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Information Sheet on Ramsar Wetlands

1. Date this sheet was completed/updated: 2002

2. Country: Argentina

3. Name of wetland: Reserva Provincial Laguna Brava.

4. Geographical coordinates:

Peñasco de Diego: 28°03' South Lat., 69°16' West Long.

Macizo del Potro: 28°24' South Lat., 69°39' West Long.

C° Veladero: 28°03' South Lat., 68°58' West Long.

C° Peñoncito: 28°32' South Lat., 68°51' West Long.

Cerro Chaparro: 28°52' South Lat., 68°56' West Long.

C° Vicuña: 28°18' South Lat., 68°42' West Long.

Coordinates correspond to site boundary points.

5. Altitude: 2500-4500 m. above sea level

6. Area: Total surface area corresponds to 405,000 hectares. The area is located in the northwest corner of the province of Rioja. The site's boundaries are the Republic of Chile in the west and the province of San Juan in the south.

7. Overview:

The site is made up of a network of saline and hyper-saline shallow lagoons which include characteristic high-Andean communities of *bofedales* (wet-marshy meadows), found above 3000m. These lands correspond to the *Puneña* and *Altoandina* phytogeographic regions with altitudes between 2500 and 4500 meters above sea level. The Reserve is host to a rich biodiversity associated with the wetland, with abundant summer populations of endemic and/or threatened waterbirds, including James' and Andean flamingos (*Phoenicoparrus jamesi* and *P. andinus*) and isolated nesting sites for both species. These flamingos are considered migratory according to the Convention on Migratory Species' definition (Appendix I of CMS), as they regularly cross international frontiers in the region they inhabit, which includes Argentina, Bolivia, Chile and Peru. The wildlife refuge is populated mostly by Camelids: vicuñas (*Vicugna vicugna*) and guanacos (*Lama Guanicoe*).

8. Wetland type:

Inland: Q-U-N-R (in decreasing order of importance)

9. Ramsar criteria: 1, 2, 3, 4

The most significant criteria for this wetland is 4.

10. Map of site included? Yes

11. Name and address of the compiler of this form:

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12. Justification of the criteria selected under point 9, on previous page:

Criterion 1

The lagoon network in the proposed area is a representative example of high-Andean wetland characteristic of this ecoregion, which sustains key hydrological functions in an environment where hydric resources are the limiting factor.

Criterion 2

During the summer there are significant populations of endemic, vulnerable and/or threatened waterbird species, such as James and Andean flamingos (*Phoenicoparrus jamesi*) and (*P. Andinus*). The various environments present in Laguna Brava sustain other rare and threatened species including vicuñas (*Vicugna Vicugna*), guanacos (*Lama Guanicoe*), and Darwin's rhea (*Pterocnemia pennata*).

Criterion 3

The endemic flora found in the area includes *Nototriche copon*, *Chenopodium frigidum* and *Lilaeopsis maclowiana*.

Criterion 4

The lagoon network in the reserve supports regional migratory waterbirds during reproduction, a critical stage of their biological cycle, mostly in the summertime. During this season, populations of endemic, rare, and threatened waterbirds feature in the area, most prominently significant populations of James and Andean flamingos (*Phoenicoparrus jamesi* and *Phoenicoparrus andinus*).

13. General location:

The site is located in the northwest corner of the province of Rioja. The site's boundaries are the Republic of Chile in the west and the province of San Juan, Argentina in the south. The area, made up of high plateaus, saline lagoons and wet-marshy Andean meadows, is specifically located in the departments of Vinchina and General Lamadrid, region I, Valle del Bermejo.

The nearest locality to the site is San José de Vinchina, capital of the Department of Vinchina, located at 100 km. from the site, with a population of approximately 2,309 inhabitants.

14. Physical features:

The site, located in the northwest corner of the province of La Rioja, covers an area of 4,050 km² (see enclosed map).

Geology: The area is geologically located in the northwest part of the *Precordillera*. The surface features intense tectonic deformations which occurred in the Tertiary.

