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Towards durable legal protections for rivers in Chile

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ABSTRACT

The protection of Chile's rivers is a matter of ongoing public and constitutional interest in the wake of Chile's failed 2019–2024 constitutional reforms. In this article we review and evaluate opportunities for greater legal protection and restoration of rivers in Chile. The legal analysis was complemented by a survey of social attitudes about river protection needs and several interviews with key experts and stakeholders, which found strong concern for enhanced river protection mechanisms in Chile. We conclude by outlining critical pathways towards durable legal protections for the future of Chile's rivers.

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Introduction

Healthy rivers deliver diverse benefits to human societies, especially those flowing in their natural state (Auerbach et al., 2014). Freshwater, transportation, flood protection, recreation, habitat creation for biodiversity, and cultural values are some of the ecosystem services provided by healthy rivers (International Panel on Biodiversity and Ecosystem Services [IPBES], 2019). It is also a great challenge to understand human–water interactions beyond the extractive benefits they provide to people. River ecosystems globally are exposed to wide-ranging pressures (Bunn & Arthington, 2002; Tickner et al., 2020), resulting from anthropogenic climate change, over-extraction, pollution, and hydromorphological changes from the development of dams, channels, pipes and diversions. Striking a balance between development and river health remains one of the world's greatest environmental and social challenges (Thieme et al., 2021; Tickner et al., 2020).

Only 37% of the world's longest rivers (>1000 km) remain free-flowing over their entire length and only 23% flow uninterrupted to the ocean (Grill et al., 2019). Irreversible losses of species habitat will arise from the continuation of business-as-usual approaches to water resource management and policy (Palmer et al., 2009; Tickner et al., 2020), jeopardizing the scenic, cultural and recreational values of rivers, among other ecosystem services.

Grill et al. (2019) define free-flowing rivers as: 'rivers where ecosystem functions and services are largely unaffected by changes to the fluvial connectivity, allowing

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unobstructed movement and exchange of water, energy, material and species within the river system and with surrounding landscapes'. This definition alludes to four types of river connectivity: longitudinal (up- and downstream in the river channel), lateral (between the main channel, the floodplain and riparian areas), vertical (between the groundwater, the river and the atmosphere) and temporal connectivity (seasonality of flows). Historically, the concept of a free-flowing river has been linked to the first level of connectivity, largely in resistance to dams and major infrastructure that altered the unobstructed flow of rivers (Palmer, 1994).

The idea of free-flowing rivers took hold in Chile as a result of conflicts surrounding hydropower development in the 1990s and 2000s (M. Aguire, Latin American Coordinator of International Rivers, online interview, 11 February 2021). The construction of the Ralco Hydropower Station on the Bio Bío river (completed in 2004) was Chile's first major environmental conflict, culminating in a public apology to the Mapuche-Pehuenche community members of Alto Biobío for flooding the Quepuca Cemetery. A second battle against a series of hydroelectric dams on the Pascua and Baker rivers, known collectively as 'Hydroaysen', was met with the 'Patagonia Without Dams' grassroots campaign. In 2016, Endesa company eventually relinquished their water rights and abandoned the project and others in the Cautín, Chillán, Puelo, Futaleufú, and Huechún rivers (Endesa, 2016). Opposition from civil society and Indigenous peoples to infrastructure projects that damage the free-flowing and pristine nature of rivers reflect shortcomings in the environmental institutionality for protecting Chile's rivers and their communities.

Several countries have national river conservation systems, including the United States, Aotearoa New Zealand, Canada, Norway, Finland, Sweden, Spain and Mexico, with China in a study phase (Perry et al., 2021). The United States was the first to protect rivers flowing in their natural state, in the 1968 Wild and Scenic Rivers Act (Wild and Scenic Rivers Act 16 USC §§ 1271-87). Chile recently started the debate in Congress to create the Protected River figure (Bulletin No. 16.629-12). Since 2020, The International Union for Conservation of Nature (IUCN, 2020) has urged governments to collaborate with various stakeholders, including civil society, communities, indigenous groups and the private sector to identify, restore, and protect free-flowing rivers and their associated ecosystems. They also advocate for balanced development through the implementation of strong legal protections and improved governance for rivers, including measures such as riparian buffer protections and other approaches from integrated water resource management (IUCN Resolution WCC-2020-Res-008-EN).

Durable legal protections, aiming to protect, maintain and restore free-flowing and healthy rivers within and across borders, should include criteria that determine which activities or projects may or may not be carried out in a river, on its banks or in its buffer zones, and concrete action to preserve or restore their values (Schäfer, 2021).

Chile is at a crossroads when it comes to environmental, water and river protection, and important questions remain about societal attitudes towards management and protection of water in the wake of the failed constitutional reforms. In this article we review and evaluate opportunities to increase the legal protection of rivers in Chile, using a combination of desktop review, expert interviews and public surveys. Our ambition is to identify legal pathways for protecting and restoring free-flowing and healthy rivers in Chile.

Methods

Our study adopts the framework proposed by Higgins et al. (2021) for establishing and maintaining long-term protection for freshwater ecosystems and the values they sustain. The steps outlined by Higgins et al. include (1) defining the values supported by freshwater ecosystems identified by society as requiring protection; (2) identification of the fundamental characteristics of ecosystems that are essential for the long-term persistence of the previously identified values as well as possible threats and their sources; (3) identification of the potential protection mechanisms that are most likely to abate or mitigate those threats over the long term; (4) application of that mechanism at the appropriate scale; and (5) monitoring and evaluating the status and change in conditions of values, key attributes among other elements. We were guided by the steps outlined by Higgins et al. to formulate the research questions and techniques underpinning this article. We used a mixed-methods approach including (1) a review and evaluation of literature, legislation, regulations and legal analysis of freshwater protection mechanisms; (2) an online survey of attitudes towards rivers and river protection; (3) a series of semi-structured interviews with experts and stakeholders involved in water policy, management and river protection; and (4) data synthesis to develop recommendations for advancing river protection in Chile.

Chile does not have a national river conservation system, and protection tools are scattered across multiple laws, policies and regulatory bodies. These include the Water Code and its 2022 reform, the Environmental Law, Protected Areas regulations, the Recreational Fishing Law, the Urban Wetland Law, and forest regulations (Weber et al., 2023). Our analysis of legislation and literature was complemented by multiple information requests to government agencies and other authorities to clarify the scope of the legal framework and its application, including consultations with the Water General Directorate (DGA), Ministry of the Environment, and the National Forest Corporation (CONAF), amongst others, to determine the functions and competencies of key regulatory agencies for.

In addition to the legal review, a survey was designed to elicit the perceptions of Chilean citizens with rivers and attitudes towards river protection and opportunities and barriers for law reform. This survey was distributed online, through social media, and using a snowball approach, with the support of different organizations, including Municipalities, non-governmental organizations, and universities from different regions of the country, to ensure a representative sample of respondents.

