




Article

Configuring Socio-Environmental Risks in Chile: Institutional Narratives and Complexities in a Risk Society

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Abstract: Living in a society characterized by risk has distinct implications for developing countries, where addressing the socio-environmental issues within established governance structures is challenging. This study aims to investigate the risks identified by the main relevant institutions in Chile based on the narratives of their authorities and how these are configured differently according to the regions and areas involved. Using a qualitative method based on individual interviews conducted with 57 representatives of institutions present in eight regions of the country, a differentiated configuration is identified depending on the institution and the region where they perform their functions. The main findings show that (1) the narrative relevance of the risks in Chile continues to be intensely based on natural hazards, (2) there are clear regional and macro-regional differences in the configuration of socio-environmental risks, showing significant institutional complexity, and (3) the ongoing challenges with deregulated events create high-level uncertainty in matters relevant to society. It is concluded that although the country is experiencing a complex crossroads in terms of the transition towards risk policies, a challenging effort would be to combine regulatory efficiency both in traditional risk problems and in the new criteria of the global development agenda.

Keywords: differentiated configuration; socio-environmental risks; narratives; risk regulation; institutions; Chile



Citation: Vallejos-Romero, A.; Sáez Ardura, F.; Cordoves-Sánchez, M.; Cisternas, C.; Lehtonen, M.; Sánchez Galvis, L.K.; Boso, À. Configuring Socio-Environmental Risks in Chile: Institutional Narratives and Complexities in a Risk Society. *Sustainability* **2024**, *16*, 5212. <https://doi.org/10.3390/su16125212>

Academic Editor: Michael A. Long

Received: 22 May 2024

Revised: 9 June 2024

Accepted: 13 June 2024

Published: 19 June 2024



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1. Introduction

According to the contemporary social theory, we live in a risk society [1–3]. Considering this diagnosis, socio-environmental risks have emerged as a problem in terms of construction and configuration. On the one hand, they represent what the population, organizations, and institutions construct, and on the other, they serve as organizing principles for public policies, governance, and regulation in various areas of society [4–7].

Advancements in the risk theory, including its configuration, narratives, and applied research, have been extensive. Although the semantics of risk have not been systematically studied, a multitude of approaches have emerged since the 1970s [8]. These approaches include the psychometric theory of risk perception [9–12]; the risk amplification theory [13]; the sociological theory [14,15]; the cultural theory [16,17]; Science, Technology, and Society

(STS) [18,19]; the post-normal theory [20]; the (negative) semantics of risk [21]; sociometric and deficit studies [22,23]; and risk narratives [24–26].

In applied research, various theoretical and methodological perspectives have been developed to investigate the risks within social spheres and among their actors. These include investigations into the media's role in risk production [27,28] as well as analyses of the risks associated with the environment, energy, and issues such as child trafficking [29–32]. Furthermore, other studies have examined the narratives generated by political, media, and scientific entities [33], along with the utilization and definition of risk concepts within governmental institutions [34]. According to Boholm and Boholm [4], some studies focusing on institutional practices reveal different dynamics, frameworks, and objectives related to risk management and regulation that provide valuable insights into how risks produced and reproduced by modern society are governed [6,7,35–52].

This theory has made considerable progress in the general conceptualization of risks on a global scale. However, the way risks are perceived, configured, and narrated at the national and regional levels displays unique features, particularly in developing countries marked by uneven growth [4,36,37,43,51]. Thus, it is important that theoretical and applied research supports the development of differentiated governance and regulation frameworks tailored to specific contexts, while also considering the construction and actions outlined by the population, organizations, and institutions [53].

The social construction of risks and their impact on the development of regulations, governance, and public policies is a complex endeavor that involves multiple stakeholders. Effective risk governance requires a comprehensive approach that considers a broad range of perspectives [54]. However, many risk management models are highly normative and homogeneous in their definitions of risk, particularly in developing countries. Public sector institutions and organizations often approach risk in a unidirectional manner, with science serving as a data provider and citizens not fully involved in the process.

Boholm and Boholm [4] argued that horizontal and collaborative organizational structures face significant challenges. The self-referentiality and insularity inherent in these entities often lead them to prioritize internal concerns over external environmental factors. Furthermore, public institutions often lack consistent constructions and definitions of risk, hindering effective governance. This study acknowledges and addresses three dimensions of this tension. First, risk has become a central aspect of society as society is defined by risk. Second, effective risk management is essential, with organizations, particularly public ones, bearing responsibility for its execution. Third, as Boholm and Boholm [4] point out, various approaches for conceptualizing risk exist among the organizations and institutions that must govern it.

The issue presented is highly relevant, as the discrepancy between the institutional configuration of socio-environmental risk and the specific local conditions of the territories they oversee can lead to ineffective interventions and governance. This misalignment may have severe consequences, including the loss of life, environmental damage, and ecosystem degradation.

The above discussion underscores that, while the existing literature has explored general conceptualizations of risk and various theoretical and methodological perspectives of risk management, our research introduces a novel focus. It enhances our understanding of the socio-environmental risk configuration specific to public government institutions in Chile. This targeted examination is the primary relevance of our study, setting it apart from previous research. To this end, a qualitative investigation was conducted by gathering information through individual interviews with representatives of public government institutions in Chile. The research questions guiding the study were (1) What types of risks are identified as socio-environmental concerns by public institutions in Chile? (2) How are these socio-environmental risks narratively constructed by public institutions? (3) What management challenges arise from the differentiated configuration of socio-environmental risks for relevant national institutions? Addressing these questions will provide meaningful guidance for the governance of socio-environmental risks in Chile.

2. Materials and Methods

This study employed a qualitative methodological design grounded in an interpretive paradigm [55]. This approach enabled the identification of socio-environmental risks constructed by institutional representatives through their narratives [25,56–59], conceptualized as intersubjective and relational actions [24,26,60–62].

Narrative analysis focused on the political institutional dimension of socio-environmental risks in Chile was conducted. This analysis aims to comprehend the social contexts that influence the emergence of analytical categories in sociological risk studies [4,26–28,31,34,57,58]. Three main aspects were examined: (1) the assessments and definitions of socio-environmental risks; (2) the implicit and explicit arguments and meanings in the informants' narratives; and (3) the differentiated configurations of socio-environmental risks in the studied regions.

The sample in this study was selected through a mixed intentional sampling strategy with chaining, involving a sufficient number of informants identified using a progressive qualitative methodology [63,64]. The selection criteria for participants included holding institutional authority positions, representing regional governmental political institutions with environmental competencies, and possessing executive influence over regional-level socio-environmental decisions. This study considered two criteria when selecting regions: socio-productive vocation and representation of the country's different zones. Consequently, the following macrozones and regions were chosen—the Northern Macrozone: (1) Arica and Parinacota, and (2) Antofagasta (both with a mining vocation); the Central Macrozone: (3) Metropolitan (industrial and service vocation) and (4) Maule (forestry vocation); the Southern Macrozone: (5) Biobío (wood industry and services) and (6) Araucanía (silvo-agricultural and tourism vocation) and (7) Los Lagos (aquaculture, livestock farming, and tourism vocation); the Austral Macrozone: (8) Magallanes and Chilean Antarctica (silvo-agricultural and tourism vocation).

A total of fifty-seven individual interviews were conducted online with representatives of eight government institutions from eight regions and four large macrozones (refer to Table 1) between November 2022 and April 2023. The interviews utilized thematic guidelines [64] to explore the experiential and narrative aspects of the participants, resulting in a textual corpus that allowed for an examination of the previously specified narrative levels related to the research questions. The analysis plan comprised three phases aligned with the theoretical model of narrative analysis: (1) the interpretation phase, which involved systematizing and characterizing the texts based on pre-analytical conjectures; (2) the analysis phase, where narrative configurations were outlined; and (3) the articulation of analysis and interpretation, which demonstrated the multiple meaning relationships supporting the social construction of socio-environmental risks in the study subjects' narratives.

