the surrounding Andean province.

### *Opening of a highway from lower Puelo, Chile*

ParksWatch supports the alternative to use a ferry on Puelo Lake, from Los Hitos to the dock in the north area of the lake. The ferry's boarding ramp should not be placed on the most vulnerable sites and a formal study should be done to decide upon the most adequate place. The ramp can be built in the area of the dock. The ferry alternative is much better than to build an extension to the Chilean highway, which would result in immeasurable environmental impacts to the national park. ParksWatch is currently lobbying for this

alternative before the Comité de Integración Región de los Lagos Argentino-Chilena (*Committee for the Integration of the Argentinian-Chilean Lakes Region*).

### ***Extension of the protected area***

The Lago Puelo N.P. boundaries are currently restricted to the natural surface of the Puelo Lake. The basins of the main tributaries are not under federal protection, and therefore the national park's main geo-morphological processes that support the natural dynamics are not being protected. ParksWatch agrees with and supports WWF and APN's plan to extend the protected area or to integrate it to a larger conservation system. If possible, the whole basin should be protected, from the headwaters to the delta in the sea, to guarantee the conservation of processes, associations, and species of the system. Some actions have started for this purpose, including the integration with the system of protected areas of Río Negro y Chubut, which protects the major basins, and the integration with Chilean conservation authorities. The Directorate acknowledges the efforts APN is carrying out for the consolidation of the Federal System of Protected Areas and the actions of the government for the Committee of Integration of the Lakes Region between Argentina and Chile, and the Lemú Project's activism.

Regardless of the Province-Nation integration efforts, we believe –as do many other specialists that have proposed this for more than 20 years– that the area of the Esperanza, Turbio, and Tigre River basins should be under *federal protection* and that a national protected area should be created with the purpose of completing the Andean corridor between Lago Puelo N.P. and the Lago Menéndez basins in the Los Alerces National Park.. The important conservation value of this area has been formerly recognized because of its regional endemisms, threatened species, intact habitats, freshwater springs, glacial refuges, and genetic dispersal corridors. The area includes Valdivian patches and the total surface exhibits a very adequate conservation status.

### ***Scientific research for adequate management***

Although the research projects about Lago Puelo N.P. are plenty and that they will make contributions to the systematic inventory of the flora and fauna, geology, limnology, and archaeology, the research themes are chosen by each research team, so the results are merely anecdotal. The protected area needs other types of research:

It is necessary to carry out a study about the research needs *from* the national park *to* the scientific community. APN can present a list of priorities to CONICET, SECyT, and other institutions.

With the results, ParksWatch may help APN locate national and foreign research teams, universities, professionals, students, and scholars that can cover the scientific needs. They can also raise funds to finance the projects.

It is evident that Lago Puelo N.P. needs to make an inventory of its basic natural resources and a distribution of the most important park elements that have to be conserved. It is also necessary to understand how global warming will affect the lake, especially the water level. It is necessary to understand the natural succession of the forests that are recuperating, to

implement more effective restoration actions. Also needed are sustainable development financial projects that will contribute to improve the quality of the life of the authorized residents. The list of priorities should also include an early warning system.

### ***Management Plan***

The staff of the park informs that they do not have a Management Plan in place. There is one that was drafted by the former director. The urgent development of a consensual, concise, and accurate management plan might be the tool that liberates the park from its problems.

### **Conclusions**

The creation of national parks is, without a doubt, the most effective action to preserve the biodiversity. The problem is that the parks are subject to the current national and international policies and to the ever-changing government authorities that almost always do not fulfill their obligation to preserve the natural heritage.

Lago Puelo N.P. is quite small and could become an example of regional sustainable National Park and National Reserve. Its ideal geographic location shelters the conservation objects. Visitors enter from one point only and only affect a small and easily controllable area. Currently, the tourists only come for the day and the activity is regulated: an information booth operates all summer and there are well-trained guides. The two organized camping grounds operate satisfactorily, although one of them raised a wire fence to keep out cattle that damage the infrastructure, and the enclosure does not “feel” like a national park. Both particular camping sites are also controlled, because one of them is quite close to the National Police post and the other is close to the Turbio administration.

The combined threats of fires, overherding, invasion of exotic species, and unsustainable land use by authorized residents, however, do not permit that the area attain its principal goal. The Turbio area (National Reserve) is no different than the adjacent areas. Land use in the area is not sustainable. The objectives of a national reserve are not attained and the residents are not happy to live inside the reserve because they cannot use the land freely.

ParksWatch has witnessed the efforts of the park rangers and of the current director (Horacio Giacchino) to face everyday pressures, working beyond the call of duty. It is necessary to implement a campaign to strengthen the present administration and hire two more rangers and purchase two vehicles for the park. The specialized staff should not be taking care of tourist services in the public beach in the north area. Perhaps the total north area should be made a concession to liberate the park management from a task that consumes 95% of their capacity. The north area requires so much work that it has been considered to grant it to the Chubut province in exchange for high-conservation value plots that are currently outside the National Parks authority (see NDVI Map). This issue has been discussed for the last 20 years but there is no solution in sight. After our next visit, we hope to produce a map showing the progress regarding compliance with the protected

area's objectives. The launching tool might well be a concise and precise management plan.

## **References**

Dinerstein, E.; D. Olson; D. Graham; A. Webster; S. Primm; M. Bookbinder; G. Ledec (1998). A Conservation Assessment of the Terrestrial Ecoregions of Latin America and the Caribbean. WWF- The World Bank, USA.

Rusch, Verónica (2002). Estado de situación de las áreas protegidas de la porción argentina de la ecoregión valdiviana. Delegación Regional Patagonia. Administración de Parques Nacionales.

Vidoz, Felix et al. (2000). Parque Nacional Lago Puelo. Caracterización ecológica, usos y estado de conservación. Delegación Regional Patagonia. Administración de Parques Nacionales.

*Written by: Adrian Monjeau, Ph.D.  
Director of ParksWatch – Southern Cone  
Publication: June 2005*