

The Laguna Merín Field Study

A Component of the Project on Remote Sensing for Ecosystem Management Treaties and Transboundary Conservation



In this oblique image, looking from the south of Laguna Merin towards the north, the location of the Brazil-Uruguay border is approximate; it floats about 1 km above the image. This image was captured from NASA's WorldWind data visualization tool.

Laguna Merín (Lagoa Mirim in Portuguese) is a large freshwater lake on the border between Brazil and Uruguay. It is the second largest lake in South America after Lake Titicaca in the Andes. The lake and the surrounding wetland complexes play host to a wide array of waterfowl as well as other flora and fauna of international importance.

This research on Laguna Merín was conducted as part of the Project on Remote Sensing Technologies for Ecosystem Management Treaties and Transboundary Conservation funded by the United States Department of State, Bureau of Oceans and International Environmental and Scientific Affairs initiatives program (OESI) and involves a collaboration among the following institutions:

- The Remote Sensing Center (CSR) of the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais (IBAMA), Brazil
- The Programa para la Conservación de la Biodiversidad y Desarrollo Sustentable de Los Bañados del Este (PROBIDES), Uruguay
- Center for International Earth Science Information Network (CIESIN) of the Earth Institute at Columbia University, USA

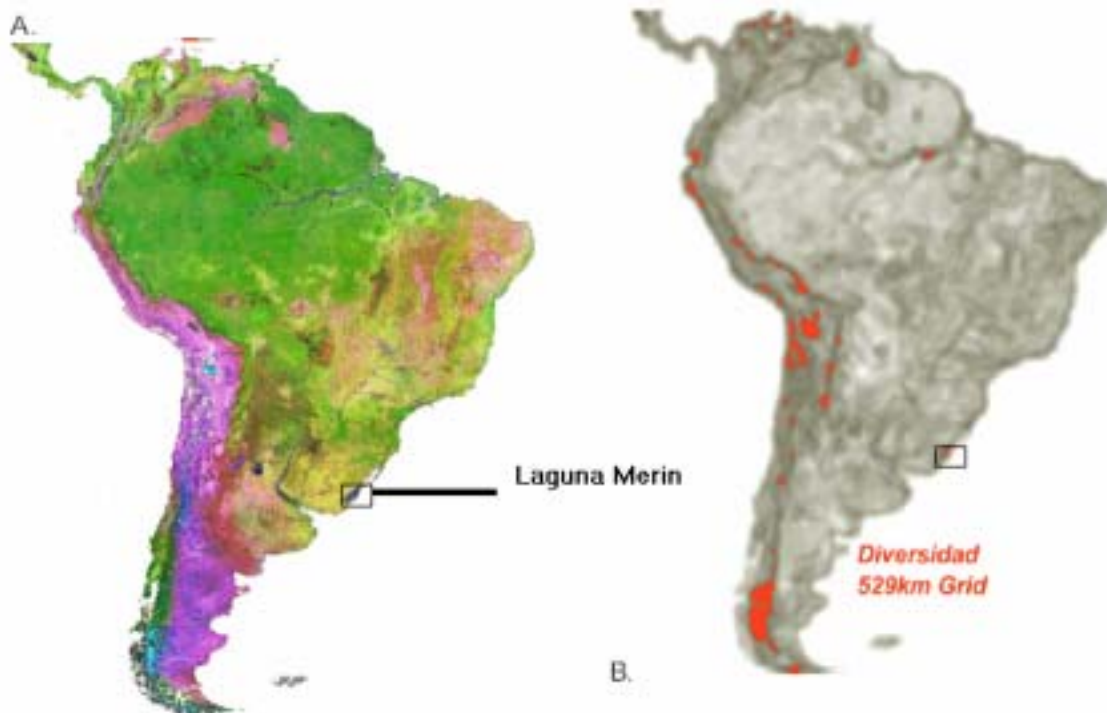
In addition, the U.S. Fish and Wildlife Service's International Division has provided technical assistance. The project duration is October 2003-September 2005.

The Importance of Laguna Merín

Laguna Merín occupies 3,994 square km, one-third of which is in Uruguayan territory and two-thirds of which is in Brazilian territory. The lake and its surrounding wetlands comprise one of the major transboundary watersheds in South America, supporting a great diversity of flora and fauna, including a large proportion of the region's endemic species and many species of migratory birds. In recognition of its value, the Uruguayan government designated

the Bañados del Este on the lake's western shore a Ramsar Wetland of International Importance and a UNESCO Man and Biosphere (MAB), and BirdLife International designated the area just south of the lake as a globally important Endemic Bird Area. On the Brazilian side, the Ecological Station at Taím is covered MAB Reserve for the Atlantic Rainforest (Mata Atlântica).