The survey was conducted online, in Spanish, between November and December 2020, and only completed questionnaires were included in the final assessment ($n = 1612$). The survey contained 28 questions (Part 1 of the [online supplemental data](#)), and was designed and launched through Typeform. Whereas most questions were multiple choice and close-ended, there was one open-ended question which asked participants to briefly describe: 'What does a free-flowing river mean to you?' The questions were arranged around: (i) people's connections with rivers; (ii) the need to protect Chilean rivers; and (iii) the definition of free-flowing rivers.

The survey was completed by 1612 people. Although we have tempered our conclusions about the relevance of the survey to acknowledge its limitations in terms of societal attitudes across Chile, the relatively large sample size, geographic and gender

distribution, and range of positionalities in supporting institutions allows us to make some interpretations about the significance of the survey findings.

We also conducted 30 semi-structured interviews between October 2020 and July 2023 of expert and stakeholder attitudes to current and potential legal protections for rivers in Chile. Interviewees were specifically asked about barriers and opportunities for protecting rivers. Interviews were intended to complement the other two methods of data collection as a triangulation method, and to influence the direction of the research. Interviewees were carefully selected to represent a wide range of organizations and backgrounds linked to river protection, including representatives of non-governmental organizations (10), politicians (2), academia (7), international experts (3), public agencies (4), Indigenous communities (2) and water users (2). A limitation was that representatives from the business sectors, such as energy developers and mining companies, were contacted, but no interviews could be arranged. A snowball approach was also used to select the interviewees.

Part 2 of the [online supplemental data](#) includes an English version of the interview outline, organized around: (1) critical analysis of the water law regime in Chile: barriers and opportunities; (2) free-flowing rivers; and (3) cluster questions about the system of protection and institutions. The interviews were conducted by video conference in Spanish or English, depending on the interviewee's preference, and recorded for later transcription. The results of the interviews were collated using a narrative extraction method, which consisted in assessing and comparing different responses to single questions. The resulting narrative is intended to be pluralistic and reflect the different perspectives, i.e., commonalities and different views the interviewees had with regards to the three main sections. However, our conclusions have been adjusted to acknowledge that the number of interviews was limited, and we may not have captured all water perceptions and values across the full range of sectors and scales.

Results and discussion

Chilean political and legal context for river protection

Chile is a long country with 1251 rivers and 12,784 lakes and lagoons (DGA, 2016). It also contains 24,005 glaciers, which function as the country's main freshwater reserves (Barcaza et al., 2017). Chile is considered a water rich country with a per-capita availability of approximately 55,640 m³/per capita/year – almost double the OECD average (31,360 m³/per capita/year; United Nations Chile, 2021). However, water is unevenly distributed throughout the country and the characteristics of rivers vary significantly, along with uses by communities and productive sectors.

From a legal perspective, water in Chile is regulated under a water management regime known as the textbook example of a market-based water policy (Borgias & Bauer, 2018). As part of a wider project of neoliberal reform during the Pinochet dictatorship (1973–1990), the Chilean water law framework was completely transformed with the enactment of the 1981 Water Code. Defining water as an economic good and separating water rights (constitutionally protected as 'property') from ownership of the land (Hadjigeorgalis, 2002), the Water Code was designed to 'foster user investment in water infrastructure and efficiency in water use' (Budds, 2020). As a consequence, Chile

experienced rapid growth in high water consumption industries such as mining and hydroelectricity (Bauer, 1998).

Water-related development in Chile has resulted in social conflicts, particularly concerning large mining projects in the north and central regions, as well as hydroelectric projects in the south, impacting communities and river ecosystems (Torres & García, 2009). The state's limited capacity to regulate the allocation and exercise of water rights protected as property under the current constitution has led to contentious constitutional and legal debates (Macpherson & Weber Salazar, 2020). These debates highlight different views regarding the role of the market and how to incorporate the concepts of public interest and the social function of property (*función social de la propiedad* in Spanish; Bauer, 2004; Vergara, 1989).

Large dams in Chile have significantly impacted the fluvial regimes, the hydroclimatic conditions of the basin, and water demand (Villablanca et al., 2022). In 2016, the Chilean Ministry of Energy assessed hydroelectric development in 12 rivers (central southern), finding it crucial for Chile's Energy 2050 Policy, aiming for 70% renewable energy by 2050. Doing so will entail major trade-offs in the fragmentation of river ecosystems, especially in southern Chile where the largest hydropower potential is located. Meanwhile, Chile has no comprehensive legal protection framework for its rivers (Weber et al., 2023). Many rivers are facing increasing pressures, in addition to hydropower, from exotic species, habitat loss, degradation and change in land use, pollution, climate change, and overexploitation (Fierro et al., 2019).

Chile's water management and administration functions are spread across the public water authority ('DGA' for its Spanish acronym) and private water users' associations (Art. 186 and following the Water Code), especially water monitoring boards ('Juntas de Vigilancia'). However, the functions of the DGA are quite limited, relating to allocation, authorization and information related to water, whereas the administration or private management of water resources are devolved at the basin level to monitoring boards (Engler et al., 2021). The Water Code, which instituted water rights that were free, indefinite and (originally) unconditioned to a specific use, enabled market mechanisms for water allocation, and delegated administration to user organizations. It served to secure water for export-oriented industries that rely on Chile's natural resources (Budus, 2020). To date, Chile's main consumptive water user is the agricultural sector, which uses 72% of the total available consumptive water rights (DGA, 2016) and is a major opponent to any significant reform to the water management model in place (Bauer, 2004). Non-consumptive rights were designed to foster hydropower development in upper watersheds without affecting downstream farmers in the valleys with pre-existing consumptive water rights (Bauer, 2015).

Chile's Institute of Human Rights has recorded more than 129 environmental conflicts related to human rights in the country to April 2018, with 44% of them linked to water (Instituto de Derechos Humanos [INDH], 2022). As Bauer (2015) describes, the majority of water conflicts involve conflicts among multiple water uses and values, with competing water demands across sectors and scales.

Until recently, Chile has been described as a country with high levels of political stability, economic growth and institutional strengths (Schmidt-Hebbler, 2006). However, since October 2019, Chile has undergone the greatest political unrest since the dictatorship, known as the 'Estallido Social' (Morales Quiroga, 2020) As pointed out

by Berasaluce et al. (2021), social discontent and perceptions of environmental injustice also triggered this social turmoil.

During this period of political unrest in Chile, environmental demands gained support among protestors, positioning the social conflict of 2019 as an ecological crisis (Calisto & Weber, 2020). Debates about the human right to water and resource extraction have been at the forefront of national constitutional conversations (Calisto & Weber, 2020). For the first time in decades, legal frameworks for water, property rights, and environmental protection, were seriously challenged, signalling a paradigm shift with respect to nature and its protection (Berasaluce et al., 2021).

