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IN THE SHADOW OF THE MEGADROUGHT: OPPORTUNITIES AND
CHALLENGES FOR ADDRESSING LOSS AND DAMAGE FROM CLIMATE
CHANGE IN CHILE AND EASTERN MONTANA, USA

By

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Thesis

Presented in partial fulfillment of the requirements

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in Resource Conservation, International Conservation & Development

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ABSTRACT

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Resource Conservation

In the Shadow of the Megadrought: Opportunities and Challenges for Addressing Loss and Damage from Climate Change in Chile and Eastern Montana, USA

Chairperson: Dr. Brian C. Chaffin

As the impacts of anthropogenic climate change mount, climate-related harms, both economic and non-economic, occur across every inhabited continent and disproportionately affect the world's most vulnerable people. In response, the Loss and Damage agenda of the United Nations Framework Convention on Climate Change has emerged to address those climate-related harms that exceed human capacities for mitigation and adaptation. Significant questions remain regarding how losses and damages emerge across the globe and how Loss and Damage policy will be implemented to address those impacts. This thesis explores two specific questions: (1) national-level Loss and Damage policy mechanisms; and (2) perceptions of losses and damages among agricultural producers in the global north. The first study leverages a framework-guided analysis of national climate policies from Chile to assess the presence, absence, and potential of national-level Loss and Damage policy mechanisms within this country. Although Chile's current climate strategies do not mirror the global Loss and Damage policy agenda, certain elements are clearly present. Results suggest limited relevance for event attribution at the national level, countering an ongoing debate on the significance of attribution for addressing losses and damages from a global perspective. The second study explores losses and damages in Montana, USA, a context not historically framed as a target of global Loss and Damage policy. Through a survey of Montana farmers and ranchers' experiences with extreme events, evidence of both economic and non-economic harms is found among respondents, as well as a potential threshold at which agriculturists may change livelihoods given consistent recurrence of extreme events. Overall, this work provides insight into the relevance of the global Loss and Damage agenda and its various elements across a wide range of societal levels and geopolitical contexts, and can prove valuable as individuals, communities, and nations around the world grapple with the impending and accelerating impacts of climate change.

Keywords: Loss and Damage, climate change, climate policy

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1. INTRODUCTION

In its most recent report, the Intergovernmental Panel on Climate Change (IPCC) delivered a stark warning: that widespread changes to the earth’s climate system are well underway, with evidence of increasing climate extremes present across every region of the globe (IPCC, 2021). The acceleration of anthropogenic climate change detailed in the IPCC report has been accompanied in recent decades by pressing questions, including many concerning who is responsible for the worst impacts of climate change on human populations. Climate change is not exclusively an environmental problem that can be addressed through scientific or technical means alone. Rather, it is a “conundrum of politics and justice,” with unequal contributions to the problem, disproportionate impacts on future generations, marginalized groups and poorer citizens, and asymmetries in decision-making power to determine appropriate responses (Tanner et al., 2015, p. 23). Today, greenhouse gas emissions from industrialized nations, which dwarf those from the developing world, have been causally linked to slow-onset trends such as sea level rise and increased incidences and severity of acute climate-related disasters (typhoons, droughts, etc.), with the most vulnerable nations and people globally bearing the brunt of resulting harms (Tschakert et al., 2017, 2019). This grim reality is central to Loss and Damage, a developing “third pillar” of international climate policy aimed at addressing the residual impacts of climate change that occur once mitigation and adaptation strategies fall short (James et al., 2014). For clarity, “Loss and Damage” in this thesis is capitalized in reference to the emerging global policy agenda while “loss and damage” refers to the actual harms resulting from climate change-related events that are beyond mitigation and adaptation. Although Loss and Damage has recently gained visibility across policy circles and research communities alike (Boyd et al., 2021), many knowledge gaps remain regarding its implementation in policy and the actual manifestations of loss and damage across geographic contexts.

1.1 A BRIEF HISTORY OF LOSS AND DAMAGE

The United Nations Framework Convention on Climate Change (UNFCCC) has long recognized mitigation and adaptation as the primary strategies for addressing anthropogenic climate change. Mitigation is understood as the reduction of greenhouse

gas emissions and the increase in carbon sinks via efforts like increasing forest cover (Armenta, 2022), while adaptation is defined as “human-driven adjustments in ecological, social or economic systems or policy processes, in response to actual or expected climate stimuli and their effects or impacts” (Armenta, 2022). Loss and Damage, on the other hand, represents an emerging third mechanism or set of strategies for addressing the impacts of climate change once adaptation and mitigation efforts fall short (James et al., 2014). The roots of Loss and Damage lie in a proposal by the island nation of Vanuatu, presented during the 1991 negotiations that preceded the formation of the UNFCCC (Broberg, 2020). The proposal, which included an international insurance pool for island states threatened by sea level rise, marked the beginning of ongoing discussions about responsibility and liability for the effects of climate change (Kreienkamp & Vanhala, 2017). Following these negotiations, 16 years passed before Loss and Damage appeared in a negotiated UNFCCC decision, the 2007 Bali Action Plan (Vulturius & Davis, 2016). This momentum carried Loss and Damage to inclusion in the 2010 Cancun Adaptation Framework and the 2012 Doha Gateway decision, spurred by parties to the convention frustrated with the slow pace of climate talks and the resulting potential for inaction (Kreienkamp & Vanhala, 2017; Vulturius & Davis, 2016)

Loss and Damage was first established as a dedicated policy mechanism in 2013, in Warsaw, Poland (COP-19), under the Warsaw International Mechanism for Loss and Damage (WIM). The WIM is the primary vehicle under the UNFCCC to address loss and damage in developing countries that are especially vulnerable to the adverse effects of climate change (UNFCCC, 2020). The mechanism serves to promote implementation of approaches to address loss and damage by undertaking three primary functions: 1) enhancing knowledge and understanding of comprehensive risk management approaches, 2) strengthening dialogue, coordination, coherence and synergies among relevant stakeholders, and 3) enhancing action and support, including finance, technology and capacity building (UNFCCC, 2020). Subsequently, the inclusion of Loss and Damage under Article 8 of the 2015 Paris Agreement (COP-21) formally distinguished it as separate from mitigation and adaptation (Serdeczny et al., 2016b). The creation of an independent status for Loss and Damage was contentious. Parties from developed and developing nations held clearly divided positions during the COP-19 negotiations,

particularly regarding the centrality of compensation to the mechanism (Broberg, 2020b), a tension still largely unresolved (if not more acutely defined) as of the recent COP-26 in Glasgow, Scotland.

1.2 DEFINING LOSS AND DAMAGE

The difficulty in agreeing upon the terms of Loss and Damage as delineated in policy points to a larger disagreement about the definition of the term itself. If anything is agreed upon in Loss and Damage research, in fact, it's that there's no agreed-upon definition of loss and damage (Boda et al., 2021). How should the actual harms stemming from climate-related events be understood? The UNFCCC refers to loss and damage in the context of the WIM as being “associated with the impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change” (UNFCCC, 2021). Consensus exists within the literature, however, that no global agreement has been reached regarding the meaning of loss and damage; nor has the UN *officially* adopted a definition (Vanhala & Hestbaek, 2016, Calliari et al., 2019; Calliari et al., 2020; Tschakert et al., 2019, as cited in Vanhala et al., 2020). This lack of a clear definition, compounding the use of unclear language in the establishment of the WIM, has resulted in considerable leeway for interpretation (Broberg, 2020). Acknowledging that losses and damages are a function of far more than just the impacts of extreme weather events and slow onset change (Scown et al., 2022), I define “loss and damage” for the purpose of this thesis as *the impacts of climate change that cannot be (or have not been) avoided through mitigation or adaptation* (Shawoo et al., 2021). The lower case “loss and damage” is differentiated here from “Loss and Damage,” which I use in reference to the global policy agenda addressing residual climate harms.

Following from inconsistent definitions of loss and damage across the literature, perceptions of the concept also vary widely, making it difficult to have practical conversations about the actions needed to address loss and damage (Boyd et al., 2017). Frequently, perceptions exist on a spectrum of understanding about how Loss and Damage relates to existing adaptation and mitigation mechanisms. These range from considering adaptation and mitigation mechanisms as sufficient for addressing all

climate-related loss and damage to considering losses resulting from climate change as unavoidable and of critical importance to address (Boyd et al., 2017). Broberg (2020) expands upon this idea, suggesting that three approaches commonly appear in the literature for distinguishing between mitigation, adaptation, and Loss and Damage. First, the “beyond adaptation” approach suggests that loss and damage = insufficient mitigation + inadequate adaptation. Second, the “tolerable risk” approach considers the range of what is perceived as acceptable when it comes to anticipating threats from climate change. The subjectivity of the term “tolerable” in this approach, however, renders it vague and of limited use in distinguishing between adaptation and Loss and Damage, additionally begging important questions: tolerable for whom, and tolerant of what? A third approach distinguishes between impacts that are “avoidable, unavoidable, or unavoided” (Broberg, 2020, p. 218). Importantly, in a review of the state of the Loss and Damage literature, McNamara & Jackson (2019) note that almost half (45.1%) of the 122 publications reviewed conceptualized loss and damage as the residual effects that occur once the “limits to adaptation” have been reached. This concept of “limits to adaptation” is the subject of a considerable body of literature which is highly relevant to Loss and Damage. Scholarship on limits to adaptation considers the presence of key vulnerabilities and tipping points which, should they be exceeded, would pose significant threats to human and ecological welfare (Dow et al., 2013).

Uncertainty about the relationship of Loss and Damage to other agendas extends to the WIM itself, where, although the preamble refers explicitly to the “beyond adaptation” conceptualization of loss and damage, the rest of the policy outlines a program more aligned with reducing the risk of [loss and damage]” (McNamara & Jackson, 2019a). In reality, the lines between the mitigation, adaptation, and Loss and Damage agendas may be economic or political in nature, involving socio-cultural and institutional factors as well as biophysical and technical ones (Broberg, 2020b). As such, those lines, as suggested above, may be easily blurred.

1.3 CHALLENGES TO IMPLEMENTATION

In addition to challenges presented by vague definitions of Loss and Damage, there are many outstanding questions about how the issue is framed, and how the

specifics of potential policy mechanisms to address losses and damages look in practice. Implementation of the WIM is carried out by the WIM Executive Committee, which aims to address the potentially unavoidable climate-related losses and damages through five workstreams, which include addressing slow onset events, non-economic loss and damage, comprehensive risk management, human mobility, and action and support (UNFCCC, 2020). This body, which operates under the guidance of the Conference of Parties, is comprised of a 20-member panel of 10 annex 1 and 10 non-annex 1¹ country representatives and is responsible for implementing the mechanism's three main functions outlined above (UNFCCC, 2020). James et al. (2014) note a fundamental, overarching question relevant to implementation of the WIM's work, however: which losses and damages are pertinent to the Loss and Damage mechanism? What counts as loss and damage from climate change?

One of the most significant implementation challenges faced by the WIM is non-economic loss and damage, or "NELD." A key consideration of the WIM and a top priority among its five workstreams, NELD includes the material and non-material dimensions of loss and damage that defy quantification or monetization, such as the loss of cultural heritage, traditional knowledge or place identity that may leave communities disconnected from their sense of self and each other (Serdeczny et al., 2016). In their poignant illustration of "one thousand ways to experience loss," Tschakert et al. (2019) suggest that attempts to assess losses and damages via purely economic metrics tend to fall woefully short of capturing their true extent. Such efforts, they argue, gloss over the non-quantifiable dimensions of harm "that are no less significant to people within their own contexts," (McShane, 2017; Preston, 2017; in Tschakert et al., 2019, p.59) Anticipating and estimating NELD for policy and planning purposes is extremely challenging due to the complexities of social interactions, difficulty of quantification, and

¹ **Annex 1 parties** include the industrialized countries that were members of the OECD (Organization for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. **Non-Annex I** parties are primarily developing countries. The Convention emphasizes activities that promise to answer the special needs and concerns of these vulnerable countries, such as investment, insurance, and technology transfer (UNFCCC, 2020c).

uncertainties associated with climate projections. This creates significant difficulty in generating sound estimates to serve as a basis for decision-making (Serdeczny et al., 2016). Scown et al. (2022) highlight a critical roadblock regarding efforts to address NELDs: there are virtually no records of NELDs globally. This absence of both data on NELDs, and general discourse on NELD within Loss and Damage policy arenas represents a significant blind spot, hindering our ability to understand and address Loss and Damage and keeping the focus (and potential solutions) trained on a narrow economic conceptualization of losses and damages globally (Scown et al., 2022; Tschakert et al., 2019).

Another challenge to implementation lies in the differential strategies necessitated by various types of climatic events. Loss and damage as defined by the UNFCCC encompasses the effects of both slow onset and extreme events linked to climate change. The definition of slow onset events includes desertification, glacial retreat and related impacts, land and forest degradation, loss of biodiversity, ocean acidification, increasing temperatures and sea level rise (UNFCCC, 2012). Acute or rapid onset events, on the other hand, include heat waves, tropical cyclones, storm surges, droughts, and floods (UNFCCC, 2012). Huggel et al. (2013) suggest that strategies to cope with each differ, with approaches to addressing slow onset event less well defined than risk management plans for extreme weather events. There has been discussion in recent years, for example, about the suitability of insurance to manage slow onset events in vulnerable countries. Traditional loss-based insurance may not be suitable to insure against longer term foreseeable climatic stressors because slow-onset events fail two preconditions for insurability: unpredictability of an event (losses should be sudden and cannot be foreseen) and ability to spread risk over time and regions (Kehinde, 2014). In other words, the slow predictability of changes like sea level rise and desertification, combined with the global reach of their effects, mean that solutions other than traditional insurance will be necessary to address these slow-onset events. Proponents of comprehensive climate risk management (CRM) approaches have proposed various frameworks to address these challenges. For example, Schinko et al. (2019) suggest the “risk layering” approach (Mechler et al., 2014) for operationalizing CRM in the context of Loss and Damage. This concept involves identifying efficient and acceptable interventions based

on recurrence as well as severity of climate-related risks. The risk layering approach involves segmenting risk into acceptable, tolerable and intolerable layers and allocating roles and responsibilities to reduce, finance or accept risks (Schinko et al., 2019). Such approaches again raise an important question, however: “acceptable, tolerable, and intolerable for whom?”

