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Socio-environmental conflicts: An underestimated threat to biodiversity conservation in Chile

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ABSTRACT

Biodiversity is vital in the functioning of ecosystems, but it's permanently being threatened by anthropic impacts derived from productive activities. Thus, conservation has become a global challenge. In Chile, the dissociation between economic activities and conservation has triggered numerous socio-environmental conflicts in recent decades. This work explores how different projects that give rise to these conflicts can represent an underestimated threat to biodiversity.

We identified socio-environmental conflicts in Chile and their associated projects by carrying out an online review of 1035 news articles published between 2004 and 2018 using the key words "environmental conflict". We selected articles describing a socio-environmental conflict between parties caused by a project or productive sector. Conflict-generating projects were classified by productive sector and capital origin. In addition, their geographical distribution with respect to High Conservation Value Areas (HCVAs, protected areas and priority sites for conservation) was determined.

A total of 283 projects were identified from 14 different productive sectors, most of them related to energy and mining, which threaten biodiversity and human well-being mainly due to pollution and habitat destruction. Chilean companies finance most of the projects, but international companies finance over half of the energy and mining projects. Moreover, 37 % of the projects were located within HCVAs either for the establishment of future protected areas or where protected areas are currently established. As countries make new efforts to maintain and recover biodiversity, it is contradictory not to consider the threats posed by conflict-generating projects to key areas for conservation, both in public policies and in spatial planning instruments.

1. Introduction

Over the last decades, there has been considerable interest and controversy over the link between biodiversity, ecosystem functioning and the ability of ecosystems to provide goods and services to humanity (Tilman, 1997; Loreau et al., 2001). Nowadays, biodiversity is considered a major determinant of ecosystem productivity, stability, resistance and nutrient dynamics (Tilman et al., 2014; Isbell et al., 2015) and has an important role in strengthening resilience to climate change (Ehlers et al., 2008; Mijatović et al., 2013; Timpane-Padgham et al., 2017). However, we are facing a critical scenario that demands urgent actions to stop the high levels of ecosystem degradation and biodiversity loss (MEA, 2005; WWF, 2018). Main threats to biodiversity are habitat degradation and loss, habitat fragmentation, overexploitation, invasive species, pollution and climate change (Groom et al., 2006). The use, exploitation and transformation of renewable and non-renewable natural resources that ensure the current global economic growth has caused changes and significant losses of biodiversity (Hautier et al., 2015) and has led to conflicts between biodiversity conservation and development.

During the last decades, several countries, NGOs and international agreements have been implementing diverse efforts to reverse this

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negative scenario (Brooks et al., 2006). In fact, nowadays, there is a strong pressure to reach the 20 Aichi Targets by 2020, by addressing the underlying causes of biodiversity loss, reducing the direct pressures on biodiversity, and improving the health of biodiversity by protecting and managing it (CBD, 2010). Moreover, issues surrounding the sustainability of economic activities, such as mining and oil and gas extraction, have been addressed since the early 2000s. Multiple fora, workshops and consultations (e.g. Starke, 2002; IPIECA, 2017) have resulted in agreements and guidelines for industry practitioners (Culverwell et al., 2002). The main purpose of these proceedings was to improve the economic performance of productive activities while minimizing the environmental impact. Many guidelines are related to strengthening associative work between government agencies, business companies and social entities, to promote development at local, national and global scale (Verschoyle and Warner, 2001; Culverwell et al., 2002). Other work has been focused on specific ecosystems, for example Chatham House (2015) hosted a workshop looking to understand the data needs for improved monitoring, regulation and control of mining impacts on forests. In addition, these instances discuss specific initiatives for conservation tools such as protected areas, for example, elaborating clear criteria to decide whether it is possible to mine close to protected areas.

In order to attain international and national conservation targets, Chile has invested in strategies to move forward on biodiversity protection and fulfilling Aichi Targets. These advances include the creation of the Ministry of the Environment (MMA), the Environmental Assessment Service (EAS) and the environmental courts (Law 20.147, 2010; Law 20.600, 2012; Jorquera-Jaramillo et al., 2012). Also, Chile is creating a Biodiversity and Protected Areas Service as a way of integrating terrestrial and marine biodiversity and protected areas (Squeo et al., 2012) and has developed a major campaign to accomplish the 11th Aichi Target by increasing its protected surface, especially in marine ecosystems (Petit et al., 2018). Furthermore, the article 19 of the Chilean political constitution (1980) assures Chilean citizens “The right to live in a pollution-free environment. It is the duty of the State to ensure that this right is not affected and to protect the preservation of nature”, making the good quality of the environment a public duty. Humanity’s right to a healthy environment is also an active resolution of the International Union for Conservation of Nature (IUCN). Indeed, during the World Conservation Congress in Hawaii (2016), it was proclaimed that humanity and all living beings have a right to the conservation, protection and restoration of the health and integrity of ecosystems.

In contrast, the pressure on the use of natural resources in Chile has considerably increased in recent years, and the obligation of assuring a pollution-free environment is struck down by the same article 19 that also states, “The law may establish specific restrictions on the exercise of certain rights or freedoms to protect the environment” (CPR, 1980). A notable example of these restrictions is the intense copper mining that started in the 1830s, which causes serious degradation of the environment (Villagrán, 2006; Mahalik and Satapathy, 2016; Latorre and Tovar, 2017), but is crucial to Chilean economy (Banco Central de Chile, 2018). This kind of loophole in legislation has led to a clash between economic value and environment that generates environmental conflicts.

Environmental conflicts that also include economic and/or social aspects are known as “socio-environmental conflicts” and have been defined as disputes between natural persons, organizations, private companies and/or the State, which are publicly expressed (e.g. news articles, protests) and show divergences of opinions, positions, interests and demands for the affectation (or potential affectation) of human rights, derived from the access and use of natural resources, as well as for the environmental impacts of economic activities (Sabatini, 1994; INDH, 2015). Furthermore, Hutchins and Lester (2015) have described “mediatized environmental conflicts” as complex interactions occurring between four key spheres of action: (i) activist strategies and campaigns, (ii) journalism practices and news reporting, (iii) formal politics and decision-making processes, and (iv) industry activities and trade. Their work follows Cottle’s concept of “mediatized conflict” (2006), that stresses the constitutive role performed by media in the enactment and experience of conflicts and their political consequences.

For decades, socio-environmental conflicts have been widespread and recent research suggests that the global economic growth will increase their number and intensity in the coming decades (Muradian et al., 2012; Dupuy et al., 2015). This has led to a renewed interest of the media in socio-environmental conflicts and the projects that cause them. Hutchins and Lester (2015) state that media play an important role in the development and resolution of conflicts, they work as agents that help to structure conflicts and their conduct. The sphere of action of journalism and news reporting allows the world to know about environmental problems using technological communication with the purpose that decision makers (e.g. politicians) become aware and generate actions that mitigate these problems. The same authors stress that media forms and practices are also resources used by different stakeholders to convey information, interpretations, and opinions to a range of personal and public networks, including social networks (e.g. Twitter and Facebook) and websites. The content that circulates through these networks also enters into the flow of news and political discourses surrounding a conflict.

Aldunate (2001) noted that the environmental issues in national press were treated from a perspective of conflict and denunciation, meaning that when there is no conflict there are no “ecological news”, a trend that continues to this day. The same author states that the conflict gives presence to the environmental issue in the press and not vice versa. For example, an analysis of the front pages of the Chilean national newspaper “El Mercurio” confirmed the tendency of Chilean media to address environmental issues from the perspective of conflict, focusing on the judicial aspect instead of the environmental one (Carmona and Jaimes, 2015).