In the face of the serious social and political unrest gripping the country, the President and governing parties signed an agreement in 2019 to pledge their commitment to re-establishing peace and public order. They committed to hold a plebiscite to determine whether Chile should draft a new Constitution, and an ample majority (78.3% versus 21.7%) voted for a constitutional reform process. At the same time, several environmental organizations started to demand an 'Ecological Constitution' as an integral solution to environmental injustices (Berasaluce et al., 2021).

On 4 September 2022, the proposal of a new Constitution was put to a vote. This document included transformative environmental changes including the establishment of a new water framework. However, this vision for a New Constitution was not approved in the 2022 Plebiscite. The process moved on to a second constitutional convention led not by a constituent assembly, but by a panel of experts appointed by the political parties and approved by the Congress. The conservative second draft constitution did not include any of the transformative environmental provisions included in the first draft, and served to strengthen the property rights regime in the original Constitution, including with respect to water. But in a classic example of Chile's so-called 'Law of the Pendulum' (Bauer, 2005) the Chilean public voted also to reject the second draft on 17 December 2023; a process that has raised serious questions about the polarization and lack of dialogue on key public issues in Chile, and how these might affect future agendas for constitutional and legislative change.

Although there is a history of diverse and longstanding river protection efforts and activism in Chile, in 2022 the Protected Rivers Initiative was created (www.riosprotegidos.cl) to bring together different civil society organizations, research centres, universities and professionals from various areas of study and locations throughout Chile, dedicated to the protection of freshwater ecosystems. The idea behind the initiative was that, through collaborative, interdisciplinary efforts and different scales, to strengthen the protection of the country's rivers through the application of existing tools, recognizing their gaps and opportunities; and to promote new legislation to protect and restore rivers. This movement seeks to include different voices in river administration and to acknowledge public demands that have been ignored for decades and advance river protection through a permanent figure, contributing in applying the existing tools and advancing a common vision of the territory and its rivers, with a new legislation that is adequate to Chile's reality and challenges.

In the following section we evaluate protections for rivers in existing Chilean law based on our literature and legal review, followed by the results of the survey and interviews.

Legal protections for rivers in Chile

Water in Chile is regulated under the Constitution, Water Code, and Environmental Law 19.300 (1994). The 1981 Constitution establishes, in its protection of property rights, that ‘the rights of individuals over water, recognized or constituted in accordance with the law, shall grant the holders ownership over them’ (Article 19 No. 24 Constitution). This statement has produced a perception of ‘privatization’ of water even though Chile’s Civil Code explicitly establishes water as a national good of public use (Art. 594). Although the Constitution implicitly links public goods with natural resources (Rivera & Vergara, 2019), the constitutional protection of the right to property has meant that, in practice, the private nature of water rights under article 19 No. 24 of the Constitution and article 5 of the Water Code prevails over the public status of water as a national good for public use. This legal context has contributed to a lack of public planning and regulation regarding access, use and exploitation of water (Moraga, 2019).

Water is also implicated in article 19 No. 8 of the Constitution, which establishes the fundamental right to ‘live’ in a pollution-free environment. In contrast to other constitutional contexts, this provision does not protect the right to a healthy environment, but the right of humans to live in a ‘pollution-free’ environment, and has been relatively weak in the environmental courts (Pulgar, 2019). Article 19 No. 8 of the Constitution also places a duty on the State to preserve nature through the three branches of government (Bermúdez, 2014). As a result of this constitutional obligation, policies such as the Water Code’s establishment of ecological flows have been developed (discussed below).

Chile’s Environmental Law 1994 established the legal framework to support the constitutional right to a pollution-free environment, including: primary and secondary environmental water quality standards, emission standards, decontamination and management plans for natural resources. However, it has been particularly inefficient when protecting freshwater ecosystems, and in some cases, it has led to the depletion of entire river ecosystems (Díaz et al., 2019; Duran-Llacer et al., 2020).

The Water Code has gone through two major reforms since its enactment. First, in 2005, after 13 years of Parliamentary debate, an amendment introduced minimum ecological flow standards, the ability for the DGA to deny water right requests in specific situations, and the creation of water flow reserves. Although considered advancements in terms of environmental protection, this reform still did not provide the DGA with sufficient authority to plan or manage the country’s water resources. In April 2022, after another 11 years of debate, Chile’s Parliament approved Law No. 21.435, as a step towards a more environmentally focused and resilient water law (Delgado, 2019). The 2022 Water Code reform recognized both the human right to water and water as a national good for public use, giving priority (for the first time) to the use of water for human consumption, subsistence and sanitation (Art. 5 bis Water Code).¹ The reform also strengthened the oversight role of the DGA, increased penalties and established a time frame for the use of new water rights (Art. 6 Water Code), guidelines for revoking unused or underused rights (Art. 5 quinquies and 6 bis Water Code), and a process for the forfeiture of rights not properly registered (Art. 2 transitory Water Code). In the case of Indigenous territories, the State committed to ‘ensure the integrity between land and water resources’ and to protect ‘existing waters’ for the benefit of Indigenous peoples

(Art. 5 Water Code). The minimum ecological flow and water flow reserve designations were modified and a new mechanism was introduced for non-extractive uses.

In January 2020, an Urban Wetlands Law was passed (Law No. 21.202), which has resulted in some level of protection for certain river sections located in estuaries near urban development. However, Chile still does not have a national river conservation system or a holistic mechanism for river protection, but rather a series of rules scattered among different legal texts that protect certain ecological attributes of rivers to varying extents (Weber et al., 2023). A tabular analysis of legal tools for river protection prior to and after the Water Code reform of 2022 is provided in the online supplemental data.

Emission norms; water quality and prevention and decontamination plans

Emission standards in Chile include regulations for the discharge of waste into surface water (Supreme Decree No. 90/00) and groundwater (Supreme Decree No. 146/97). There is also a specific emission standard for the Carén Estuary, located in Melipilla, Santiago, which allows higher sulphate and molybdenum levels in the estuary than in other parts of the country, enabling the State-owned Codelco mine 'El Teniente' to dump liquid effluent. The Constitutional Court dismissed a recent review of the constitutionality of this standard (Pastén, 2019). The emission standards were intended to work in conjunction with the quality standards.

Chile has a limited set of secondary water quality norms, which establish the maximum or minimum permissible concentrations of substances, elements, and energy that may constitute a risk for the protection or conservation of the environment. Chile currently only has six quality norms for four river basins and two lake catchments: Serrano River Basin (2010), Llanquihue Lake (2010), Villarrica Lake (2013), Maipo River Basin (2014), Bio-Bio River Basin (2015), and Aconcagua (2023). A norm for the Valdivia River has been under development since 2015. After initial approval, the Valdivia river basin norm was challenged and overruled in court in 2020 due to the illegality of the socioeconomic analysis conducted (R-26-2016 Environmental Court). On April 2024, the Council of Ministers for Sustainability and Climate Change pronounced favourably on the Final Draft of the Secondary Environmental Quality Standards Norma for the Valdivia water basin.