Additionally, the role of responsibility for climate-related harms, particularly as it relates to financial compensation, presents one of the most contentious struggles in the evolution of Loss and Damage policy globally. Loss and Damage negotiations are frequently torn between demands for climate justice and the reluctance of other parties to consider actions to address Loss and Damage outside of an adaptation framework (Schinko et al., 2019). Perceptions of climate justice as it relates to responsibility vary: some frame it primarily as a financial matter, centering on compensation by high-emitting nations for increases in extreme or slow onset related risk (Schinko et al., 2019). More holistic definitions of climate justice, however, frame the issue as an existential matter, requiring examination of the underlying drivers of loss and damage (Boyd et al., 2021). Viewed from this perspective, losses and damages often cannot be tied solely to climate change, but are “entangled with layers of entrenched vulnerabilities as well as other drivers that produce uneven outcomes and future risks” (Tschakert et al., 2019, p. 69). This perspective places an emphasis on addressing both historic harms associated with uneven greenhouse gas emissions and on the restrictions faced by vulnerable people in adapting to climate change (Boyd et al., 2021). Such divergent perspectives on liability and compensation (payments and who pays) as opposed to adaptation, disaster risk management and insurance (pre-emptive programs) present a challenge for the WIM Executive Committee, whose current work program balances the two perspectives without explicitly referring to justice and equity principles (Schinko et al., 2019), a challenge many scholars find impossible.

Finally, the numerous drivers of disproportionate vulnerability to climate change add layers of complexity on the study of losses and damages and the administration of Loss and Damage policy. Differential vulnerability of human populations to climate change results from a wide array of social, economic, historical and political factors, all of which operate in different and complex interacting ways across scales (Thomas et al.,

2019). Such drivers of change, which include but are not limited to hyper-neoliberal policies, poor land use choices and legacies, institutionalized marginalization, and the inequitable influence of state policies, exacerbate the impacts of climate change and therefore drive losses and damages in step with the actual impacts of climatic events themselves. Understanding the complex interactions of climatic events, underlying drivers of vulnerability, and resulting losses and damages presents a formidable challenge for researchers seeking to untangle these relationships.

1.4 THE ROLE OF EVENT ATTRIBUTION IN LOSS AND DAMAGE

The research field of event attribution, which focuses on attributing the increased severity and/or frequency of individual weather events to the presence of anthropogenic greenhouse gas emissions, has become a central focus in the Loss and Damage debate. The potential role of event attribution in establishing a basis for loss and damage compensation has become highly politicized (James et al., 2014), and developed nations including the United States have pushed back forcibly against its inclusion in Loss and Damage negotiations, frequently labeling them a distraction from adaptation and mitigation efforts (Jézéquel et al., 2018). Despite the contentious nature of the attribution subject, James et al. (2014) point out that the question of causality cannot be avoided forever. Considering the UNFCCC's mandate to tackle anthropogenic interference with the climate system, one of its largest outstanding challenges is to estimate where and when losses and damages can be attributed to climate change.

The sophistication of attribution science has evolved significantly over the past decade, as recently evidenced by the rapid attribution of the 2021 heatwave in the Northwestern United States and Canada (Philip et al., 2021). The process of attributing an extreme event to climate change, as outlined by Philip et al. (2020) in reference to the World Weather Attribution (WWA) initiative's methodology, is a complex, eight-step undertaking. In simplified terms, the WWA method entails determining the spatial and temporal extent of the extreme event in question, determining whether the event exhibits a trend above natural variability, and using physical climate models to attribute any detected change in the event's probability and intensity to anthropogenic forcing (Philip et al., 2020; WWA, 2021). Multiple approaches to attribution are outlined within the

literature. One such framing is a risk-based approach, which answers the question of attribution probabilistically, in terms of the likelihood of a given event occurring, and treats natural climate variability as background noise (Shepherd, 2016). A second framing, termed the “storyline approach,” looks alternatively at various factors *contributing* to the occurrence of the event in question, including but not limited to natural variability (Shepherd, 2016).

As event attribution capabilities have blossomed, so have the debates regarding its potential role in connecting losses and damages to anthropogenic climate change. Although some scholars have voiced enthusiasm about the potential of attribution to support informed policymaking (Huggel et al., 2013b) and foster restorative justice by holding historic emitters accountable (Jézéquel et al., 2018), a number of critiques have also been levied at this potential application. One such critique centers on the inequities present in observation and attribution of extreme events. Huggel et al. (2016) affirm that the most vulnerable countries globally are those for which extreme event attributability is the lowest. Their analysis of attributed impacts (based on the IPCC AR5 report (IPCC, 2014)) revealed that over 60% of attributed impacts considered came from Annex-1 nations, whereas Annex-2 nations represented less than 40% of observations and least developed countries (LDCs) and small island developing states (SIDS) totaled less than 20% of detected and attributed events combined. A second critique suggests that establishing liability for attributable events should be a secondary concern; that losses and damages also occur due to natural climate variability, and that a fixation on the attributable fraction of loss and damage would subvert proactive measures to minimize and avert loss and damage in the first place (Wallimann-Helmer, 2015). Additionally, Roberts & Pelling (2018) suggest that, given the many challenges to operationalization that event attribution still faces, it should by no means constitute a pre-requisite for global action on loss and damage. Support should be given foremost to the most vulnerable, not the most attributable. Finally, Scown et al. (2022) highlight an imbalance regarding attribution: not only does the ability to perform such studies rest primarily in developed countries, but those same developed countries have also largely been the focus of completed studies to date. This indicates a misalignment between the attribution of climatic events and the regions known to be most vulnerable globally.

1.5 RESEARCH QUESTIONS

There seems to be a pressing question of “now what” looming over the issue of Loss and Damage. How will the WIM and the topic of Loss and Damage be addressed and implemented, not only globally, but regionally, nationally, and locally? How will outstanding questions about the specifics of Loss and Damage be answered at these various scales? As Kreienkamp & Vanhala (2017) suggest, there are viable ways to move forward with addressing Loss and Damage, but without strong international support, such efforts will remain an empty policy prescription for much of the world hard hit by climate change. As an international framework, the Warsaw International Mechanism for Loss and Damage (WIM) exists for the purposes of coordinating Loss and Damage efforts at the global scale, however significant knowledge gaps remain regarding how (and even if) Loss and Damage is implemented in policy by individual nation-states, as well as how actual harms linked to climate-related events manifest across geographic contexts.

Currently, few policy mechanisms exist that explicitly address losses and damages at the level of national governments; most mechanisms rely on the processes and politics of international climate governance. The most notable exception is the country of Bangladesh, which has made considerable strides towards developing a national mechanism to address Loss and Damage from climate change (Haque et al., 2019; Huq et al., 2016). Although many other nations may have policies in place which address some portions of the global Loss and Damage agenda through a focus on climate governance generally, these national policies may be framed differently; couched as adaptation or disaster risk reduction rather than Loss and Damage explicitly. Global Loss and Damage strategies have been studied with increasing frequency within climate policy research circles (Tschakert et al., 2019), however this relative abundance of studies highlights a glaring void: there’s a comparative paucity of knowledge about how national-level actors approach the Loss and Damage problem (Vanhala et al., 2021). Citing recent developments in UNFCCC negotiations and within the literature, Calliari & Vanhala (2022) suggest the emergence of a “national turn” in Loss and Damage governance. The authors raise important questions regarding how national policymakers conceptualize Loss and Damage, highlighting the importance of understanding where Loss and Damage is included (or not) within the landscape of national-level climate

governance (Calliari & Vanhala, 2022). Addressing this gap in the collective knowledge of Loss and Damage is essential, not least because the impacts of climate change are inherently multi-scalar and political (Adger et al., 2005; Hall & Persson, 2018; Javeline et al., 2014 as cited in Vanhala et al., 2021), necessitating different strategies to address them at various scales of governance. To this end, examining how existing country-level institutions currently respond to climate-related disasters in ways that deal with losses and damages will be essential in supporting Loss and Damage policymaking from the global to the local level (Calliari & Vanhala, 2022).

In addition to lacking studies on national mechanisms, the Loss and Damage literature has historically contained few empirical investigations regarding how climate-related harms are manifesting globally (van der Geest & Warner, 2015; Warner & van der Geest, 2013). To date, most Loss and Damage research has been theoretical, focused on conceptualizations of loss and damage from a variety of perspectives and linkages to other policy frameworks, with significantly less empirical research (McNamara & Jackson, 2019 as cited in Thomas et al., 2020). Despite this historic lack of empirical loss and damage research, studies are beginning to emerge which investigate different types of loss and damage across contexts (Calliari & Vanhala, 2022; Cunsolo & Ellis, 2018; Tschakert et al., 2019). Other studies are attempting to frame the impacts of extreme events as losses and damages (or not) relative to mitigation and adaptation measures by leveraging various methodologies and data types (Boda & Scown, 2021; Scown et al., 2022). The lack of empirical knowledge about losses and damages extends to numerous aspects of the Loss and Damage debate, including NELDs and attribution science (Scown et al., 2022), limiting the capacity for informed policymaking regarding these topics. Although the origins of Loss and Damage policy and scholarship are primarily concerned with climate-related harms in the Global South, the current expansion of empirical research on losses and damages will likely lead to continued explorations across geographic and development contexts. The specifics of losses and damages as experienced vary greatly from place to place, and the continued evolution of scholarship may be central to supporting a parallel evolution within global Loss and Damage policy to address losses and damages when adaptation and mitigation fail, an occurrence present far beyond the Global South.

Augmenting the body of empirical studies documenting climate-related harms is critical to improving our understanding of losses and damages globally and will additionally be relevant to capturing progress on Loss and Damage within the 2023 global stocktake of the Paris Agreement (Thomas et al., 2020). More importantly, however, empirical information on loss and damage will aid in identification of the types of action and support needed, what works and in which contexts, and how such action and support can be delivered (Thomas et al., 2020). If a truly global understanding of loss and damage is to be pursued, bridging the gaps in the areas of collective knowledge articulated above will be immensely important. In this thesis, I explore questions relevant to both gaps: first, the paucity of research on national-level Loss and Damage mechanisms and, second, the adjacent lack of scholarship empirically examining losses and damages.

1. How does the global Loss and Damage agenda influence national-level policy responses to climate change?
 - a. How are global Loss and Damage concepts and approaches incorporated into national-level climate policies?
2. How are losses and damages perceived and experienced differently across geographic contexts, specifically in places not generally associated with global Loss and Damage?
 - b. How are losses and damages linked to extreme climatic events perceived and experienced in a rural, agricultural landscape of a developed nation?

1.6 ROADMAP TO EXPLORING LOSS AND DAMAGE IN THIS THESIS

As outlined above, this thesis is comprised of two independent but related studies regarding two gaps in the Loss and Damage literature. The investigation regarding the first gap leans on the possibility that, although only a few countries globally have explicitly implemented dedicated Loss and Damage policies, others may exist that are not explicitly couched in the UNFCCC language of Loss and Damage. To this end, Chapter 2 leverages national-level climate policy documents to explore policies not specifically framed as Loss and Damage mechanisms, but nonetheless with the potential to address losses and damages, offering insights into how alternative approaches to addressing Loss and Damage at the national level might look. Using an analysis of five national-level climate policies from the South American nation of Chile, this chapter explores potential

national-level Loss and Damage mechanisms not explicitly identified as such. Chile is well-positioned regarding this exploration, being both particularly vulnerable to myriad climate impacts and poised at a watershed moment of new and forthcoming climate policies with the potential to address losses and damages. I apply a framework to the Chilean policy documents designed to detect evidence relevant to the major aspects of modern global climate policy, aiming to gauge parallels to the global Loss and Damage policy agenda.

Chapter 3 addresses the second major gap in the Loss and Damage scholarship through an empirical exploration of losses and damages vis-à-vis survey data collected from agricultural producers across eastern Montana, USA. Eastern Montana, along with much of the northwestern United States and southwestern Canada, experienced a record-breaking heatwave in June of 2021, the severity of which was the subject of an attribution study conducted shortly thereafter (Philip et al., 2021). Importantly, although this survey is framed around respondents' experiences with extreme events, this focus does not preclude consideration of slow-onset events. Rather, it serves to make legible the human influence on the climate system by focusing on acute weather events and perceptions of their increasing frequency and severity over time. Although a study of losses and damages in the developed USA is not in the original spirit of the Loss and Damage agenda, it nonetheless holds value for the reasons outlined above. As our collective understanding of losses and damages evolves, it will be important to conceptualize how climate impacts beyond those mitigated or adapted to manifest in contexts beyond the Global South. A more thorough understanding thereof can help inform and evolve the debate about both losses and damages -and Loss and Damage policy- both globally and at the national level.

Although this survey was intended to be deployed in Chile to empirically assess loss and damage from prolonged drought, University and global travel restrictions linked to the COVID-19 pandemic made deployment of meaningful survey or interview research in Chile infeasible. Each chapter is presented in this thesis as a standalone peer-reviewed manuscript, complete with a full description of methods employed in each phase of the research. Much of the work conducted was a modification to initially proposed research due to the challenges presented by the pandemic. Although the final

research design yielded valuable results, future research on these topics would benefit from the inclusion of in-person, qualitative interviews across both the national contexts (Chile and USA) investigated. Importantly, this research was conducted in conjunction with a global effort investigating the disproportionate impacts of climate extremes (DICE) across multiple national contexts. The insights and expertise of DICE researchers have been central informing my own understanding of Loss and Damage and were instrumental in designing and reviewing the survey deployed in eastern Montana (USA).

2. EXPLORING LOSS AND DAMAGE IN CHILEAN CLIMATE POLICY

2.1 INTRODUCTION

Societal recognition of anthropogenic climate change's acceleration over recent decades has been accompanied by a constellation of debates regarding how to address its many impacts. Long conceptualized as a largely scientific challenge, climate change in reality represents a “conundrum of politics and justice” which cannot be addressed through scientific or technical solutions alone (Tanner et al., 2015, p. 23). Today, greenhouse gas emissions from industrialized nations, which dwarf those from the developing world, have been causally linked to slow-onset trends such as sea level rise and increased incidences and severity of acute climate-related events, with the most vulnerable nations and people globally bearing the brunt of resulting harms (Stott et al., 2016; Tschakert et al., 2019; Tschakert et al., 2017). Currently, the “Loss and Damage” agenda of the United Nations Framework Convention on Climate Change (UNFCCC) serves as a mechanism for addressing those harms linked to anthropogenic climate change which exceed the capacity of mitigation and adaptation strategies to prevent their occurrence (James et al., 2014). Although mitigation and adaptation mechanisms, including programs, processes, funding, and policies remain critical to limiting future global harms as a result of climate change, losses and damages *will occur* as extreme and slow-onset events such as sea level rise continue to surpass human capacities to prepare, avoid, and adapt (Roberts & Pelling, 2018).