The most characteristic geological elements of this area are given by the presence of Carbonic sedimentite, granitic and volcanic rocks of diverse compositions, all corresponding to different superimposed magmatic episodes. The rocks considered most ancient belong to the *Ranchillos* formation. They crop out over the eastern slopes of Cerro Carnerito, the western slopes of Sierra del Peñón, east and west of Laguna Verde, and on the southern slope of Cerro Morado; composed of greywackes, sub-greywackes, *cuarcitas*, and *lutitas*. The Carbonic sedimentites are made up of granitic rocks belonging to the *Carnerito* formation, of the Upper Triassic, amongst them granite, granodiorites, porphyritics, and rhyodacites. These rocks make up small formations that intrude the elements of the *Ranchillo* formation. Groups of volcanic rocks (*Veladero* formation) of mixed composition are present in large sections of the basin, Cerro Carnerito, Sierra del Peñón, and Cerro Morado, among them basalts and basaltic andesites made up of plagioclase, basaltic hornblende, and orthopyroxene in a quartz-feldspatic paste. The quaternary sedimentites mostly occupy the depression of Laguna Brava. More recent material is made up of alluvial and elluvial sediments, while present-day material contains evaporite deposits located both in Laguna Brava and Laguna Verde.

Geomorphology: The most dominant physiographic features of the mountainous landscape include volcanoes, lagoons and salt lakes. At an altitude of over 4,000 meters and with a negative hydric balance, an environment prone to sedimentation due to evaporation is created

Mountain ranges: The orographical units that form part of the Laguna Brava ecosystem are made up of Lower to Middle Paleozoic metamorphites and sedimentites, permo-triassic granitic plutonites, and volcanic and sub-volcanic rocks from the Tertiary. The mountain ranges that make up of the basin include: Veladero and Cerro Morado to the north, Cerro Carnerito and Fandango to the west, and Sierra del Peñón and Sierra del Pilar to the east.

Slope:

Corresponds with the area of alluvial cones that surround the mountainous areas. An environment extremely affected by fluvial erosion, where mixed particles of coarse material: blocks and gravel in a matrix of sands.

Lagoon-salt lake:

The most dominant feature is the great depression occupied by Laguna Brava, a surface that has favoured the accumulation of continental and volcanic sedimentites that fill the basin. The slope of the alluvial plain in the surrounding sectors of the lagoon varies between 1-3%. Above 4350 meters the observed values vary between 6-11%.

Soils:

Soils in Laguna Brava are characteristic of highlands between 4000-4400 meters (Altoandina province). In this type of environment soils belong to the Entisol order, and the *Torriortente* suborder.

This type of soil is characteristic of arid areas, where potential evapo-transpiration exceeds precipitation, thus the water cannot filter through and edafogenic horizons do not develop.

Typical *Torriortentes*:

These correspond to soils with a fragmented texture (where rolling materials and blocks are dominant) in the mountainous folds, to limed textures in areas between mountains. Soils with a fragmentary texture (blocks and rolling materials are dominant) in mountain slopes and limey textures in inter-mountain pockets. Materials in this subgroup are of alluvial, colluvial, and alluvial-eolic origin.

Structure:

The depression is flanked by two mountainous blocks: Cerro Carnerito to the west and Sierra del Peñón to the east. These formations come up to north-northeastward faults which create the limits of the Laguna Brava and Verde. The Carbonic sedimentites are folded over a wide synclinal area. Activity having occurred between the Upper Paleozoic to the Triassic is responsible for the area's tectonic profile. The present landscape is defined by activity occurring since the Upper Oligocene.

Seismicity:

According to zoning evaluations by the National Institute for Seismic Prevention the area is encased in a high-seismicity zone, indicating that the risk of tectonic movements is very high.

Climate:

The area is characterized by a harsh climate referred to as *Andean-arid-puneño*, typical at levels above 4,000 meters. A wide thermal amplitude can be observed; low temperatures and strong western winds prevail, with snow storms occurring during the fall and winter seasons. The area does not have a meteorological station; climate data has been obtained by the National Guard from the San Francisco pass (province of Catamarca), an area with similar physiographic characteristics. The most representative data include:

Temperature:

Annual mean temperature: 0.8°C

Minimum temperature: -24°C

Maximum temperature: 26°C

Winds:

Maximum wind speeds: 120 Km/h.

Prevailing wind direction: north, west.

Rains:

Yearly precipitation: 20 mm/year.

Maximum precipitation: 10mm/year.

Hail:

Occurrence: 30 days/year.

Medium atmospheric pressure: 530 mmHg.