Current norms are minimal given the number of rivers in the country (1251 rivers in 101 watersheds), do not cover all types of pollutants, and have only been set for certain activities (Melo & Pérez, 2018). They refer only to physicochemical parameters for river health, without considering aquatic bioindicators such as macroinvertebrates (P. Valenzuela, Campaign Coordinator 'Queremos Parque', online interview, 6 June 2022). To date, there are no prevention or decontamination plans for freshwater resources, even though some of the parameters have been surpassed for some time (DGA, Information Request No. AM006T0002775, response 8 April 2022). Without effective water quality norms for rivers and lakes, the definition of a pollution-free environment (Constitutional Rights 19 No. 8) lacks content, making it hard to prove in court that waters should be protected from pollution (Rosen, 2012). Indeed, the Chilean Constitutional Court has confirmed that 'pollution only exists when there is a specific legal canon with respect to the respective pollutants', and that 'legally, contamination is not just any environmental impact or alteration, but the situation that exceeds the established environmental parameters' (Constitutional Court Rol No. 577-06, 2007).

Prevention and decontamination plans are environmental management instruments that must be issued once a latent zone (environmental quality standard between 80% and 100% of the NSCA value) or saturated zone (standard 100% or more of the NSCA [secondary quality standard norms] value) has been declared. Currently, all the NSCA are exceeded in one or more parameters and only Lake Villarrica has been declared a saturated zone, which also does not have a decontamination plan.

Since 1996, 11 programmes regarding the development of norms have been published, as well as one strategic programme to dictate emission and quality norms (DGA, 2021b). The OECD urged Chile to expand water quality standards in its 2016 Environmental Performance Review (OECD, ECLAC, 2016). However, no new norms have been approved or updated except for the Valdivia NSCA although in January 2022, the Ministry of the Environment initiated a process for developing secondary environmental quality standards for the protection of northern Patagonian lakes (Ministry of Environment, 2022).

Minimum ecological flows

In 2005, the Water Code reform introduced a requirement to set minimum ecological flows when issuing new water rights (Art. 129 bis 1 Water Code). However, their effectiveness was undermined by the fact that, by 2005, most flows from river basins in northern and central Chile were fully allocated or overallocated (Budds, 2004; Riestra, 2018).

The Water Code does not provide a definition of minimum ecological flow, but establishes that they may not amount to more than 20% of the average annual flow rate in the corresponding watercourse. The President, on the advice of the Ministry of Environment, can issue a decree specifying a different minimum ecological flow, higher than the legal limit of 20% but less than 40% of the average annual flow rate. The Water Code does not provide for a methodology for calculating minimum ecological flow. In 2008, the DGA approved a new Manual for the Management of Freshwater Resources. However, the methods utilized yield results of extremely low flows and do not take into account local ecological criteria (Jamett & Rodrigues, 2005).

The Water Code reform enabled the DGA to establish minimum ecological flow in protected biodiversity areas, such as national parks. However, minimum ecological flow still does not apply to all water rights and there were no modifications to the methodology to apply them.

Minimum flows have also been established under the Environmental Law in the Environmental Impact Assessment Process, which allows the Service of Environmental Impact Assessment to set, as a mitigation measure, minimum flows for projects that will have an impact on freshwater resources. The Service has rarely departed from the recommendation of the DGA (Macpherson & Weber Salazar, 2020). However, this practice has been criticized on the basis that it duplicates the functions of two separate government institutions and creates ambiguity around the nature and scope of environmental flows (Jaeger, 2010).

Denial of water rights and water reserves

According to the DGA, there are seven water flow reserves (DGA, 2021c, 2022), created because of exceptional circumstances and for national interest (Cochamó, Petrohué, Murta, Del Oro, Chaihuín, Baker, Pascua). ‘Exceptional circumstances’ typically arise from ecological conditions and low anthropic intervention of the watersheds (Larraín & Schaeffer, 2010), whereas ‘national interest’ is based on environmental values and other

protection mechanisms applying to the territories in which the watersheds are located (e.g., National Parks).

These water flow reserve declarations have been challenged in court by the companies denied water rights: (1) Sur Electricidad y Energía S.A.; Exploraciones, Inversiones y Asesorías Pachino S.A.; y, Exploraciones, Inversiones y Asesorías Huturi S.A. for the Palena, Golgol and Cisnes rivers; and (2) Centrales Hidroeléctricas Aysén for the Pascua and Baker rivers. In the first case on 25 January 2014, the Fourth Chamber of the Court of Appeals in Case No. 893–2010 accepted the appeals filed by the companies against the decrees that created the water flow reserves in Palena, Golgol and Cisnes rivers, nullifying the norms. In the second case, and in a much different context, in the middle of the ‘Patagonia Without Dams’ campaign, the Court of Appeals dismissed all of the company’s arguments, and indicated that no arbitrariness or illegality was apparent in the acts issued, and therefore, on 15 May 2017, ratified the decision of the Ministry of Public Works to partially deny Hidroaysén’s applications for non-consumptive water rights in the Baker and Pascua rivers. The company continued by filing two appeals on the merits, which were unsuccessful. Therefore, in those rivers, water flow reserves are still in place.

Since the 2022 Water Code reform the President may establish reserves of available surface water or groundwater (Art. 5 ter Water Code), and actively reserve water in those watersheds where there is water available for the purpose of ecosystem preservation. In addition to the ability to deny applications for water rights for exceptional circumstances and national interest. The first two rivers with the water flow reserves for ecosystem preservation will be the Futaleufú and the Puelo river, located in Patagonia. After grass-roots campaign to protect those rivers which involved community members, local, national and international actors (www.porlasaguasdelfutaleufu.cl and www.pueloreservadeagua.cl), reflecting strong societal concern for the protection of Chile’s still free-flowing and healthy southern rivers. A significant benefit of water flow reserves is that they are not subject to a maximum limit in terms of the geographic area or water quantity they may apply to.

Non-extractive water rights

One of the most innovative modifications of the 2022 Water Code reform solved the historical impossibility of requesting water rights for in-stream purposes. After the 2005 Water Code reform, the Municipality of Pucón, which had previously requested water rights for a number of key rivers for conservation purposes to protect its tourism industry, was sanctioned for non-use, because it had not built the infrastructure to use the water. The municipality was forced to relinquish its water rights and hand them over to the Ministry of the Environment (DGA, 2017). The 2022 Water Code reform allows water rights to be left in-stream for environmental purposes or for the development of sustainable tourism and recreational projects (article 129 bis 1 A WC). Regulations to allow the implementation of these reforms remain pending; however, they may provide an opportunity for non-productive uses of the river and to involve a broader range of stakeholders in water decision-making.

Minimum fishing flow

Contemplated in the Recreational Fishing Law (No. 20.256) It is established by the DGA in conjunction with the resolution of the declaration of Preferential Area for Recreational Fishing, issued by the Regional Government. It seeks to ensure that the amount of water available allows the development of hydrobiological species of interest and recreational fishing activity in that area. The rights granted within the recreational fishing preferential zones may not affect the minimum fixed flow. To date there is no practical application of this instrument, so its effectiveness cannot be evaluated (DGA, 2021d).

Protected areas

Chile has a clear bias towards terrestrial conservation (Jorquera-Jaramillo et al., 2012) in which ‘rivers serve as boundaries or play ancillary roles’ (Perry et al., 2021). Pliscoff concluded that 23.42% of the national territory has some degree of protection at both the public and private levels (Pliscoff, 2022) and more than 40% of Chile’s maritime territory is under some category of protection (Marine Protection Atlas). Rivers are not recognized as protected areas themselves, but as parts of the complex ecosystems that constitute protected areas (article 36 Environmental Law). As a result, it often confers few benefits for securing freshwater biodiversity and the reciprocal contributions of such ecosystems (Acreman et al., 2019; Azavedo-Santos et al., 2017; Darwall et al., 2011; Leal et al., 2020). Globally, the effectiveness of protected areas for freshwater-related purposes is being questioned (Hermoso et al., 2016)

Water protection within protected areas in Chile has also been hampered by the DGA’s power to grant water rights within them. The DGA reports that from 1956 to 1984, 937 water rights have been granted within protected areas or exist in territories that are currently protected, including for hydropower and mining (DGA Information Request No. AM006T0002112, November 2020). On some occasions, the protection of these areas has relied on Court resolutions. However, the 2022 Water Code reform established that no water rights could be granted in protected areas except for activities that are compatible with the conservation objectives of the area (Art. 129 bis Water Code).

The new Biodiversity and Protected Areas Service is intended to address these shortcomings and its legislation open new spaces for a public–private stewardship of these areas, given that the SBAP [Service for Biodiversity and Protected Areas] can create management plans for protected areas together with local authorities, Indigenous communities and other associations in the territory where the protected area is located.

Riparian legislation

Chile also has a range of siloed and fragmented legislation managing riparian vegetation (Romero et al., 2014), dispersed across different legal and regulatory mechanisms arising from past eras, with various contradictions, inconsistencies, incompleteness and, sometimes, ‘expiration dates’ in terms of current objectives (Gallardo, 2013). These include Decree No. 4.363 of 1931, known as the Forestry Law, which in article 5 prohibits ‘(1) the cutting of native trees and bushes located less than 400 m above the springs that originate in the hills and those located less than 200 m from their banks from the point where the spring originates to the point where it reaches the plane and (2) the cutting or destruction of trees located less than 200 m from the springs that originate in non-irrigated flat lands’.

In addition, Law 20.282 establishes that '[a]ll native forest cutting actions, regardless of the type of land on which it is located, shall be carried out after a management plan approved by CONAF (. . .)', which is currently administered and enforced by the Service of Biodiversity. Romero et al., 2014 argue in this context that Chile needs a public policy that is specifically responsible for ensuring the integrity of riparian ecosystems, given the multiple goods and services they provide for the well-being of both natural systems and human beings.

Urban wetlands

Finally, the Urban Wetland Law (No. 21.202), passed in 2020, seeks to protect wetlands totally or partially within the urban boundary. It subjects all projects or activities that may have an impact on urban wetlands to the Environmental Impact Assessment System, and requires municipalities to pass ordinances for their conservation. These include minimum criteria to safeguard ecological and functional characteristics, maintenance of the surface and subterranean hydrological regime of urban wetlands, and rational use of urban wetlands (Decree No. 15, Regulations of the Urban Wetland Law). Finally, it establishes that urban wetlands declared by the Ministry of the Environment must be included in the territorial planning instruments at all scales as a 'protection area of natural value'.

Since 29 December 2023, 106 urban wetlands have been declared, including the mouth of the Lluta river (Arica y Parinacota Region), Elqui river in section Altovalsol to mouth (Coquimbo region), the mouth of the Aconcagua river (Valparaíso Region), Mapocho river in the El Monte and Talagante sections, Maipo river in Isla de Maipo (Metropolitan Region), Trancura river 'La Poza and Delta del Trancura', in Pucón, lago Villarrica and a wetland on the Cautín river, Sector Antumalén (Araucanía Region).

The Urban Wetland Law is undoubtedly a step forward, but the full implementation of this legislation and the effectiveness of protection is determined, as in protected areas, by the management plans and the issuance of various regulatory instruments under the jurisdiction of various public agencies. These agencies are responsible for assessing how projects or activities will meet the sustainability criteria; however, the law does not expressly prohibit or allow activities within the protected area or buffer zones. In order to properly assess the impact of this legislation on protecting rivers, it will be necessary to analyse the municipal ordinances that are issued and what specific measures they incorporate.

Survey results – attitudes towards free-flowing rivers and river protection

Our survey canvassed the relationship of respondents with the rivers of Chile, the need to protect these ecosystems and perceptions of the concept of free-flowing rivers. The survey results, from the questions in Part 1 of the [online supplemental data](#), follow.

The questionnaires were mainly completed by women (63%), in contrast with men (37%) and those who choose not to be identified by gender (less 1%). We did not conduct an analysis of the results by gender. Geographically, 4% of respondents were from northern Chile (from Arica and Parinacota to Coquimbo) and 4% from Austral (from Aysén and Magallanes). The central and southern regions include the most responses, whereas 9% of respondents were from Valparaíso; 29% from the Metropolitan region; 18% from Biobío; and 17% from Los Lagos. The geographic distribution of respondents

was concentrated in the central and southern regions of the country. This coincides with the geographic population distribution of Chile, where the majority of citizens live in the Metropolitan region (40%), the BioBio region (5%) and Valparaíso (10%) (INE, 2017). The predominant age group was from 25 to 34 years old and 63% are part of the Chilean workforce, whereas 15% are students.

Most survey respondents had some relationship with Chilean rivers (Figure 1); 80% related to rivers within their own region. In the Tarapacá (North), Metropolitan (Central) and Magallanes (Austral) regions, a significant percentage of respondents indicated that they relate to rivers outside the region where they live (100%, 47% and 50%, respectively). Only 14% responded they did not have any connection to a specific river, with 39% citing a lack of physical access, even though riverbanks and lakeshores in Chile are considered national assets for public use, ‘Bienes Nacionales de Uso Público’.

Among those who do have a connection, the main reasons given were recreational and cultural (Figure 2), with consumptive uses also weighing in strongly.