Policy mechanisms addressing Loss and Damage at the international level are the rapidly increasing object of academic attention (Calliari, 2018; Tschakert et al., 2019). Research on Loss and Damage policy mechanisms at the national level, however, are sparse (Vanhala et al., 2021), despite the recent assertion of scholars that a “national turn” for Loss and Damage is imminent (Calliari & Vanhala, 2022). One of the few anomalies is the country of Bangladesh, which has made significant progress towards developing a national Loss and Damage mechanism designed around a centralized framework for accounting, coordinating, disbursing finance, and evaluating programs that address climate-related losses and damages (Haque et al., 2019). The gap in national Loss and Damage scholarship is due in part to the nature of the international agenda, whose global scope doesn't explicitly facilitate its inclusion in national policy agendas.

Regardless, Roberts & Pelling (2018) suggest that Loss and Damage is set to have increasing meaning and value at the national scale given the distinctly national threats posed by climate change (loss of statehood, for example), which make addressing Loss and Damage a particularly urgent challenge for individual countries. Improving our understanding of national strategies that respond to climatic events can provide insight into different approaches to Loss and Damage globally, as well as potential synergies across levels of governance.

Given the dearth of research on Loss and Damage mechanisms at the national level, there are many outstanding questions about how individual countries approach the harms imposed by climate change within their national borders. In this paper, I explore 1) how climate-related losses and damages are addressed in South American country of Chile, a nation with no explicit Loss and Damage policy mechanism in place, and 2) whether and how elements of the global Loss and Damage agenda manifest within Chile's national-level climate policies. To do so, I conducted a textual analysis of five national-level climate policies in Chile, which serves as a fitting study location given the nation's current climatic and political contexts, which include severe ongoing drought and recent proliferation of national climate policies. This investigation is both timely and relevant given the IPCC AR6 projections, which reveal that global temperatures will continue to rise until at least mid-century, with changes in the earth's climate system- and associated climatic events- becoming more extreme in direct relation to warming (IPCC, 2021). Generation of knowledge surrounding national strategies to address climate harms—and the potential synergies of those strategies with the global Loss and Damage agenda—represent important steps toward a cohesive global approach to addressing loss and damage.

2.2 BACKGROUND

2.2.1 WHAT IS LOSS AND DAMAGE?

Loss and Damage exists today as a third pillar of international climate policy alongside the adaptation and mitigation agendas of the UNFCCC. The term Loss and Damage has come to represent both a policy mechanism and the sum of impacts inflicted by climate-related events (Boyd et al., 2021). Considering the dual nature of the term and

following van der Geest & Warner (2020), I use the lower case ‘loss and damage’ to refer to the actual harms resulting from both extreme and slow-onset climatic events and the upper case ‘Loss and Damage’ to refer to the associated debate over policy strategies to address losses and damages. A short history of Loss and Damage policy and the challenges inherent in its implementation follow below.

2.2.2 THE EVOLUTION OF LOSS AND DAMAGE

Conceptually, Loss and Damage first emerged in 1991 as a proposal from the Alliance of Small Island States (AOSIS) (Broberg & Romera, 2020). The proposal, which called in part for an international insurance pool to support low-lying nation states affected by sea level rise, represented the beginning of ongoing debates about responsibility for climate-related harms (Broberg, 2020). Since 1991, the concept of Loss and Damage has slowly gained traction, first appearing in a negotiated UNFCCC decision (the Bali Action Plan) in 2007, then continuing to inclusion in the 2010 Cancun Adaptation Framework and the 2012 Doha Gateway decision (Kreienkamp & Vanhala, 2017; Vulturius & Davis, 2016). Loss and Damage was first established as a dedicated policy mechanism at the 19th conference of parties (COP-19) in Poland, under the Warsaw International Mechanism for Loss and Damage (WIM), and was formally enshrined in policy at COP-21 under the 2015 Paris Agreement (Calliari, 2018). The agenda has since been highlighted in the establishment of the Santiago Network for Loss and Damage at COP-25 in Madrid (2019) and recently at COP-26 in Glasgow (2021) where, although the issue was squarely in the spotlight, national monetary contributions were minimal and a much-anticipated finance facility dedicated to Loss and Damage was never established (Mountford, 2021; Pill, 2022). Although it can be argued that strategies to avert and minimize loss and damage are currently being undertaken globally, there are many who claim that actual actions addressing climate-related losses and damages are still lacking (Pill, 2022).

2.2.3 DEFINITIONS, PERCEPTIONS & CHALLENGES

Although Loss and Damage has gained increasing attention in both research and policy circles in recent years (Calliari, 2018; Tschakert et al., 2019), it remains a poorly

defined concept, with no officially agreed-upon definition established within the literature (Boda et al., 2021; Boyd et al., 2017) or by the UNFCCC itself (Vanhala et al., 2021). Additionally, some studies have distinguished between the terms “loss” and “damage,” framing losses as permanent or irreversible and damages as reversible (Doelle & Seck, 2019; McNamara & Jackson, 2019; Tschakert et al., 2019; van der Geest & Warner, 2020), while others, particularly in climate negotiations, frame the two as a single concept (Broberg, 2020b; Fankhauser et al., 2014).

The absence of a clear definition has spurred numerous debates across the literature with regard to what Loss and Damage is, and how the established Loss and Damage agenda relates to other international climate policy objectives, such as mitigation and adaptation (Boyd et al., 2017) leading to a variety of challenges regarding its implementation. One of the most significant implementation challenges for WIM is how to address non-economic loss and damage, or NELD, which includes the elements of loss and damage that defy quantification or monetization and represents an urgent priority of the WIM Executive Committee (Serdeczny et al., 2016). Combined with a lack of information on NELDs globally (Scown et al., 2022), the difficulty in anticipating and estimating NELDs makes related planning and policy formation extremely challenging (Serdeczny et al., 2016). Another challenge to implementation lies in the differential strategies necessitated by various types of climatic events. Strategies to cope with acute events (i.e., hurricanes), for example, are much different from those needed to cope with slow-onset events like sea level rise (Huggel et al., 2013). Finally, questions of responsibility are hotly contested in Loss and Damage negotiations, which are frequently torn between demands for compensation for climate harms and the reluctance of developed nation parties to consider actions addressing Loss and Damage outside of an adaptation framework (Schinko et al., 2019). Event attribution science, which focuses on attributing the increased severity of individual weather events to the presence of anthropogenic greenhouse gas emissions, has become central to this debate, however developed nations resisting notions of liability frequently label them a distraction from adaptation and mitigation efforts (Jézéquel et al., 2018). Despite the contentious nature of the attribution subject, however, James et al. (2014) point out that the question of causality cannot be ducked forever.

2.2.4 THE NATIONAL MECHANISMS GAP

Global Loss and Damage strategies have been studied with increasing frequency within climate policy research circles (Tschakert et al., 2019), however this relative abundance of studies highlights a glaring void: there's a comparative paucity of knowledge about how national-level actors and institutions approach the Loss and Damage problem (Vanhala et al., 2021). Although many nations may have policies in place which address some portions of the global Loss and Damage agenda, these national policies are generally framed differently; couched as adaptation or disaster risk reduction (DRR) rather than Loss and Damage explicitly. The most notable exception to the national mechanisms gap is the country of Bangladesh, where a proposed framework that works towards addressing loss and damage is under development (Haque et al., 2019). The nation's direct actions toward addressing loss and damage via collaboration across government ministries and disaster response platforms have been the subject of several publications (Haque et al., 2019; Huq et al., 2016). These recent studies on Bangladesh may represent the leading edge of what Calliari & Vanhala (2022) describe as a "national turn" in research on Loss and Damage, in which an emerging body of scholarship explores how the Loss and Damage concept is understood among national-level policy actors. This body of work collectively suggests the utility of empirical evidence for understanding how Loss and Damage as a governance challenge originating in the global climate regime is translated into national policy processes (Calliari & Vanhala, 2022; Roberts & Pelling, 2018; Vanhala et al., 2021).

The impacts of climate change are, by their nature, political and highly variable across biophysical scales (Adger et al., 2005; Hall & Persson, 2018; Javeline et al., 2014 as cited in Vanhala et al., 2021). These impacts present a distinct threat to individual nations and their institutions, impeding national development strategies while simultaneously and paradoxically requiring implementation of development strategies to address them (Roberts & Pelling, 2018). Accordingly, an improved understanding of how national actors are working to address climate harms is an important piece of the global Loss and Damage puzzle. Many questions remain about how to address the growing and highly disproportionate impacts of climate change across geographies and levels of governance. These outstanding questions render the national mechanisms knowledge and

implementation gap a critical one to bridge, highlighting the need to understand how losses and damages, accelerating in step with anthropogenic climate change, will be addressed not only globally, but nationally and regionally as well.

2.2.5 STUDY “LOCATION”

Several characteristics make Chile an ideal focal subject for an exploration of national Loss and Damage mechanisms. Under criteria developed by the UNFCCC, Chile is a country highly vulnerable to climate change, encompassing low-lying coastal areas, arid and semi-arid zones, forest areas, areas prone to drought, and mountain ecosystems within its boundaries, among many others (Gobierno de Chile, 2014). Much of Chile has experienced an uninterrupted sequence of dry years since 2010, with mean rainfall deficits of 20–40%. This ‘Megadrought,’ as it has been termed, is Chile’s longest drought event on record, with few analogues in the last millennia (Garreaud et al., 2020). The Center for Climate and Resilience Research (2015) in Chile estimates the contribution of anthropogenic forcing to the Megadrought to be 25%, indicating that a large fraction of the Megadrought’s severity would not be actualized without anthropogenic climate forcing. In addition, Chile appears to be at a watershed moment regarding its national strategies to confront climate change. The country has recently drafted or renewed several national-level climate policies, and a draft framework climate change law is currently under discussion in Congress (Gómez de Cuenca, 2021). Additionally, In October of 2020 and in the wake of unprecedented social unrest, a large percentage of Chileans (nearly 80%) voted in favor of a referendum to draft a new national constitution (Berasaluze et al., 2021). Drafting of the new constitution, combined with the election of progressive candidate Gabriel Boric to the presidency, is expected by some to produce a shift away from Chile’s neoliberal past² and towards a serious reckoning with climate change and its associated environmental concerns (Casals, 2022). Given the current climatic and political context in Chile, the country appears to have both the motivation (general vulnerability to climate change, successful attribution of the Megadrought) and

²Chile’s current social and physical landscapes have been shaped by a complex political economic history which resulted in extractive resource policies designed to spur rapid economic expansion (Carruthers, 2001; Latta & Aguayo, 2012). A full account of Chile’s environmental history is beyond the scope of this paper., however a basic understanding of this history will provide readers with valuable context.

the means (new and forthcoming climate policies, constitutional reform) to join a roster of nations crafting strategies to confront loss and damage within their borders. This combination provides a unique and timely opportunity to examine current policy responses to climate change, and potentially loss and damage, at the national level in Chile.

2.3 THEORETICAL FRAMEWORK

As numerous studies have affirmed, Loss and Damage is a poorly defined concept within the UNFCCC and beyond (Boda et al., 2021; Boyd et al., 2017). The umbrella of Loss and Damage within scholarly literature encompasses a wide range of policy issues, spanning domains including disaster risk management while also engaging with the limits to adaptation (Vanhala et al., 2021). Contrasting Chilean climate policies with the global Loss and Damage agenda, therefore, means capturing the range of issues that fall under this broad umbrella. After considerable literature review, no clear framework exists for evaluating explicit, potential, or implicit Loss and Damage mechanisms in national-level climate policy. Thus, I rely here on the Loss and Damage literature to design a comprehensive framework for this analysis. To cast the necessary wide net, I assembled essential elements of four policy domains that comprehensively define the global Loss and Damage agenda (Table 2.1). From these, I created an analytical framework to apply to the context and content of national climate policy documents to identify and compare critical elements of the global Loss and Damage agenda at the national level.

Table 2.1: Categories, descriptions and key references for the theoretical framework used to assess Chilean climate policies for similarity to the global Loss and Damage policy agenda

Category	Description	Key References
Event attribution	Event attribution science leverages climate models under various greenhouse gas scenarios to determine the probability of a climatic event exceeding a certain intensity. Attribution of losses and damages to climate change requires attribution of weather events to anthropogenic climate forcing and subsequent attribution of losses and damages to the weather event in question. This has been a contentious subject in Loss and Damage negotiations given its frequent association with principles of liability and compensation. Given the mandate of the UNFCCC to address anthropogenic interference with the climate system, however, attribution is of high relevance to both the UNFCCC and the WIM.	Huggel et al. (2016) James et al. (2014) Otto et al. (2018) Philip et al. (2020) Stott et al. (2016)
Losses and damages Identifiers: Losses and damages (general), NELD, Slow-onset events	Refers to recorded losses and damages resulting directly from a climate change-attributable event. This may include climate-related harms referred to as "beyond" or "exceeding limits" to adaptation, per the separation of the Loss and Damage and adaptation agendas under the 2015 UNFCCC Paris Agreement. Economic and non-economic losses and damages are both explicitly considered by the WIM and may be alternately referred to as tangible and intangible losses and damages. The WIM also differentiates between losses and damages from slow onset vs. acute events.	Serdeczny et al. (2016, 2018) Tschakert et al. (2019) UNFCCC Guide to Loss and Damage (2020)
Risk management Identifiers: risk management (general) risk assessment, risk reduction, risk transfer, risk retention	Risk is generally understood as a function of an event's probability and consequences, as well as exposure and vulnerability of assets. The WIM Excom identifies comprehensive risk management (CRM) as one of its primary functions relative to addressing Loss and Damage, and outlines the strategies encompassed therein as risk assessment, risk reduction, risk transfer and risk retention. Much of the scholarly Loss and Damage literature supports the relevance of such comprehensive risk management strategies in addressing Loss and Damage.	Huggel et al. (2013) Kehinde (2014) WIM Compendium on CRM (2019)
Social development Identifiers: Education, Gender equity, Health, Poverty reduction, Vulnerability	The five-year workplan of the WIM ExCom identifies the need to address the disproportionate vulnerability of populations due to their geography, socioeconomic status, livelihood, gender, age, indigenous or minority status or disability; and the ecosystems that they depend on. The WIM's focus on addressing disproportionate vulnerability is reflected within the scholarly Loss and Damage literature, within which Loss and Damage has been framed as the "failure of sustainable development." The "human development" approach currently represents the most advanced perspective on sustainable development and is identified as relevant for informing the development and implementation of Loss and Damage policy. This approach focuses on the most vulnerable in society and on freedoms to achieve desired capacities well-being. This approach employs a complex dashboard of indicators to assess wellbeing, including but not limited to achievements in education and health, economic performance, environmental quality, and political freedom.	Aleksandrova & Costella (2021) Boda et al. (2020) Boda et al. (2021) Roberts & Pelling (2018)

These Loss and Damage elements provide the basis for a set of framework categories, related identifiers, and associated search terms with which to assess each Chilean policy. The framework contains four primary categories: event attribution, losses and damages, risk management, and social development. Under these primary categories are a total of 13 identifiers, which serve to refine the analysis, capturing thematic material within the policy documents that relates to each primary category. Collectively, the framework and categories address a gap in policy research captured by Thomas et al. (2020), who note that framing Loss and Damage research in the language of the UNFCCC may help foster a more cohesive understanding of Loss and Damage, while making scholarship relevant for the UNFCCC, the WIM Executive Committee, and the 2023 Paris Agreement global stocktake. Below, I develop each framework category independently using the relevant supporting literature.