Until today, the projects behind the main socio-environmental conflicts in Chile that are highlighted in the media have been considered as a threat to human health and well-being, but not much attention has been paid to their potential impacts on biodiversity and its conservation. The research about these conflicts in Chile has been focused mostly on social implications (Delamaza et al., 2017; Maillet and Albala, 2018). In this study, we focused on online media because it is quickly becoming an alternative to the written press and the official sources of information (Lester and Hutchins, 2012; ITU, 2017).

Hence, the main objective of this work was to illustrate if conflict-generating projects covered by online media represent a threat to biodiversity conservation efforts in Chile, in particular High Conservation Value Areas (HCVAs). HCVAs are spaces that, under natural conditions, provide relevant ecosystem services or whose ecosystems, habitats, species, landscapes or natural formations have characteristics of uniqueness, scarcity or representativeness, and in which one or more conservation management measures can be applied, such as: declaration of priority sites; declaration of protected areas; restauration, conservation and management plans for native species; measures or plans for prevention, control, containment and eradication of exotic species (MMA, 2017, 2019b). Furthermore, given the current trade liberalization and its consequences on the environment, addressed during IUCN World Conservation Congresses (IUCN, IUCN World Conservation Congress, Amman, 2000; IUCN, IUCN World Conservation Congress, Hawaii, 2016), we also explored the productive sectors and the origin of the capital financing conflict-generating projects, in order to assess the source of the conflicts that impact HCVAs and help addressing specific solutions.

2. Materials and methods

We searched for socio-environmental conflicts resulting from massive projects that have had online media coverage in the last 15 years.

Based on Aldunates' (2001) observation, we considered that if there was an online news article, there was a conflict.

The projects triggering socio-environmental conflicts are hereby defined as "conflict-generating projects". We considered future, ongoing, rejected by the Environmental Assessment Service (EAS) (i.e. that they were not established), suspended and finished projects that have led to a socio-environmental conflict.

The research was focused on continental Chile because the methods we used to gather news articles in online media only showed continental results.

2.1. Conflict-generating projects and biodiversity impacts

In order to define which conflict-generating projects have been covered by online media in the last 15 years, a theme search was conducted in the Google search engine with the key words "conflicto ambiental" (*environmental conflict* in Spanish). This research method was inspired by former studies by Temper et al. (2018) and Chevallier et al. (2019). The analysis was restricted to the last 15 years in order to limit the effects of the information deletion occurring in private data centers (Riesch, 2011). A review of all resulting news articles was done per year, from January 1st 2004 to December 31st 2018, in order to determine which articles actually covered at least one socio-environmental conflict. Chile was set as the research country, we selected to view "All News" in the News tab and chose Spanish as the language for results.

News articles were selected within all the Results pages if (1) they referred to socio-environmental conflicts associated to a specific project or productive sector, and (2) stakeholders and/or companies associated to the projects or sectors were clearly mentioned. Sources of the articles were mainly online newspapers, such as Diario Universidad de Chile, El Ciudadano, La Tercera and El Mostrador.

The selected news articles were classified per year in a database, including the title of the article, its source, the date and year. For each news article, we identified the projects that were held responsible for the conflict. For each conflict-generating project we determined the administrative region where it was located, its productive sector (for classification), the financing companies and the capital origin of the company (international, national, mixed), using the Human Rights National Institute database for socio-environmental conflicts (INDH, 2020) and the Google search engine. We also quantified the number of news articles concerning each conflict-generating project. We determined the official project status (future, ongoing, rejected, suspended and finished) for the ten projects most covered by online media using the Universidad de Los Lagos socio-territorial conflicts database (2018) and the EAS database (SEA, 2019).

Conflict-generating projects were located in a map using Esri's ArcMap 10.2.2 with the UTM coordinates found on the databases from the EAS, from the National Human Rights Institute, or using the Google search engine.

In order to illustrate how these conflict-generating projects could have an impact on biodiversity, we did an extensive review of literature regarding the known impacts of the productive sectors to which they belong. We searched on Google Scholar and Web of Science using the name of each productive sector as key words.

2.2. Conservation areas and mapping

The productive sectors of these projects depend on the use of natural resources, land use and land cover change, which are known to induce biodiversity loss (Groom et al., 2006). Given the nature of the projects, we determined their geographic location in relation to conservation areas in Chile, to assess if they could represent a threat to biodiversity conservation.

Firstly, conservation strategic planning (CPS) was used to identify HCVAs, as done by Squeo et al. (2012) and Martinez-Tillería (2015), where conservation portfolios were generated for all continental Chile, using Marxan 2.1.1 as a decision support tool and with 25 km^2 planning units. HCVAs were selected using a scenario where existing public and private protected areas were considered mandatory, priority sites for conservation (identified by the National Strategy of Conservation, but not legally decreed) were suggested, and highly anthropized areas were excluded, because of high conservation costs. We obtained HCVAs that represented the best solutions for the establishment of new protected areas, as a Chilean conservation portfolio (including existing areas). These areas would allow to fulfill conservation goals at a smaller conservation cost and with less edge effects.

Secondly, a map was elaborated showing the location of conflict-generating projects that were weighted according to the number of online news articles that mentioned each project, and the location of best solution HCVAs in continental Chile.

We recorded the number of conflict-generating projects that were inside and outside best solution HCVAs, as a measure of threat to these conservation areas.

3. Results

3.1. Conflict-generating projects: productive sectors and capital origin

We identified 1035 news articles from 67 different sources that highlighted 283 projects associated to socio-environmental conflicts in Chile, that were classified into 14 productive sectors (Appendix 1 in Supplementary material).

From the 283 conflict-generating projects recorded, the majority corresponded to the energy (31 %) and mining (28 %) productive sectors (Fig. 1). The rest of the productive sectors ranged from 10 to 0.4 % each. Among these sectors, we can highlight fisheries and aquaculture, ports, manufacturing facilities and environmental sanitation, which had over 10 conflict-generating projects each, and together represented 24 % of the total number of projects (Fig. 1).

Forty-six percent of the projects were owned by companies with national Chilean capital (Fig. 1), and from these, 77 % were private and 23 % were public. Thirty nine percent of the projects were financed by companies with international capital, all private. The remaining projects (13 %) were owned by companies with mixed capital. However, concerning the most conflict-generating productive sectors, 64 % of energy projects are actually financed by international companies, and mining projects are financed by international and national companies equally (44 % each). Capital origin for three projects remained unidentified.

Capital of international and mixed origin came from 17 different countries (besides Chile): USA, Spain, Canada, France, UK, Australia, Brazil, Norway, Singapore, Italy, Switzerland, Japan, South Korea, Argentina, China, Colombia and Sweden. We did not find the proportion of international invested capital for every conflict-generating project, but USA, Spain and Canada were the countries linked to the highest number of international and mixed projects, apart from Chile.

3.2. Conflict-generating projects as a threat to biodiversity

The impact that extractive activities have on natural systems in terms of overexploitation, habitat destruction, invasive species and disease, pollution, and climate change are well known. In Table 1, we summarize some of the impacts described in the literature of the productive sectors that we have identified originating conflict-generating projects in Chile. These impacts are direct and indirect, and their influence area can vary depending on the affected ecosystem and the type of impact. In addition, all of these activities generate waste that does not always receive a proper treatment. The impact of litter on biodiversity, both in land and the ocean, is a transversal consequence (Gall and Thompson, 2015).

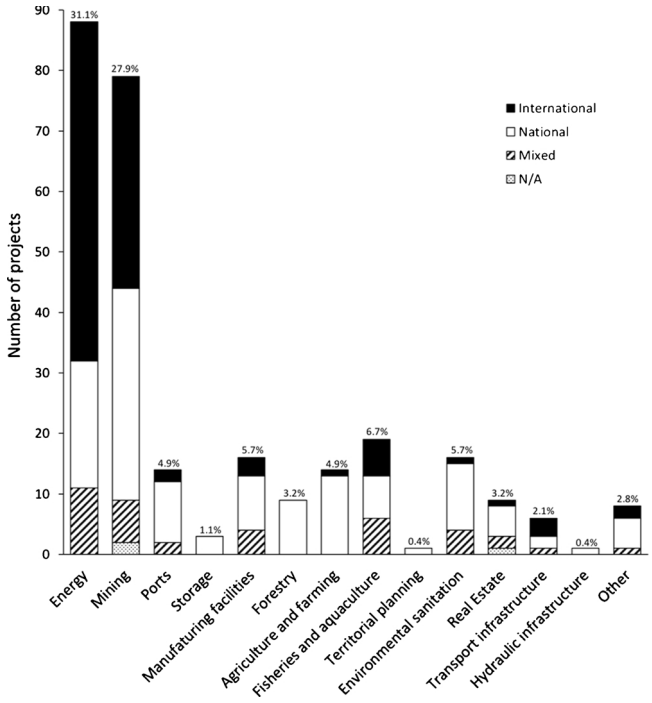

Fig. 1. Number of conflict-generating projects by productive sector and capital origin (n = 283). Productive sectors were sorted from left to right according to their link with each other. Percentages on top of each bar represent the proportion of projects belonging to each sector. Territorial planning refers to inter-communal regulation plans that define exploitable and non-exploitable areas in a limited territory.

3.3. Geographical distribution of conflict-generating projects

Conflict-generating projects organized by region and productive sector are listed in Appendix 2 in Supplementary material. The largest number of projects were located in the Antofagasta region, northern Chile, with a total of 42 projects, followed by the Valparaíso region, with 36 projects (15 % and 12 % respectively) (Fig. 2). Both regions were dominated by energy industry conflicts, but in the case of Antofagasta the number of mining and energy projects was even (14 energy and 13 mining projects), and in Valparaiso there were more energy projects than mining. The regions that followed with the largest number of conflict-generating projects were Bío Bío and Los Lagos (9.5 % each), Metropolitana (9.2 %) and Coquimbo (8.5 %).

In Atacama, Arica y Parinacota, Tarapacá and Coquimbo (Northern regions), mining projects accounted for 75 %, 73 %, 64 % and 57 % of the total regional projects respectively, making mining the main cause of conflict.

In contrast, in the Southern regions, conflicts caused by the energy sector were dominant. For example, in the Araucanía region, 60 % of the conflict-generating projects were caused by the energy industry (mostly hydroelectricity) and none by mining. A similar trend was observed for the Bío Bío and Maule regions, where about 57 % of the conflicts were related to the energy sector and fewer conflicts were associated to mining. Conflicts associated to forestry and manufacturing facilities were relevant between the Maule and Los Ríos regions (South-Central Chile).

In Central Chile, in the O'Higgins region 55 % of conflicts were associated to agriculture and farming, mostly related to pig farms. In the Metropolitan region (where the capital Santiago is located), half of conflicts were related to mining and environmental sanitation (Til Til town).

In the extreme southern regions, salmon farming represented 30 %, 46 % and 67 % of the conflict-generating projects at Los Lagos, Aysén and Magallanes regions respectively.

3.4. The most controversial projects in online media: the Chilean top ten of conflicts

Conflict-generating projects had different amounts of media coverage. 164 projects were mentioned only once in the news articles resulting from our research (i.e. 58 % of the projects). However, some projects had more media coverage, such as the hydroelectric power plant *"Cuervo"*, the copper mine *"División Andina"*, the copper smelter and refinery *"División Ventanas"*, the thermoelectric plant *"Castilla"*, the *salmon farming industry* in the Los Lagos region and the thermoelectric plant *"Punta Alcalde"*. Even though these projects had considerable media coverage, other projects were even more recurrent in online news articles, some even being source of massive public protests, like Pascua Lama, Dominga and HydroAysén. These strongly mediatized projects were part of the top ten list of most conflict-generating projects (Table 2), which included four mines, two hydropower plants, an industrial park, a pig farm, a pulp plant and an industrial waste treatment plant. From this list, 6 projects are ongoing and 2 were suspended for environmental non-compliance. Details of these projects are given in Appendix 3 in Supplementary material.

3.5. Conflict-generating projects as a threat to biodiversity conservation efforts

Of all 283 projects, only 272 had geographic coordinates available and could be located. 101 projects were located inside HCVAs which were considered as best solutions for the establishment of protected areas or where protected areas are currently established, this represented 37 % of the conflict-generating projects (Figs. 2 and 3, Appendix 4). Antofagasta, Atacama, Coquimbo and Los Lagos regions concentrated the greatest absolute number of projects inside HCVAs, followed by Bío Bío and Araucanía regions (Figs. 2 and 3). However, Arica y Parinacota, Atacama, Coquimbo, Ñuble, Araucanía and Magallanes had the highest percentage of conflict-generating projects

Table 1
Summary of some environmental impacts of productive sectors behind conflict-generating projects that threaten biodiversity in Chile.

Productive sector	Environmental impact
Energy (Thermal and hydroelectric power stations)	Water extraction and wastewater release affects directly the biodiversity as disruption in migratory cycles of aquatic species (Venugopalan et al., 2012). Death of organisms caused by water temperature change or mechanical harms (Pokale, 2012). Toxic substances release to water and atmosphere, due to the use of anti-fouling substances and paintings (Vásquez et al., 2008). Emission of mercury and sulphur dioxide by coal-fired power plants that can precipitate in the form of "acid rainfall" (Glass, 1979)[a]. Lower presence of refuges for fish, poorer habitat quality, more pools and less riffles and macrophytes, and shallower water levels, also smaller fish abundance and average size in reaches impacted by hydropower plants (Benejam et al., 2016). Flow fluctuations reduce biomass of benthic invertebrates and fish (Moog, 1993). Land conversion resulting from the obstruction of rivers, flooding and human migration generates fragmentation and permanent loss of habitat in submerged highlands and reduces biodiversity in areas with new human settlements (Benchimol and Peres, 2015).
Mining	Flora and soil removal; surface and groundwater and glaciers pollution (Villagrán, 2006). The noise of drilling and blasting and other actions drive away animals; habitat destruction (Mahalik and Satapathy, 2016; Latorre and Tovar, 2017). Water and soil pollution by heavy metals or toxic chemical substances, such as mercury, zinc, copper, arsenic and coal. Sand mining is especially damaging by producing a large amount of sediments (Barletta et al., 2010)
Ports and Storage	Increase of the concentration of heavy metals in sediments by the intense activity of shipping in certain coastal areas (Reddy et al., 2004). Tank washings and discharges are source of oil and chemical substances spills that damage birds and other animals (Hampton et al., 2003). Introduction of alien species (Wonham et al., 2001). Modification of currents and sedimentary regimes with an increase of erosion affecting intertidal and subtidal habitats; impact on mobile species as marine mammals and sea turtles (Niner et al., 2017). Impact of propellers and anthropogenic noise (Lindgren and Wilewska-Bien, 2016). Spills from storage facilities pollute freshwater and seawater, and damage cultures nearby (Chávez, 2011; Osses, 2011)
Manufacturing facilities	Discharges from manufacturing facilities, such as pulp plants, into water bodies, cause the death of aquatic fauna, such as birds (González and Roldán, 2014). Oil refinery effluents contain many different chemicals at different concentrations – including ammonia, sulphides, phenol and hydrocarbons – they can be lethal, and they can often have sublethal effects on growth and reproduction (Wake, 2005).
Agriculture and farming and Forestry	Habitat loss and fragmentation with land cover change for croplands (Pimm and Raven, 2000). Land use and land cover change have a negative effect on the local and global climate (Kalnay and Cai, 2003; Salazar et al., 2015). Excessive use of fertilizers reduces freshwater and coastal water quality causes salinization of soils and the loss of the native habitats (Foley et al., 2011). Water extraction for intensive agriculture, combined with deforestation and dry seasons could reduce or dry up completely rivers with the death of native biodiversity (Barletta et al., 2010). Forestry activities cause harm by replacing native forest; loss of the original ecosystem (Carnus et al., 2006); effects in other ecosystem services such as pollination (Kremen et al., 2002).
Intensive aquaculture	Eutrophication caused by effluents (Herbeck et al., 2013). Conversion of wetlands and mangroves (Seto and Fragkias, 2007; Rahman et al., 2013). Source of floating marine debris (Hinojosa and Thiel, 2009). Overexploitation of wild fishes to make pellets (FAO, 2018). Genetic alteration (Yarahmadi et al., 2016). Water concentration of antibiotics and hormones near aquaculture facilities and death of predators near facilities (Diana, 2009). Exotic species introduction causes displacement of native species, competition for space and food, and pathogens spread (Martinez-Porchas and Martinez-Cordova, 2012).
Environmental sanitation	Landfill pollutes groundwater and agricultural soils (Akinbile, 2012) and causes disease in humans and fauna (Jurinović et al., 2014).
Infrastructure and Real Estate	Real estate projects on coastal environments remove dunes and the associated vegetation which causes habitat loss (Davenport and Davenport, 2006).
Territorial planning	Habitat fragmentation by roads and increased mortality of animals (Geneletti, 2003; Carvalho et al., 2014). Bad coordination and dialogue between mechanisms and tools of territorial planning, causing that many visions overlap, and many zoning efforts remain only on paper, leaving natural and agricultural areas with no effective protection of natural heritage (Cross, 2016).

[a] This impact has also been described for "clean" or "green" thermal power stations.

inside best solution HCVAs in relation to the total number of conflict-generating projects per region (Appendix 4 in Supplementary material).

4. Discussion

4.1. Conflict-generating projects

Our research allowed us to identify 283 conflict-generating projects in Chile until the end of 2018. This highly exceeds previous numbers of conflicts reported in Chile, such as the 116 socio-environmental conflicts listed by the Human Rights National Institute (INDH, 2020), the 101 socio-territorial conflicts illustrated by Delamaza et al. (2017), and the 58 cases of ecological struggles in Chile registered by the Environmental Justice Atlas (EJAtlas, 2020). This difference could be expected because our methods differed from those used in previous studies. We focused on socio-environmental conflicts found in online media, which included mediatized environmental conflicts as defined by Hutchins and Lester (2015), and we did not analyze the territorial aspect of the conflicts resulting from our research.

Our classification of conflict-generating projects by productive sector showed that energy and mining accumulated nearly 60 % of the conflict-generating projects in the country. Similar results were reported by Delamaza et al. in 2017, based on socio-territorial conflicts in Chile between 2005 and 2014, showing that energy and mining remain

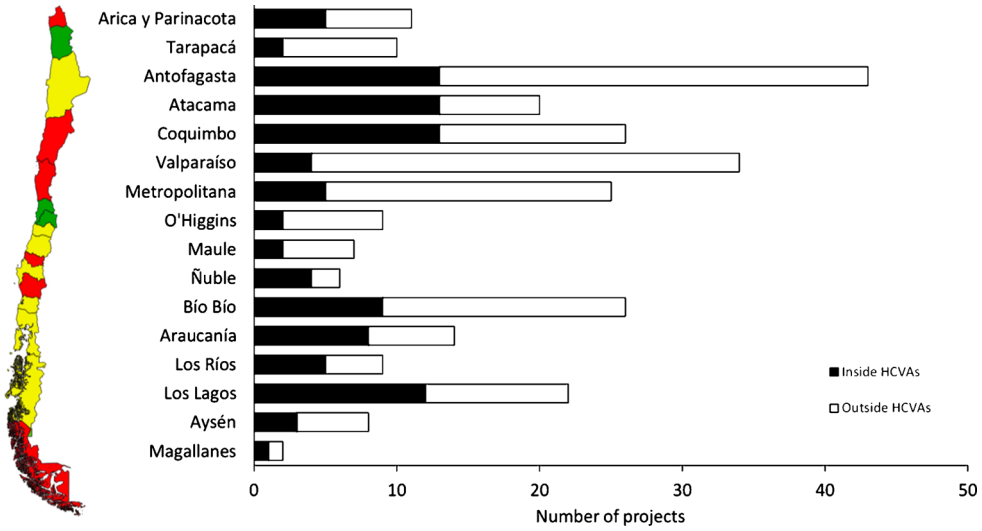

Fig. 2. Distribution of conflict-generating projects identified by Chilean administrative regions, and their location in relation to High Conservation Value Areas (inside or outside HCVAs). The colors of the map correspond to: 0 %–20 % of conflict-generating projects inside best solution HCVAs, green; 21 %–40 %, yellow; > 41 %, red.

the main cause of socio-environmental and territorial conflicts. Furthermore, these sectors are highly associated because many energy plants supply power directly and specifically to the mining sector, the latter being considered key to the Chilean economy (Banco Central de Chile, 2018). As for the energy sector, power plants in Chile are mostly hydroelectric and thermoelectric. Port infrastructures are also closely linked with mining and energy sectors. Indeed, ports have a key role in the export of natural resources and have direct and indirect consequences on biodiversity loss in coastal and marine habitats. It is worth mentioning that the Dominga mine-port project was rejected in 2017 mainly because of its impact on marine and terrestrial biodiversity and its proximity to protected areas in the Humboldt Archipelago, which has been declared a Hope Spot (Mission Blue, 2018). However, this project is getting a second chance to be approved because of the lack of integrated space planning in the Coquimbo Region (Ministry of the Interior and Public Security, 2019) and is currently in court battle. This triggered protests against the Dominga project to continue in the region. The rich and productive Humboldt Archipelago has been threatened by other projects in the past. Three thermoelectric power plants tried to settle in the nearby area about a decade ago: Farellones, Cruz Grande and Barrancones. The Farellones project was abandoned in 2008, Cruz Grande requested to postpone the project until 2011 to finalize the environmental assessment and was later withdrawn (Cárcamo et al., 2011), but the Barrancones project was approved in August 2010, causing a series of massive regional and national protests, in addition to serious questions about its evaluation process and environmental institutions (Neira and Portilla, 2010). Public pressure was extreme, which ultimately resulted in the President asking investors to relocate the project elsewhere, and later the project was withdrawn from the EAS by its investors (Cárcamo et al., 2011).

The geographical distribution of the conflict-generating projects was not homogeneous throughout the country and seemed to depend on the availability of natural resources (Fig. 2; Appendix 2 in Supplementary material). In summary, conflict-generating projects were distributed as follows: in Northern and Central Chile, mining and thermoelectric power plants; in Central Chile, animal farms and waste treatment plants. In fact, land use and land cover change are some of the main causes of biodiversity loss in Central Chile, where the greatest diversity of vascular plants is concentrated, and is one of the 34 hotspots of global biodiversity (Mittermeier et al., 2004; Squeo et al., 2012). It is also worth mentioning that the country's agriculture is highly concentrated in Central Chile (ODEPA, 2017), and some areas are intensively exploited, causing severe drought, like is the case of avocado plantations in Petorca, in the region of Valparaiso, that have deprived the communities of the territory of drinking water (Velásquez, 2018). Moreover, since 2010, the territory between the regions of Coquimbo and La Araucanía (Central Chile) has experienced a rainfall deficit close to 30 %. The temporal persistence and spatial extent of the current drought are extraordinary in the historical record, which is why this phenomenon is called "mega-drought" and is believed to be enhanced by the current climate crisis (CR2, 2015). In South-Central Chile, forestry projects and hydroelectric power plants dominated, and in the extreme South (Patagonia), salmon farming, known for water pollution and introduction of invasive species (Diana, 2009; Herbeck et al., 2013). The geographical distribution also showed that in certain territories, threatening productive sectors were highly concentrated, thus forming "sacrifice zones" such as the Industrial park Quintero-Puchuncaví in the Valparaíso region, Huasco in the Atacama region and clusters of coal-fired power plants in Tocopilla and Mejillones, in the Antofagasta region (Fundación Terram, 2016; Scott and Smith, 2017).

In terms of the origin of the capital financing these conflict-generating projects, we found that most of them were financed by national capital (46 %), the majority being private companies. Energy projects were mostly foreign (64 %), and mining projects were equally financed by national and international companies. This is relevant because foreign investment in Chile represented 2% of the gross domestic product in 2018 (World Bank, 2020). Plus, the country has signed 29 trade agreements which have radically changed its economic relations with the world, boosting the country's exports. In 2017, 8167 Chilean companies exported to the world, and 94.5 % of exports went to countries with which Chile has agreements, China being the most important trading partner (SUBREI, 2020). Furthermore, we found that capital of international and mixed origin financing conflict-generating projects came from 17 different countries, all of which have ongoing trade agreements with Chile (e.g. Mercosur, P4, EFTA, European Union). Such agreements refer to political, commercial, economic and financial, scientific, technological, social, cultural and cooperation fields. And may be extended to other areas that the Parties agree on. This matters because these associations can indeed facilitate the establishment of foreign projects in Chile. Being aware that these agreements can mean not only economic growth to the country but also environmental hazards, a proper balance should be found to maintain high standards of environmental compliance.

The origin of capital and the geographical distribution of conflict-generating projects, depending on the availability of natural resources, reflect the globalized economic model of privatization based on extractivism of raw materials for the export of low-priced commodities (Svampa, 2012; Delamaza, 2018). Furthermore, almost half (52 % considering mixed capitals) of the companies behind these conflict-generating projects had foreign capital, an example of "telecoupling" in

Table 2
The top ten conflict-generating projects by mention in news articles in Chile. Productive sectors: MI — mining, EN — energy, O — other, AG — agriculture and farming, MF — manufacturing facilities, ES - environmental sanitation.

Ranking	Project name	Administrative region	Productive sector	Name of the company	Capital origin	Number of news articles associated	Public/private	Inside best solution HCVAs	Project status
1	Pascua Lama Mine	Atacama	MI	Barrick Gold	International	68	Private	No	Suspended
2	Proyecto minero-portuario Dominga	Coquimbo	MI	Andes Iron	National	65	Private	Yes	Future
3	HidroAysén	Aysén	EN	Enel Generación Chile/Colbún S.A.	Mixed	48	Private	Yes	Rejected
4	Los Pelambres Mine	Coquimbo	MI	Antofagasta Minerals (Grupo Luksic), Nippon LP Investment and MM LP Holding BV	Mixed	44	Private	No	Ongoing
5	Parque Industrial Quintero-Puchuncaví	Valparaíso	O	ENAP, Oxiquim, Gasmar, Copec, CODELCO, GNL Quintero, AES Gener	Mixed	39	Public	No	Ongoing
6	Mina Invierno	Magallanes	MI	Mina Invierno S.A. (Ultramar, COPEC)	National	33	Private	No	Ongoing
7	Planta de cerdos "Freirina"	Atacama	AG	Agrosuper	National	32	Private	Yes	Suspended
8	Alto Maipo	Metropolitana	EN	AES GENER/Antofagasta Minerals	Mixed	30	Private	No	Ongoing
9	Planta de Celulosa Valdivia	Los Ríos	MF	CELCO-Arauco	National	26	Private	Yes	Ongoing
10	Planta de tratamiento de residuos industriales CIGRI Til Til	Metropolitana	ES	Ciclo Chile/KDM	Mixed	26	Private	No	Ongoing

the sense of how countries with ecological debt rely on countries still rich in natural resources to maintain their functioning and welfare (WWF, 2018; IPBES, 2019). In addition, some companies do not have the same harmful practices in their country of origin as they do in Chile. For example, salmon farms in Chile financed by foreign capital use up to 20 times more antibiotics than in Norway (Fuentes, 2017). This model of economic growth has been shown to be opposite to the sustainable development model that explicitly recognizes that social and economic development can only be achieved through sustainable management of natural resources (UNEP-WCMC, IUCN & NGS, 2018).

This sustainable management of natural resources would aim to the development of productive activities without damaging biodiversity and generating integrated conservation policies. Such policies would include in-situ and ex-situ conservation while taking into account the different stakeholders surrounding a protected area (Koziell and Saunders, 2001). According to McShane et al. (2011), there will always be trade-offs between conservation and the development of productive activities. Therefore, something will have to be lost to gain something else and difficult decisions will have to be made on the basis of this balance. It is important to address these situations with transparency and a trade-off perspective instead of a "win-win" perspective. The notion behind the push to think and communicate in terms of trade-offs is that making these more explicit will result in better designed, more resilient and more sustainable initiatives, and/or the capacity to recognize when and why this may not be possible (McShane et al., 2011). Sustainable development will not be possible if the model does not recognize the importance of ecosystems for the well-being of people.

Some examples that these trade-offs are difficult to address are the case of mining and energy generation. In Chile, mining has a strong presence, which can be an opportunity for the economic development of the country, at the expense of its biodiversity (Table 1; Virah-Sawmy et al., 2014). In the case of energy generation, acknowledging it cannot stop, the trade-off is established between renewable and non-renewable energy. Chile is already moving forward with energy transition and reached the first place in renewable energy investment in Latin America and the Caribbean according to the New Energy Finance Climatescope (Bloomberg, 2018). Currently, hydropower dominates renewable electricity generation worldwide, accounting for two-thirds globally. In the context of the current climate crisis, hydropower facilities are considered to emit less greenhouse gases than fossil fuels (IPCC, 2019). Nevertheless, Ocko and Hamburg (2019) found that there are enormous differences in climate impacts among hydropower facilities and over time, some facilities being even on par with fossil fuels. If gas emissions from hydropower plants are indeed lower than equivalent fossil fuel generation, switching from fossil fuels to hydropower would be a trade-off, considering that the construction of hydropower plants and consequent flooding could entail more local biodiversity loss (Lees et al., 2016). This needs to be considered in weighing which source of energy generation is more environmentally damaging at different scales. In June 2019, the Chilean government announced its decarbonization plan, setting the goal of removing the 28-existing coal-fired power plants from the National Electricity System by 2040, starting by disabling the 8 oldest plants by 2024 (Ministry of Energy, 2019). However, some organizations considered the goal was not ambitious enough and believe it should be attained by 2030 (Fuentes, 2019).

4.2. Conflict-generating projects, conservation efforts and public policies in Chile

Our study showed that 37 % of the 272 conflict-generating projects that we could successfully locate were inside HCVAs in Chile. These included (i) protected areas where the government has already invested in conservation measures for decades and (ii) national portfolios of priority areas for conservation, determined by a spatial portfolio optimization tool (Squeo et al., 2012; Martinez-Tillería, 2015). In general, conflicts outside of HVCAs can be more associated with human health

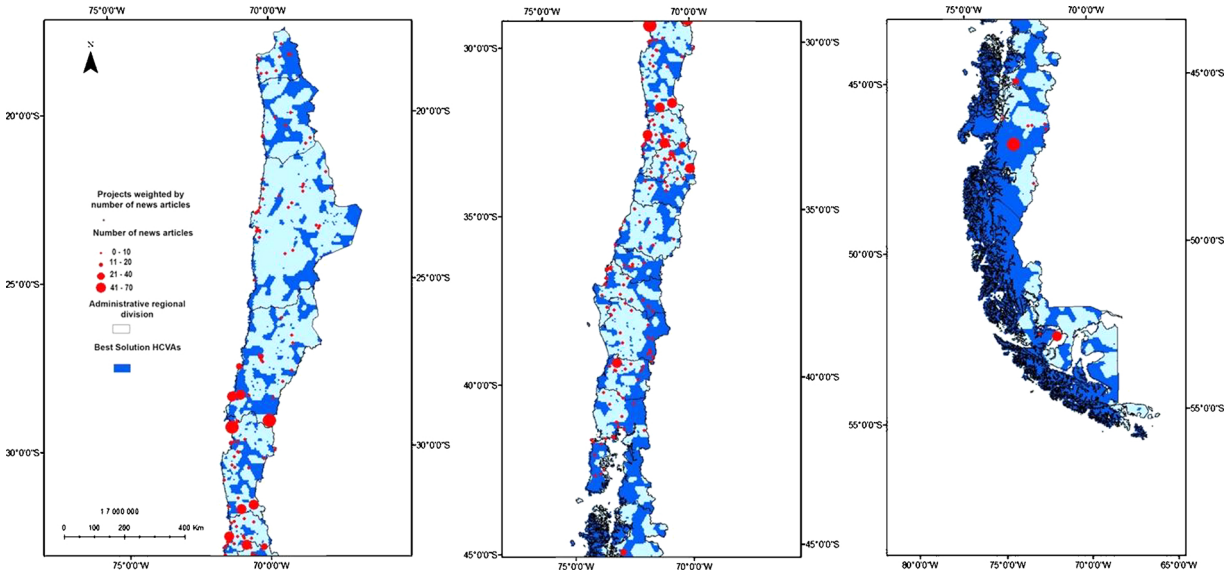

Fig. 3. Distribution of conflict-generating projects in Chile in relation to best solution HCVAs (based on Martinez-Tillería, 2015). The diameter of circles represents the number of online news articles about each project.

than with threats to biodiversity. This study did not allow us to assess the presence of some forestry and salmon farming projects inside or near HCVAs, because they were widespread and there was not enough information available to locate them. In addition, because of our research methods, there can be an underestimation of the number of existing conflict-generating projects in Chile, leaving some out of our analysis, such as plastic pollution and its impacts on biodiversity, that have been highly documented in recent years in rivers (Rech et al., 2014) and in coastal and marine environments (Honorato-Zimmer et al., 2019). Air pollution had to be left out of the analysis in spite of its presence in the media, because it is not limited to one strict location and time. All the same, our results show an alarming picture and highlight the need for environmental enforcement. Indeed, in 2016, the IUCN World Conservation Congress (WCC) in Hawaii recognized that environmentally damaging industrial activities and infrastructure impede achievement of the Strategic Plan for Biodiversity 2011–2020 and the Aichi Biodiversity Targets, as well as the United Nations Sustainable Development Goals. Furthermore, the importance and relevance of IUCN's existing resolutions and recommendations regarding environmentally damaging industrial activities and infrastructure projects located in, around, or otherwise negatively affecting, any protected areas were reaffirmed. It was also recognized that the concept of areas being "no-go", or off-limits, to environmentally damaging industrial activities, including mining, oil and gas and agriculture, and environmentally damaging infrastructure, such as dams, roads and pipelines, is essential to conservation policy for protected areas and other sites of known importance for biodiversity and ecosystem services, such as HCVAs in Chile.

In fact, Chile has an institutional framework to prevent environmental damage of any activity, inside or outside HCVAs, and most of conflict-generating projects registered in this study were approved by the Environmental Assessment System (EAS). Other projects were only asked for a sworn statement guaranteeing they would not degrade the environment (MMA, 2013), and others were approved only by sectoral permits (e.g., salmon farms). So, in spite of existing regulations, and multiple recommendations by the IUCN, there are 101 out of 272 conflict-generating projects that threaten biodiversity located in areas that should be effectively protected. Furthermore, Chile has made great efforts to attain Aichi Target 11 to conserve "at least 17 % of terrestrial and inland waters, and 10 % of coastal and marine areas, (…) through effectively and equitably managed, ecologically representative and well-connected systems of protected areas (…) by 2020", and has now protected over 21 % of terrestrial and inland waters and over 41 % of coastal and marine areas (MMA, 2019b). But the analysis made by Petit et al. (2018) showed that by 2017 only 12.4 % of terrestrial protected areas and none of the marine protected areas in Chile had effective management plans.

Some possible explanations for these contradictions are that the current natural resources governance is not effectively focused on sustainable development and conservation and lacks effective participation. Although citizen participation is legally mandated in Chilean environmental legislation (Law 19.300, 1994; MMA, 2013), it is still far from being effectively implemented as a right (OCDE-CEPAL, 2016; Costa and Belemmi, 2017). We understand governance of natural resources as presented by the IUCN WCC (IUCN, IUCN World Conservation Congress, Bangkok, 2004), meaning the interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have their say in the management of natural resources, including biodiversity conservation. In particular, Chile has not implemented spatial planning as a tool for supporting decision-making. The National Urban Development Policy (Law 458, 1976), exclusively defines the uses of urban territories, but in Chile 251 of 356 communes were classified as rural by the OECD (2014), and a lot of these communes do not have spatial planning (Observatorio Urbano, 2019). Likewise, the National Policy of Uses of the Coastal Border is elaborating regional zoning in order to define areas of industrial use and prevent conflicts in coastal areas, but this tool is not mandatory. Thus, a large portion of the country remains unregulated. Moreover, current Chilean legislation does not consider ecosystem services. Biodiversity is seen from a utilitarian perspective and is sectorized as natural resources for productive activities through different laws and legal codes (Mining, Water, Fisheries and Aquaculture, Forestry, Energy, Environment), which makes environmental governance more difficult (Cordero, 2011). In the case of water, it is indeed a national good of public use, however, rights of use can be provided to private persons, in conformity to the Water Code. This means that any holder of water rights (e.g. private companies) can use, enjoy and dispose of it in conformity to the law (Law 3.549, 1981).