Respondents were asked whether environmental protection of Chilean rivers was necessary, to which an outstanding 99% answered affirmatively (Figure 3).

Do you have a connection to a specific river in Chile?

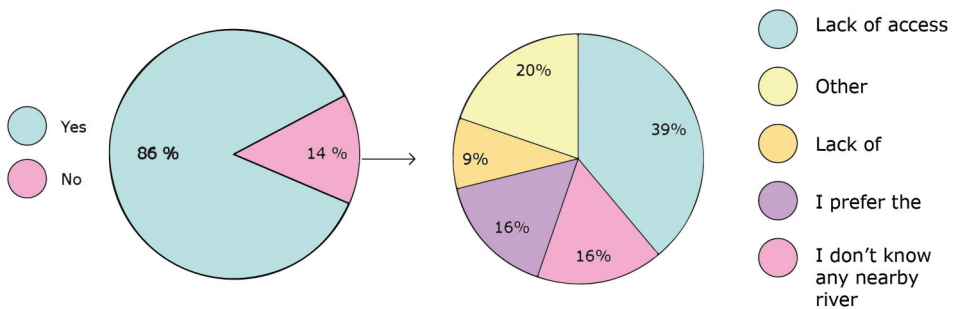


Figure 1. Connection with a specific Chilean river (in percentage of responses).

Wich option indicates best your connection with the river?

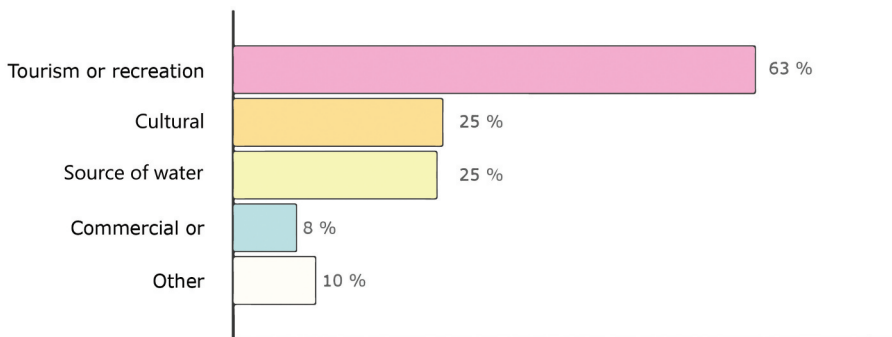


Figure 2. Type of connection with Chilean rivers.

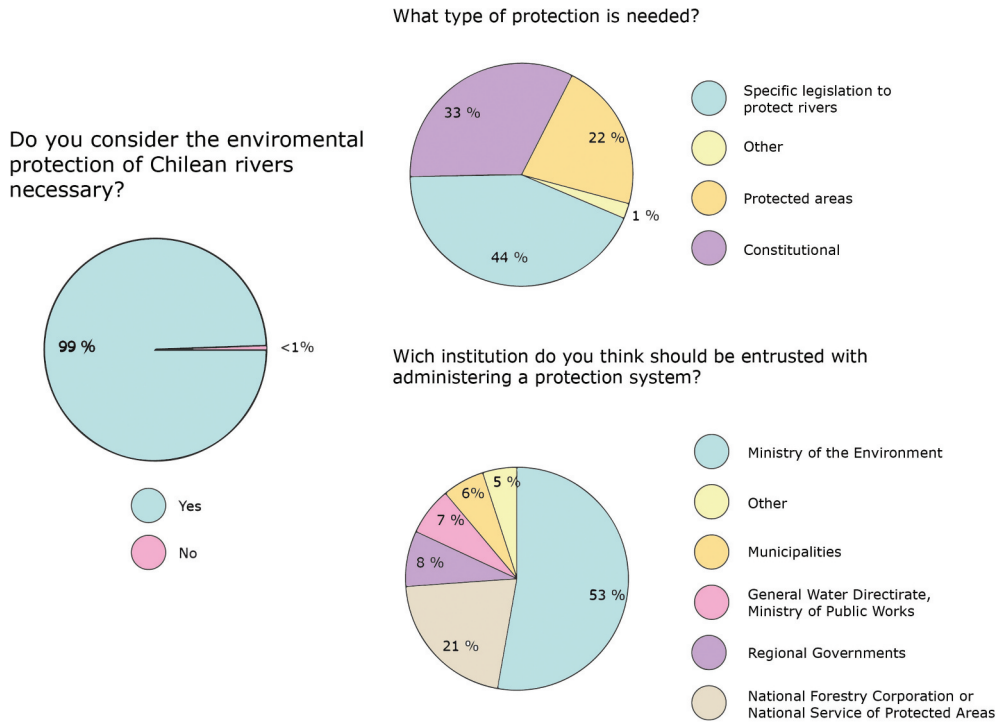


Figure 3. Attitudes to the environmental protection of rivers.

Respondents identified environmental values as the highest priority (95%) followed by cultural (65%), recreational or touristic (56%) and scenic landscapes (52%). Associated with key ecological attributes (i.e., hydrologic regime, connectivity, water quality, habitat and biotic composition) respondents identified threats to their interactions with the river: 58% of respondents acknowledged pollution; alteration in the flow of the river 45%, loss of biodiversity (42%); flow reduction (40%); and river fragmentation (32%). Only 5% of respondents did not identify any impact on the river.

Respondents were asked to identify what types of legal protections should exist. The survey provided different options including constitutional protection (the highest domestic legal mechanism). Forty-four per cent of respondents thought that specific river protection legislation was the best option, followed by 33% who preferred constitutional protection, and 21% preferred recognizing rivers as protected areas (Figure 3). We did not ask respondents about the appropriate scale of implementation (Step 4; Higgins et al., 2021).

The vast majority of respondents (82%) thought that rivers should be protected regardless of the state of intervention (Figure 4). This not only included free-flowing rivers, but also rivers that are highly intervened or polluted.

The highest percentage (86%) considered a protection mechanism was needed to recognize the intrinsic value of freshwater ecosystems regardless of their utility value for humans (Figure 5). However, more than 50% of the respondents also support the protection of rivers

If you consider the protection of rivers in Chile necessary, wich rivers do you think should be protected?

- A) Rivers in their most nature condition that flow without human intervention
- B) Rivers with some mild interventions or mild pollution
- C) Highly intervened or polluted rivers



Figure 4. Attitudes to the types of rivers that should be protected.

What positive impacts do you think could result from establishing a protection mechanism for Chilean rivers?

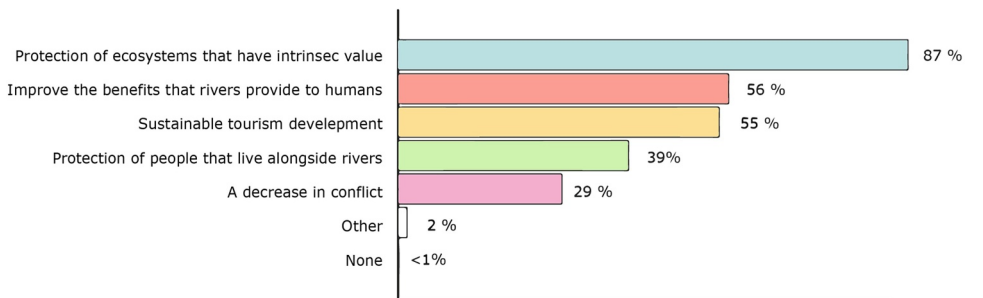


Figure 5. Attitudes to the positive aspects of river protection.

based on the ecosystem services they provide (56%) and some value the provision of recreational services (54%). The conservation of freshwater and riparian biodiversity and reducing conflicts between users were also highlighted as important justifications for protecting rivers.

In terms of negative aspects, respondents (25%) indicated that the protection of many rivers across the country could escalate social conflicts and increase transaction costs limiting productive activities impacting rivers. Impacts on economic development were identified by 24% of the respondents, and some stressed the impacts of specific sectors, with irrigated agriculture most negatively affected (20%), followed by hydroelectricity (19%) and mining (17%). Only 37% of the respondents did not see any negative aspects (Figure 6).

Given that the concept of free-flowing rivers may not mean the same thing to everyone, we asked survey participants to indicate which of the different possible

What negative impacts do you think could result from establishing a protection mechanism for Chilean rivers?

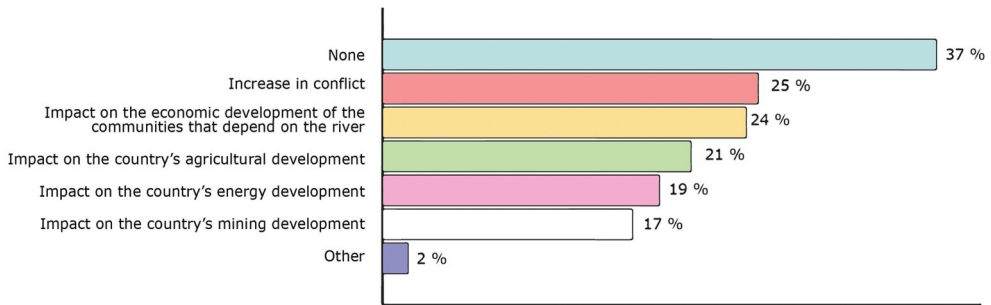


Figure 6. Attitudes to negative impacts of river protection.

definitions provided in a multiple choice question they considered to be correct. Fifty-six per cent of the respondents indicated ‘A river that flows without human intervention from its headwaters to its mouth’ and 54% choose the river for its values ‘A river with an environmental value, cultural value, recreational value or other value for present and future generations’.

Then, we asked ‘What does a free-flowing river mean to you?’, as the only open-ended question. The majority of those surveyed associate it with a river without contamination, not humanly intervened, or running without any interruptions (Figure 7).

When asked if they know of any free-flowing rivers in Chile, only 29% said they did, and placed them mostly in the Los Lagos (28%) and the Aysén regions (28%), in the area described as Chilean Patagonia (from Cochamó in Los Lagos Region to Magallanes Region).

In summary, the survey results showed that the respondents valued the need to protect rivers in Chile and had an awareness of what such protections could look like. They also reflect the fact that the number of free-flowing rivers, understood as rivers with no human intervention, is relatively low, with participants associating the concept with rivers located in the less-populated and southern parts of the country.

What does a free-flowing river mean to you?

WITHOUT HUMAN
INTERVENTION

WATER LIFE RIVER NATURAL
FLOW RIVERBED

Figure 7. What does a free-flowing river mean to you? (Software: RStudio).

Interview results: attitudes of water experts and stakeholders

Our interviews uncovered a range of water experts' and stakeholders' attitudes to legal protections for free-flowing rivers. The interview results, from the questions in Part 2 of the [online supplemental data](#), follow.

When asked, 'What does a free-flowing river mean to you?', the majority of the interviewees were in agreement that the term refers to a river that flows freely without major human interventions. Some interviewees linked the definition to the river's intended use (e.g., a river that should be fully open to the public for recreational or non-extractive uses). Finally, five interviewees indicated that this was a new concept for them and, although they could speculate about its meaning, they had not heard the term 'free-flowing river' before, although they did understand the concept of connectivity. This suggests that even when free-flowing river is a concept that has been used strategically to protect rivers the concept is still not widely understood among all stakeholders in Chile.

There was a general consensus among interviewees that existing legal tools have not maintained the levels of connectivity, water quality, and minimum biodiversity standards and there was a lack of political will to implement existing protections. In particular, interviewees raised concerns about: the inadequate development of water quality standards (H. Peña, former Director DGA, online interview, 2 January 2021); limited construction of 'pollution' in environmental standards (Art. 2 Environmental Law) and exemption of non-point pollution from agriculture (A. Stehr, Researcher Concepción University, online interview, 4 April 2022); proactive application and flow limitations of minimum ecological flows and failure to consider incentives to reduce water consumption in agriculture or other uses to free up water for the environment (N. Dasencich, former lawyer, Monitoring Board Maipo river, First Section, online interview, 19 February 2021); inadequate judicial knowledge of environmental and water concerns (T. Celume, Researcher San Sebastián University, online interview, 8 February 2021); and insufficient refinement of water reserve declarations (C. Boettinger, Research Professor Centre for regulatory and business law, Diego Portales University, online interview, 15 April 2021).

The legal protections considered most effective by interviewees were, first, water flow reserves, because of their potentially large scope to prevent dams (Sergio Salinas-Rodriguez, Research associate Colegio de la Frontera Sur, Unidad Villahermosa, personal communication, 2 January 2021 in Perry et al., 2021), and perhaps because of their influence in stopping Hydroaysén and protecting highly touristic places like 'Los Saltos del Petrohué' (Los Lagos Region). However, most interviewees pointed to the need for a Presidential decree as producing a risk of political influence.

Interviewees also considered that protected areas could offer potential new pathways for the protection of free-flowing rivers, and that some rivers have already been technically protected in this way (C. Silva, GEF Coastal Wetlands Project National Coordinator and J. Ibarra, Operational Coordinator of the Ministry of the Environment for GEF project, online interview, 17 June 2022).

There was consensus among interviewees that legislative reform is needed to protect Chile's rivers, especially those they recognized as free-flowing. However, one interviewee pointed out that the transition costs to greater river protection, especially if this entails the reallocation of water use rights, should not only fall

on rights holders (N. Dasencich, former lawyer, Monitoring Board Maipo river, First Section, online interview, 19 February 2021). Determining the transition costs associated with moving from the current state to a new system, both from a monetary perspective and from a governance and management perspective, was repeatedly mentioned during interviews.