2.3.1 EVENT ATTRIBUTION

One of the thorniest questions in global Loss and Damage negotiations revolves around whether and/or how to establish responsibility for the impacts of climate-related events by first attributing an event's severity or probabilistic variation to anthropogenic forcing (James et al., 2014; Stott et al., 2016). This determination is central to the Loss and Damage debate, as the losses and damages addressed by the WIM are specifically those resulting from anthropogenic forcing; if an event's severity or probability is not thus attributed, by definition it cannot cause losses and damages. The emerging field of event attribution science makes addressing these questions more feasible (Swain et al., 2020), however many developed-nation parties to the UNFCCC approach attribution with reticence, often associating it with potential responsibility, blame, and eventual compensation (Schinko et al., 2019). Although the current framing of Article 8 of the Paris Agreement provides no basis for liability or compensation, the question of causality (and thus responsibility), as James et al. (2014) point out, can't be avoided forever. Considering the UNFCCC's mandate to tackle anthropogenic interference with the climate system (James et al., 2014), attribution will remain a central consideration of the WIM and is therefore an essential component of this framework. In the analysis process, I

reviewed each policy for direct references to attribution studies or explicit connections between losses and damages and extreme events *via* attribution studies.

2.3.2 LOSSES AND DAMAGES

In assessing Chile's policy responses to climate change for similarities to the international Loss and Damage agenda, it was necessary to explore whether actual climate-related harms are discussed in terms akin to those employed by the UNFCCC. This objective led to three specific identifiers under the losses and damages framework category, as well as a general losses and damages identifier which captured content relevant to climate harms that did not fit within the specific identifiers

The first specific identifier concerns NELDs, which, as noted previously, are at the forefront of work under the WIM ExCom and represent the body's fourth action area (Huggel et al., 2019). Within this action area, the WIM identifies three categories of NELD: individual, societal, and environmental (UNFCCC, 2020). NELD entails losses of things or values not traded in markets that nonetheless are highly relevant to those affected (Boyd et al., 2021). These material and immaterial losses and damages include but are not limited to loss of human life, biodiversity, cultural heritage, traditional knowledge or place identity (Serdeczny et al., 2016; Serdeczny et al., 2018). Given the centrality of NELD to the work of the WIM ExCom, this identifier aims to capture policy content regarding non-quantifiable harms which fit within the WIM's three identified NELD categories.

Additionally, global Loss and Damage policy grapples with how to address impacts resulting from slow onset as well as extreme events. Slow-onset events require different response strategies than do extreme events, being less easily addressed through strategies such as traditional insurance (Huggel et al., 2013). Slow-onset events comprise one of the workstreams of the WIM, under which the ExCom aims to better understand and enhance capacities to address them, particularly at regional and national levels (UNFCCC, 2020). As such, the inclusion of this identifier captures policy content related to this focal area of the WIM, looking specifically for recognition of the eight types of slow-onset events identified by the ExCom (UNFCCC, 2020).

Finally, although the relationship of the Loss and Damage and adaptation agendas is contested within the scholarly literature (Boyd et al., 2017; Broberg, 2020), their explicit separation under the 2015 Paris Agreement speaks to a clear distinction between the agendas under the UNFCCC (Calliari & Vanhala, 2022). The establishment of separate roles for adaptation and Loss and Damage has played out against the backdrop of a growing body of literature exploring the limits of adaptation (Adger et al., 2009). Considering the UNFCCC distinction between the agendas and considering the expansion of literature supporting the possibility of climate-related impacts which surpass adaptation capabilities, the final identifier is intended to capture policy content in which climate-related harms are discussed as beyond adaptation, or in any way exceeding Chile's national capacities to adapt.

2.3.3 RISK MANAGEMENT

Significant tensions frequently arise between actors from developed and developing nations over how losses and damages should be addressed. According to Mechler & Schinko (2016), although many developed nations agree on the need to help vulnerable populations suffering from climate harms, many are also unwilling to consider notions of liability. As such, key negotiation stances lean towards liability and compensation for developing nations, and disaster risk management and insurance for developed nation parties (Schinko et al., 2019). Developing countries consistently argue that work on WIM ExCom's third action area ('enhancing action and support, including finance, technology and capacity building') is eclipsed by work on the first action area, which concerns enhancing knowledge and understanding of comprehensive risk management approaches (Vanhala et al., 2021). Against this backdrop, Roberts & Pelling (2018) emphasize the need for comprehensive risk management frameworks with sustainable development at their core, addressing the root causes of vulnerability and building resilience to limit future loss and damage to human societies. Per the recommendation of Thomas et al. (2020) that more Loss and Damage research be framed in the language of the UNFCCC, this category is designed around the UNFCCC framing of Comprehensive Climate Risk Management (WIM ExCom, 2019). The WIM CCRM compendium outlines four sub-categories including risk assessment, risk reduction, risk

transfer and risk retention. In searching each policy for risk management content relevant to Loss and Damage, I aim to determine how Chile’s strategies regarding climate risk align with the four categories of Comprehensive Risk Management outlined in the workplan of the WIM. The five identifiers in this category reflect those of the WIM compendium and include a “general” identifier to capture content referencing risk management generally.

2.3.4 SOCIAL DEVELOPMENT

Although extreme or slow-onset climate events may be superficially responsible for incurred losses and damages, much recent scholarship points to the necessity of addressing the underlying factors that exacerbate their severity and predispose certain people or groups to disproportionate harm (i.e., vulnerability, structural inequalities, etc.) (Aleksandrova & Costella, 2021; Gach, 2019; Roberts & Pelling, 2018). The necessity of addressing disproportionate vulnerability to climate change is stated often within reports and other publications of the WIM (UNFCCC, 2020; WIM ExCom, 2017, 2019). This broad focus on uneven vulnerability is refined within the Executive Committee’s rolling five-year workplan, the cross-cutting considerations of which require that the body take into account not only *countries* vulnerable to climate change, but also *populations* vulnerable given their unique geographies, socioeconomic status, livelihoods, gender, age, indigenous or minority status or disability; and the ecosystems on which they depend (WIM ExCom, 2017).

A growing body of scholarship echoes this focus on vulnerabilities within the WIM workplan, emphasizing the importance of social protection policies for addressing disproportionate climate-related losses and damages (Aleksandrova & Costella, 2021). Much of this academic literature specifically notes the relevance of sustainable development to the advancement of Loss and Damage in both theory and practice (Aleksandrova & Costella, 2021; Boda et al., 2020; Roberts & Pelling, 2018). Losses and damages have been conceptualized by some, for example, as the global failure to maintain a sustainable development (Boda et al., 2020), while others suggest that Loss and Damage represents a “clarion call” for a revision of inequitable and unsustainable development priorities and mechanisms (Roberts & Pelling, 2018, p.9). Boda et al.

(2021) further suggest that *specific* approaches to sustainable development may help inform Loss and Damage research. In particular, the “human development” approach, which centers on the freedoms people have to achieve a certain level of well-being and identifies the most vulnerable populations as priority targets for Loss and Damage governance actions, represents a valuable perspective to inform strategies to address losses and damages (Boda et al., 2021). The approach leverages a complex dashboard of indicators to assess wellbeing, including but not limited to achievements in education and health, economic performance, environmental quality and political freedom (Chiba et al., 2018 in Boda et al., 2021), aligning closely with the priorities of the ExCom in regard to addressing underlying vulnerabilities to climate change. Coupled with the focus of the WIM on addressing harms to the world’s most vulnerable, the broad consideration of human development actions outlined by Boda et al. (2021) provided the basis for this social development category.

2.4 METHODS

Data for this analysis included five national-level climate laws and policies in Chile (Table 2.2): National Climate Change Action Plan (NCCAP); Nationally Determined Contribution (NDC); National Adaptation Plan (NAP); National Policy/Plan for Disaster Risk Reduction (DRR Policy/Plan); and the Draft Framework Climate Bill (FWB) which was released for public comment in 2019 and is currently under debate by the Chilean Congress.

Collectively, the selected policies in their untranslated (Spanish) forms totaled 826 pages in length and were obtained from the government of Chile, or the UNFCCC in the case of the NDC. Of the selected policies, only the NDC was available in English. I chose Google Translate to supplement my remedial Spanish for the purpose of translation, converting the remaining four policy documents in this manner.

Table 2.2: Titles and descriptions of national-level Chilean climate policies analyzed

Policy	Date	Description
National Climate Change Action Plan (NCCAP)	2017	The plan is aimed at the effective implementation of measures that have been identified to adapt to climate change and to reduce the vulnerability of the country
Nationally Determined Contribution (NDC)	2020	The updated NDC reflects Chile’s contributions to addressing climate change, this time with the addition of a “social pillar” to the historical categories of mitigation and adaptation. This NDC update lays out Chile’s path to becoming the first developing nation to commit to carbon neutrality by 2050.
National Adaptation Plan (NAP)	2014	The NAP is the "articulating instrument" of the Chilean public policy on adaptation to Climate Change. It provides the guidelines for adaptation and provides the operational structure for the coordination and coherence of the actions across the different sectors and levels of territorial administration.
National Plan & Policy for Disaster Risk Reduction (DRR)	2020	The National Policy and its respective National Strategic Plan 2020-2030 constitute the guiding instruments in the country in matters of Disaster Risk Management (DRM), defining objectives, actions, goals, deadlines and involved national actors, through which they will be designed and they will execute the initiatives aimed at Disaster Risk Reduction (DRR) within the framework of sustainable development to which Chile aspires.
Draft Framework Climate Change Bill (FWB)	Forthcoming	The purpose of the bill is to create a legal framework that assigns specific responsibilities for the implementation of mitigation and adaptation measures to climate change. It seeks to strengthen and give continuity to policies, plans, programs and actions on climate change, with a long-term view which transcends the government of the day.

The analysis process consisted of two stages: a keyword search followed by a qualitative analysis of each national-level policy. The keyword search analysis, conducted first, entailed a simple term-based search of all five documents, allowing me to identify overall trends and frequency of search term occurrences. The qualitative analysis combined inductive and deductive coding, allowing me to capture relevant search terms not initially identified, as well as related policy content. Together, the two processes provided a thorough understanding of how each framework category is represented in Chilean policy.

To determine the initial set of keywords for each identifier (Table 2.3), I reviewed relevant UNFCCC and scholarly literature to identify a set of terms frequently associated with each policy domain of the Loss and Damage framework. These terms provided the initial basis for the keyword search, while the subsequent qualitative analysis provided an opportunity to refine the keyword list, adding relevant terms as they occurred during a thorough a detailed reading of each text. Terms identified inductively as part of the qualitative analysis are bolded in Table 2.3.

Table 2.3: List of keyword search terms by framework category. Terms not bolded were identified prior to analysis using UNFCCC documents and scholarly Loss and Damage literature. Terms identified inductively during the qualitative analysis process are in bold font.

Framework Category	Identifier	Search Terms
Event Attribution	<i>N/A</i>	"Attribut-," "Caused by"
Losses and Damages	<i>Losses and damages (general)</i>	"Loss," "Damage," "Loss and damage/damage and loss," "Losses and damages/damages and losses," "Adverse effects," "Impact-," "Disproportion-," "Projected /expected impacts," "Projected/expected effects," "Irreversib-"
	<i>Non-economic loss and damage</i>	"Non-economic," "Intangible," "Human li-," "Mobility," "Death" , "Biodiversity loss/loss of biodiversity," "Spiritual-," "Religio-," "Heritage," "Identity," "Value," "Well-being," "Emotion-," "Migration," "Mental health," "Quality of life"
	<i>Slow-onset events</i>	"Slow onset," "Desertification," "Biodiversity loss/loss of biodiversity," "Degradation," "Glaci-," "Acidification," "Sea level," "Salinization," "Rising temperatures," "Warming"
Risk Management	<i>Risk Management (General)</i>	"Risk Management," "DRM"
	<i>Risk assessment</i>	"Risk assessment," "Map-," "Assess-," "Analy-"
	<i>Risk reduction</i>	"Risk reduction," "Reduc-," "DRR," "Structural," "Non-structural," "Awareness," "Education"
	<i>Risk transfer</i>	"Risk transfer," "Insurance," "Financial protection"
	<i>Risk retention</i>	"Risk retention," "Fund," "Financial protection"
Social Development	<i>Education</i>	"Education-"
	<i>Gender equity</i>	"Gender," "Gender equity," "gender perspective," "women"
	<i>Health</i>	"Health," "health care," "health system"
	<i>Poverty</i>	"Poverty," "Poor"
	<i>Vulnerability</i>	"Vulnerab-"

During the keyword search, I text-searched each policy document for the terms I had selected based on UNFCCC documents and relevant academic literature. I examined all term occurrences within each policy closely, reading each in context to determine its relevance to its respective identifier and FW category. Many terms were necessarily broad in nature or frequently used (i.e., "vulnerab-" under the social development identifier or "assess-" under the risk assessment identifier). Some terms were additionally present in multiple categories given the potential for dual meanings/uses. Therefore, a close contextual reading ensured that each term counted was used in a manner that made

it relevant to its identifier. I omitted terms used in ways unrelated to the Loss and Damage context (i.e., “damage” in reference to automobile accidents), as well as those occurring within the table of contents, section headers, and government ministry and document titles, as these provided little to no context with which to assess the term’s relevance. Search terms occurring on their own *and* within part of another term were counted only as part of the larger term (i.e., “loss” occurring within “loss and damage” was only counted under “loss and damage” and not under the separate term “loss”).

