LEGAL PROTECTION FOR NORTHERN CHILEAN WETLANDS (VEGAS AND BOFEDALES)

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Abstract

For centuries, indigenous communities from Northern Chile managed natural resources and environment on a sustainable basis. Their holistic understanding and knowledge is noteworthy, specially in regard to the northern wetlands of Chile called Bofedales.

Due to pressure to get water rights for nonagricultural uses (mining, water consumption, etc.) over these wetlands, people started to drain them with the consequent loss of associated flora and wild fauna as well as reducing the power of ancestral rights of indigenous communities on natural resources (included water), putting at risk the sustainability and survival of both local populations and wetlands on which they depend.

In 1992 the Water Law of 1981was changed to prohibit any groundwater exploration and exploitation of aquifers feeding these wetlands. Since 1996, the northern wetlands are thus legally protected: 303 wetlands and their 176 aquifers, covering a total surface of 3500 km^2. Studies are going on and more wetlands are likely to be protected in the near future.

1 INTRODUCTION

The Water Law established in Chile in 1981 radically changed the system of water rights previously prevailing in the Country by strengthening private property rights, favoring market incentives, and reducing state regulation. The resulting benefits should be a greater efficiency and flexibility of water use and reduced interventions and expenditure from the state. However, their drawbacks include important social and environmental externalities.

Wetlands are important for environmental, social, cultural and economic aspects. They are unique ecosystems with a high vulnerability to hydric stress and our knowledge on the processes involved is limited, given the complex interaction of their basic components: land, water, animals and plants. Wetlands can provide drinking sites for animal and their vegetation can be an important resource. In addition, they have both economic and cultural values for indigenous communities of the Altiplano.

Since 1981 the impact of this Water law was extremely negative for northern wetlands (vegas and bofedales) and their surroundings. These wetlands started to dry with the consequent loss of associated flora and wild fauna as well as reducing the power of ancestral rights of indigenous communities on natural resources (included water). The pressure on water rights for nonagricultural uses (mining in the first place, and also for water consumption in the cities), has put at risk the sustainability and survival of both local populations and wetlands on which they depend.

The new and democratic Government of 1990 modified the water law in 1992, which leaded to the legal protection of 303 wetlands and their 176 corresponding aquifers, covering a total surface of around 3.500 km2. Studies are going on and more wetlands are likely to be protected in the near future. The governmental agency responsible for water issues, including these protections, is Direccion General de Aguas (DGA).

2 VEGAS AND BOFEDALES: MAIN CHARACTERISTICS

In the north of Chile there is a very dry environment. In the cases where these environments receive a constant or a seminconstant flow of water, a special type of vegetation systems (Altoandinos wetlands) develops, vegas and bofedales. They form on soils, mainly organic, permanently saturated, with a wide biological diversity. These wetlands represent food and water supply for a lot of species in danger of extinction (vicuna, guanaco, llama and alpaca, among others). The bofedales's flora is adapted to the extreme conditions of the Puna Andina and is characterized by a channel network in the shape of a "pillows" and containing running water. The vegas have a typical vegetation due to the high and permanent humidity content in the soil. In these systems, there are no running water and their existence is dependant on water table levels characteristic of salty groundwater.

3 LEGAL PROTECTION OF THESE WETLANDS

As it was said, in 1992 the Chilean Water Law of 1981 was changed, adding in the articles 58 and 63 the protection of the wetlands of the Chilean Altiplano, through the prohibition of the exploitation and exploration of groundwater resources that feed these wetlands. So, DGA defined the wetlands's aquifers and protected these areas by law, and makes periodic field studies to update the aquifers's limits in order to protect effectively this wetlands.

4 OTHER PROTECTIONS OF THE ANDEAN CHILEAN WETLANDS.

4.1 RAMSAR Convention

In the last four decades, a lot of work has been done to protect wetlands around the whole world. Among others, Ramsar convention was created in 1971, in the city of Ramsar, Iran. This convention was ratified by Chile in 1984. Nowadays, 7 of the 4042 wetlands identified by Ramsar are located in Chile:

- Salar de Surire
- Salar de Huasco
- Sistema Hidrológico de Socor
- Salar de Tara
- Laguna del Negro Francisco y Laguna Santa Rosa.
- Humedal El Yaly
- Carlos Andwanter Sanctuary

4.2 Environmental Law (Ley N°19.300, Bases Generales del Medio Ambiente, 1994)

The environmental law, through the Environmental Impact Assessment System (SEIA: Sistema de Estudio de Impacto Ambiental) protect the Andean wetlands and also wetlands in general along Chile, not only in the north.

4.3 SNASPE Sites

The National System of Protected Natural Areas (Sistema Nacional de Areas Silvestres Protegidas del Estado, SNASPE) was created by law in 1984, for the conservation of national parks in Chile. Currently, there are 94 of these units under protection and 6 of them encompass northern wetlands:

Monumento Natural Salar de Surire;

Parque Nacional Lauca;

Reserva Nacional Las Vicuñas;

Parque Nacional Volcan Isluga;

Parque Nacional Llullaillaco

Reserva Nacional Los Flamencos

5 STUDIES AND ASSESSMENTS MADE BY DIRECCION GENERAL DE AGUAS TO PROTECT NORTHERN WETLANDS'S AQUIFERS

The studies developed by DGA followed these steps: Identify the aquifers that feed the northern wetlands, delimit them, update this delimitation through the time according to the information given by the indigenous communities.

The specific objectives of these studies were:

- To get information about the geology and hydrology of the area of interest related to wetlands and native communities,
- Identify the particular aspects that would allow the delimitation of the hydrogeological units from basic information obtained in the field and other technical facts,
- Identification and delimitation of the aquifers that feed these wetlands,
- Creation of a digital information database in GIS of these wetlands and their aquifers.

6 METHODOLOGY

- The identification was made on satellite images (of northern Chile, with special emphasis in the basins of the upper parts, due to in those areas the water resources have their origin) through a Vegetational Index, which allowed to determine areas with vegetational associations associated to wetlands and shallow water.

- On these same images, we validated the limits of the wetlands identified by the Vegetation Index method by comparing with field data. The accuracy of our classification was 90%. For each of the existing wetlands and its correspondents IV, we selected the corresponding aerial photograph (1: 50 000) in order to detect the roads, relevant topographic aspects, etc.

- The photocentrum of each of the selected photos was located in a map to make the field work easier and faster.

- In the field, the wetlands were localized using a GPS and their extent was calculated from the delimitation of the area identified on the aerial photo.

- Because of financial constraints, we did not use stereographic pairs of photos for the geological photointepretation of the structure of the rock units. This work was made in the field, drawing on the photo the contacts and the types of rock units, as well as the soil structures.

- This information collected in the field served as a basis for the geographic delimitation of the aquifers.

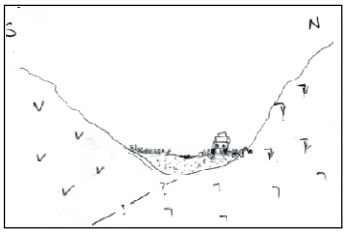
7 RESULTS AND CONCLUSIONS

7.1 Specific Results and Conclusions

The results obtained from these studies allowed DGA to protect aquifers that feed northern wetlands. The project leaded to the protection of these unique ecosystems, and their associated endangered species. The Indian communities also benefited from the project. The current studies about associated aquifers will increase the protection of these systems. Another important outcome of these studies is the recognition and identification of the different types of wetlands according to their source of water. In the next section, we describe these different types of wetlands.

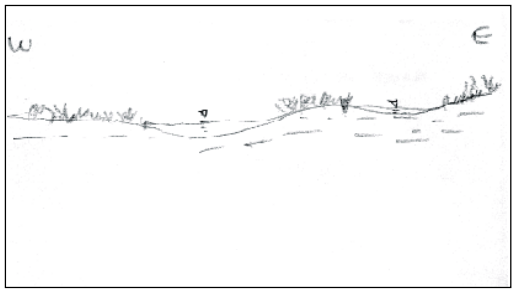
7.2 Wetlands fed by groundwater

Ravine Bottoms (Fondos de quebradas)



They are characterized by floristic associations typical of ravine streams bottoms, with intermittent water flow. In the streams, there is a sedimentary soil layer head, with a shallow aquifer that feed the vegetation.

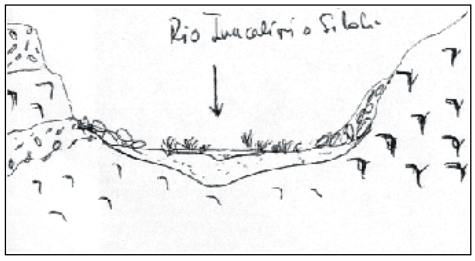
Salares



The areas of basins associated to closed depressions or salares have vegetational associations fed by shallow water table located in one of the edges of this closed system, specifically in the discharge area of it. It was detected the existence of at least two kind of aquifers in these closed basins. The aquifers are independent between them hydrology and geologically. The aquifer connected with wetlands is the upper one. The influence of the deep aquifer in the upper aquifer has not been studied yet, neither its influence in the support of the wetlands.