Due to Chile's particular geography and diversity of river systems, the majority of interviewees agreed that any future system must incorporate not only the less-intervened and free-flowing rivers that remain mainly in Patagonia, but also those in central and northern Chile and in urban areas that are already highly intervened.

Interviewees emphasized the need for developing shared values and criteria to select rivers for protection, such as: scenic, aesthetic, recreational, or ecological importance (P. Urrutia, Executive Director NGO Bestias del Sur Salvaje, online interview, 10 July 2023). Orlando Contreras, President of the Peasant Communities and Ethnicities of Chile, said 'of course we have to protect them, but it is also necessary to recognize the reality that Chile has been hit hard by climate change. We already have 30% less water for our activities, so it is especially hard for those of us who live in rural areas. So it is necessary to ask ourselves, what kind of rivers do we want to focus on? The issue of protection is still quite incipient in Chile, and the fear is that these protections might leave us without water' (O. Contreras, President of the Peasant Communities and Ethnicities of Chile, online interview, 4 April 2021).

There was consensus among interviewees that conflict may increase in the short term; however, in the long term, as rules become clear, conflict will reduce.

The majority of the interviewees were reluctant to support the creation of new governance institutions, as they believed that there are already so many different institutions in the environmental and water space that new institutions would increase bureaucracy and fiscal expenditure. Some interviewees emphasized a need for a more decentralized governance (V. Delgado, Director of the Program in Law, Environment and Climate Change, Concepcion University, online interview, 9 October 2022). As highlighted by Delgado, the 2022-formed Interministerial Committee for a Just Water Transition (Ministry of Environment, 2022), led by the Ministry for the Environment, may offer a new opportunity to address the challenge of advancing in water governance and to propose the legal or normative modifications necessary to carry out institutional reforms across scales (V. Delgado, online interview, 9 October 2022).

Interviewees highlighted the importance of strong regulatory powers for governance institutions, including a power to reallocate water, and close involvement of communities that live around rivers. Many interviewees referred to the new Biodiversity and Protected Areas Service as an institution that should ensure river protection.

Discussion and conclusions

Our analysis of Chile's legislative framework has shown that there is a significant gap between current tools to protect rivers and a permanent mechanism for river protection that can maintain and restore the free-flowing rivers status and integrity of the river to sustain their key ecological attributes like the hydrologic regime, connectivity, water quality, habitat and biotic composition. These findings were complemented by our survey analysis and, in particular, the interviews, which suggested that river protections have not been well implemented due to lack of political will and bureaucratic inefficiencies.

The attitudes of the public, and experts and stakeholders, are important because societal perception around rivers ‘often drives the decision to undertake restoration as well as the decision about what type of restoration should be attempted’ (Wohl, 2005).

We suggest three possible pathways for moving towards enhanced river protection in Chile, especially for free-flowing rivers: (1) ensuring the implementation of existing legal protections in all rivers and basins (short–medium term); (2) improving, coordinating and integrating existing protections through policy and regulatory development and administrative changes (short–medium term); and (3) new river legislation (long term).

For the short–medium term, greater implementation of water flow reserves, in particular, could enhance protections of river flows, noting the limitations of minimum ecological flow under the Water Code non-consumptive water rights could also be used more extensively, to guarantee in-stream flows for conservation or sustainable tourism and recreational projects. It is essential that the full range of legal tools, including emission and quality norms, minimum ecological flow, water reserve flows, protected areas and urban wetlands, are integrated and consistent to work effectively together to advance a more holistic protection for rivers. The space generated by the Interministerial Committee for a Just Water Transition seems to be a good place to advocate for a prompt implementation of the new tools approved by the 2022 Water Code Reform and to advance towards a permanent legislation for river protection, in addition to highlighting the importance of grassroots movements in order to promote public policies and prioritize certain rivers in the country.

Our mixed-methods analysis has uncovered a need for law reform to ensure durable legal protections for Chile’s rivers, but the approach must be tailored to Chile’s sociocultural and environmental context. The idea of protecting a river or a river section could allow the concept of free-flowing rivers to have more flexibility, whereby rivers that in some sections have higher levels of intervention can be partially protected in other sections. There may be a clear public interest in keeping the ‘wild’ rivers in southern Chile free-flowing, but there are rivers such as the Mapocho, Maipo, Loa and others located in the central and northern part of the country that are extremely impacted and are the focus of constant debate regarding their use and exploitation or abuse (ONG Ecosistemas, 2021). The restoration of those urban rivers has the potential to generate significant ecosystem and social benefits.

If a future river protection law in Chile allows for grades of protection, high-impact activities could be restricted in the most protected rivers, such as reservoir construction (impoundments), mining activities, channelization, commercial clear-cutting of timber within a certain area, and the use of motorized vehicles. The criteria should be decided for each river catchment in collaboration with local communities, based on the ecological attributes of the river and their societal values. For example, in the Futaleufú river, where people go fishing, kayaking, rafting, and swimming, community members recognize these scenic and recreational values, so connectivity may be key. However, the only current legal tool to protect connectivity is to declare a water flow reserve, which does not explicitly forbid hydropower development. A durable legal protection regime could allow or prohibit certain activities across a range of ecological and social attributes.

Until now, the vision for how Chile’s rivers should be used has come from sectors that have economic power, such as large companies and the authorities, and resist change. Despite the failure to pass the constitutional reform, Chileans continue to value river protection and recognize the need to improve legislation. This is

significant, because it suggests ongoing potential to harness the values of governments, development entities, and community members to garner support for protection efforts. Further studies are needed to assess the perspectives of productive and industrial interests.

However, enhanced river protections will benefit not only the business sector or whoever has property rights, but also communities, who value water for personal, cultural or recreational uses. Our analysis suggests that the place to begin is with those rivers where values are well accepted in order to minimize conflict. The Futaleufú and Puelo Rivers, both located in Chilean Patagonia's Los Lagos Region, have already conducted successful grassroots campaigns to declare water flow reserves for ecosystem protection and connectivity. And recently the Palena and the Yelcho river, also located in the region, have been working on their campaigns to declare water flow reserves. These first protected rivers can serve as precedents to build support, legitimacy and confidence to take on more difficult challenges, while securing the last free-flowing rivers in the country. This appears to be happening, as in early 2024, a new law reform proposal seeking the creation of river protection system has been initiated in the Parliament (Bulletin No. 16629-12 that 'Regulates the conservation instrument called "Protected River", and amends Law No. 19,300, as follows'). Our hope is that this legislation will advance strategic planning regarding the protection and restoration of Chile's rivers, by establishing the pillars on which a national system of river protection and restoration should be built, aiming to converse with the National System of Protected Areas, and the new Service to be created.

Note

1. The addition of 'semel', 'bis', 'ter', 'quater' and 'quinque's indicates that an article has been modified once, twice, three, four or five times.

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