15. Hydrological values:

Laguna Brava possesses numerous endorrheic basins which form lagoons at altitudes

above 3,500 meters. Laguna Brava is the most important, with a surface area of approximately 5,000 hectares (17 km long by 3 km wide). It is located at an altitude of 4,230 meters and is considered hyperhaline, with values of total solids between 335.4 y 226.3 g/l. Another significant lagoon is Mulas Muertas, located north of Laguna Brava, at an altitude of 4,000 meters and a surface area of approx. 700 ha.

16. Ecological features:

Phyto-geographically, Laguna Brava corresponds to the *Chaqueño* (province of Monte) and *Andean-Patagonian* (Altoandina and Puna provinces). The province of Monte is located in the lower part of the mountain range, penetrating into Puna province through creeks at altitudes of 3,000-3,100 meters. Puna province (3,000-3,700 meters) is characterized by isolated steppe bushes of 0.5 to 1.2 meters. La Rioja belongs to the *Subdistrito Central*, a transition between the *Distrito Cuyano* (south) and *Distrito Jujefío* (north). The Altoandina province (3,700-4,650 meters) is an open steppe with xerophile grasses with sharp leaves associated to pulvinate and ligno-dwarf dicotyledons. The climax vegetation corresponds to an open steppe of grassy xerophiles arranged in a pattern resembling cushions. Protected by these species, smaller dicotyledons and, on occasion woody ones, can grow. In general terms the vegetation is stratified, with a low coverage of small-sized plants. Considering the topographic characteristics and vegetation, three types of habitats can be observed in the Reserve area:

Plains:

Extensive high plateau rocky plains, with slopes lower than 10% and open plant communities.

Slopes:

High slopes (above 10%) with low ground coverage.

Water meadows:

Swamps located in the lowest part of valleys, on the banks of rivers or in slopes where natural springs occur. Characterized by the presence of water and complete ground coverage. These are not distributed uniformly, but rather form patches in different parts of the Reserve. Different plant sub-units are present in each habitat.

Plains can be divided in seven sub-units:

1. Grasslands dominated by *Stipa*, with 74-100% coverage.
2. Grasslands of *Adesima spp.*, dominated by *Stipa* (58%) y *Adesmia* (42%).
3. Plains of *Adesima spp.*, species of this plant genus represent 100% of the coverage.
4. Plains of "Copa", *Nototriche copon* being the dominant species, with coverage between 92-100%.
5. Woody plant communities of *Lycium spp.*(30%) y *Ephedra breana* (7%).
6. Associations of *Adesmia spp.* (74%) and *Ephedra multiflora* (26%).
7. Plains without vegetation corresponding to rocky grounds.

There are three sub-units in slope areas:

1. Grasslands dominated by *Stipa* (61%) and *Chenopodium frigidum* (13%).
2. Woody plant communities dominated by *Ephedra breana*(46%), *Lycium spp.* (8%). Also, species of *Stipa* are also found (19%).

Three sub-units are found in the water meadows:

1. Meadows with *Lilaeopsis madowiana*. This species has the largest coverage (46%), along with *Deschampsia caespitosa* (31%).
2. Meadow grasslands associated with *Deyeuxia eminens* (50%) and various *Stipa* (32%).
3. Meadows with *Scirpus atacamensis* which is dominant, with a coverage of 55%, associated to species of the *Festuca* genera (13%)

17. Noteworthy flora:

The most relevant species that can be mentioned include: *Stipa speciosa* and *Stipa leptostachya*, *Festuca scirpifolia*, *Juncus balticus*, *Nototriche copon*, *Adesmia spp.* *Lilaeopsis maclowiana*, *Scirpus atacamensis*, *Deyeuxia eminens*, *Ephedra brean*

18. Outstanding fauna:

Fauna present corresponds to the zoogeographic regions Puneña, Altoandina y de Monte. Significant summer populations of endemic and/or threatened waterbirds are found: Andean flamingos (*Phoenicoparrus jamesi*) and James' flamingo (*P. Andinus*); in addition to other terrestrial and aquatic birds like the condor (*Vultur gryphus*), Darwin's Rhea or *Choique* (*Pterocnemia pennata*), black-chested buzzard-eagle (*Geranoaetus melanoleucus*), great horned owl or Ñacurutu (*Bubo virginianus*), aplomado falcon (*Falco femoralis*), diademed sandpiper-plover or Chorlito de vincha (*Phegornis mitchellii*), rufous-bellied seedsnipe (*Attagis gayi*), grey-breasted seedsnipe (*Tinocorus orbignanus*), black-winged ground dove (*Metropelia melanoptera*), plain-capped ground tyrant (*Muscisaxicola alpina*), *Keu andino* or *pisaca* (*Tinamontis petlandii*), Baird's sandpiper (*Calidris bairdii*).