Map Situating Laguna Merín in South America. (A) The Global Land Cover 2000 land cover classification for South America. (B) An analysis utilizing the software *Diversidad* found that Laguna Merín showed up on the continental scale as having high levels of landscape diversity, which translates to high potential biodiversity.



In the areas surrounding Laguna Merín there is a floodplain depression system with various wetland ecosystems, including riparian habitats such as gallery forests, temporary marshes, lagoons, swamps, and coastal dunes. There are also some remnants of the original Atlantic Rainforest in the riparian corridors. These habitats support a great variety of flora, for example, the world's largest population of Butiá palms (*Butia capitata*), which are nearly extinct on the Brazilian side. The fauna in the basin is also quite diverse. Migratory birds spend the austral summer in the wetlands and along the lake shore, feeding, mating and resting from their long journey from one hemisphere to the other. Among them are seagulls, sea swallows, plovers and sandpipers.

The lake also plays host to a variety of resident and migratory bird species such as coscoroba swans (*Coscoroba coscoroba*), southern screamers (*Chauna torquata*), roseate spoonbills (*Platalea ajaja*), maguari storks (*Ciconia maguari*), swamp cardinals (*Paroaria coronata*), ducks (*Dendrocygna bicolor*, *Amazonetta brasiliensis*, *Netta peposaca*) and, one of the symbols of the region, the black-necked-swan (*Cygnus melanocoryphus*). There are a number of big herbivorous rodents such as the coypus (*Myocastor coypus*) and the capybara (*Hydrochoerus hydrochaeris*), and there are predators such as the caiman (*Caiman latirostris*) and otter (*Pteronura brasiliensis*).

The Challenge

Since the 1970s the region has seen a dramatic expansion in rice cultivation that has encroached on wildlife habitats, and there has also been an expansion of plantation forests (pine and eucalyptus) and tourism development (on the Uruguayan side). These developments have had a significant impact (albeit not systematically studied) on the ecosystems of the basin. An integrated approach to conservation and development is therefore essential to maintain healthy ecosystems and protect biodiver-

sity. Fortunately, in addition to the international site designations mentioned above, the basin is under a bi-national treaty for cooperation and resource utilization which foresees “harmonization ... of the studies, plans, programs and projects necessary for achievement of joint works designed to improve utilization of natural resources” (Article 3b), and “the defense and suitable use of mineral, plant and animal resources” (Article 4e) (Parliament of Uruguay, 1977).

Wetland drainage canal to improve the suitability of the land for rice cultivation (Brazilian side)



The Research

The main goal of the remote sensing pilot project was to construct baselines of ecologically relevant land cover patterns (using Landsat imagery) that reflect relative importance to migratory water fowl, wading and shore birds and resident passerine and non-passerine arboreal bird species (see image following page). The process was informed by field work in March and October 2004 on both sides of the lake, conducted by a bi-national team of biologists in the areas in and around Arroio del Rei (Brazilian side) and to the south of the Rio Tacuari (Uruguayan side) (see image on cover). By establishing adequately detailed geospatial baselines

and conservation priorities, and by providing decision support templates, future surveys and conservation efforts can be optimized to protect and conserve regional resources.

The pilot project also sought to test the utility of the Diversidad software package, which utilizes the diversity of pixels in an the image as a proxy for biodiversity richness. The preliminary results suggest a reasonably high correlation between pixel diversity and bird species richness for the October survey (R^2 of .20, $P < .10$).

From left to right: Collared Plover chick (*Charadrius collaris*), Great Horned Owl (*Bubo virginianus*), Carnations of the Air (*Tillandsia aeranthis*), Hilaire's Side-necked Turtle (*Phrynops hilarii*)



Land Cover Types of Importance to Birds. The remote sensing work and field surveys identified the following land cover types of importance to the area's birdlife: (1) coastal dunes and lake, (2) seasonally flooded wetland (3) wet gallery forest, (4) riparian edge forest, (5) Dry upland forest, (6) seasonally flooded forest, and (7) crop matrix (rice in rotation with pasture).



The remote sensing and field work has highlighted the importance of conserving remaining habitats in the basin, and represents a tool for long-term monitoring

of land-cover change. The bi-national character of the work has helped to foster collaboration and capacity building among the partners.

References

Parliament of Uruguay. 1977. Tratado Sobre Cooperación para el Aprovechamiento de los Recursos Naturales de la Cuenca de la Laguna Merín. Available at <http://www.parlamento.gub.uy/htmlstat/pl/tratados/trat14748.htm>

PROBIDES. 1999. *Plan Director de la Reserva de Biosfera Bañados del Este*. UNDP, GEF, MVOTMA, Rocha 152 pp.



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For reports, downloadable data, and other information on the project, please visit:
<http://sedac.ciesin.columbia.edu/rs-treaties/laguna.html>