The qualitative analysis, which followed the keyword search, had both deductive and inductive components. During this process, I read each policy document thoroughly, deductively coding relevant text to each framework category and respective identifiers using NVivo 11 to organize my workflow. This framework-guided analysis served as a broad net to capture Loss and Damage content within each policy document. In addition, I also coded inductively during this process, stopping at keywords and other occurrences of framework-relevant policy content, evaluating the text and noting whether it contained important terms not already captured under the framework categories. If additional terms relevant framework arose during this qualitative process, I first revisited the relevant UNFCCC documents and academic literature to decide whether that term was appropriate and necessary to include within the search term list. If so, I added the term to the search term list and captured it within the total term counts and frequencies. As an example, "financial protection," although not a term not typically used in UNFCCC descriptions of risk transfer/retention and therefore not included in my initial term list, is used to collectively reference/encompass these strategies in Chilean policy. As such, I added it as a search term and captured all relevant occurrences within the final counts/frequencies. In this way, the combination of the keyword search and qualitative analysis comprised an iterative process, allowing for a continual revision of the search terms and a robust understanding of how each framework category is addressed across these five Chilean policy documents.

After conducting the keyword search and qualitative analysis, I extracted coded text from the database I set up using NVivo software and selected quoted text to better interpret how each framework category is addressed in Chilean policy relative to the global Loss and Damage agenda. I translated keyword occurrence frequencies of terms

within each category into percentages relative to the total word count of the combined documents for a relative comparison of the salience and prevalence of a topic within a document.

2.5 RESULTS & DISCUSSION

From this analysis, evidence of all framework categories (albeit uneven across identifiers) was present within the Chilean climate policy documents—with the exception of event attribution. This distribution of content across the framework was surprising, given the centrality of attribution to the global Loss and Damage agenda and surrounding discourse. The results additionally reveal the notable recognition of several policy domains linked to UNFCCC conceptualizations of Loss and Damage and the striking omission of others. Overall, although the results highlight some Loss and Damage-relevant thinking among Chilean policymakers, the evidence also suggests some conceptual divergences from the global agenda. As a result, it seems that the existing similarities to the global agenda may at present not constitute a national Loss and Damage mechanism explicitly identified or not.

A breakdown of results in relative frequencies of search terms for each framework category follows below (See Table 2.4). In the discussion of each category, I provide comments on potential synergies between Chile’s national climate policies and the global agenda that may prove useful as Chile strives to address the impacts of climate change occurring within its own borders.

2.5.1 EVENT ATTRIBUTION

References to attribution in the five analyzed policy documents are extremely sparse. Explicit references to event attribution studies all focus on past investigations of the Megadrought, which linked approximately 25% of continued drought severity to anthropogenic forcing (Garreaud et al., 2020). Given the negligible representation of this category relative to others within the framework, the centrality of attribution to the global Loss and Damage agenda does not appear to be reflected within the Chilean policies analyzed. This lack of content may simply indicate that few studies have pursued

attribution of climatic events in Chile to date, however it also brings the relevance of this Loss and Damage policy domain for Chile and other national actors into question.

Table 2.4: Relative frequency of search terms by framework category

Framework Category	Identifier	Identifier Totals	Framework Category Totals	Relative Frequency of Search Terms by Category
Event Attribution	<i>N/A</i>	N/A	4	0.34%
Losses and Damages	<i>Losses and damages (general)</i>	353	510	36.90%
	<i>Non-economic loss and damage</i>	87		
	<i>Slow-onset events</i>	70		
Risk Management	<i>Risk Management (General)</i>	136	475	32.30%
	<i>Risk assessment</i>	81		
	<i>Risk reduction</i>	238		
	<i>Risk transfer</i>	11		
	<i>Risk retention</i>	9		
Social Development	<i>Education</i>	107	444	30.50%
	<i>Gender equity</i>	46		
	<i>Health</i>	77		
	<i>Poverty</i>	14		
	<i>Vulnerability</i>	200		

It is important to consider that Chile may stand to gain very little from focusing attention on attribution within its national climate policies. Lahsen et al. (2020) suggest that greater attention to the politics of place is needed before assuming that centering climate change discourse on attribution is the most strategic means of achieving national goals of climate action and disaster preparedness. The authors emphasize the importance of contextual understanding when evaluating framing choices regarding disasters and climate change, noting that it cannot necessarily be assumed that knowledge or conviction regarding the reality of climate change warrants emphasis on its role in disasters, even where attribution studies might find such a role (Lahsen et al., 2020). What benefits do the nation and its people gain from the knowledge that a climatic event is attributable? Losses and damages resulting from climatic events, like those undoubtedly resulting from the Megadrought, will continue to occur whether Chile’s policymakers emphasize attribution in policy or not. The nation’s policymakers do not appear to be grappling with whom to blame for losses and damages, as is the trend in global Loss and Damage discourse. Instead, the country, as with most countries, will

need to simply respond, and attempt to avoid future losses to the greatest extent possible. Further exploration of the contextual factors underlying Chile's approach to attribution, if desired, might include Congressional records, hearings, and discussions debating disaster response to extreme and slow-onset climatic events, as well as Ministry policies on disaster responses to specific kinds of events.

Finally, an emphasis on attribution in policy might counterintuitively disguise the root causes of loss and damage, focusing attention on global politics and climate processes while underlying vulnerabilities within Chile's borders continue predisposing portions of the country's population to disproportionate harm. Lahsen & Ribot (2022) describe the calculus of leveraging attribution as a moral and strategic challenge for national actors, pointing out that attribution-centric framing of climate extremes can "erase from view—and, thus, from policy agendas—the very socio-economic and political factors that most centrally cause vulnerability and suffering in weather extremes and disasters" (Lahsen & Ribot, 2022, p.1). Significant space is dedicated within these five policies to recognition of inequities and vulnerabilities that predispose certain populations in Chile to climate-related harm. Given this heavy focus on vulnerabilities to climate change and associated risk management efforts (discussed below), the national priorities regarding framing of climatic events may be oriented *away* from attribution in strategic favor of other, more immediately relevant focus areas.

In the future, it is possible that attribution will play a more significant role in Chile's national climate strategies than it does at present. As climatic events and related impacts linked to anthropogenic forcing continue to intensify, national policymakers may be increasingly incentivized to seek compensation for losses and damages from sources like multinational corporations or foreign governments. For the moment, however, it appears that the country of Chile and its policymakers are grappling with questions of how best to endure the worst effects of climate change and prepare the country and its people for the future. The finding in this category underscores the suggestion of Lahsen et al. (2020) that a deeper examination of attribution's centrality to global policy processes (i.e., the WIM) and is needed. Global-level assumptions of attribution's universal relevance for individual nations, the authors suggest, is ripe for revision. Attribution may ultimately have real relevance only for answering questions of "who

pays?,” which, although important at the global scale, has less relevance for the climate strategies of individual nations.

2.5.2 LOSSES AND DAMAGES

“Losses and damages” was the most-referenced framework category by a slim margin. Considering the category’s identifiers, roughly half of the search terms occurred within the general losses and damages identifier. Content in this identifier provides some interesting insights into how climate-related harms are conceptualized in Chilean policy and how that conceptualization relates to the global Loss and Damage discourse. Policy content related to NELDs was the second most common identifier, followed by slow-onset events.

2.5.2.1 Losses and damages (general)

Within this identifier are three notable themes regarding Chilean policymakers’ conceptualizations of climate-related harms. The first of these is the disproportionality of climate change impacts, which reflects a central component of the global Loss and Damage agenda. The WIM’s focus on disproportionate climate impacts on developing nations is reflected in the NAP, which states that:

[g]lobal warming is already underway and adaptation strategies are urgently required, especially for developing countries, which are already disproportionately feeling the effects, and putting their economic progress and food security at risk (Gobierno de Chile, 2014, p.12).

In addition to the recognition of national disproportionality, the disproportionality of climate impacts on local communities and municipalities is also noted:

[l]ocal communities and municipalities... will suffer the direct impacts of climate change, and their ability to respond to such impacts is essential to reducing the damage and losses caused by extreme events (Gobierno de Chile, 2020a, p.18).

A second theme present within the Chilean policies’ discussion of climate harms is the potential irreversibility of climate impacts, which represents one of the cross-cutting considerations of the WIM’s five-year workplan. According to the NCCAP:

[m]ore and more voices are raised to warn about Climate Change, the greatest challenge facing humanity: because of its devastating effects, because of its

planetary implications, and because we are talking about damage, mostly irreversible (Gobierno de Chile, 2017, p.8).

Within global Loss and Damage discourse, “loss” is typically conceptualized as permanent or irreversible, while “damage” is understood to be reparable (Schinko et al., 2019). Given the above excerpt from the NCCAP, this distinction may not be perfectly reflected within Chilean policy, however recognition of the irreversibility of some climate impacts represents an alignment with the conceptualization of loss and damage under the WIM.

Finally, there is a notable *absence* of policy content in which climate-related harms are conceptualized as ‘beyond adaptation.’ This suggests limited recognition by Chilean policymakers that the impacts of climate change are currently exceeding (or will exceed in the future) the nation’s capacity to adapt to them. This is a highly salient finding, as losses and damages are conceptualized under the UNFCCC specifically as the residual harms that occur *once adaptation capacities prove insufficient* (James et al., 2014). The preamble of the WIM itself acknowledges that climate-related loss and damage “includes, and in some cases involves more than, that which can be reduced by adaptation” (UNFCCC, 2014, p.6). Given the prolonged Megadrought and other climate extremes affecting the country, Chile is undoubtedly experiencing climate change-attributable losses and damages, making the relative absence of “beyond adaptation” discussion both notable and concerning. The DRR Plan acknowledges, for example, the increased frequency and intensity of extreme climatic events in Chile (including the Megadrought), which it notes resulted in 15 Decrees of Water Scarcity from the General Water Directorate, affecting 129 communes across the country in 2019 (Gobierno de Chile, 2020b). This highly specific recognition of harms resulting from climate change, paired with the absence of discussions of impacts beyond adaptation, suggests that Chilean policymakers diverge significantly from the UNFCCC perspective on this matter, potentially aligning more closely with the last of the typologies suggested by Boyd et al. (2017), in which mitigation and adaptation are considered sufficient for addressing climate-related losses and damages. One excerpt from the NCCAP may affirm this:

[l]eft unchecked, climate change will increase the likelihood of serious, widespread and irreversible impacts on people and ecosystems. However, there are options for adaptation to climate change and with rigorous mitigation

activities, it is possible to ensure that the impacts of climate change remain at a controllable level, creating a clearer and more sustainable future (Gobierno de Chile, 2017, p.13).

The phrase “remain at a controllable level” appears to suggest, concerningly, that adaptation and mitigation are sufficient to keep climate impacts within some sort of status quo, and also that Chile’s policymakers believe they are still within the range of “control,” which, given the global nature of the climate crisis, is tenuously true.

2.5.2.2 *Non-economic loss and damage*

Search terms captured within the NELD identifier account for less than a quarter all references within the losses and damages category, however this result suggests a recognition by Chilean policymakers of climate impacts that extend beyond the monetarily quantifiable. Although terms like “non-economic” and “intangible” are never employed, climate-related impacts are referenced which fall into all three of the WIM ExCom’s designated areas of NELD: individual, societal, and environmental (UNFCCC, 2020). For example, the NAP suggests that:

[s]piritual and material fulfillment, which ultimately means the well-being of the population, can be affected by the impacts of climate change, either by reducing the availability or quality of water or food, in the safety of people, in employment, in the goods and services provided by ecosystems, or the negative effects on the health of the population (Gobierno de Chile, 2014, p.31).

This excerpt alone acknowledges potential climate-related impacts to individuals (reduced employment, food/water quality), society (health of the population), and environment (ecosystem services). The NCCAP additionally suggests that increases in the intensity of heat waves and extreme weather events will impact the mental health of the population (Gobierno de Chile, 2017), while the NDC outlines the importance of forest ecosystems to the identities and emotional balance of indigenous groups within the country—specifically noting the potential disruption of those values by climate change (Gobierno de Chile, 2020a).

In the NCCAP quote above, the proposed response centers on adaptation. the NAP asserts that the State’s role in protecting the population’s well-being is to:

prepare the country to adapt to climate change, so as not to compromise the current well-being and that of future generations... promot[ing], coordinat[ing], supervis[ing] and execut[ing] activities that increase the adaptive capacity of sectors exposed to climate change (Gobierno de Chile, 2014, p.31).

The same holds true across all five policies: adaptation and risk management are the primary proposed strategies of Chilean policymakers for addressing non-economic harms. For example, addressing the potential increase in climate-related human mobility is discussed by the NDC within the context of required increases in adaptive capacity (Gobierno de Chile, 2014). In the same vein, addressing the threats posed to cultural heritage by disasters (inclusive of climate-related disasters) is suggested by the DRR Plan to fall within the realm of risk assessment and reduction (Gobierno de Chile, 2020b). This framing of non-economic harms as addressable via adaptation and risk management appears to be very future-focused, with losses seemingly conceptualized as preventable harms to come; not as impacts likely occurring today.

Finally, although non-economic harms are recognized in the policy texts, there are also inconsistencies regarding how such harms are discussed relative to concepts of quantification. For example, the DRR policy differentiates non-economic (social) harms from more typically economic ones:

The possibility of frequently suffering significant damages and losses both in terms of human lives, as well as economic and financial ones, is one of the greatest challenges facing the country (Gobierno de Chile, 2020b, p.15).

On the other hand, the NCCAP appears to combine social and economic losses under GDP for purposes of quantification:

[it] is estimated that in Chile the environmental, social and economic losses in the country due to [climate change] could become significant, reaching 1.1% of GDP per year by the year 2100 (Gobierno de Chile, 2017, p.16).

This apparent discrepancy suggests that, although Chile acknowledges the occurrence of non-economic harms, the distinction between these and more monetarily quantifiable impacts is not yet common in Chilean climate change discourse. The apparent lack of distinction between economic and non-economic harms has implications for potential policy responses and their impact in turn on the Chilean population. Tschakert et al.

(2019) summarize these implications clearly, observing that continued prioritization of quantifiable harms in policy (as has been the historical trend) subverts the importance of non-economic ones, the loss of which, the authors note, are keenly felt and often highly impactful to individuals.

Although the policy content captured in this identifier omits some terms typically applied in UNFCCC discussions of NELD (“non-economic” and “intangible,” for example), non-economic climate harms are nonetheless acknowledged—a surprising finding, particularly given Chile’s political economic history. Serdeczny et al. (2018) note that NELDs often go unrecognized in national policy due to governance contexts historically dominated by liberal economic, market-based approaches to climate change. Given that Chile’s political economy in the wake of the Pinochet dictatorship has been largely driven towards market-based environmental policies (Latta & Aguayo, 2012), the recognition of non-economic climate impacts within Chilean policy is striking. But although non-economic harms are recognized, those harms appear largely conceptualized as problems for the future to be addressed through adaptation or risk reduction, with the additional challenge of inconsistency regarding policymakers’ approach to quantification of such harms.

2.5.2.3 Slow-onset events

In its guide to Loss and Damage, the WIM ExCom recognizes slow-onset events as including desertification, loss of biodiversity, land and forest degradation, glacial retreat, ocean acidification, sea level rise, ocean acidification, soil salinization and rising temperatures (UNFCCC, 2020). Although the term “slow-onset” never appears within any of the Chilean policy documents analyzed, seven of the eight slow-onset event types recognized by the WIM ExCom are referenced at least once, with salinization being the exception. This recognition of 7/8 of the WIM’s identified slow-onset event types may be due to the nation’s geographic context. Chile has an immense latitudinal span and encompasses a wide diversity of ecozones, including a 4,000-mile coastline. As a result, the slow-onset climatic events to which the country is exposed may be much greater than other nations.

2.5.3 COMPREHENSIVE RISK MANAGEMENT

The comprehensive risk management category was second in term frequency only to the losses and damages category. Comprehensive risk management strategies as conceptualized within the WIM are integral to minimizing, averting and addressing losses and damages. Taken alone, individual strategies such as risk transfer tools are insufficient for addressing the impacts of climate change, which leads to the WIM's emphasis on a holistic approach to risk management (Kehinde, 2014; WIM ExCom, 2019), inclusive of all the elements included in this category as identifiers. Policy content captured within this category, which align with the 2nd action area of the WIM ExCom, was spread largely across the general, risk assessment, and risk reduction identifiers, with very low term occurrence for risk transfer or retention.

2.5.3.1 Risk Assessment

The search terms within the risk assessment identifier occurred somewhat less frequently than those in the general risk management or risk reduction identifiers but are nonetheless well-represented. Risk assessment in the five policies analyzed manifests largely as understanding risks and vulnerabilities via systematic analysis processes, mapping, etc. The NCCAP highlights the need, for example, to:

characterize the vulnerabilities of the country's communes, their climate contexts, and their adaptation options in order to identify areas of heightened risk to extreme climatic events (Gobierno de Chile, 2017, p.113).

Although risk assessment content is well-represented, the WIM Compendium on CRM provides a potential explanation for its slightly lower representation relative to risk reduction despite the necessity of assessment *for* reduction: that risk assessment efforts like hazard and vulnerability mapping are time and resource intensive which, in a country as large and socially/geographically diverse as Chile, may present a significant hurdle to be overcome. The discrepancy between the two, as discussed below, may also be due simply to the global prevalence in risk management discourse of the Sendai Framework for Disaster Risk Reduction³, an agreement which Chile both helped formulate and subsequently adopted (Gobierno de Chile, 2020b). Additionally, it is possible that more

³ <https://www.undrr.org/implementing-sendai-framework/what-sendai-framework>

abundant, detailed content relative to risk assessment might be found elsewhere, such as in Chile's sectoral adaptation plans (not considered in this analysis) given their dedicated focus on climate preparedness for specific areas of national concern relative to climate change.

2.5.3.2 Risk Reduction

As suggested by this identifier's centrality to one of the policies analyzed, Chile's approach to climate risk management emphasizes risk reduction quite heavily. The national DRR Plan outlines the axes of the country's risk reduction strategy, which include understanding disaster risk, strengthening risk governance, planning and investing in risk reduction for resilience, providing an effective disaster response, and promoting sustainable recovery from such events (Gobierno de Chile, 2020b). Strategies for risk reduction as discussed within the national policies range from generating training programs to bolster DRR awareness to improving early warning, communication and evacuation systems (Gobierno de Chile, 2020b). These stated objectives roughly align with those of risk reduction as described under the WIM CRM Compendium, which defines risk reduction as consisting of systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (WIM ExCom, 2019). Regarding the slightly lopsided representation of terms within the risk assessment and reduction identifiers, it is frequently noted across many of the policies analyzed that Chile is both a signatory to the Sendai Framework for Disaster Risk Reduction and played a central role in the framework's development. As such, and given that risk reduction is a globally accepted, relatively non-contentious approach to minimizing damage from climate change and related events, it is not ultimately surprising that risk reduction is emphasized to a degree that somewhat overshadows related risk assessment strategies.

2.5.3.3 Risk Transfer & Retention

Search term occurrences within these two identifiers (combined here as they are frequently referenced in tandem) are surprisingly sparse, representing a small fraction of

those captured within the risk management category. As suggested in the WIM Compendium on CRM, risk transfer and retention are a key component of addressing climate-related losses and damages by absorbing impacts that result from frequent low intensity events and shifting the burden of financial consequences from more significant events (like prolonged drought or severe storms) which could be disastrous for the country (WIM ExCom, 2019). Kehinde (2014) notes that often, developing countries that experience climate-related loss and damage must divert funds from their national budget or obtain loans and donations from the international community. These strategies are not always timely or adequate, however, and insurance and other risk transfer/retention options present an avenue for reducing losses and damages by prompting payouts that help alleviate human suffering. Within Chilean policy, these strategies are frequently referred to as “financial protection,” defined as:

...the optimal combination of mechanisms or financial instruments for the retention and transfer of risk to be able to access timely economic resources... which improves the capacity to respond to the occurrence of disasters (minor events and recurrent and large low recurrence disasters) and protects the fiscal balance of the State (Gobierno de Chile, 2020b, p.137).

The details of financial protection are explored very minimally, however, with related measures mentioned only briefly under one of the DRR Plan’s strategic objectives.

Measures under this objective include:

[preparing proposals] for evaluating the application, scope, coverage and impact of... mechanisms and instruments for financial protection against disaster risk (Gobierno de Chile, 2020b)

Additionally, a single funding mechanism is specifically noted (but not elaborated upon) within the appendices of DRR Plan, which may constitute a mechanism for risk retention:

Law No. 20,444...creates the National Reconstruction Fund and establishes tax incentive mechanisms for donations made in the event of a catastrophe (Gobierno de Chile, 2020b, p.165).

The quotations above are accompanied by minimal context, making it difficult to understand the specifics or relevance of the proposed financial protection instruments or the National Reconstruction Fund. How will funds from these mechanisms be used/distributed? To what degree are (or will they be) relevant to alleviating human suffering in the wake of climatic events? These excerpts also suggest that examination of

additional sources may be necessary for a comprehensive understanding of Chile’s risk transfer and retention strategies for climate-related events. These strategies may be better represented and/or expanded upon in specific disaster or emergency response policies, or within legal frameworks related to disaster response.

Given Chile’s national vulnerability to climatic events (Gobierno de Chile, 2020a), the limited representation of risk transfer and retention strategies within the five national policies analyzed is concerning. Kehinde (2014) notes that limited recognition or pursuit of risk transfer strategies can also be due to lack of data on risk and exposure, particularly in areas where hazard and vulnerability mapping is difficult, as this knowledge foundation is central to informing risk transfer strategies. As mentioned previously, given Chile’s large latitudinal span and the wide array of climate zones within its national territory, the difficulty of hazard mapping may indeed present a formidable challenge. Importantly however, as mentioned above, these strategies may be better represented and/or expanded upon in documents other than national climate policies.

Ultimately, the uneven distribution of risk management content may offer additional insight into how climate-related harms are conceptualized among Chilean policymakers. Like the absence of thinking “beyond adaptation” discussed above, the overwhelming focus here on risk assessment and reduction suggests that climate-related harms are approached primarily as future eventualities to be planned for. The relative absence of risk transfer and retention, which represent measures to address harms that exceed what is planned for or can be coped with, suggests again that harms exceeding adaptation, risk assessment, and risk reduction capabilities are approached with less urgency and immediacy. This finding reinforces the understanding that Chile’s national climate change strategies are highly future-oriented, with little consideration of unavoidable impacts that are already occurring—if not occurring already.

2.5.4 SOCIAL DEVELOPMENT

Overall, the frequency of results in the social development category was similar to that of the risk management category. The results here reflect the presence, albeit unevenly represented across identifiers, of thinking linked to the UNFCCC and WIM objectives of reducing underlying vulnerabilities that exacerbate the likelihood of

climate-related harms. This potential alignment of priorities between the WIM and the Chilean policies analyzed is underscored by the inclusion of a “social pillar” in the updated NDC, which calls for the need to maximize synergies between Chile’s climate commitments and the U.N. Sustainable Development Goals⁴. This social pillar emphasizes the inherent relationship between climate change, the actions taken to address its effects, and the provision of equitable access to the benefits of sustainable development (Gobierno de Chile, 2020a). Importantly, the DRR Plan also lists “human development” as one of its “cross-sectional approaches,” stating the policy’s intended alignment with the Agenda 2030 commitment to “ensure that no one is left behind” (Gobierno de Chile, 2020b, p.27). The policy subsequently invokes the role of the State to:

be at the service of the human person and... promote the common good, for which it must contribute to creating the social conditions that allow each and every one of the members of the national community their greatest possible spiritual and material fulfillment (Gobierno de Chile, 2020b, p.27)

A breakdown of findings by identifier for this category is provided below.

2.5.4.1 Education

Although education is the second-most frequent identifier, all content captured refers to the need for climate- or risk-specific education, rather than access to education more generally. For example, the NAP sets a target to:

develop formal and informal climate change environmental education processes, to empower the citizenship for climate action (Gobierno de Chile, 2014, p.38)

Under the human development approach in Boda et al. (2021), education (or lack thereof) is framed as an underlying contributor to disproportionate climate vulnerability and a general inability of people to achieve well-being. This framing is generally absent from the five Chilean policies analyzed, which instead frame education as a tool for disseminating climate information. Although valuable, this differs from the framing of education as central to the reduction of vulnerability referenced in the WIM workplan.

⁴ <https://sdgs.un.org/goals>

2.5.4.2 Gender Equity

Concepts of gender and gender equity are frequently referenced across all five policies, with clearly stated recognition of differential vulnerabilities based on gender and related power dynamics. The DRR Plan, for example, identifies gender among its cross-sectional approaches, aiming to:

...tak[e] into account...the differences between women and men in any activity or field given in a policy. ...[This] involves the recognition of the existence of a set of power relations that define the division of labor and the norms, values and ideologies about masculinity and femininity that are associated with said division (Gobierno de Chile, 2020b, p.29).

This focus on uneven vulnerability based on gender extends frequently to climate vulnerability specifically, as exemplified in the NCCAP:

[in] this Plan, special attention has been given to obtaining information on vulnerability and risk, disaggregated by sex, considering that women and men may be differently affected or affected by climate change (Gobierno de Chile, 2017, p.40)

This explicit focus on gender discrepancies in climate vulnerability aligns closely with the stated priorities of the WIM ExCom under the five-year workplan.

2.5.4.3 Health

The health identifier is the third-most frequently referenced within the social development category. The search terms captured reference a variety of impacts on human health and well-being that climate change is expected to exacerbate. The FWB, for example, defines “adverse effects of climate change” as:

[c]hanges in the environment, caused by climate change, that have significant harmful consequences on the composition, resilience or productivity of ecosystems, on human health and well-being, or in socioeconomic system (Gobierno de Chile, 2019, p.21).

The NAP notes that:

[t]he relationship between the phenomenon of climate change and the effects on human health is extremely complex (Gobierno de Chile, 2014, p.25).

acknowledging that direct impacts to human health are possible, as are indirect effects resulting from compromised systems which provide health support such as water and food. The NCCAP suggests that these impacts extend, particularly in the cases of heat waves and extreme weather events, to "...direct impacts on the physical and mental health of the population" (Gobierno de Chile, 2014, p.17).

2.5.4.4 Poverty Reduction

Search term occurrences in the poverty reduction identifier were sparse, however the link between poverty and vulnerability to climate change is firmly established in the policies analyzed. The NAP notes that:

[i]ncreased pressure on health services and human settlements is... expected, especially among the poorest segments of society, who are often at risk and least able to cope with the consequences of extreme weather events... and other impacts of climate change (Gobierno de Chile, 2014, p.30)

while the NDC identifies poverty as a key focus within its intended 2025 climate change risk assessment for vulnerable groups. In this sense, although terms within this identifier are infrequently referenced, an alignment with the WIM's framing of poverty as an underlying driver of climate vulnerability is apparent.

2.5.4.5 Vulnerability

Within the social development category, vulnerability is the most referenced identifier, accounting for nearly half of the total search terms captured in the entire category. Vulnerability is broadly defined in Chilean policy regarding *who* is considered vulnerable:

those groups most vulnerable to risk situations [include] women, children and adolescents, the elderly, people with disabilities or dependence in some area, migrants, refugees, among others, and also of those who live in more exposed territories (Gobierno de Chile, 2020b, p.31).

This discussion of who is vulnerable appears to be informed by a strong focus on underlying drivers of that vulnerability. For example, the DRR Plan recognizes the constructed nature of disasters, stating that:

[d]isasters are not natural but rather the crystallization of the vulnerabilities of a community, where poverty and marginality become determining factors in the configuration of disaster risk (Gobierno de Chile, 2020b, p.13).

Chilean policymakers appear to recognize the progressive nature of this stance on vulnerability, stating in the DRR Plan that:

there are still few countries that have focused their efforts and resources on understanding and reducing the predetermining conditions that enhance the occurrence of a disaster, the so-called underlying risk factors. Chile is a pioneer in this scope (Gobierno de Chile, 2020b, p.14).