Historically, nesting events have been recorded, distributed in the different lagoons that make up the proposed wetland site:

*Laguna Veladero, 270 active nests of *P. chilensis*, March 1982, direct observation.

*Photographic documentation of nesting sites in Laguna Brava during 1982

* Laguna de Mulas Muertas, northern border, nesting events, December 1999

* Laguna Brava, western border, abandoned nesting colony of *Phoenicoparrus jamesi* in an advanced state of incubation, 2000.

According to the final report (March 2001) of the project "Priority Actions for the Conservation of the High Andes Flamingos" developed by Fundación Pachamama and the Grupo para la Conservación de los Flamencos Altoandinos (an initiative of biologists and natural resource managers of Argentina, Bolivia, Chile y Perú), and based on biological criteria, Laguna Brava and its adjacent areas are considered as key areas, since isolated nesting events for both species have been recorded (only site in Argentina amongst 45 wetlands surveyed between 70-4797 meters above sea level).

Among the mammals found on site, there are important populations of Camelids: guanacos (*Lama guanicoe*) and vicuñas (*Vicugna vicugna*); also, the puma (*Felis concolor*) and South American red fox (*Dusicyon culpeus*); as well as reptiles such as *Liolaemus andinus sp.*, *Liolaemus andinus andinus*, *Centrura punae*, *Liolaemus ruibali*. The presence of *Homonota andicola*, constitutes a new citation in the province of Rioja.

19. Social and cultural values:

The unique environmental characteristics of Laguna Brava Provincial Reserve, as compared with other southern or northern regions, have made the area extremely favourable for use by populations in the past.

Human settlements possibly dating back as much as 10,000 years possibly employed different subsistence strategies because of the variety of potential usable resources that can still be observed in the area. Geomorphological formations and natural conditions led the Inca Empire, in its latter period, to use the region of Laguna Brava not only because it is more accessible than other parts of the mountain range. Additionally, it could be used as a natural strategic enclave from which to dominate indigenous groups from present-day Chile and the trans-Andean region, thus expanding the empire's dominance. In retrospect, it is apparent that the region developed a vital importance within the Argentinean northwest:

- Historically, it was used by miners to send extracted materials to Copiapó, where they were utilised or bartered.
- In the distant past the trade of livestock on foot from and to Chile created much activity that is still remembered in Copiapó and La Rioja. Eloquent testimonies collected from the refuges built in the area during the presidencies of Dr. B. Mitre and Dr. D.F. Sarmiento (1863-1874) provide evidence of this.
- Within Argentinean political history, it was witness to epic expeditions during the campaigns of liberation from Spanish domination, led by General José de San Martín. The Zelada-Dávila expeditions also traversed the west of La Rioja during the summer of 1817 to liberate Chile from royalist oppression.
- Further back, in the fall of 1536, Diego de Almagro attempts to conquer the "kingdom" of Chile by following one of the Inca trails through the present-day Reserve.
- Finally, the Inca penetration towards Copiapó.

The expansionist policies of the Inca Empire took advantage of the optimal spatial conditions in the region. While the primary reasons for their territorial expansion towards Chile are not known, it is believed that they were political (as a tool for domination) or economic (as a transport route for the minerals from Famatina to be transported to the Valle of Río Jorquera and processed at the Inca center for metalworks of Viña de Cerro.

In the area of the Reserve there are important cultural values present, including archaeological remains that corroborate these theories, as well as *tamberias* and Inca *Tampus* at various sites such as Mudaderos, Lagunita Verde, Laguna Brava, Río Tamberias, and ceremonial platforms at the summit of the Veladero volcano (6435 m.) whose origin and antiquity is yet to be determined.

20. Land tenure/ownership of:

The area corresponds to the "Reserve for Vicuñas and for Preservation of the Laguna Brava Ecosystem", administered by the province, according to the legislation for the creation of said Reserve. However, there are private citizens that have legal right to use certain zones to be determined within the Reserve.