Table 1. Public institutions considered in the study.

No.	Institution	Interviews
1	Regional Ministerial Secretary (SEREMI) of Health	7
2	Regional Ministerial Secretary (SEREMI) of the Environment	8
3	Regional Ministerial Secretary (SEREMI) of Energy	8
4	National Disaster Prevention Service (SENAPRED)	8
5	Directorate of Hydraulic Works (DOH)	7
6	Agricultural and Livestock Service (SAG)	7
7	National Geology and Mining Service (SERNAGEOMIN) *	5
8	National Forestry Corporation (CONAF)	7
	Total	57

Note: own elaboration. (*) In the Metropolitan Region, the Central Zonal Director operates, and in Biobío, Araucanía, Los Lagos, and Magallanes, the person in charge is the Southern Regional Director.

The analysis plan was implemented using Atlas-ti.8.0 and NVivo 10 software, which facilitated textual analysis, coding processes, and the recoding of information.

3. Results

3.1. Identified Socio-Environmental Risks

The results showed a highly complex configuration and distribution of socio-environmental risks at the institutional level. Although a risk narrative is displayed in categories identified at the country level, certain regions exhibit some conceptual dimensions with greater notoriety than the others do. Therefore, the risks were differentiated and territorially configured (Figure 1).

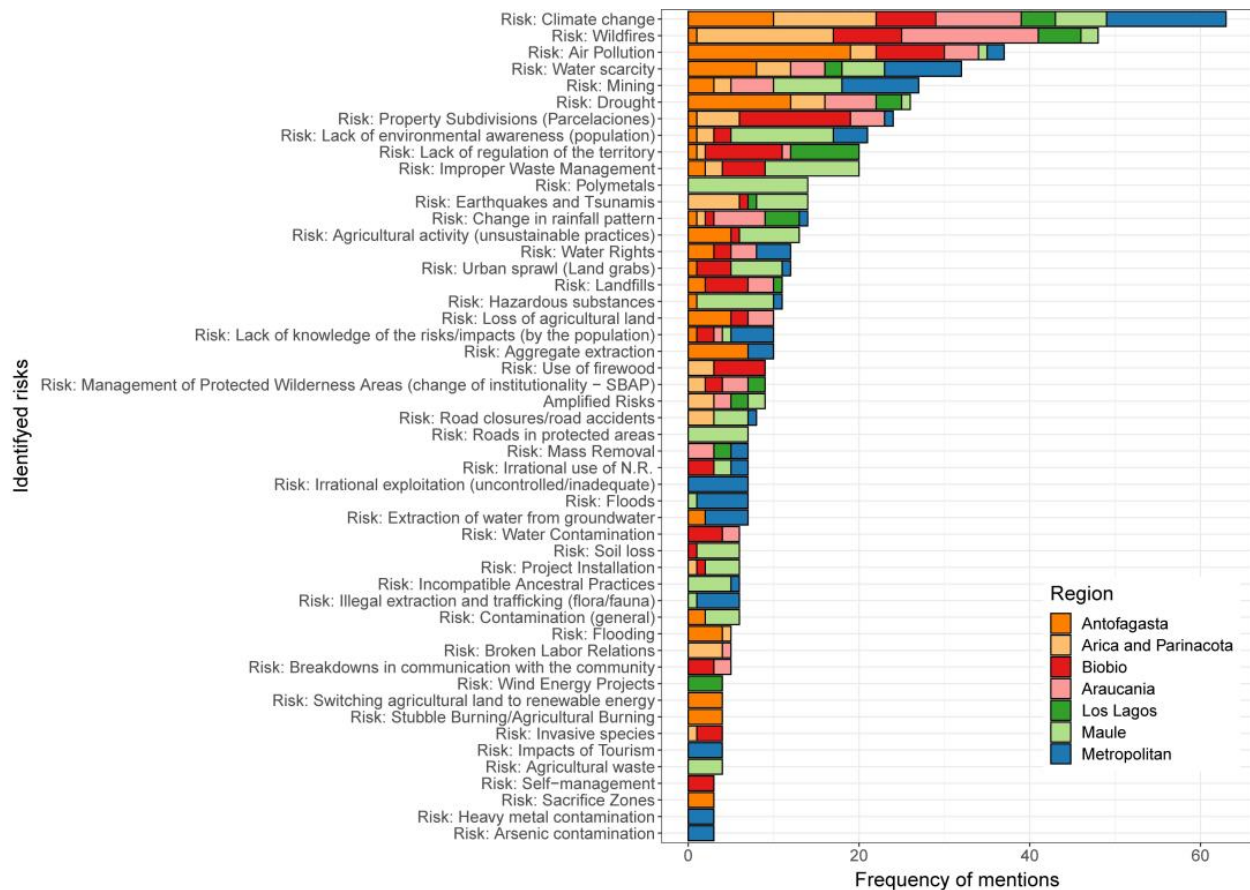


Figure 1. The risks identified in descending order, according to the number of mentions, by the public institutions in the 8 regions under study. This figure displays only the top 50 codes with the highest frequency of mentions. Note: own elaboration.

Logically, climate change is a global risk that is consistently referenced in the narratives of those interviewed. Droughts, wildfires, and property subdivisions are frequently mentioned, with territorial deregulations being widely highlighted by the authorities (I7-I12-I26-I45). Regionally, various socio-environmental risks are identified in the institutional narratives, with each institution highlighting these risks based on its sectoral competencies and obligations (Figures 2 and 3).

The data from macrozone differentiation (see Figure 4) reveal six categories of socio-environmental risks that are not aligned with the country's model of life and socioeconomic development: (1) natural hazards, (2) climate change, (3) the impact of productive activities, (4) waste and forest fires (resulting from social inadequacies), (5) water scarcity and air quality, and (6) deficiencies in associativity and risk management.

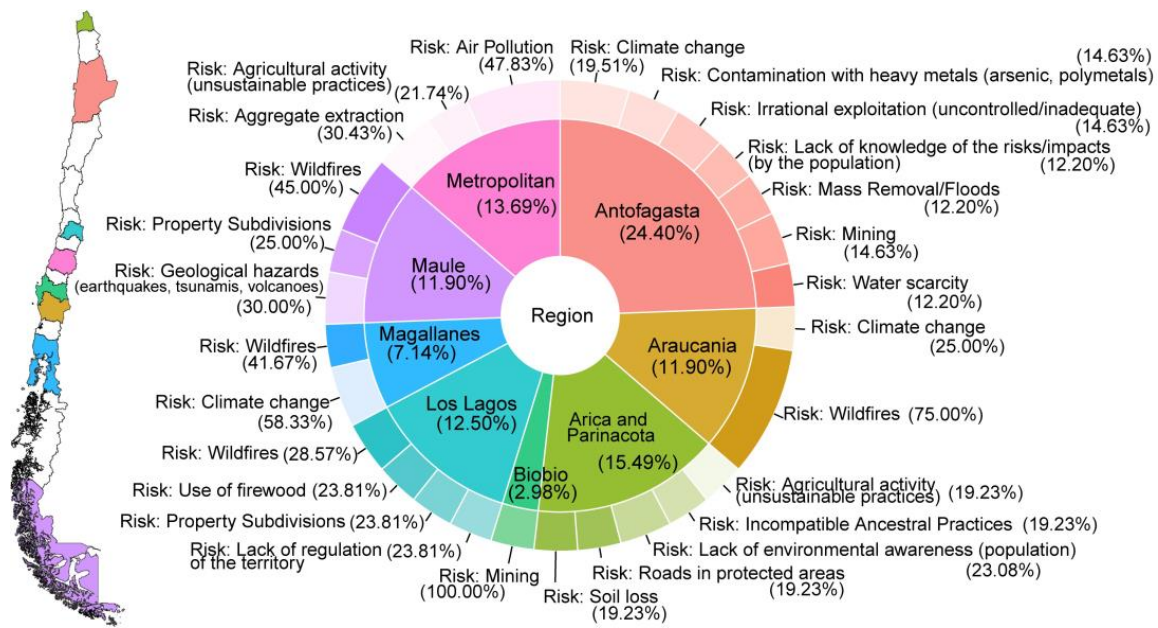


Figure 2. Risks in Chile differentiated by region. Note: own elaboration. This table shows the risks identified by the public institutions considered in this study for the 8 selected regions.