Frequent assertions of the need to prioritize the nation's most vulnerable when identifying and implementing climate actions underscores this dedication:

[this plan will] prioritize those adaptation measures aimed at the most vulnerable groups and the poorest sectors of the population, where the effects of climate change could have a greater impact (Gobierno de Chile, 2014, p.52).

Chile's focus on addressing the vulnerabilities that underly climate harms distinctly reflects the focus on disproportionality that is central to the global Loss and Damage agenda, especially in its focus on poverty and gender, which are explicitly note in the WIM workplan (WIM ExCom, 2017). Importantly, Chile's position on vulnerability aligns as well with assertions from the academic literature that "to minimize, avert, and address L&D, climate change risk and adaptation discussions must include a focus on addressing root causes of vulnerability" (Boyd et al., 2021).

2.5.5 IMPLICATIONS FOR LOSS AND DAMAGE POLICY IN CHILE AND BEYOND

In the context of the emergent "national turn" within Loss and Damage research and policy (Calliari & Vanhala, 2022), this study provides an illustrative exploration of potential Loss and Damage mechanisms in a national context where no explicit mechanism currently exists. The research questions of this study aimed to determine how Chile currently addresses losses and damages, and specifically whether Loss and Damage as conceptualized by the global agenda is currently embedded in national-level Chilean climate policy; expressly identified as such or not. To this question, the answer appears to be largely "no," but not without exceptions.

Importantly, there appears to be a fundamental misalignment between Chilean climate policy and the global Loss and Damage agenda with one particularly salient point of divergence. That is, Chilean policymakers do not appear to be engaging with the

concept of inevitable loss. For example, the framing of losses and damages as “beyond adaptation” is entirely absent; policymakers appear to anticipate mitigation and adaptation strategies being largely capable of countering the future impacts of climate change, with no substantive consideration of how residual impacts might be addressed. As another example, risk assessment and risk reduction (which largely encompass strategies to assess vulnerabilities and prevent losses and damages *before* they happen) are well-represented, however risk transfer and retention (which provide avenues for obtaining funding to address losses and damages *once they’ve already occurred*) are considerably less so.

Additionally, it appears that event attribution, which is of central importance to global Loss and Damage discourse, is likely less relevant at the national level. Importantly, event attribution (and the associated question of who should pay for losses and damages) may not be of significant concern for individual countries that are instead focused simply on coping with the impacts of climate change on their populations. In fact, it is possible that a concerted emphasis on attribution may unintentionally obscure the root causes of disproportionate climate vulnerability by placing blame for climate-related harms elsewhere. This finding may hold true for other climate-impacted nations and not just for Chile.

Despite the misalignment noted above, certain elements of the global Loss and Damage agenda are undeniably present in Chilean policy. Under the NELD identifier, for example, Chile explicitly recognizes the potential of climate change to impact the mental and spiritual well-being of the Chilean population. Under social development, Chile recognizes structural inequities such as gendered power dynamics and poverty that underly disproportionate climate vulnerabilities. The caveat to these recognitions is that, in policy content directed toward *addressing* them, the misalignment noted above arises, with these elements treated as primarily future problems which can be avoided through adaptation or risk reduction and not current challenges associated with loss, damage, and the social-ecological impacts thereof. Although these strategies are essential components of a national response to climate change, adaptation or risk assessment/reduction alone, particularly in a climate-vulnerable country like Chile, falls short of answering a critical question: what happens if (and likely when) these strategies fall short?

2.5.5.1 *The Future of National Mechanisms*

What are the implications of these findings, both for Chile and for national Loss and Damage mechanisms globally? As an example, in the case of Chile, the DRR plan describes the Megadrought-induced water scarcity decrees issued across 129 Chilean municipalities in 2019 (Gobierno de Chile, 2020b). Losses and damages incurred from the this and other climatic events will continue to increase in frequency and magnitude given current climate projections—regardless of whether policymakers are grappling with the reality of unavoidable losses to come. I suggest early in this paper that Chile appears to have both the motivation and the means to address loss and damage in its climate policies. Upon completion of this analysis, although the means do appear to exist (in the form of new climate policies and high national energy around climate action) the motivation of policymakers may have yet to reach a critical threshold regarding addressing losses and damages. This may shift in coming years, particularly given the current recognition of looming climate harms in Chile’s existing policies. Chile is entering a potentially transformative political moment, with constitutional reform on the horizon and a young, progressive candidate recently elected to the presidency. Although implementing national strategies to address Loss and Damage is a process that necessarily varies by country and represents a significant challenge in both financial and political terms, Chile appears well-positioned to do so; however, the country’s policymakers must commit to taking the next step.

Concerning the global viability of national-level Loss and Damage policies, my findings suggest that it is critical that a country both recognizes the potential for losses and damages *and* is motivated to respond to those losses and damages beyond simply scaling up its adaptation and mitigation efforts. Returning to the discussion of motivation among Chilean policymakers and drawing from Calliari & Vanhala (2022), the drive to supplement mitigation and adaptation will depend on numerous factors within individual national contexts. One contextual factor relevant to motivation is likely the national geographic and climatic context itself. These contexts in Chile, for example, are radically different from those of a low-lying nation imminently threatened by sea level rise. Chile’s climate crisis, while real and pressing currently, lacks the specific existential threat posed

by total loss of national territory to inundation, which partially underlies the disproportionate national-level action on Loss and Damage among low-lying and island nations. Another relevant contextual factor is economic, concerning the much-debated question: “where will the money for Loss and Damage come from?” To this question, nations with a history of holding private industry within their borders accountable might have an easier answer, and therefore a higher degree of motivation for pursuing national Loss and Damage strategies. Given Chile’s long history of deference to industry in favor of export-based profit; this motivator likely holds little power in the country currently. Considering the above, global policymakers affiliated with the WIM and the UNFCCC will need to consider the many possible factors that render nations around the world more or less driven to expand their climate strategies to address inevitable losses and damages. As a final note, the viability of national Loss and Damage mechanisms, given the findings here, does not appear to hinge on the establishment of event attribution. This policy domain, which has gained traction at the international level given its centrality to assigning responsibility and compensation for losses and damages, appears to be considerably less relevant for individual nations in their approaches to climate-related harms.

Tschakert et al. (2019), in their global compilation of case studies on non-economic loss and damage, illustrate the vast array of climate-related harms currently spanning every inhabited continent. This is a prescient warning and underscores the importance of continued research on national responses to loss and damage. It is increasingly clear that national responses to loss and damage, given highly varied national contexts and motivations, cannot be expected to follow a standardized global-level template. Therefore, an urgent challenge facing global policymakers lies in fostering better articulation of the global Loss and Damage agenda with national actors across the full range of national contexts; facilitating these necessarily varied responses as countries around the world grapple with the inevitability of harms to come.

2.6 CONCLUSION

This chapter provides an illustrative exploration of how losses and damages from climate change are addressed in Chilean national-level climate policies, and whether

elements of the global Loss and Damage agenda are reflected therein. I conducted an iterative, two-stage policy analysis on five Chilean national-level climate policies, consisting of a keyword search and a deductive/inductive qualitative analysis. This analysis was guided by a theoretical framework designed around four central policy domains of the global Loss and Damage agenda (event attribution, losses and damages, comprehensive risk management, and social development) and was supported by both UNFCCC and scholarly literature. I found evidence of three out of four framework categories within the five policies, with the notable exception of event attribution, suggesting that this aspect of the global agenda may have limited relevance at the national level. I additionally find that although key policy areas relevant to the global agenda (NELD, for example) are recognized in Chilean policy, there is an apparent lack of engagement among policymakers with the concept of inevitable loss. Many potential harms, although clearly acknowledged, appear largely considered as future occurrences to be addressed and prevented through adaptation and risk reduction, rather than potentially inevitable harms which will require additional strategies to address. As such, although elements of the global Loss and Damage agenda are acknowledged in Chilean policy, I suggest that they do not amount at present to an analogue for the global agenda.

These findings are directly relevant for both the country of Chile and for global-level progress on supporting national Loss and Damage mechanisms. It appears to be critical that a country both recognizes the potential for losses and damages *and* is motivated to supplement its response to those losses and damages beyond simply scaling up its adaptation and mitigation efforts. Motivation will likely vary greatly across national climatic, economic, and political contexts, posing an urgent challenge for global policymakers seeking synergies between national and international strategies for addressing losses and damages. The misalignment of Chilean climate policies with the global Loss and Damage agenda underscores the fallacy of expecting a single international policy agenda to prove relevant for nations across a world of contexts.

Considering the emerging “national turn” in Loss and Damage policy (Calliari & Vanhala, 2022) and given the documented proliferation of climate-related harms around the world (Tschakert et al., 2019), it is readily apparent that loss and damage presents a current and accelerating issue of immense importance to address. As such, this and other

studies examining national-level Loss and Damage strategies will be essential to informing how global-level efforts can provide relevant guidance and support for nations grappling with losses and damages around the world.

3. LOSS AND DAMAGE IN EASTERN MONTANA

3.1 INTRODUCTION

Recent advances in climate science have prompted stark warnings about the extensive impacts to human and ecological systems that will result from anthropogenic climate change, many of which are already manifesting globally (McNamara & Jackson, 2019; Pearson et al., 2021; Tschakert et al., 2019 in Henrique et al., 2022). Climate-related harms that exceed existing capacities for mitigation and adaptation fall within the purview of Loss and Damage, a policy agenda under the United Nations Framework Convention on Climate Change (UNFCCC) that works to address such harms, acknowledging that they fall most heavily on the poor and marginalized within societies (Tschakert et al., 2017). Within both policy and academic research, there has been a growing attention to Loss and Damage in recent years, however many questions remain regarding one of the policy agenda's key focal areas: non-economic loss and damage (NELD). NELDs are harms that defy quantification and are therefore difficult to address in policy, such as loss of social cohesion, identity, or cultural heritage (Serdeczny et al., 2016). Research has also begun emerging on the phenomenon of psychological impacts such as grief and anxiety resulting from climate change (Cunsolo et al., 2020), which represent a new and poorly understood form of NELD. Although the importance of NELD is of high concern for the UNFCCC, empirical information on these forms of loss and damage is lacking, which effectively hinders the implementation of informed, effective policy actions to address them (Scown et al., 2022; Thomas et al., 2020). Additionally, although much of the historic focus of Loss and Damage scholarship, (and therefore NELDs) has been on developing nations, recent research demonstrating the global distribution of NELDs suggests that additional studies across both developed and developing contexts will be useful in clarifying the collective understanding of these harms.

Bridging the knowledge gap concerning how NELDs manifest in various contexts requires additional empirical research, which is necessary to inform policy responses to non-economic harms. To contribute to bridging this gap, we investigate experiences with extreme climatic events among Montana ranchers and farmers east of the Rocky Mountains. The state of Montana, located in the northwestern United States, is

particularly vulnerable to the effects of climate change considering the reliance of many of the state's residents, and their livelihoods, on agriculture (Whitlock et al., 2017). Climate change is projected to bring rapidly warming temperatures and increasing precipitation variability to Montana, which combined may present a significant challenge to farmers and ranchers dependent on specific climatic conditions for their livelihoods (Whitlock et al., 2017). The summer of 2021 provided insight into the grim reality of these projections when a record-breaking heatwave swept the Pacific Northwest, bringing temperatures that shattered previous records by as much as 6° C (Overland, 2021). The successful attribution of this extreme event's severity to anthropogenic forcing by Philip et al. (2021) suggests that climate-related losses and damages, including NELDs, were likely sustained by ranchers and farmers in Montana in 2021, adding to and potentially compounding those resulting from prior extreme events. As such, an analysis of Montana's agricultural producers offers a valuable contribution to the gap in empirical research on NELDs. In conducting this investigation, we explore two questions: 1) how losses and damages from extreme events are perceived and experienced among agricultural producers in the rural, developed-nation context of eastern Montana, and 2) whether and how NELDs are being experienced by this population. To do this, we leverage an analysis of survey data gathered online during January and February of 2022.

NELD poses a unique threat to individuals and communities, being both comparable in consequence to more monetarily quantifiable harms (Tschakert et al., 2019) and also largely unrecognized by most climate impact analyses. The frequently invisible nature of NELDs means that they typically go unaddressed in major climate policy actions at the global, national or subnational scales, forgoing significant opportunities to address this form of loss and damage. An improved understanding of NELD, supported by additional inputs of empirical research, will help to clarify who is impacted and how, additionally highlighting avenues for policy responses at various levels of governance to help cope with these impacts; or avoid them entirely. Given the above, this study aims to provide insight into how extreme events and resulting harms, including non-economic harms, are experienced among ranchers and farmers in Montana. It provides a needed contribution toward the global shortage of empirical research on NELDs and is additionally timely considering its relevance to the 2023 Paris Agreement

global stocktake, during which recent progress on Loss and Damage will be assessed (Thomas et al., 2020).

3.2 BACKGROUND

3.2.1 LOSS AND DAMAGE: A COMPLEX AGENDA

The proliferation of impacts resulting from slow-onset and extreme climatic events in recent years, coupled with their disproportionate effect on poor and marginalized communities around the world, underlies the origins of the Loss and Damage agenda of the UNFCCC (James et al., 2014). This agenda has its roots in the early 1990s, when the Alliance of Small Island States, highlighting the outsized contribution of developed nations to global greenhouse gas emissions to climatic change, called for an international insurance pool to support island nations affected by sea level rise (Calliari et al., 2020). The Loss and Damage agenda was formally established under the Warsaw International Mechanism (WIM) in 2013. Subsequently, it has been termed the “third pillar” of international climate policy due to its establishment as a separate agenda from mitigation and adaptation under the 2015 Paris Agreement (Broberg, 2020). Today, the international agenda is overseen and implemented by the WIM Executive Committee, a 20-member body made up of representatives of parties to the UNFCCC. “Loss and Damage” is used in this paper to denote the UNFCCC policy agenda, while “loss and damage” refers to those residual impacts of climate change which cannot be—or have not been—avoided through mitigation and adaptation strategies (Roberts & Pelling, 2018).