21. Current land use:

a) Within the site:

In low altitude areas (mostly meadows) there is small cattle ranching activities (less than 300 heads of cattle in the whole Reserve area). Mining activities were carried out in the area during the 70's. The Provincial Directorate of Mining presented a study in 1980 indicating that existing reserves of sodium sulphate in the saline areas of Laguna Brava amount to 9,574,000 tons. In 1994 the La Rioja attorney's office recommended to reject bids for exploitation of the sodium sulphate reserves and suggested the pertinent studies be carried out to evaluate possible environmental impacts derived from mining activities. Between 1993-1997 important prospecting activities were conducted within the Reserve by multinational companies, with no known results, which could potentially affect or modify the fragile ecosystem if commercial mining is indeed carried out in the Reserve. Other possible alterations in habitats used by migratory birds include the construction of an international road towards Chile currently underway (40% is finished), which crosses the Reserve area nearby the shoreline of Laguna Brava and Laguna de Mulas Muertas.

b) surrounding areas:

Land use in surrounding areas is composed of almost-insignificant cattle ranching activities, due to the fact that there are no human settlements in the area (no exact numbers available on heads of cattle present).

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:

There are potential threats to the site related to the development of the international road to Chile, such as the extraction of water for irrigation and the partial destruction of tributary meadows, mostly feeding Laguna Brava and Laguna de Mulas Muertas.

23. Conservation measures taken:

The whole of the site is a protected area, as declared by provincial Law N° 3944 declaring the creation of the "Reserva de Vicuñas y Protección del Ecosistema Laguna Brava, setting the location and surface area of the reserve, designating the competent authorities, and providing for the formulation of regulations for the operation of the Reserve, as well as Law N° 7138/01 of the Provincial System of Protected Areas.

There is an outpost for park rangers in the town of Alto Jague, including an information, registration and help center for visitors. It is also equipped with a 4x4 vehicle and a permanent staff of 4 park rangers assigned to the protected area.

24. Conservation measures proposed but not yet implemented:

Preliminary design of a Management Plan and a proposal for zoning measures according to historical, current, and potential uses of the Reserve have been carried out. Management activities in place include: registration of visitors, emergency help, tourism and environmental activities. There is an Operational Plan in place, implemented since 1996. Funding for the elaboration and implementation of a Management Plan is required. Currently, the main objective is for the site to be presented to the corresponding national authorities (DRlyA) so that it can be submitted to the Ramsar

Convention, as an appropriate step for the conservation and wise (sustainable) long-term use of the site.

25. Current scientific research and facilities:

The following projects are currently being developed:

- a) "Ecology and Management of the vicuña en el Laguna Brava Reserve". Universidad Nacional de Córdoba, SECyT - Universidad Nacional de La Rioja.
- b) Census of flamingos - Programa de Humedales Altoandinos (Universidad Nacional de Salta, with help from the Ramsar Convention Wetlands for the Future Fund, the US Fish and Wildlife Service, and the cooperation of the Delegación Técnica Noroeste de la Administración de Parques Nacionales and the World Wild Life Conservation Society.
- c) Project: "Inkas: Prospecting of the Inca Archeological Register in the north and west of the La Rioja province, Provincial Reserve Laguna Brava". Dirección de Preservación del Patrimonio Cultural, Agencia de Cultura La Rioja.

There is also an office equipped with two bedrooms, bathroom, kitchen and utilities, as well as refuges within the Reserve area.

26. Current conservation education:

Visitors to the Reserve area can receive information brochures. Information, historical and environmental signs were erected. Finally, chats are given in primary and secondary schools, as well as in other sites.

27. Current recreation and tourism:

The site is an alternative tourism area due to the great distance from large population centres, its geography and altitude, all of which keeps the number of visitors low. The approximate number of visitors is around 800/year, mostly from Buenos Aires, Córdoba, and Europe. The alternative tourism activities present include bird watching, photographic safaris, mountaineering, and overlanding. The main season for tourism is the summer, between October and March.

28. Jurisdiction:

Territorial jurisdiction:

Reserve Area: Superior Gobierno de la Provincia de La Rioja.

Administrative Jurisdiction:

- Secretaría de Producción y Turismo.
- Dirección General de Turismo, Medio Ambiente y Desarrollo Sustentable.
- División Áreas Protegidas.

29. Management authority:

División Áreas Protegidas, Dirección General de Turismo, Medio Ambiente y Desarrollo

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30. References: