ALIANZA HUMEDALES ANDINOS

State of Protection of the Andean Wetlands in Chile

Policy Brief No. 1 | February 2024

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The Alianza de Humedales Andinos (Andean Wetlands Alliance) brings together civil society organisations, local communities, and socioenvironmental movements in Argentina, Bolivia, and Chile. Its goal is to protect, conserve, and defend Andean wetlands in peasant and indigenous territories. The Alliance's work is grounded in environmental conservation, respect for human rights, and environmental justice in the face of the ecological and climate crisis.

In Chile, the Alianza de Humedales Andinos consists of the following organisations:

Fundación Tantí
https://www.fundaciontanti.org/

ONG FIMA
https://www.fima.cl/

ONG Defensa Ambiental
https://www.ongdefensaambiental.cl/

Formando Rutas
https://formandorutas.tech/

Contributors to this volume:

Javiera Pérez (ONG FIMA); Paulina Hidalgo (Fundación Tantí); Cynthia Escares (ONG Defensa Ambiental); Antonio Pulgar (ONG FIMA); Ramón Balcázar (Fundación Tantí).

Introducción

In the context of a new geological era, the Anthropocene, in which humanity has become the principal driver of transformations on our planet, ecological systems are undergoing essential, structural changes.[1] These transformations centre on the intensive use of fossil fuels and economic activities since the start of the industrial era, leading us towards an accelerated process of global warming and a mass extinction of species.[2]

Within the framework of international climate change negotiations, there is growing emphasis on the need to abandon fossil fuels and transition energy systems towards non-conventional renewable energy sources.[3] In this drive to decarbonise economies, there has been a marked increase in the demand for minerals considered essential for this process, particularly lithium. Some of the main reserves of this element are located in the so-called "lithium triangle" spanning Chile, Argentina, and Bolivia, drawing significant global attention.

According to Bringel and Svampa, the "consensus on decarbonisation" carries the latent danger of perpetuating the intensive extraction of raw materials and the ideology of endless economic growth.[4] This has important political and practical consequences. On the one hand, it enables a process of "commodification of territory," which continues the neoliberal logic that has prevailed in Chile over the past five decades, especially regarding lithium mining.[5] On the other hand, it obscures some of the essential elements of the socio-ecological systems of salt flats, understood as high-altitude wetlands. Chile's fragmented regulation has not succeeded in establishing an integrative framework for all aspects of this debate; rather, it has prioritised an instrumental view of these ecosystems that needs re-examination.

1 Crutzen, P. J. (2006). The "Anthropocene." In Ehlers, E. & Krafft, T. (Eds.), *Earth System Science in the Anthropocene*. Springer, Berlin, Heidelberg. Available at: https://doi.org/10.1007/3-540-26590-2_3

2 IPCC. (2018). *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 3–24. Available at: https://doi.org/10.1017/9781009157940.001

3 New COP28 draft deal stops short of fossil fuel "phase out" (2023). Available at: https://www.reuters.com/markets/commodities/new-cop28-draft-deal-stops-short-fossil-fuel-phase-out-2023-12-11/

4 Bringiel, B. y Svampa, M. (2023). "Del «Consenso de los Commodities» al «Consenso de la Descarbonización»", *Nueva Sociedad* N° 306. https://nuso.org/articulo/306-del-consenso-de-los-commodities-al-consenso-de-la-descarbonizacion/

5 Bustos-Gallardo, B. & Prieto, M. (2019). Nuevas aproximaciones Terica's a las regiones-commodity desde la ecología política. Revista EURE - *Revista de Estudios Urbano Regionales,* 45(135). Available at: https://doi.org/10.7764/2635

The aim of this document is to highlight relevant points for public discussion and to propose recommendations that will enable better management and protection of the high-Andean salt flats.

1. *Regulatory Aspects of the Protection of Andean Wetlands*

The regulations applicable to Andean wetlands in Chile are dispersed. Various legal frameworks exist to protect them, such as wetlands of international importance or protective measures for the waters that feed them, as well as for the Indigenous communities that inhabit or carry out their lives around them. However, a significant portion of Chilean legislation—far from safeguarding these ecosystems and, in doing so, jeopardising their conservation—is guided by the principles of the so-called "economic public order," which prioritises economic growth by facilitating the extraction of minerals such as salts, lithium, and their derivatives, as well as the extraction of fresh surface or groundwater that feeds the salt flats.