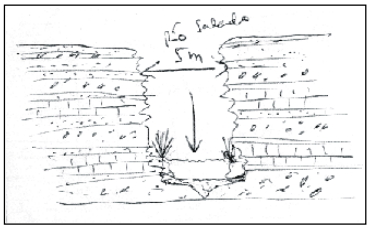
Alluvial plain (Llanura Aluvial)

This wetland type occur in extensive geographic areas associated with a morphologic unit of alluvial plain, without permanent superficial flow. Inside these alluvial plains there are freatic granular aquifers, with shallow water tables that are recharged in the highest part of the watersheds.



Karstic (Cársticas)

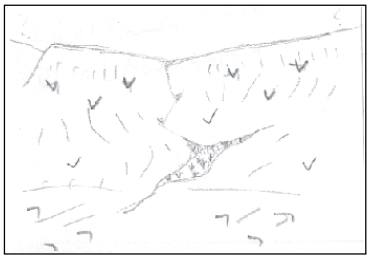
Over the calcareous rocks outcrops, mainly subhorizontals, there is a thin cover of sedimentary soil layers in which exists wetland vegetation. The source of water for this vegetation is an aquifer made of calcareous rocks (karstics). These wetlands are the only type of vegetation associated with an aquifer located in a non granular layer.



Wetlands fed by subsuperficial flow

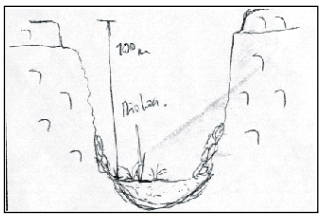
Revines Upper parts (Cabeceras de quebradas)

They are floristic associations that exist in a higher level than the mainstream flow. They are located in a granular sedimentary sequence, of low head and low extension, fed by direct recharges to the watershed, and where the porous layer is the unit that keeps and transmit the subsuperficial water in it.



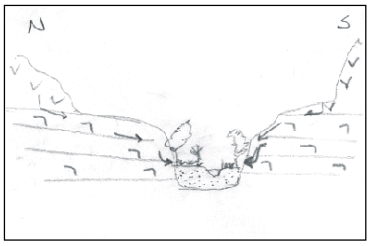
Stream beds (Lechos de cauce)

They are wetlands in streams with constant flow and a wide cross section. There is a superficial runoff restricted into a portion of the stream that feeds detritus deposits. Over them a wetland vegetation is developed.



Springs (Vertientes)

It is the outcrop of groundwater into the surface making a permanent flow.



Specific Consequences

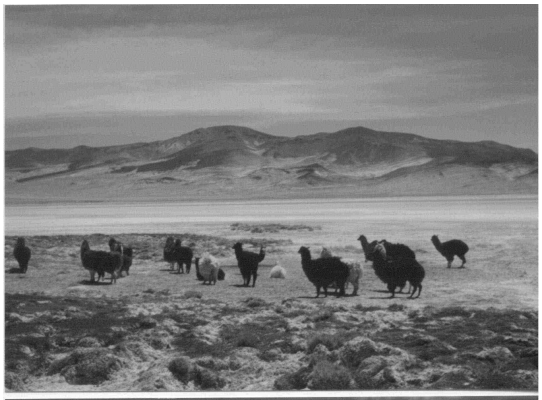
With this definition of the aquifers that feed the northern wetlands and the legal protection given to them, the areas of these aquifers are protected from new exploitation or exploration of groundwater. It is thus not allowed to build new wells, for pumping water or conducting research. The conservation network will be accessible in DGA's web site through a GIS that will show the location of these protected wetlands, its delimitation, vegetational characteristics, photos, technical highlights, and a procedure that will allow general public to know the coordinates of a specific place for which they may have an interest, and get all the information available.

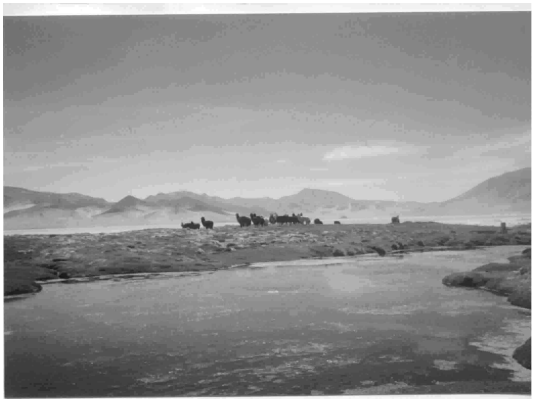
8 GENERAL RESULTS AND CONCLUSIONS

With the challenges that face many countries in the context of social and economic development, hydric resources are becoming increasingly at risk. The way countries manage their natural resources, among which water resources are included, is so far nonsustainable. For this reason, a drastic change of attitude is needed and a holistic approach has to be undertaken.

There is a need for a strong commitment for water resources and environment. Studies like the one we presented here should help understanding that stakeholders can manage water resources of their surroundings in a sustainable way.

Some photos





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