The IUCN WCC (IUCN, IUCN World Conservation Congress, Amman, 2000) questioned the role of bilateral and multilateral financial institutions in supporting extractive or infrastructure activities, calling on them to respect national legislation protecting biodiversity and protected areas. It also urged countries to strengthen their national

legislation in this regard. However, over the past year, Chile has sought to join the Trans-Pacific Partnership or TPP. This treaty regulates free trade between 11 Pacific countries and defends the economic interests of transnationals, establishing external International Tribunals that mediate conflicts, being able to sue a country for the development of policies that protect the environment if this does not benefit the investing parties. Under this scenario, Chile would lose the possibility of generating new and better public policies for the protection of biodiversity, including the participation of citizens. On top of this, Chile withdrew from the Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean at Escazú, Costa Rica, even though it highly promoted this agreement (González, 2019), meaning that the country is not bound to information transparency and public participation in environmental issues.

This highlights the importance of citizen participation and how it is implemented in natural resources governance (Campese et al., 2016). The fact that conflict-generating projects are defined as such is precisely because there are citizen demands that are publicly expressed but have not been met, since the current environmental legislation does not guarantee the right of participation (Costa and Belemmi, 2017). Such demands can be expressed in the form of protests and do have a role in driving policy shifts in Chile. By protesting, people realize that they are not alone, thus strengthening the perspective of those who are like-minded and providing an essential voice for minority groups. They also serve as a form of promulgation, spreading information and ideas which can alter the government agenda and help to start a debate. This means pushing both politicians and citizens to think about solutions that can bring different stakeholders together, a crucial part in the enactment of mediatized environmental conflicts (Hutchins and Lester, 2015). Experience in Chile has shown the success that powerful social movements can have. This was seen in 2010 with the Barrancones thermoelectric power plant project, and in 2019, with the social explosion through which Chilean society expressed the precariousness in which a large part of the country was living, resulting in a referendum to be held in October 2020 where Chileans will decide if they want a new constitution. These resolutions came when the two ends met, there were publicly expressed citizen demands and a political will to make a change.

We have discussed how socio-environmental conflicts are generated in Chile because of loopholes in public policies regarding environmental purposes, biodiversity conservation and economic interests, and how the projects responsible for them pose a threat to biodiversity and its conservation. However, this phenomenon is prone to happen in different countries of the world. A recent example is the Amazon rainforest fires, started in August 2019, a conflict resulting mainly from practices linked to land use and land cover change and the undercut of environmental policing power by the current government. Brazil has been well positioned to replace the United States of America as the global leader in soybean exports. Thus, the demand for soybeans has created pressure to rapidly clear forests and plant soy (Sullivan, 2019). This priority area for conservation is threatened by livestock and agriculture, where most of it goes for export. Indeed, Brazil is the world's leading meat exporter (Zia et al., 2019), and Amazon deforestation in July 2019 increased 278 % over the same period in 2018 (Wanatabe, 2020).

4.3. Recommendations

The activities behind socio-environmental conflict-generating projects in Chile contribute to the country's economy, and could hardly be eradicated, but they could be limited and mandatorily turned into sustainable practices. Chile has a long way to go regarding environmental legislation before being able to effectively implement this kind of solutions. However, there are sustainable practices that could greatly benefit the country, provided the proper changes in legislation are made.

Our results can help addressing solutions according to the source of the conflict. The present environmental legislation in Chile requires effective and exhaustive surveillance and enforcement in relation to national companies, public and private, and further control before establishment and ensuring environmental commitment for international companies, as a starting point. This would allow a stronger filter as to what activities are allowed to be developed in the country, especially near areas with high conservation value. These are key aspects to the success of sustainable practices, as seen in food and energy production, and also transportation in Sweden (Fallde and Eklund, 2015; Sonesson et al., 2016; Lundqvist, 2018), and rural bioenergy solutions in Sub-Saharan Africa (IRENA, 2018). Future amendments to legislation should guarantee the protection of natural resources in Chile, taking into account the mosaic of ecosystems that the country has and reflecting commitment to biodiversity conservation, human well-being and the sustainability of extractive activities. For example, if the Water Code does not change, allowing deprivatization of water resources, this could trigger socio-economic, political and environmental conflicts in the next few years. Furthermore, there is also need of characterizing and incorporating the concept of environmental crimes into legislation, as it has been addresses in the IUCN WCC (IUCN, IUCN World Conservation Congress, Hawaii, 2016). Moreover, Chile should consider the terms by which it commits to international trade agreements, such as the TPP11, since its weak environmental policies, along with the large amount of national natural resources and a low industrial infrastructure to process them autonomously, are a focus of economic interest for many countries that will try to take advantage of this. A greater effort should be made by the government to invest in research and national technological development to process the country's own natural resources.

Chile would benefit from adapting the main productive sectors identified in this work in order to do production and extraction in a more environmentally and socially responsible way. Negative impacts of mining should be reduced by avoiding the conversion of natural habitats to mining grounds, in particular HCVAs. Worldwide, NGOs have demanded that exploration and extraction of mineral resources should be restricted in protected areas, demands that were captured in 2000 by the IUCN WCC in Amman (Koziell and Omosa, 2003). Thus, establishing "no-mining zones" and defining a "minimum safety distance" of such areas to mining activities (Starke, 2002) would be trade-offs benefiting biodiversity conservation and the environment. Reducing the negative effects of the energy sector, as well as transitioning to renewable energy sources, being aware of the trade-offs this entails, should also be a priority in Chilean public policies. In addition, minimizing biodiversity and climate impacts should be a priority in the design and construction of new hydropower and other renewable energy facilities. Fisheries and aquaculture, in particular salmon farms, could implement the application of probiotics instead of synthetic chemicals or antibiotics in sustainable aquaculture (Dawood et al., 2019). As for manufacturing facilities, production can be done following sustainable supply chain management. This includes product design (environmentally sustainable product innovation), material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end of life management of the product after its useful life (Golicic and Smith, 2013), which can also improve firm performance (Hart, 1995). Agriculture and farming could benefit from sustainable practices for plant disease management used in traditional farming (Thurston, 2019), small scale agriculture and certification (DeFries et al., 2017; Jouzi et al., 2017), thus promoting landscape configurational heterogeneity that maintains pollinators (Happe et al., 2018; Hass et al., 2018), as well as crop selection and production defined by the resources available (e.g. water) to avoid shortages. Moreover, the certification of other productive activities could also improve their environmental performance. In general terms, the location of such projects in relation to HCVAs, thorough environmental impact assessment and surveillance, and good management

remain of utmost importance and should not be disregarded.

Chile's Environmental Assessment Service (EAS) should improve and implement new criteria to allow a better evaluation of the socio-environmental impact generated by projects, allowing for the effective participation of scientific entities as an independent third party and moving from symbolic to real citizen participation (Guillen et al., 2009), including legally binding participation. Regarding the participation of indigenous peoples, that represent around 12.8 % of Chilean population (INE, 2017), in 2016, the EAS incorporated the Indigenous Consultation to comply with the obligations of International Laboral Organization (ILO) Convention 169 (SEA, 2016). The latter goes in line with the IUCN recommendations on indigenous peoples, sustainable use of natural resources and international trade (IUCN, IUCN World Conservation Congress, Amman, 2000), urging all governments, without prejudice to their obligations under international law, to put their sustainable use principles into action in order to improve the viability of indigenous and local communities, which depend on the harvesting of renewable resources. Cárcamo et al. (2013) have already suggested some theoretical and practical tools to prevent conflicts between economic growth and biodiversity in Chile. The ecological risk assessment framework or DPSIR (Driving force, Pressure, State, Impact and Response) could be useful for improving EAS protocols. These protocols should be also modified to avoid the splitting up of projects that allow them to declare less production, and consequently less impact on the environment, which means that some projects are not evaluated rigorously and are allowed to be implemented through less demanding sectoral permits. In addition, the decisions of the Environmental Assessment Service should not respond to the council of ministers in order to avoid approval of environmental harmful projects due to conflict of interest. Moreover, it is important to also keep in mind that some internationally funded projects do not abide by the same environmental standards in Chile as they do in their own countries. Such disregard for environmental responsibilities should be better managed in the environmental assessment process by revising the standards of environmental compliance, in order to adapt them and to maintain high standards in spite of the origin of capital of potentially hazardous projects, and the international relations between Chile and the countries of origin.

The scenario brought to light in this work shows the need for effective management of protected areas, recognized as natural solutions to climate change in several fora. This could start with the approval of the law that creates the Biodiversity and Protected Areas Service, finally approved by the Senate in July 2019, after 8 years of debate, thus concluding its first constitutional process, and continuing its discussion in the Chamber of Deputies. This service will manage a single National Protected Areas System integrating all the existing protected areas in Chile, marine, terrestrial, public or private, that are currently scattered across five different ministries – Agriculture, Economy, Culture, National Assets and Environment – making the consistent management of protected areas more effective (MMA, 2019a, 2019b). It is important to highlight the need for scientific research, since some areas in Chile lack basic scientific knowledge. There is urgent need to know and understand Chilean biodiversity in order to build effective management plans, starting by being able to define conservation objects in a completely informed manner. In addition, it can be hard to properly assess the environmental impact in areas where the biodiversity remains unknown. Academia and science are fundamental for conservation in the face of a growing market for environmental consulting, which privileges profitability regardless of biodiversity loss. Research institutions should be an ally of the State in the evaluation of projects with environmental impact, preferring them to environmental consulting firms in the market.

Governance of natural resources in Chile would improve by encouraging analysis of the types and quality of governance, paying particular attention to stakeholder participation and decentralization processes. This is needed in project impact assessment, as well as in protected areas management. Transboundary conservation and co-management should also be encouraged, e.g. in the Andes. Applying the Precautionary Principle in environmental decision-making and management promoted during the IUCN WCC (IUCN, IUCN World Conservation Congress, Bangkok, 2004) should also be a priority. Regarding spatial planning, it is necessary for rural areas to be included in spatial management plans. In addition, marine spatial planning should be implemented.

Like in environmental assessment, protected areas management and governance of natural resources would also benefit from citizen participation. In Chile, species classification, following IUCN categories and criteria, is a conservation tool that is already involving citizen participation. Indeed, classification of threatened species is open to suggestions, any citizen can nominate a species to the threatened species list in Chile by submitting a standard form which will be later evaluated by an expert committee (MMA, 2020). More outreach on this subject should be implemented to encourage participation. Regarding spatial planning, indiscriminate citizen participation should be legally binding, giving way to a more balanced dialogue and representation, thus promoting practices related to indigenous and local communities of co-management arrangements, and efficient management. In 2019, a new reform bill for the Environmental Assessment Service was submitted. It aims to strengthen the EAS by increasing citizen participation, decentralizing decision-making, improving the technical component in the assessment of projects and decreasing processing deadlines, as well as equal access to environmental justice (Presidency of the Republic of Chile, 2019). However, at the moment, it has not considered implementing indigenous consultation for this process, even though it has been recommended by the ILO (2019). Therefore, this bill has been questioned for this and other reasons, such as the current crisis of institutional legitimacy in Chile.

It is important to emphasize that solutions to resolve and prevent socio-environmental conflicts and promote the sustainability of productive activities depend on the political will to be implemented. They require a paradigm shift, from extractive economic growth policies towards a sustainable development model, including biodiversity as a common good for which there is common responsibility (WWF, 2018; UNEP-WCMC, IUCN and NGS, 2018).

Globally, a large number of countries, including, Chile are in the process of reviewing the 2020 Aichi Targets compliance and are trying to face the current climate crisis, addressed in the COP 25 Conference on Climate Change (hosted by Chile in Madrid). Thus, we may wonder if countries are prepared for facing these challenges.

5. Conclusion

The present study allows a better analysis of projects that are related to socio-environmental conflicts and their potential as a threat to biodiversity conservation. The main productive sectors causing conflicts in Chile are energy and mining linked with ports, followed by fisheries and aquaculture, environmental sanitation, manufacturing facilities and agriculture and farming. These are activities that can cause water and soil pollution, land use and land cover change that result in habitat loss and degradation, among other known impacts. The capital financing the 283 conflict-generating projects we identified is mostly Chilean, but energy and mining projects are mainly financed by international capital. Locating 272 of these conflict-generating projects in relation to HCVAs allowed us to illustrate the potential threat that 101 conflict-generating projects inside HCVAs represent, and to do a better analysis on the underlying causes and the impacts they have on the biodiversity and conservation objectives in Chile, offering a more effective tool for decision making. It is important to keep in mind that this study has been based in information from the last 15 years. This is a short time compared to all the years Chile has been actively using its natural resources. Moreover, social-environmental conflicts can be repeated, and there is a trend to continue with the current extractive

model.

We conclude that Chile is not currently complying with international conservation standards. IUCN resolution against sacrifice of HCVAs in favor of industrial projects is not being respected. To address the loopholes that have been identified in this work, it is important to emphasize that reducing the environmental debt of Chile depends on the political will to implement appropriate solutions. The fact that conflict-generating projects are defined as such is precisely because there is a citizen demand for well-being, for equitable access to ecosystem services and for consideration of intrinsic values of biodiversity (Jorquera-Jaramillo et al., 2012; Cárcamo et al., 2013; Gudynas, 2014). Rather than focusing on whether people's concern is a problem, we should modify the usual way of making decisions through Environmental Governance based on the analysis of social-ecological systems. There is a need to improve the application of the Environmental Assessment Service, in technical and political terms, and a greater surveillance and enforcement of environmental compliance. It is also necessary to further explore the underlying causes of growing threats to biodiversity and human health that represent conflict-generating projects. There is little information of the real effect that these projects are having on the well-being and health of people, in many cases vulnerable populations. More scientific research is also needed on how the projects mentioned in this paper are affecting local and regional biodiversity in the territory. Conditions that contribute to biodiversity loss should be alleviated, and a balanced economic development with the persistence of traditional ways of life should be promoted (Ostrom, 1990; Berkes and Folke, 1997; Delamaza, 2018). Regarding High Conservation Value Areas, it is even more urgent not only to create and implement protected areas but also to ensure their effectiveness, otherwise, conservation efforts could seem useless.

Declaration competing of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Daniela M. Carranza: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing, Visualization, Supervision, Project administration. **Katerina Varas-Belemmi:** Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing. **Diamela De Veer:** Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing. **Claudia Iglesias-Müller:** Conceptualization, Methodology, Formal analysis, Investigation, Visualization. **Diana Coral-Santacruz:** Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing. **Felipe A. Méndez:** Conceptualization, Methodology, Investigation. **Elisa Torres-Lagos:** Conceptualization, Methodology, Investigation, Writing - original draft. **Francisco A. Squeo:** Conceptualization, Methodology, Validation, Resources, Supervision. **Carlos F. Gaymer:** Conceptualization, Methodology, Validation, Resources, Writing - original draft, Writing - review & editing.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.envsci.2020.04.006.

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