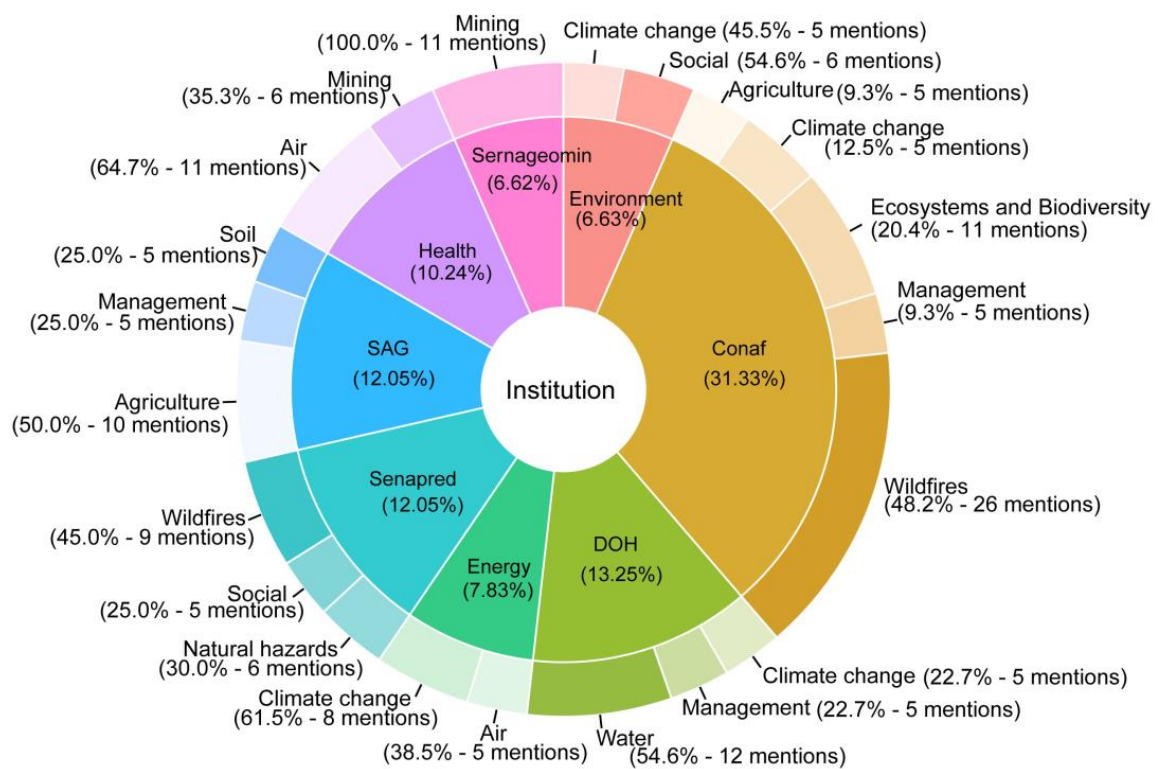


Figure 3. Distribution of the main topics identified by institution. Note: own elaboration. Only those risks with a rating greater than 4 were considered.

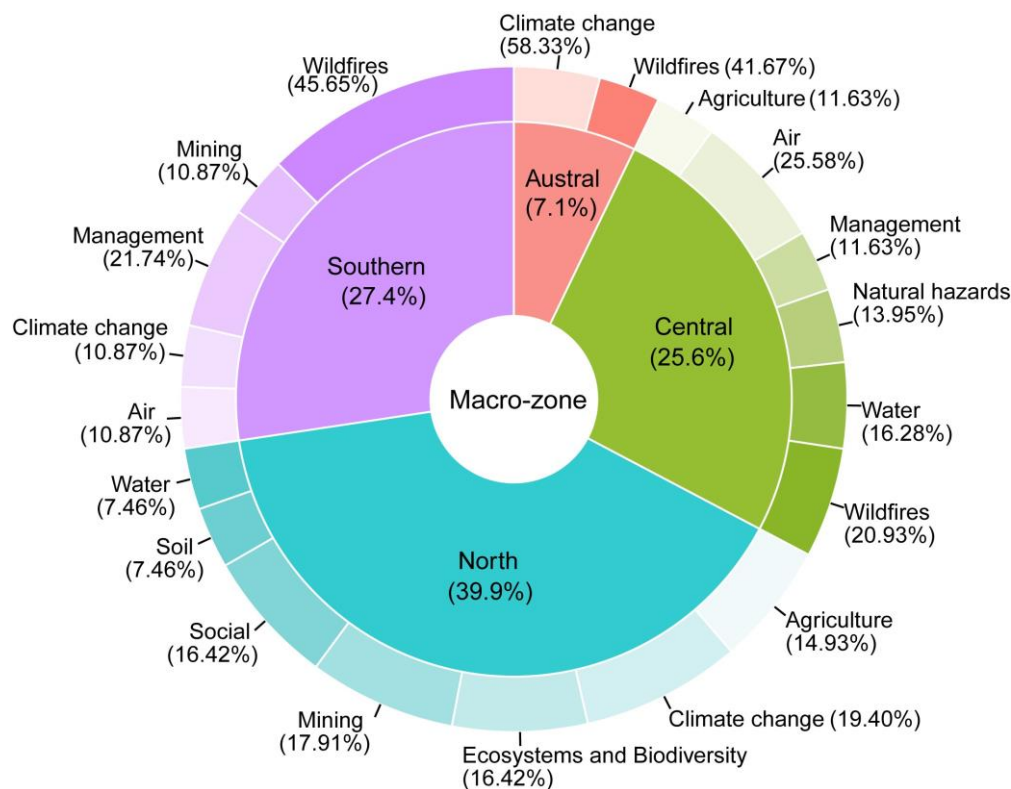


Figure 4. Topics identified by macrozone. Note: own elaboration. Only those codes associated with risks that have a frequency of appearance greater than four were considered.

3.1.1. Natural Hazards

Geological hazards are recognized as significant issues, and these are typically linked with natural disasters, such as earthquakes, tsunamis, and volcanic eruptions. The SENAPRED addresses these concerns by prioritizing people’s safety and implementing prevention programs (I4-I26-I32). In the Arica and Parinacota Region, this is particularly important, as tsunamis can increase the risks associated with hazardous materials, making it the most prominent category in this area. In Maule, the prevention efforts are focused on tourism (I26), and it is considered essential to train organizations and groups that work in this sector to deploy social protection, especially for unprepared tourists who may face the occurrence of natural hazards. In Biobío, the lack of territorial regulation hinders prevention measures (I32). Subdivisions and population growth are considered amplifiers of risk by increasing the exposure of population groups in danger areas. In Magallanes, although the existence of natural hazards is recognized, as in other macrozones, their origin is different, highlighting tsunamis (I53).

3.1.2. Climate Change

Rather than being treated as an independent topic, climate change is intricately linked to other subjects, serving as an aggravating factor for the socio-environmental risks identified by the informants (I17-I39). Its main impact is associated with an increase in extreme weather events, such as tornadoes or red tides, in areas where they are uncommon. This connection underscores the concern regarding how climate change can alter climatic patterns globally.

3.1.3. Impact of Productive Activities

The productive activities across various industries, including energy, mining, agriculture, aquaculture, tourism, and forestry exploitation, are recognized as potential risk factors in the country, with problematic externalities. Some examples include mining-related contamination with heavy metals in the Northern Macrozone (I1-I2-I8), unsustainable

agricultural and livestock practices in the North and Central Macrozones, such as pesticide use (I5-I7-I20), and wind energy projects in the Austral zone (I31-I52).

Energy is narratively linked to access restrictions and energy poverty, as evidenced by the SEREMI of Energy in Araucanía, Los Lagos, and Magallanes (I38-I45-I52). In addition, the slow pace of rural electrification, particularly in Antofagasta (I10), is a matter of concern. Polluting energy sources are also connected to this issue, with renewable energy projects such as wind energy being seen as both a solution and a dilemma. While this technology helps to reduce the dependence on fossil fuels and facilitates electrification in various areas, its implementation presents socio-environmental challenges due to social concerns about the potential risks associated with the location of wind turbines and their impact on nearby communities (I31-38-I55).

In the realm of mining activities, uncertainties frequently arise because of contamination with heavy metals and hazardous substances, which can have a significant impact on human health, particularly in the Northern Macrozone. The institutional efforts focus on prevention and education (I1-I2-I8-I9), with collaboration among the SENAPRED, the SEREMI for the Environment, and the SEREMI for Health, particularly in Arica and Parinacota. The aim is to minimize the exposure of the population to contaminants, which can be intensified by natural events, such as tsunamis, and social processes, such as human migration and illegal land occupation (I8).

Additional mining-related hazards include proximity to communities and issues related to illegal mining operations. In the Magallanes region, hydrocarbon pollution from the oil industry has become a significant concern (I50). Conversely, in the Arica and Parinacota regions, mining roads that cut through protected areas, as identified by the CONAF (I7), can have negative impacts on local flora and fauna, while also increasing the risks of contamination and forest fires. This situation highlights the inherent tension between environmental conservation efforts and pursuit of local economic development objectives.

In agriculture, unsustainable practices are closely linked to adverse effects on forests and other natural resources (I17-I26). Furthermore, cultural conflicts arise due to the deep ancestral roots of these practices, which complicate the institutional efforts for change. Such socio-environmental risks can have severe outcomes, as evidenced by the negative impacts of pesticide use on human health, particularly in terms of increased suicides, a concern emphasized by institutions in the Northern Macrozone (I1).

Within the broader context of productive activities, the results show that the problems related to aquaculture, tourism, and the forestry industry are primarily driven by the actions and influence of private companies, impacting the natural environment of the regions in which they operate. In the Los Lagos and Magallanes regions, for instance, the primary institutional concern is the aquaculture sector (I45-I53). For institutions such as the CONAF, managing this issue poses a significant challenge, particularly in Marine Protected Areas (I49-I57).

The impact of tourism on biodiversity is a major concern, especially in Antofagasta (I11), where the exploitation of native plants for culinary purposes has been identified as the primary contributor to adverse outcomes. In La Araucanía, the proliferation of second homes is perceived as problematic due to their potential to intensify water pollution (I36). Additionally, the escalation of forest fire risks, attributed to negligence in tourist activities, is highlighted as an institutional concern in the Magallanes region (I50-I57).

3.1.4. Risk Construction and Insufficiencies

This research highlights two significant environmental risks in the institutional narratives: forest fires associated with natural ecosystem loss and waste management, which negatively impact public health due to hazardous industrial effluent treatment.

It is believed that forest fires are intensified by human activities, resulting in increased magnitude and frequency. To address this issue, institutions such as the SENAPRED and the CONAF have diverse perspectives. While the CONAF mainly focuses on the environmental consequences of fires, which vary by region (I7-I29-I42-I49-I57), other institutions, such

as the SEREMI of the Environment in Arica and Parinacota and the Metropolitan SAG, emphasize the impacts on bird breeding areas (I2), particularly from controlled agricultural fires (I21).

In Arica and Parinacota, institutions such as the SEREMI of health connect fires to air pollution, increasing the health risk (I1). In Magallanes, the occurrence of fires is linked to climate change and a lack of environmental awareness, which increase the socio-environmental risks (I50-I57). In other regions such as La Araucanía, Los Lagos, and Maule, climate change is also perceived as an amplifier of the risk of forest fires. For instance, in Maule, the SENAPRED highlighted the vulnerability of the areas and the damage to homes (I26), whereas the SAG noted that subdivisions exacerbate fires by altering land use (I28). In La Araucanía, fires are associated with criminal acts, particularly wood theft (I41), while in Los Lagos, institutions such as the CONAF focus on the environmental and economic impacts generated by such events (I57). The SENAPRED underscores the need for regionally coordinated planning (I46).

In the context of waste management, the treatment of industrial substances is a pressing issue in regions with limited disposal sites and insufficient recycling technologies. This situation is particularly relevant in the Southern and Austral Macrozones, where transporting waste to the northern part of the country is a complex problem (I43-I44-I50-I51-I54). Furthermore, the Arica and Parinacota regions face the challenge of ecosystem contamination due to heavy metals and other hazardous substances, as well as the presence of clandestine landfills (I1-I2-I8-I9). The impact of these landfills on water bodies in Magallanes is also a source of concern, with the DOH identifying bureaucracy as a significant obstacle in effectively addressing this issue (I54).

3.1.5. Water Scarcity and Air Quality

Water scarcity and air pollution have emerged as significant socio-environmental risks for various institutions and macrozones across Chile. According to the authorities interviewed (I13-I28-I55), the irrational use of natural resources and the introduction of non-native forest species are contributing factors to water scarcity.

The concerns regarding water include contamination, a lack of access to water rights, inadequate resource management, and droughts. These issues are highlighted in regions such as La Araucanía, Los Lagos, and Magallanes (I36-I49-I50). Water scarcity is closely related to soil degradation and land use changes. In the Metropolitan region, drought prompts modifications in land use by limiting irrigation, which is a matter of concern for the SAG due to the potential reduction in agricultural productivity (I21). The implementation of renewable energy projects has also been identified as a driving force behind land use changes (I41). Furthermore, phenomena such as erosion and deforestation contribute to soil loss in different regions of the country (I20-I26-I41).

Regarding air quality, the risks mainly focus on atmospheric pollution, particularly from firewood use and fires (forest and agricultural). Institutional actions concentrate on replacing heaters and implementing environmental decontamination plans, acknowledging the impact on health and quality of life, particularly in the southern regions (I16-I37-I43).

3.1.6. Deficiencies in Associativity and Risk Management

The interviewees expressed their concern about the social aspects of existing risks in the country, as they have the potential to intensify socio-environmental hazards. The identified challenges include insufficient citizen associativity in the face of threats, limited pro-environmental awareness, and socio-environmental conflicts. In terms of management, the informants highlighted institutional deficiencies that are prevalent in emerging nations, including outdated sectoral regulations (I16-I29), a loss of responsibilities for certain institutions (I16-I50), problems with supervisory processes (I20-I37-I47-I50), internal conflicts (I23), and recurring territorial deregulation, particularly in the Central Macrozone (I25-I31-I45).

Additionally, the socio-environmental concerns indirectly affect risk mitigation. These factors encompass aspects related to social interaction, information availability and usage,

environmental awareness, and human mobility as well as internal management issues linked to territory regulation and institutional coordination (both internal and external) (I20). Permissiveness in the Environmental Impact Assessment System was also under-scored in terms of project management (I25).

The results demonstrate a distinct pattern of socio-environmental risks at the macro-zone level, which are influenced by the socio-productive and ecological vocations of each region. In the Northern Macrozone, as depicted in Figure 5, the primary institutional concerns involve risks associated with contamination from heavy metals and hazardous substances, as well as those related to mining. In contrast, the Central and Southern Macrozones, as illustrated in Figures 6 and 7, the primary concerns center on water scarcity and aggregate extraction, which are compounded by a diverse array of socio-environmental risks, including forest fires, property subdivisions, and a lack of regulation of the territory. Furthermore, air pollution is considered as a pressing issue, particularly because of the widespread use of firewood.

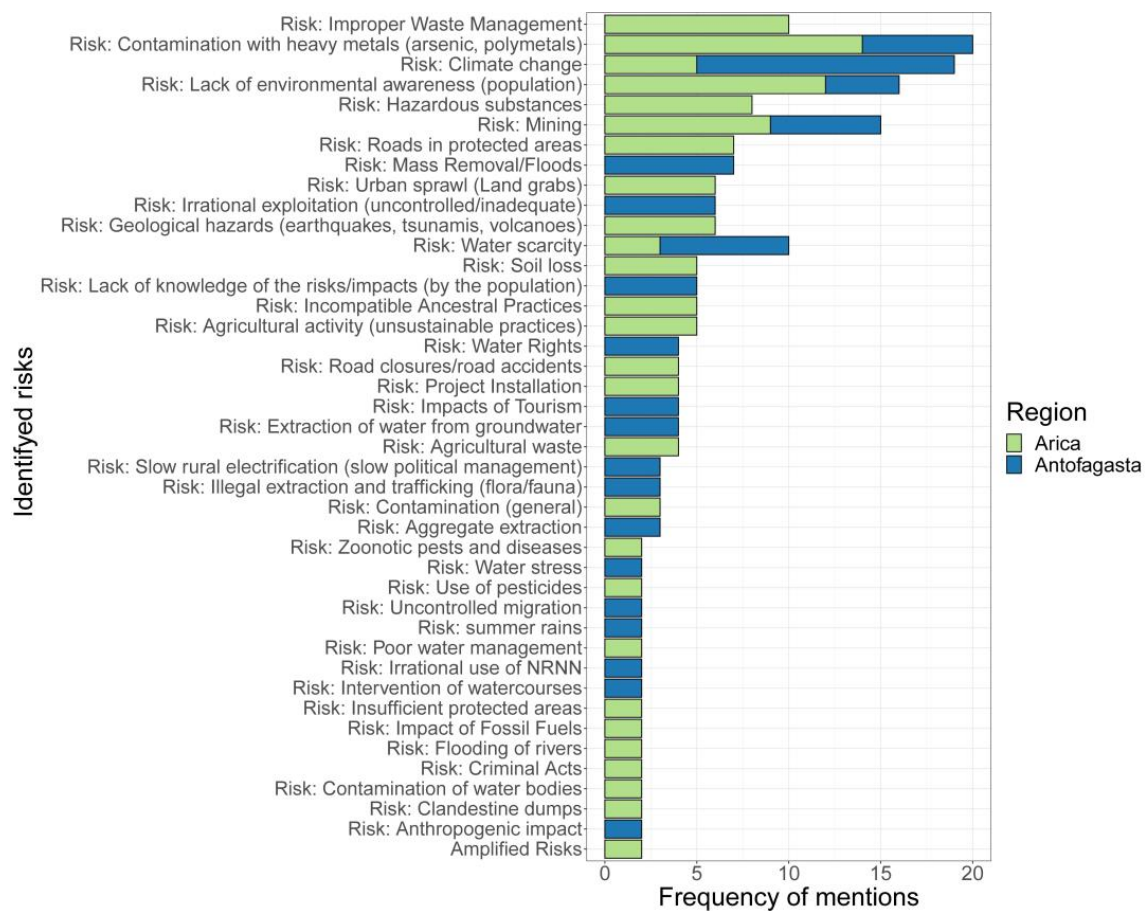


Figure 5. Risks identified for the Northern Macrozone. Note: own elaboration.

Finally, for the Austral Macrozone (Figure 8), represented by the Magallanes region, improper waste management emerges as the primary concern. This socio-environmental risk seems to be associated with the high cost of waste management, leading people to seek inadequate alternatives for waste disposal. Forest fires are a problem because of their impact on native forests. Although it is considered a controlled risk in the region, the effects of climate change and its anthropogenic origins make it a persistent institutional concern.

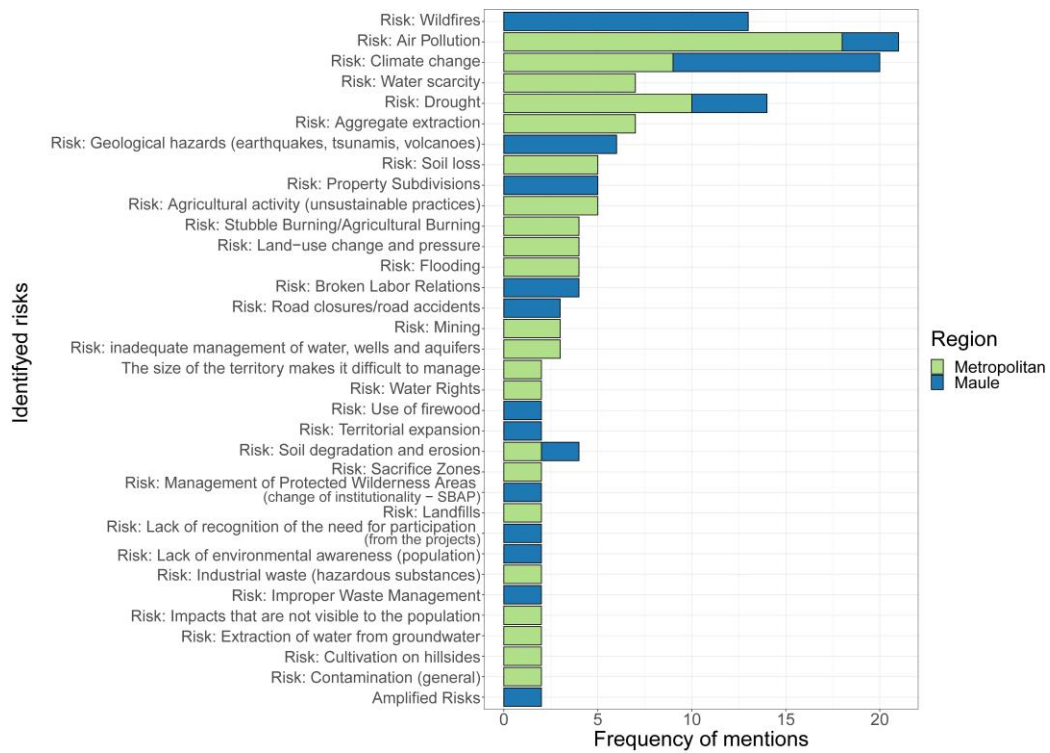


Figure 6. Identified risks for the Central Macrozone. Note: own elaboration.

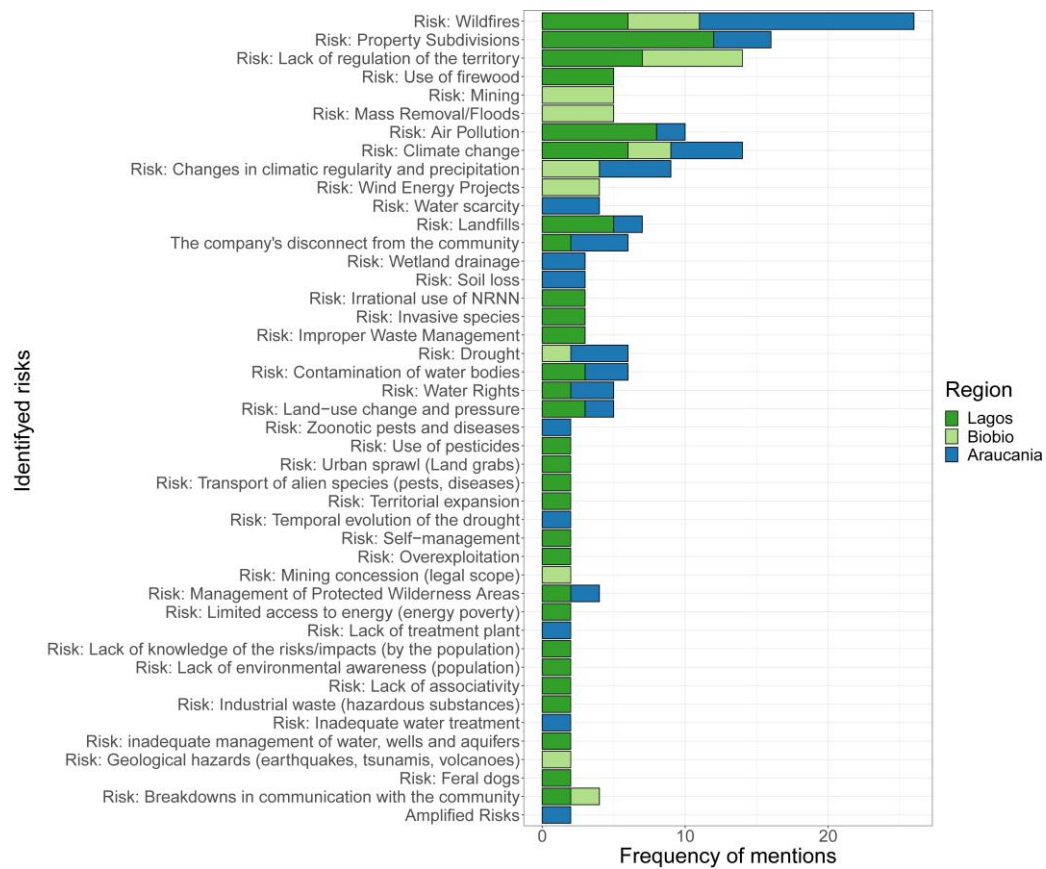


Figure 7. Risks identified for the Southern Macrozone. Note: own elaboration.

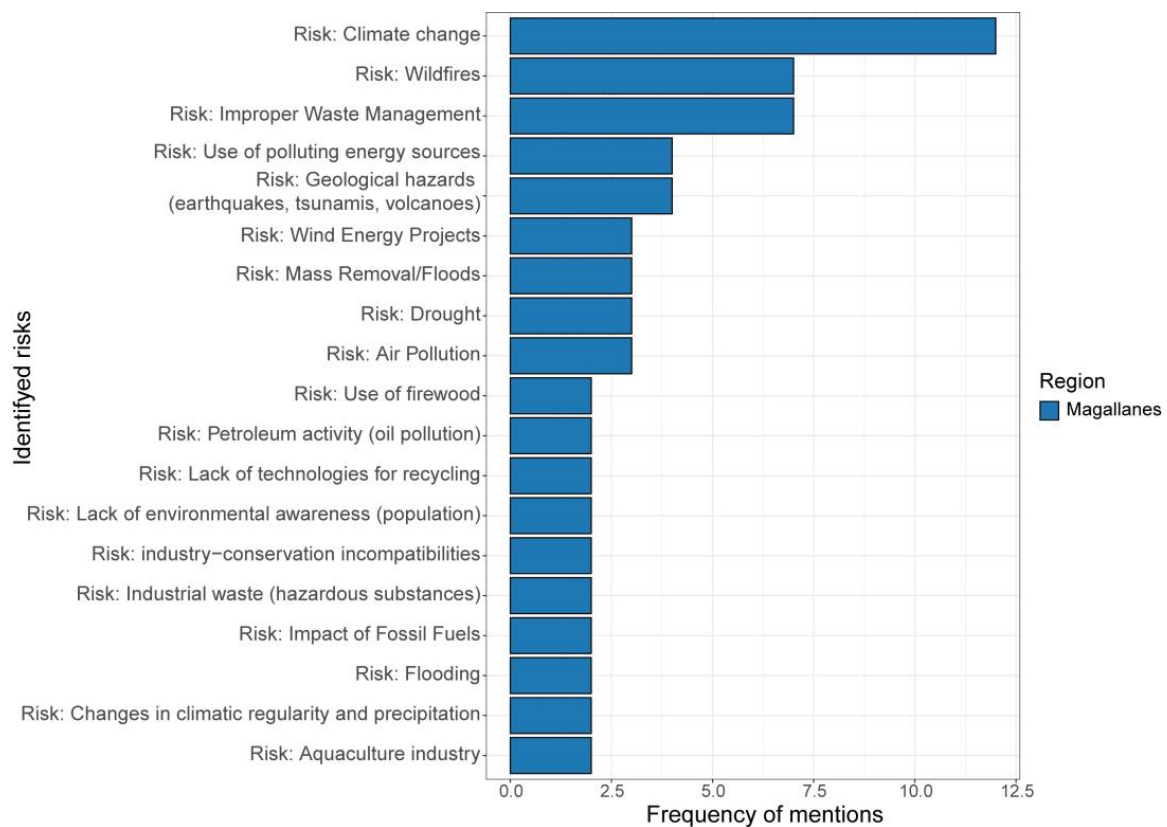


Figure 8. Identified risks for the Southern Macrozone. Note: own elaboration.

3.2. Macrozone Convergences of Socio-Environmental Risks

The findings of narrative analysis reveal interesting parallels in the differentiated configuration of socio-environmental risks in Chile. Notably, the informants expressed shared concerns, such as the transport of hazardous substances, as noted by the SENAPRED and the CONAF in Arica and Parinacota (I4-I7). This issue is linked to the harm caused by the production and use of polymetals, which pose a threat to human health and freshwater ecosystems, particularly in the Northern Macrozone, as highlighted by the SEREMI of Health and the SEREMI of the Environment of Arica and Antofagasta (I1-I2-I8-I9). Another significant convergence is the risks associated with unauthorized land holdings in the same macrozone, which is of particular concern to authorities such as the SEREMI of the Environment and the DOH in both regions (I2-I9-I12). Furthermore, the CONAF and DOH authorities in the same macrozone (I7-I12-I15) also draw attention to various persistent difficulties in the field, which include traditional farming methods and environmentally harmful practices, such as burning and specific irrigation techniques.

From a configurative standpoint, there are similarities in the concerns related to the risks that impact the quality of life and health of the population. These include issues such as micro-garbage dumps and inadequate waste management, which have been widely mentioned by institutions such as the SEREMI of the Environment and the SEREMI of Health, as well as SAG in the regions of Arica and Parinacota, Antofagasta, Metropolitana, Maule, Los Lagos, and Magallanes (I1-I2-I5-I8-I9-I13-I16-I17-I23-I24-I43-I44-I50-I51). Although this risk may seem secondary at the national level, it has been referred to by multiple authorities, indicating its importance in terms of management and prevention. Similarly, droughts have been widely reported by informants from the DOH and the SEREMI of Health in the regions of Antofagasta, Maule, Biobío, and Araucanía (I8-I12-I23-I27-I33-I36-I40). This underscores the fact that water scarcity is recognized globally in the country, affecting both the urban and rural areas and communities.

As previously discussed, air pollution is a pressing concern in cities throughout the country. The specific nuances of this socio-environmental risk vary depending on the location. For instance, in the territories of the North, Central, and South, institutions such as the SEREMI of Health and the SEREMI of the Environment in the regions of Arica and Parinacota, Antofagasta, and Metropolitana attribute this problem to the urban life models and industries present in cities (I1-I2-I8-I9-I16-I17). However, in the Southern and Austral regions, institutions such as the SEREMI of Health and Energy in Araucanía, Los Lagos, and Magallanes view this problem as an externality caused by the indiscriminate use of wet firewood (I36-I38-I43-I45-I52).

The results emphasize another important aspect of differentiated socio-environmental risk configurations, namely, territorial deregulation. This concept has been repeatedly mentioned by various institutions, such as the SEREMI de Energía, the SENAPRED, the SEREMI de Medio Ambiente del Maule, Biobío, and Los Lagos (I25-I26-I32-I45). While its definition is initially somewhat unclear, it refers to the sectoral problems caused by deregulation, ranging from forest fires to the emergence of socio-environmental conflicts resulting from inadequacies in territorial planning. This would lead to a permissive attitude towards business initiatives that have ecological implications for regional territories, as well as high exposure to natural hazards. Institutions such as the DOH of the Metropolitan Region (I20) and the CONAF in Maule, Biobío, and Araucanía (I29-I35-I42) have also indicated this deregulation, which corresponds to authorities in the Central and Southern macrozones of the country.

3.3. Socio-Environmental Risks as Macrozonal Challenges in Chile

These findings indicate a high level of complexity in the configuration of the primary socio-environmental risks identified by Chilean institutions. While the narrative approach used in this study does not permit the determination of inconsistencies or discrepancies in official risk attention among institutions, it does highlight significant challenges and institutional concerns in addressing socio-environmental risks in an emerging society such as Chile.

The natural dangers associated with socio-environmental risks, such as heavy metal contamination in Northern Macrozone communities (I1-I2-I12) and recurring forest fires in the center and south (I26-I29-I41-I46), pose a threat to families, towns, and cities due to changes in land use. However, it is not always an external factor that intensifies these risks; rather, the internal conditions hinder the ability to address environmental problems. Authorities often point to insufficiencies that can be perceived as institutional risks that negatively impact the ability of institutions to manage environmental risks.

The data reveal significant shortcomings in various sectors, including outdated regulations. Issues such as mass migration and irregular settlements in the north (I2-I12), the loss of regulatory powers concerning diseases caused by water or air contamination in the center and south (I31-I36-I43-I52), and supervisory difficulties in sectoral matters (I16-I37-I47-I50) are major concerns that contribute to the amplification of socio-environmental risks. These risks are not solely attributed to anthropogenic processes beyond institutional control, but also to institutional shortcomings (I23-I30). Each organization's goals and sectoral focus determine the causes and consequences of heightened socio-environmental risks, as emphasized by informants based on specific locations and macrozones. While the authorities in all the regions agree that natural hazards contribute to the intensification of risks (I4-I11-I17-I23-I32-I39-I45-I54), they have different views on other factors that amplify the socio-environmental risks, which are often related to the types of industries present in each region.

The configuration of anthropic aspects and amplifiers of socio-environmental risks are evolving in the Central, Southern, and Southern Macrozones. In the center, the evidence gathered indicates that the determining factors are associated with the territorial planning of highly deregulated areas, leading to consequences, such as the loss of biodiversity, the emergence of micro-gardens, and challenging-to-control forest fires (I16-I17-I29). This

finding suggests that the main challenges in risk management for the government institutions in these regions lie primarily in the forestry and agricultural sectors, which generate externalities that are difficult to manage. However, this does not imply that other sectors, such as tourism, irregular settlements, or air pollution, do not amplify the effects. This indicates that the forestry and agricultural sectors pose the greatest challenges in the context of socio-environmental risk management in these regions.

In the southern regions, particularly in areas known for firewood production, such as Araucanía, Biobío, and Los Lagos, the focus shifts towards energy issues. This poses unique socio-environmental management challenges, requiring the reconciliation of seemingly divergent institutional approaches, especially concerning urban pollution. For instance, while institutions such as the SEREMI of the Environment advocate the regulation of irresponsible wood stove heating practices (I30-I37-I44), the SEREMI of Energy and the CONAF work on developing policies to bolster firewood for sustainable biomass (I31-I38-I45, I35-I42-I49). This represents a significant challenge for the Chilean government in terms of risk policies.

In the Southern Macrozone, particularly in Magallanes, the risk amplification axes revolve around the implementation of non-conventional energy industries and energy transition processes. Although the government recognizes ambivalences related to wind energy projects and green hydrogen generation, the effective implementation of these initiatives is unclear. Despite progress in global indicators, negative impacts on native birdlife, visual pollution, and productive reconversion are evident (I52-I55).

The country's socio-environmental risk configuration presents management dilemmas and challenges, resulting in strong ambivalence towards sustainable technologies and their socio-environmental externalities. The reporting authorities demonstrate that the institutional challenges associated with configured risks are influenced by wide-ranging anthropic processes outside the control of institutions, thereby amplifying the socio-environmental risks associated with the increased complexity of human societies. For instance, tourism is a significant aspect of socio-productive development in the Northern Macrozone, but it also contributes to risky externalities, such as illegal waste dumps and the loss of flora and fauna in areas of tourist interest (I11-I15). Similarly, non-conventional renewable energy generation projects in the Southern and Austral Macrozones (I31-I38-I52-I55) also exhibit this phenomenon.

4. Discussion

(1) Prioritized institutional risks are distinguished by their heterogeneous configuration and are predominantly focused on societal events that have a considerable socio-environmental impact. In Chile, these risks are largely associated with the ecological issues and externalities that arise from emerging development models across various regions of the country. Governmental institutions with regulatory authority are particularly concerned about the diverse ecosystem and socio-productive conditions present in regional territories, which vary considerably. Natural events continue to be perceived as significant sources of danger, and regulatory challenges arise from both citizen associations and governmental entities. As a result, risk management remains a significant challenge for organizations [34].

The evidence gathered highlights the ability of governmental organizations to recognize environmental management challenges for more effective governance. This involves improving the regulatory frameworks, acknowledging the failures as part of the methodological process, and transferring risk-based standardized management modalities, as suggested in the specialized literature [38,42,43]. In Chile, governmental institutions understand their operational domains and prioritize socio-environmental risks that hold public significance, which is essential for regulatory purposes [47,49]. This differentiated approach underscores the importance of inter-institutional coordination, which is a complex regulatory challenge in modern states, particularly concerning risk management [43,50].

The above underscores the contribution of our study to both research and practice by elucidating how institutional representatives shape and prioritize policies in the context

of socio-environmental risks. By revealing the differentiated configuration of these risks, our findings can inform national policy actions tailored to support local contexts where these risks manifest. Our results also provide a critical connection and illustrate the related effects between risk configuration from the institutional perspective, serving as both a foundational basis for further research and a valuable contribution to practical application.

(2) The differentiated configuration within the country's governmental institutions highlights the regional risks or concerns that directly affect people's health and population (heavy metals in water in the northern area, drinking water quality in the central area, and air quality in the southern area). Consequently, the essential aspects of the population and ecosystems continue to be prioritized in terms of organizational effort, which is characteristic of entities that consciously or unconsciously integrate the concept of risk into their activities [6,7,46,48]. It is worth noting that in Latin American models and generally in emerging societies of peripheral capitalism, this does not imply the implementation of risk-based general management, as in more advanced nations [4,42,43]. The various events that amplify the risk in different productive and territorial sectors of the country, emphasized in the differentiated configuration of this study, demonstrate extensive areas with high-level semantic recognition, but lack efficient regulation. Given the polysemy of risk [34], big uncertainties are generated in the country in events that were once considered inevitable natural events, but are now defined as threats generated by society (e.g., floods or forest fires). In this context, government agencies must have the minimum capacity to respond [38,65].

Based on these outcomes, it can be asserted that the governmental organizations of the country have constructed a differentiated configuration of risks. This configuration presents a convergence of issues of public relevance from both old and new perspectives (e.g., forest fires in areas adjacent to unregulated urban settlements or water pollution from traditional industries such as mining, and the implementation of wind farms and so-called sustainable tourism). Thus, the current scenario presents a highly challenging context for the country's governmental institutions responsible for mitigating and preventing socio-environmental risks, characterized by inevitable semantic difficulties in the risk–development relationship, which is common in these types of organizations according to the literature [24,34,47].

Diversity in ecological and socioeconomic regional contexts requires a comprehensive network of institutions to address a task that is not easily achieved under the current system: internalizing risk as a guiding principle [38,47,65]. In Chile, one of these regulatory crossroads, as narratively revealed by the actors within the framework of the differentiated configuration, highlights the need to focus on issues related to the traditional energy matrix, but also to assume complementary those socioeconomic processes driven by the global agenda. At this level, important, yet underdeveloped, themes, such as waste treatment, the promotion of solar energy, or the conversion to non-hydrocarbon-based forms of energy, may be given adequate attention.

(3) The differentiated configuration of established risks shows difficulties for government organizations in deploying operations in the face of socio-environmental risks and threats, as these organizations attempt to incorporate and transmit risk as an organizing operational criterion [34,65]. In certain sectors, this situation results in the isolated treatment of impacts, inadequacies in preventive measures, and difficulties with inter-institutional coordination in addressing shared socio-environmental risks, both within and between regions. However, it is noteworthy that some agencies tend to emphasize their efforts in coordinating with other institutions to address certain risk areas. This presents important regulatory challenges for Chile, such as reconciling sustainable development with ancestral socio-productive practices (such as cultivation on steep slopes and land burning), establishing new protected spaces under national legislation (such as Marine Protected Areas or urban wetlands), and developing plans for the decontamination of air pollution and freshwater sources.

Although some institutions in Chile may not always act in opposite directions regarding socio-environmental risks, they require a higher level of legitimacy, both internally and

externally, to establish themselves as key players in risk management [43,47,49]. This point is considered essential for improving regulatory efforts and enhancing efficiency [43,47,49]. The scientific evidence indicates that prioritizing risks in government institutions responsible for managing them, particularly when they impact public safety and manifest in a wide range of complex events, is challenging [38,51]. Therefore, integrating failure or adverse outcomes into risk management is part of the organizational reflexivity effort required by institutions aiming to gradually consolidate risk-based management over time [65]. The complexity of the Chilean case suggests that governmental institutions are engaging in risk management, but do not necessarily operate as risk-based organizations [43,49]. As demonstrated by more successful countries in this regard, this transition is slow, challenging, and gradual, but feasible.

This study has several limitations that can be addressed in future research. One limitation is its (1) qualitative approach, which could be enhanced with mixed methods, including quantitative approaches and instruments such as surveys, to obtain a more comprehensive understanding of the institutional risks in Chile. Second, (2) this study focused on a limited group of institutions which, although relevant, represents only a subset of a broader group that could be included in future research as part of a sample frame. Expanding the scope to include additional institutions and regions within the country would provide more extensive analysis. Finally, (3) while the study adopts a narrative approach, it only considers the perspective of institutional representatives. This could be complemented by incorporating the narratives of other social agents, both public and private, who play significant role in shaping socio-environmental risks in the country.

5. Conclusions

This study aimed to examine the narrative dimension of socio-environmental risks among authorities from the most relevant institutions in Chile, establishing a differentiated configuration based on their scope and responsibilities.

Based on the results obtained, it is worth noting that, in Chile, the configuration of socio-environmental risks depends on a complex combination of natural, institutional, and economic factors inherent in each macrozone. Considering the country's vast territorial extent, which involves a complex network of institutions responsible for sectoral risk control, three key aspects emerge in the path of Chilean institutionalization towards more efficient policies in socio-environmental regulation.

First, socio-environmental risks that have become concerns and priorities in Chilean institutions have both natural and anthropogenic origins. There is a growing trend that indicates that the latter is increasingly taking precedence over the primacy of natural inevitability. In this regard, a significant challenge lies in complementing traditional risks in a nation's development history with cutting-edge risks associated with the global climate change agenda. The most significant field of action for this new aspect of differentiated risk configuration is linked to the generation of new sources of unconventional renewable energy, which is crucial for Chile and other emerging Latin American nations.

Second, although there is a tendency towards risk management in the country, institutions may not necessarily incorporate this principle as a central part of their operations. Further research in this area is required. If the risk policies were effectively implemented, many of the current events and threats that exceed the capacity of regulatory bodies to control them, as acknowledged by the representatives of various institutions, would decrease rather than increase. Some examples of such events include the consequences of widespread river flooding; recurring and increasingly deadly forest fires in the Central, Southern, and Austral macrozones; the proliferation of irregular human settlements; the contamination of water basins and lakes in the North Patagonian region; and air pollution resulting from biomass use.

Third, it is possible to project onto the research agenda certain fields of scientific inquiry into socio-environmental risks that may address the inherent ambiguities of a study, such as the one presented. These include: (1) investigating whether relevant risks are being

overlooked, but remain somewhat invisible to institutions; (2) examining more deeply the influence of pressure groups, which are present in all socio-environmental risks, on the institutional definition of the risk agenda; (3) qualitatively exploring the extent to which Chilean governmental institutions are reflexive in terms of regulation and management of socio-environmental risks, which could benefit the identification of issues, such as whether they are able to establish regulatory priorities and how they do so; and (4) determining whether institutions, due to normative, technical, or financial deficiencies, are generating institutional risks that hinder the improvement of socio-environmental regulation efficiency.

Author Contributions: Conceptualization, A.V.-R.; methodology, A.V.-R. and À.B.; software, M.C.-S.; validation, A.V.-R., C.C., F.S.A. and M.C.-S.; formal analysis, A.V.-R., M.C.-S., À.B. and F.S.A.; data curation, A.V.-R., M.C.-S. and F.S.A.; writing—original draft preparation, A.V.-R. and F.S.A.; writing—review and editing, A.V.-R., C.C., F.S.A., M.L. and L.K.S.G.; visualization, M.C.-S.; supervision, A.V.-R.; project administration, A.V.-R.; funding acquisition, A.V.-R., M.C.-S. and F.S.A. All authors have read and agreed to the published version of the manuscript.

Funding: This work was funded by the National Science and Technology Research Fund (FONDECYT) of the Government of Chile, as part of two Regular Projects [Projects numbers 1210714; 1240707] and two Projects for the Initiation of Research [Projects numbers 11230601; 11230310].

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Universidad de La Frontera (Folio Number 043/21, 12 May 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are unavailable due to privacy and ethical restrictions.

Conflicts of Interest: The authors declare no conflicts of interest.

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