This regulatory framework reflects an anthropocentric and neoliberal viewpoint, chiefly manifested in mining laws at various levels. Some Andean wetlands, particularly salt flats, have been included in the Constitution, the Mining Code, and the Organic Constitutional Law of Concessions, conceptualising them as mineral deposits and distinguishing between minerals subject to concessions and those that are not, with the State reserving decisions on their exploitation. Thus, exploration and mining activities in the salt flats focus on extracting minerals contained in these fragile ecosystems—particularly salts, minerals, and their derivatives such as lithium.

In 1979, Decree Law No. 2886 was enacted, stipulating that lithium is a reserve of the Chilean State and excluding it from substances eligible for mining concessions.[6] A similar approach is taken by Law No. 18.097 (1982) and the Mining Code (1983). Both regulations state that non-concessible substances may only be explored and exploited directly by the State and its companies or through administrative concessions or special operating contracts, under conditions determined by the President of the Republic via a Supreme Decree.

At present, in the Salar de Atacama (Atacama Salt Flat) in the Antofagasta Region, lithium ownership is under the control of the Corporación

6 Its original purpose was related to the nuclear interest in lithium, owing to its suitability for nuclear or atomic energy generation. Currently, the crucial importance of lithium lies in the global energy transition process, which requires solutions for electricity storage and for advances in and interest in electromobility.

de Fomento de la Producción (CORFO, Production Development Corporation). Meanwhile, the Corporación Nacional del Cobre (CODELCO, National Copper Corporation) controls lithium in the Salar de Pedernales and Maricunga in the Atacama Region, whereas the Empresa Nacional de Minería (ENAMI, National Mining Company) manages it in the Salar de Aguilar, also in the same region.[7]

Furthermore, Article 1 of the Mining Code establishes that salt flats are mines, stating:

> *"The State has absolute, exclusive, inalienable, and imprescriptible ownership of all mines, including quarries, metalliferous sands, salt flats, coal and hydrocarbon deposits, and other fossil substances, except for surface clays, notwithstanding the ownership by natural or legal persons of the lands in which they are located."*

However, other legal provisions present different perspectives that attempt to address the protection of these ecosystems. The 1971 Ramsar Convention on Wetlands of International Importance (Ramsar Convention) is an international treaty providing a framework for the conservation and protection of wetlands. This instrument promotes international cooperation to preserve and manage wetlands sustainably, recognising them as essential ecosystems for biodiversity, water sources, food, carbon sinks, and other ecosystem services vital for sustaining life in these territories. The Convention has 172 contracting parties, and Chile has been a member since 1981.

This international regulation enshrines a broad definition of wetlands in Article 1, which states:

> *"Areas of marshes, swamps, and peat bogs, or surfaces covered by water, whether natural or artificial, permanent or temporary, stagnant or flowing, fresh, brackish, or saline, including areas of marine water whose depth at low tide does not exceed six metres."*

Under this definition, high-Andean wetlands can be considered—these are fragile ecosystems located in the Puna de Atacama and Altos Andes that serve as crucial sources of water and food for the flora, fauna, and life systems present there.[8]

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7 Burdiles, Gabriela (2021). "La regulación jurídica de los salares en Chile: obstáculos para su protección a la luz del caso del Salar de Atacama", p. 184. En Balcázar Morales, R., *Salares Andinos, Ecología de Saberes para la Protección de Nuestros Salares y Humedales.* https://cl.boell.org/sites/default/files/2021-03/Libro_Salares%20Andinos_version_definitiva_castellano.pdf

8 CONICET. (2022). *Clasifican a los humedales altoandinos de la Puna según su composición florística.* Available at: https://www.conicet.gov.ar/clasifican-a-los-humedales-altoandinos-de-la-puna-segun-su-composicion-floristica/

The Ramsar Convention assigns duties and obligations to contracting States concerning these ecosystems. Chile boasts 16 Ramsar sites, including Salar de Aguas Calientes, Salar de Pujsa, the lagoon complex Laguna del Negro Francisco and Laguna Santa Rosa, the Soncor Hydrological System of the Salar de Atacama, Salar de Tara, Salar de Huasco, and Salar de Surire, in addition to other wetlands that are not salt flats.

Other mechanisms also exist for ecosystem protection, including salt flats, although Chile lacks a single legal framework systematising all national protected areas. There are currently more than 20 laws, treaties, and regulations that govern different protective mechanisms, such as Law No. 17.288 on National Monuments, the Convention on Biological Diversity, Law No. 19.300 on General Environmental Bases, and the new Law No. 21.600, which establishes the Biodiversity and Protected Areas Service and the National Protected Areas System.

Among the Ramsar-listed salt flats, most have been afforded other forms of complementary official protection. For instance, the Salar de Surire was declared a Natural Monument in 1983; the Salar de Huasco was designated a Nature Sanctuary in 1995; the Salar de Tara and Salar de Pujsa are partially included within the Los Flamencos National Reserve, established in 1990; the Soncor Hydrological System of the Salar de Atacama also lies within the Los Flamencos National Reserve; and the Laguna del Negro Francisco and Laguna Santa Rosa complex belongs to the Nevado Tres Cruces National Park, created in 2011, a third of which overlaps with the Salar de Maricunga.[9] However, some salt flats do not hold Ramsar status, and others that do hold Ramsar status have not yet been granted additional, complementary official protection at the national level, such as Salar de Aguas Calientes IV.

The SBAP Law aims to coordinate and systematise the prior fragmented regulations, with the goal of preserving biological diversity and safeguarding natural heritage.[10] Moreover, this law incorporates various designations established in international instruments, such as Ramsar sites. Thus, Article 37 indicates that sites declared under the Ramsar Convention will be included under one of the protection categories in Article 56 (Virgin Region Reserve, National Park, Natural Monument, National Reserve, Multiple Use Conservation Area, Indigenous Peoples' Conservation Area). It further provides that the Biodiversity and Protected Areas Service:

9 ONG FIMA (2023). *Apuntes de política ambiental: Nueva legislación para la naturaleza: ¿Qué es la ley SBAP y cuál es su importancia para Chile?* https://www.fima.cl/wp-content/uploads/2023/10/Apuntes-politica-ambiental-edicion-especial.pdf

10 ONG FIMA (2023). *Apuntes de política ambiental: Nueva legislación para la naturaleza: ¿Qué es la ley SBAP y cuál es su importancia para Chile?* https://www.fima.cl/wp-content/uploads/2023/10/Apuntes-politica-ambiental-edicion-especial.pdf

> *"Will promote the conservation and sustainable use of wetlands of international importance or Ramsar sites, considering the ecological, economic, and social dimensions, in order to contribute to the protection of national, regional, and local environmental heritage and the well-being of local communities."*

Although the creation of the SBAP Law enables progress in protecting designated areas, challenges remain because of regulatory fragmentation and ecosystem degradation, largely driven by the effects of intensive activities within these areas. At present, we face a range of opportunities and hurdles to ensure the law's effectiveness and implementation.

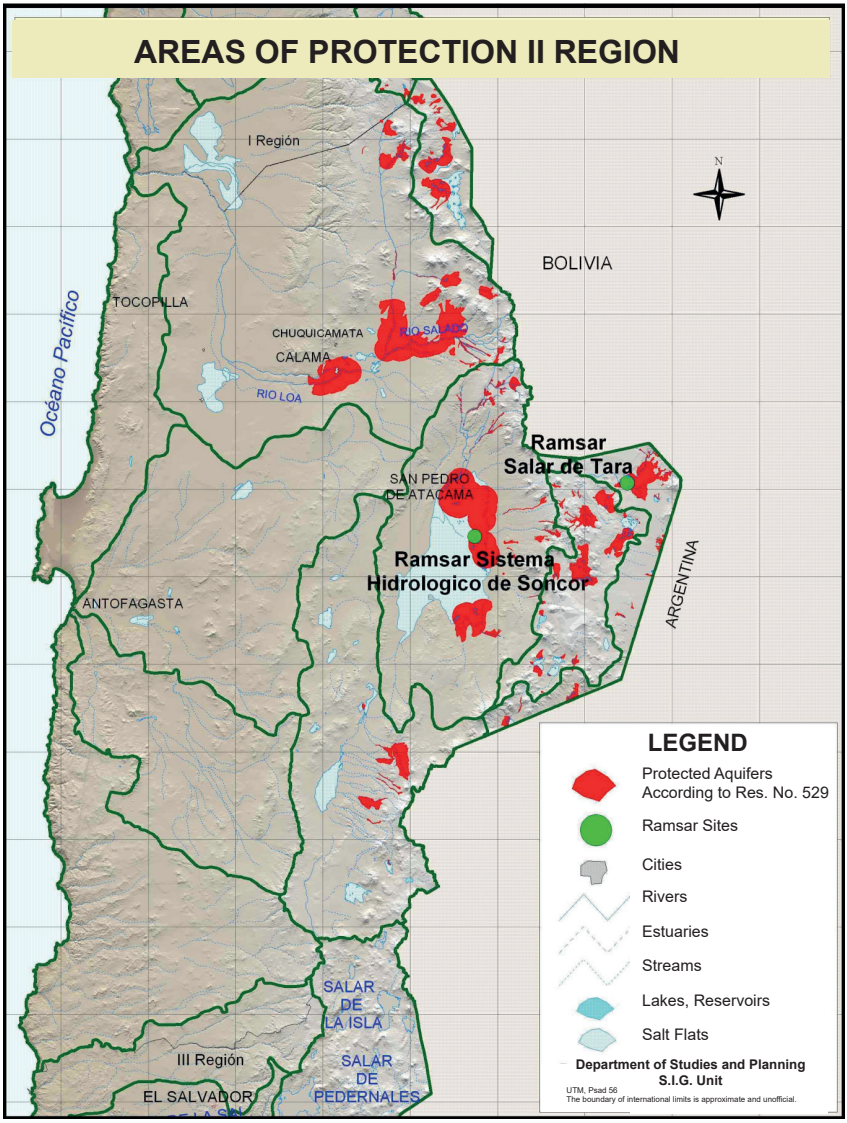
For example, neither the Water Code nor its amendments have specifically addressed the regulation of salt flats as high-Andean wetlands. Nevertheless, a sign of protection can be found in the Indigenous Law and its implementation regarding so-called "Indigenous waters." This recognition also arises from the provisions of ILO Convention No. 169, whose Article 15 affirms that "the rights of the peoples concerned to the natural resources existing on their lands shall be specially safeguarded," including water resources. Additionally, the Indigenous Law specifically states in Article 64 that the waters belonging to Aymara and Atacameña communities must be protected.

Moreover, Article 58 of the Water Code states:

> *"No exploration may be carried out on public or private land in areas that feed high-Andean meadows, marshes, and peat bogs in the regions of Arica and Parinacota, Tarapacá, Antofagasta, Atacama, and Coquimbo without the founded authorisation of the Dirección General de Aguas (General Water Directorate), which must first identify and delineate these areas (...)*
>
> *Likewise, no exploration may be carried out on public or private land in areas corresponding to aquifer sectors that feed wetlands declared by the Ministry of the Environment to be threatened ecosystems, degraded ecosystems, or priority sites, provided that this declaration, in coordination with the General Water Directorate, demonstrates that the structure and functioning of said wetland depend on the underground water resources supporting it."*

Since 1993, the General Water Directorate has conducted studies to pinpoint areas of high-Andean meadows and peat bogs and to define the aquifers that feed them.[11] In 1996 and 2003, resolutions were issued to delineate aquifers in the Antofagasta Region, thus protecting 228 wetlands—a total area of 5,149 m^2—including 12 wetlands in the Salar

11 Burdiles, G. (2021). op. cit., p. 182.



Source: General Water Directorate, 2011.

de Atacama system.[12] This means that in this area, which accounts for no more than 4.07% of the total surface area of the region, no groundwater exploration or granting of water-use rights may be authorised without a prior environmental assessment.

Taking all this into account, it becomes evident that, despite national and international legislation intended to protect these ecosystems, the current framework remains insufficient to achieve conservation objectives. This shortfall stems primarily from the predominance of mining-sector regulation and the fragmented approach to conservation. Institutional incentives designed to foster extractive activities have not faced adequate counterbalances to prevent or internalise the environmental costs of such development.

Thus, to further incorporate environmental justice dimensions, more public information is needed about these ecosystems, as well as increased dialogue and participation in decision-making processes, allowing the inclusion of ecological and social perspectives that are highly specific to these ecosystems and their associated life systems. The following sections explore these dimensions in greater detail.

2. *Sociocultural Aspects Linked to the Environmental Protection of the Salt Flats and Andean Wetlands*

An important consideration for protecting the salt flats concerns sociocultural factors that incorporate respect for the cosmovision of the Indigenous peoples who have inhabited these territories since ancient times.

These inhabitants have shaped these landscapes over the years through interaction with natural phenomena, whereby their irrigation systems, grazing activities, and deliberate movements—among other practices such as transhumance or irrigating wetlands via canals—have moulded and forged a space that is both natural and cultural.

Because of this, the Andean salt flats are viewed as both tangible and intangible cultural heritage, the protection of which is of interest to their inhabitants and to the State of Chile. This direct link between human action and the formation of salt flats has frequently been rendered invisible or deliberately overlooked, thereby directly or indirectly favouring mining processes through the overexploitation of aquifers whose waters have been used in such operations.[13]

12 Burdiles, G. (2021). op. cit., pp. 182–183.
13 Jerez, B., Garcés, I. & Torres, R. (2021). Lithium extractivism and water injustices in the Salar de Atacama, Chile: The colonial shadow of green electromobility. *Political Geography*, 87, 102382. Available at: https://doi.org/10.1016/j.polgeo.2021.102382

Prior to lithium extraction, there are cases where copper mining led to the disappearance of ecosystems, or even where mining tailings were placed on them, causing the degradation of wetlands, rivers, and pollution of Indigenous territories.[14] Examples include the Salar de Punta Negra, whose environmental degradation was the subject of a lawsuit by the Consejo de Defensa del Estado (State Defence Council) against mining companies Escondida, Zaldívar, and Albemarle, or the Salar de Talabre in Chiu Chiu,[15] where mining tailings have been deposited.

In order to address the protection of ecosystems linked to Andean salt flats, it is necessary to generate knowledge drawn from the social and cultural reality of the peoples who have inhabited and shaped these spaces, from their ancestral viewpoint. At the core of the Andean peoples' cosmovision lies water, conceived as the binding element of life between human beings and the natural environment. Mining intervention in the salt flats contributes to the intensification of drought in the water bodies connected to them, affecting local agriculture and livestock rearing—socioeconomic activities essential for the survival of these peoples and communities.

As shown by on-the-ground information campaigns, the identity of human groups and cultures is affected, and these groups are internationally protected under ILO Convention No. 169. Water is a key element in their rituals and ceremonial practices. It is sacred within Andean culture, and when it evaporates as a result of lithium extraction operations, it also affects the habitat of fauna such as flamingos (or parinas), reducing the availability of feathers used by yatiris (wise people) for ceremonial rites. Owing to climate change and mining, these species vanish along with the degradation of their breeding grounds, revealing a clash of visions and paradigms between two forces with differing aims in the same territory.[16] Another identity-related activity associated with the salt flats is the gathering of high-altitude herbs—such as bailahuén, chachacoma, and pingo pingo—found at 2,500–4,800 metres above sea level, used by the Andean peoples for medicinal, ritual, and even everyday purposes.

14 Consejo de Defensa del Estado demanda a tres mineras por daño ambiental en Salar de Atacama. (2022). Available at: https://www.1ta.cl/consejo-de-defensa-del-estado-demanda-a-tres-mineras-por-dano-ambiental-en-salar-de-atacama/; CDE, pueblos atacameños y mineras entregaron los últimos argumentos en la demanda por daño ambiental por afectación a acuífero en el Salar de Atacama. (2024). Available at: https://www.1ta.cl/primer-tribunal-ambiental-escucho-los-alegatos-finales-de-la-demanda-por-dano-ambiental-en-contra-de-minera-los-pelambres-2/

15 Entre el extractivismo y el cuidado: una breve historia sobre las aguas del desierto de Atacama. (2024). Available at: https://endemico.org/breve-historia-sobre-las-aguas-del-desierto-de-atacama/

16 Gutiérrez, J. S., Moore, J. N., Donnelly, J. P., Dorador, C., Navedo, J. G. & Senner, N. R. (2022). Climate change and lithium mining influence flamingo abundance in the Lithium Triangle. *Proceedings of the Royal Society* B, 289(1970), 20212388. Available at: https://doi.org/10.1098/rspb.2021.2388

Salar de Talabre and Mining Operations.
Source: Fundación Tantí, 2024.

Thus, one crucial aspect to consider is the right of these peoples to public participation in decisions regarding their territories. Ensuring the involvement of communities in processes that are well publicised, enjoy broad attendance, are transparent, conducted in good faith, and supported by informed consent is of critical importance, applying the standards of ILO Convention No. 169, the Escazú Agreement, and the United Nations Declaration on the Rights of Indigenous Peoples.

The tensions outlined so far are evident in the standards governing the exercise of environmental democracy rights. According to interviews with communities, one conflict that previously emerged regarding mining activity in the salt flats involved shortcomings in the application of national regulations and the standards employed, compared to international criteria. Consequently, Chile's legal and institutional framework facilitates mining processes at the expense of environmental and cultural protection. This points to the dominance of the economic valuation of these ecosystems over issues concerning life.[17]

17 Fundación Tantí. (n.d.). *Informe antropológico del pueblo Colla de Copiapó.*

With respect to the right of access to information, another tension concerns the development of baseline studies on the salt flats' environmental components and their long-term monitoring systems. From fieldwork and interviews, it was found that, in some cases, baseline studies produced for environmental impact assessments by external agents (not from the communities themselves) have been deficient, erroneous, or poorly executed, favouring those aiming to undertake economic activities in the wetlands.[18] Baseline studies, monitoring systems, and follow-up plans should integrate ancestral knowledge and the participation of Indigenous community leaders in the territory, as mechanisms to ensure reliability.

Several communities have developed the capacity to conduct independent monitoring or have secured resources to procure equipment for observing the salt flats' environmental variables. Nonetheless, support for on-site oversight is required, given that these territories are vast and impose an excessive workload on public agencies that the State is unable to fully address. Generating information grounded in local ecological knowledge could serve as a more effective guide, aligning with the needs and perspectives of the territory, as understood by those who can read its signals.

Pressure arising from the growing national and international demand for minerals contained in the salt flats is increasing. It is necessary to expand the technical and professional capacity dedicated to guaranteeing the right to environmental justice, with specialists who can serve the public interest, since the State lacks a dedicated public service akin to an Environmental Ombudsman.[19]

The consequences of the expansion of extractivism and lithium exploitation within a territory's fabric relate to the intensification of conflicts among its actors, some newly arrived and others longstanding. When external agents intervene in territories with their own systems of organisation and representation, reactions and responses arise in these social contexts, which are often marked by the absence of the State. An example is the agreement between SQM and CODELCO,[20] which, according to communities in the Salar de Atacama, lacked information, participation, and certainly any form of prior consultation within the territory, thereby prompting community mobilisation.[21]

18 Fundación Tantí. (n.d.). op. cit.
19 ONG FIMA. (2022). *Hacia una Constitución Ecológica: Acceso a la justicia ambiental.* Available at: https://www.fima.cl/wp-content/uploads/2022/05/informe-acceso-a-la-justicia.pdf
20 SQM y CODELCO Acordaron un Memorandum de Entendimiento. (2023). Available at: https://ir.sqm.com/Spanish/noticias/noticias-de-talles/2023/SQM-y-CODELCO-Acordaron-un-Memorandum-de-Entendimiento/default.aspx
21 Comunidades atacameñas mantienen posición en el salar de Atacama y comuneros

All this underscores the need to generate situated knowledge that reflects the territorial reality and its relationship with the distinctive features of the ecosystems where Andean wetlands are located. In these territories, there are life systems that have deeply integrated a connection with the environment and with life itself, and that acknowledge applicable human rights protection frameworks. Only through this understanding can institutional frameworks embrace the rich complexity of socio-ecological systems, making space for these voices.

3. *Ecological and Biogeochemical Aspects of the Andean Salt Flats of Chile*

To deepen understanding of this discussion, it is vital to place the human dimension in a specific time and space: the ecology of high-altitude Andean wetlands. In terms of their ecological composition, it is necessary to rely on scientific certainties about the available knowledge of these ecosystems so that they can be incorporated into public debate and used to strengthen protection instruments.

Salt flats are endorheic basins, occupied by numerous saline lakes and salt crusts. In Chile, they are bordered by a succession of north–south-oriented mountain ranges, within an area of approximately 53,000 km². These define a strip between 18°S and 27°S, around 1,000 km in length and an average width of 120 km, ranging from 50 to 250 km on the western slope of the Andes mountain range.[22] The Andean and pre-Andean salt flats in northern Chile form one of the world's most significant evaporitic complexes.[23]

Salt flats are zones of both groundwater and surface water discharge in closed basins, where evaporation has created surfaces with a high accumulation of salts. The brines and salts in salt flats and saline lagoons originate from the evaporation of incoming water, belonging to four categories:[24]

- Flowing springs

visibilizan preocupación por impactos de la minería en el medio ambiente. (2024). Available at: https://salares.org/comunidades-atacamenas-mantienen-posicion-en-el-salar-de-atacama-y-comuneros-visibilizan-preocupacion-por-impactos-de-la-mineria-en-el-medio-ambiente

22 Cabello, J. (2022). Reservas, recursos y exploración de litio en salares del norte de Chile (p. 297–306). Andean Geology, 49(2). Available at: http://dx.doi.org/10.5027/andgeov49n2-3444

23 Risacher, F., Alonso, H. & Salazar, C. (2003). The origin of brines and salts in Chilean salars: a hydrochemical review (p. 249–293). *Earth-Science Reviews*, 63(3–4). Available at: https://www.scribd.com/document/473411641/risacher2003

24 Risacher, F., Alonso, H. & Salazar, C. (1999). Geoquímica de aguas en cuencas cerradas: I, II y III regiones - Chile. Santiago, Chile: Ministerio de Obras Públicas, Dirección General de Aguas.

- Diffuse springs
- Rivers and streams
- Subsurface aquifers

Chile also has two types of salt flats:[25]

- Coastal and Central Valley salt flats: These are inactive, fossil salt flats with very dry salt crusts. Deposits of nitrates and iodine are found here.

- Andean salt flats: These are active. They receive water input from their drainage basins, which concentrate via evaporation in surface lagoons where evaporitic salts precipitate.

The complexity of these ecosystems stems from several factors. The hyper-aridity of the Atacama Desert results from the combination of a high-pressure subtropical centre and the cold Humboldt coastal current, creating a constant temperature inversion, along with marine winds and the Andean rain shadow effect restricting moisture advection from the east of the mountain range.[26]

Out of the 59 salt flats identified in the Chilean Altiplano, only four in the Antofagasta Region have been declared Ramsar sites, as mentioned earlier. All support considerable biological diversity and are located in the high-Andean zone.[27]

These ecosystems possess a complex surface and subsurface hydrological network. Lakes, lagoons, wetlands, and bogs support populations of aquatic birds (both resident and interhemispheric migrants) as well as mammals such as the vicuña (Vicugna vicugna) and vizcacha (Lagidium viscasia). They also provide breeding sites for at least two species of South American flamingos under conservation pressure: Phoenicoparrus jamesi and Phoenicopterus chilensis. The Salar de Aguas Calientes IV, for instance, serves as a feeding and breeding area for important avifauna species under threat of extinction, including the suri (Pterocnemia pennata), piuquén (Chloephaga melanoptera), puna partridge

25 Risacher, F., Alonso, H. & Salazar, C. (1999). op. cit.
26 Houston, J. & Hartley, A. J. (2003). The central Andean west-slope rainshadow and its potential contribution to the origin of hyper-aridity in the Atacama Desert (p. 1453–1464), *International Journal of Climatology*, 23(12). Available at: https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.938; Bull, A. T., Asenjo, J. A., Goodfellow, M. & Gómez-Silva, B. (2016). El desierto de Atacama: recursos técnicos y la creciente importancia de la nueva diversidad microbiana (p. 215–234), Revista Anual de Microbiología, 70(1). Available at: https://www.annualreviews.org/doi/abs/10.1146/annurev-micr-102215-095236
27 CONAF difundió Día Mundial de los Humedales en región de Antofagasta. (2014). Available at: https://www.conaf.cl/conaf-difundio-dia-mundial-de-los-humedales-en-region-de-antofagasta/ The four salt flats designated as Ramsar sites are the Salar de Tara, the Soncor Hydrological System (a tributary of the Salar de Atacama), the Salar de Pujsa, and the Salar de Aguas Calientes IV.

(Tinamotis pentlandii), and mammals like the Andean chinchilla (Chinchilla brevicaudata) and vicuña (Vicugna vicugna).[28]

Another significant aspect of these ecosystems is that the lagoons formed by these waters host a broad diversity of extremophilic microorganisms.[29] This highly distinctive and diverse microbial community performs complex biogeochemical processes that maintain the region's high degree of endemic biodiversity.[30] The Atacama Desert, together with the greater Atacama region, encompasses a spectacularly broad range of ecological niches, harbouring a rich microbial diversity newly recognised as the most recent and least explored resource in this ecosystem.[31]

The lithium brines of the Salar de Atacama represent one of the saltiest environments described to date. Their high concentration may significantly shape microbial diversity, providing insights into the adaptability of microorganisms capable of withstanding extremely high concentrations of various salts.[32]

On the other hand, how to protect such highly complex ecosystems is examined in the regulatory section of this document. For example, the Ramsar Convention, with its expansive definition of wetlands, underpins Chile's Urban Wetlands Law, which also includes saline and brackish waters in its definition.

Hence, with both scientific and regulatory certainty that salt flats are wetlands—and, indeed, highly complex and vulnerable systems—it is essential to move beyond describing them as arid, lifeless territories suitable only for mining operations, and towards an understanding of them

28 Aramayo, O. et al. (2005). *Levantamiento de información, estudio de línea base e instrumento legal para la conservación de la biodiversidad en el sitio priorizado en la Estrategia Regional de Biodiversidad: Aguas Calientes IV.* Vicerrectoría de Investigación y Desarrollo de la Universidad de Chile.

29 Extremophile organisms are those capable of withstanding extreme conditions in which other organisms would die. Such conditions may include cold temperatures near 0°C, high temperatures of up to 121°C, very acidic or very alkaline pH, barometric pressures of several tonnes, oxygen deprivation, and even radioactivity.

30 Dorador, C. (2021). Conservación de salares: Aprendizajes desde los microorganismos. In Balcázar Morales, R. (Ed.), *Salares Andinos, Ecología de Saberes para la Protección de Nuestros Salares y Humedales*. Available at: https://cl.boell.org/sites/default/files/2021-03/Libro_Salares%20Andinos_version_definitiva_castellano.pdf

31 Bull, A. T., Asenjo, J. A., Goodfellow, M. & Gómez-Silva, B. (2016). op. cit.; Cubillos, C. F., Aguilar, P., Grágeda, M. & Dorador, C. (2018). Comunidades microbianas de la reserva de litio más grande del mundo, Salar de Atacama, Chile: vida en altas concentraciones de LiCl. Revista de Investigación Geofísica: Biogeociencias, 123, 3668–3681. Available at: https://doi.org/10.1029/2018JG004621

32 Cubillos, CF , Aguilar, P. , Grágeda, M. , y Dorador, C. (2018). "Comunidades micro bianas de la reserva de litio más grande del mundo, Salar de Atacama, Chile: vida en altas concentraciones de LiCl", *Revista de Investigación Geofísica: Biogeociencias* 123, p. 3668-3681. https://doi.org/10.1029/2018JG004621.

as complex ecosystems with high biodiversity. The challenge is evident and intricate: these uniquely global ecosystems are earmarked as the future of the country's extractive economy, in line with geopolitics and the tensions inherent in the global energy transition.

Such circumstances produce tensions typical of socio-ecological transition processes. To advance the justice dimension of this process, we propose the following recommendations.

4. Recommendations

a. Regulation of Brine as a Wetland Water Body

- Recognise brine extraction as water-body extraction in sectoral water regulations. Currently, its treatment applies only to mineral exploration and exploitation, without integrating brine as an environmental variable in environmental impact assessments.

- Legislation should acknowledge the significance of the hydrological composition of salt flats as high-Andean wetlands, in line with their ecosystem services.

- Adopt a basin-level perspective for brine extraction processes, given the associated impacts at basin scale. Extracting brine can alter the hydrogeological behaviour of the aquifer, affecting the salt flat as a whole and the availability of water resources in its surroundings (Final Report of the National Lithium Commission, 2014).

b. Implementation of Protection Instruments for High-Ecological-Value Ecosystems

- Use the window of opportunity offered by the implementation of the SBAP Law to include new protection categories for these ecosystems. This could highlight their ecological value and reinforce related protection systems, along with their governance structures.

- Strengthening protection systems can mobilise economic and human resources, enabling improved public environmental information on these ecosystems. A key gap here is the shortage of data and studies regarding basin water balance and the ecological status of the salt flats, thus providing a comprehensive basis for informed environmental decision-making.

c. Environmental Democracy

- Decision-making on environmental matters concerning wetland ecosystems must adhere to the participation standards set out in international human rights instruments. This implies the strict application of the participation standards in the Escazú Agreement and the standards for prior, free, and informed consultation in ILO Convention No. 169, along with the rights perspective of the United Nations Declaration on the Rights of Indigenous Peoples.

- Environmental information creation should be developed in consideration of local, situated knowledge. Valid and respectful practices must be adopted to ensure the genuine inclusion of local ecological knowledge associated with territories containing salt flats.

- Furthermore, baseline environmental data, environmental monitoring, and follow-up plans linked to environmental permits must incorporate local knowledge and engage representatives of the territories, ensuring the reliability of both the information and the outputs produced.

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