Negotiations and discourse surrounding the Loss and Damage agenda have been contentious since the agenda’s emergence. This is due largely to the ongoing debate surrounding potential litigation against historically high-emitting nations, which comes with the possibility of required compensation for resulting losses and damages. The WIM is concerned with those residual impacts that can be effectively linked to anthropogenic greenhouse gas emissions, requiring the use of event attribution studies, which leverage climate models under various greenhouse gas scenarios to determine the probability of a climatic event exceeding a certain intensity (Stott et al., 2016). Such attribution studies are necessary in connecting losses and damages from a particular event with

anthropogenic emissions (Scown et al., 2022), and therefore with the debate around responsibility for historic emissions described above. Developed nation parties to the UNFCCC have historically been resistant to the inclusion of attribution in negotiations on these grounds (Mechler & Schinko, 2016).

Although Loss and Damage has become the subject of a growing body of academic research (Boyd et al., 2021), several of the agenda's focus areas still lack conceptual clarity, resulting in a poor understanding of the problems or impacts to be addressed. For example, Loss and Damage discourse to date has been plagued by the lack of a concrete definition, leading to divergent perspectives on the meaning of loss and damage among scientists, policymakers and practitioners (Boyd et al., 2017, 2021). These perspectives have been described as a spectrum, within which Loss and Damage has varying relationships to the UNFCCC mitigation and adaptation objectives (Boyd et al., 2017). The absence of a concrete definition of Loss and Damage is problematic for policymakers, for whom crafting responses to climate-related harms is contingent upon knowing what those harms are. This lack of conceptual clarity is not limited to definitions of Loss and Damage, however; it also extends to the research and discourse surrounding NELD.

3.2.2 THE UNIQUE CHALLENGE OF NELD

Serdeczny et al. (2016) describe the scenario of an island community displaced by sea level rise to frame the core concepts of NELD. The authors suggest that, in such a context, the loss of arable land is also the loss of landscapes; the loss of historic ways of knowing might overshadow new ways of generating income, and when fishermen or farmers are disconnected from their waters or lands, a poignant question emerges: "what happens to their identity? Is that lost too?" (Serdeczny et al., 2016, p.1). In more basic terms, non-economic losses and damages are the loss and damage to intangibles that cannot be traded in markets, and thus the absence of an agreed-upon price to quantify harm is one of the main reasons why assessing non-economic losses is challenging (Fankhauser et al., 2014). Under this non-market definition, NELDs encompass a wide array of impacts, such as loss of cultural heritage, loss of Indigenous and local knowledge and loss of identities (Boyd et al., 2021). Research has also started to emerge on the

phenomenon of psychological impacts arising from climate change (Cunsolo et al., 2020), representing a still-poorly understood type of NELD. Importantly, these non-economic harms are mediated by societal factors which influence vulnerabilities, and by culture, which contextualizes how items lost are experienced and valued (Serdeczny et al., 2016; Serdeczny et al., 2018). The loss of non-quantifiable items and values is deeply impactful to individuals, note Tschakert et al. (2019), who observe that continuing to prioritize only quantifiable harms in research and policy (as has been the historical trend) subverts the importance of non-economic ones, which are “no less significant to people within their own contexts” (McShane, 2017; Preston, 2017; in Tschakert et al., 2019, p. 59).

Recognition of NELD within the policy and academic literature has expanded alongside that of the broader Loss and Damage agenda over the past decade (Roberts & Pelling, 2018; Serdeczny et al., 2016; Tschakert et al., 2019; Tschakert et al., 2017). This has been attributed partially to increased scientific understanding regarding the limits of climate adaptation even under modest warming scenarios, and partially to the increasing attention to loss and damage in international policy negotiations (Tschakert et al., 2019). On this road to recognition, NELD has evolved along a trajectory from early deliberations over what could be counted as NELD through subsequent studies proposing various typologies of non-economic harms. These typologies include framings of NELD as material and immaterial (Morrissey & Oliver-Smith, 2013) and intrinsic and instrumental (Serdeczny et al., 2016), among others. Although such typologies may prove useful for policy and knowledge production purposes, Boyd et al. (2021) note that because individual experiences with NELD vary immensely depending on worldview, such categorizations of NELD are potentially infinite.

NELD represents one of the foremost concerns of the WIM Executive Committee and is identified as a priority action area in the body’s five-year rolling workplan (WIM ExCom, 2017), however the intangible and highly contextual nature of NELD means it is infrequently captured in assessments of climate-related impacts, and therefore remains poorly understood. Loss and Damage research to date generally has been largely theoretical, with comparatively little empirical research conducted (Thomas et al., 2020). This lack of studies empirically examining NELDs, including their range, impact, and

relationship to event, has resulted in a significant blind spot for the Loss and Damage research field, hindering collective abilities to holistically understand and address losses and damages (Tschakert et al., 2019). The poor understanding of how NELDs manifest and who they affect poses a significant challenge for policymakers as well (Serdeczny et al., 2016). Given low availability of empirical data on NELDs, policymakers may necessarily turn instead to more quantitative, economic measures of harm. Although such quantitative approaches can be useful for measuring and reporting, note Tschakert et al. (2019), prioritizing quantifiable measures of NELDs effectively erases lived experience. In addition to producing policy that is disconnected from lived realities and therefore ineffective, McShane (2017) suggests that this erasure of experience constitutes a significant injustice, particularly when quantitative estimates of loss are aggregated for comparison's sake.

Finally, much of the focus of Loss and Damage research, and therefore NELD, has been on the developing world. The UNFCCC definition of loss and damage in the body's online guide to the topic, for example, describes those harms "...associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change" (UNFCCC, 2020). Fankhauser et al. (2014) note, as another example, that in many developing countries, non-economic losses may well be more significant than economic ones. Despite this historic emphasis on the developing world, research is emerging which demonstrates the occurrence of NELDs across every inhabited continent; developed and developing nations alike (Tschakert et al., 2019). In this context, elucidation of NELDs across all development contexts will be essential to better understanding these losses and damages, and to the formulation of appropriate, timely policy responses. Given that individuals with highly climate-dependent livelihoods, such as farmers and ranchers, may be the most vulnerable to losses and damages due to their dependence on particular climatic conditions (Yung et al., 2015), these individuals may be among the first to experience the negative impacts of climate change. As such, investigating impacts to farmers and ranchers may serve as a leading indicator of impending climate harms—providing current information for policymakers across levels of government which may help avoid potential losses and damages in the future.

3.3 METHODS

To add an empirical investigation of NELDs to the global literature on L&D, we leveraged survey data collected from ranchers and farmers with operations east of the Rocky Mountains in Montana. This survey specifically targeted individuals' experiences with extreme events such as drought, heat, wildfire, severe storms, and/or flooding. The survey instrument is provided in full in the supplementary materials. The survey was hosted online using the web-based survey tool Qualtrics, with data collected in January and February of 2022.

We distributed the survey to ranchers and farmers with the assistance of conservation district⁵ (CD) staff and Montana State University Extension⁶ agents. We first reached out to every CD office within areas 1-4 as designated by the Montana Association of Conservation Districts (MACD) using contact information provided on the organization's website. These areas encompass a total of 37 districts and correspond generally to the extent of the state east of the Rocky Mountains, the region which best represents the state's largely rainfed agricultural characteristics. In districts from which we received no response, we subsequently contacted the local Extension office. Through this combined outreach, we were able to contact 26 of the districts, 24 of which agreed to assist with survey distribution—representing roughly 40% of the districts in the state. Following initial contact with CD office staff and/or Extension agents, we provided a template email containing the link to the Qualtrics survey site which they could then forward to producers, as CD administrators were largely unable to share their contact lists with the research team. Each point of contact received a follow-up email template three weeks after the survey link was provided, which encouraged producers to complete the survey if they had not done so already. All outreach communications are included in Appendix B. Although the survey was initially intended to be distributed entirely by email, we granted permission to CD administrators or Extension agents who asked to post

⁵Conservation districts are governmental subdivisions of the state with broad responsibility to carry out programs that conserve soil and water, protect streams and rivers, and improve wildlife habitat (see www.macd.org)

⁶ Montana State University (MSU) Extension agriculture and natural resources programs apply university research and resources to help agricultural producers and landowners increase profits, reduce loss, protect our food supply and sustain future resources (see <https://www.msuextension.org>)

the survey to district social media, websites and/or newsletters. In these cases, we required administrators to remove the link three weeks after posting. Additionally, survey participants were allowed to request a paper survey be sent via mail (one was requested).

This method of participant selection was non-randomized, and therefore provided a non-probability dataset. This precludes generalization of results to a population outside the sample (i.e., all agricultural producers in MT), however data aggregation, response counts and frequencies and basic statistical tests nonetheless provided the means to analyze collected data and yield valuable insight. I calculated response frequencies for individual survey questions using the total number of respondents who answered each question, not the total number of survey respondents. Correlations between responses to pairs of survey questions were determined by calculating Pearson's coefficient in R; appropriate for our survey data given that most of the data gathered is ordinal.

The survey received 95 responses, of which 18 were non-substantive (i.e. the respondent opened the survey but responded to no questions). The 77 responses left included one self-identified as having an operation in Beaverhead County, which was outside the study area. The respondent also had operations within the study area, however, so this response was retained. Three responses were removed for which none of the questions being analyzed here were answered. As a result, only 74 responses were used in this portion of the analysis.

3.3.1 CASE STUDY LOCATION

Across the western United States, climate change has been linked to declining snowpack, more frequent drought, and lower stream flows in late summer; all of which are expected to continue to worsen throughout the 21st century (Frankson et al., 2022). The northwestern region in particular is projected to experience increases in high temperature extremes and variability of precipitation timing (IPCC, 2021). Within this region, the state of Montana –which straddles the junction of the Northern Rockies and the Great Plains– is projected to continue warming across all its geographic locations, seasons, and under all emission scenarios throughout the 21st century (Whitlock et al., 2017). The state's temperatures are projected to increase by up to 6°F (3°C) by mid-century and up to 9.8°F (5.4°C) by the end of the century based on a “business as usual”

carbon emission scenario, increases which are larger than the average changes predicted nationally and globally (Whitlock et al., 2017).

The state of Montana may be particularly exposed to the impacts of climate change in given its dependence on agriculture, the leading industry in the state, which generated \$4.9 billion through the sale of both crops and livestock from nearly 27,000 farms and ranches in 2020 (USDA, 2020). As of 2017, 62.4% of state land area was dedicated to farms or ranches, and the sector employed 10% of the state's labor force in direct production or related activities (Haynes et al., 2020).

Montana, along with much of the northwestern United States and southwestern Canada, was affected by severe heat during the early summer of 2021. The heat wave, which occurred roughly a month before the region's temperatures typically peak and exceeded 104°F throughout much of the area, was found in a rapid attribution study to be virtually impossible without the contribution of anthropogenic forcing (Philip et al., 2021). This event, which coincided with an exceedingly dry year (CITE), represented a significant challenge for agricultural producers. The intensity and frequency of such droughts is projected to increase in the future, state Frankson et al. (2022), who note that even if regional precipitation increases slightly as projected, rising temperatures will increase the rate of soil moisture loss during dry spells. Projected temperature and precipitation increases may be favorable in the short term for some Montana crops and forage production, but the effects of warming will become increasingly disruptive as they accelerate beyond adaptation thresholds (Whitlock et al., 2017). Agriculture—and thereby agricultural producers—are particularly vulnerable to climate change, note Yung et al. (2015), who suggest that the impacts of climate change on these modes of production are set to influence rural futures around the world.

3.4 RESULTS

The survey outreach generated responses from participants in three of the four MACD areas surveyed (Figure 3.1), however identification of the county or counties within which respondents' ranching operations were located was an optional response. As such, the location of some respondents' operations may not be reflected here. The single response from outside the study area (Beaverhead County, area 6) is pictured at bottom

left. Survey respondents were primarily male (74.6%) and largely Caucasian (96.9%) with a small American Indian/Alaska Native representation (3.1%). The average reported respondent age was 59.7, very close to the overall average age of U.S. farmers, which was 57.5 in 2017 (USDA, 2019).

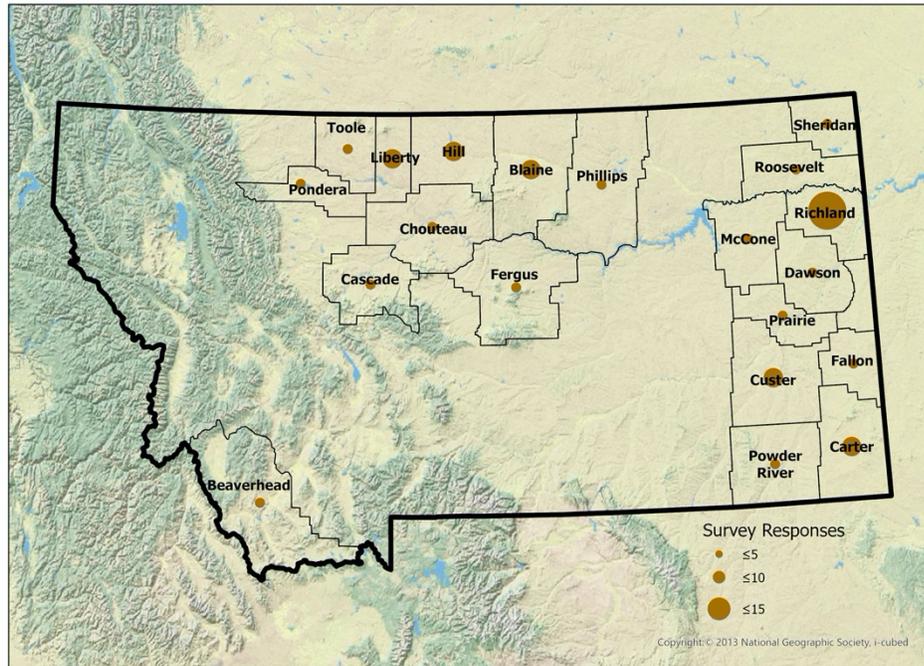


Figure 3.1: Geographic distribution of survey responses within the state of Montana (Cartographer: Sapana Lohani, Ph.D.)

We first asked survey respondents about their general experiences with extreme events (such as floods, droughts, storms or fires) using a likert scale matrix to gauge their agreement with a set of statements (Figure 3.2). 50.6% of those who responded to the statement “I have noticed changes in extreme events over my lifetime” either somewhat or strongly agreed. A majority (67.9%) somewhat or strongly agreed that extreme events were a regular occurrence for as long as they could remember. Finally, although 49.4% somewhat or strongly agreed that extreme events have become more severe than they once were, respondents’ agreement about whether extreme events are linked to climate change was evenly split, with 37% in agreement and 38.3% in disagreement.

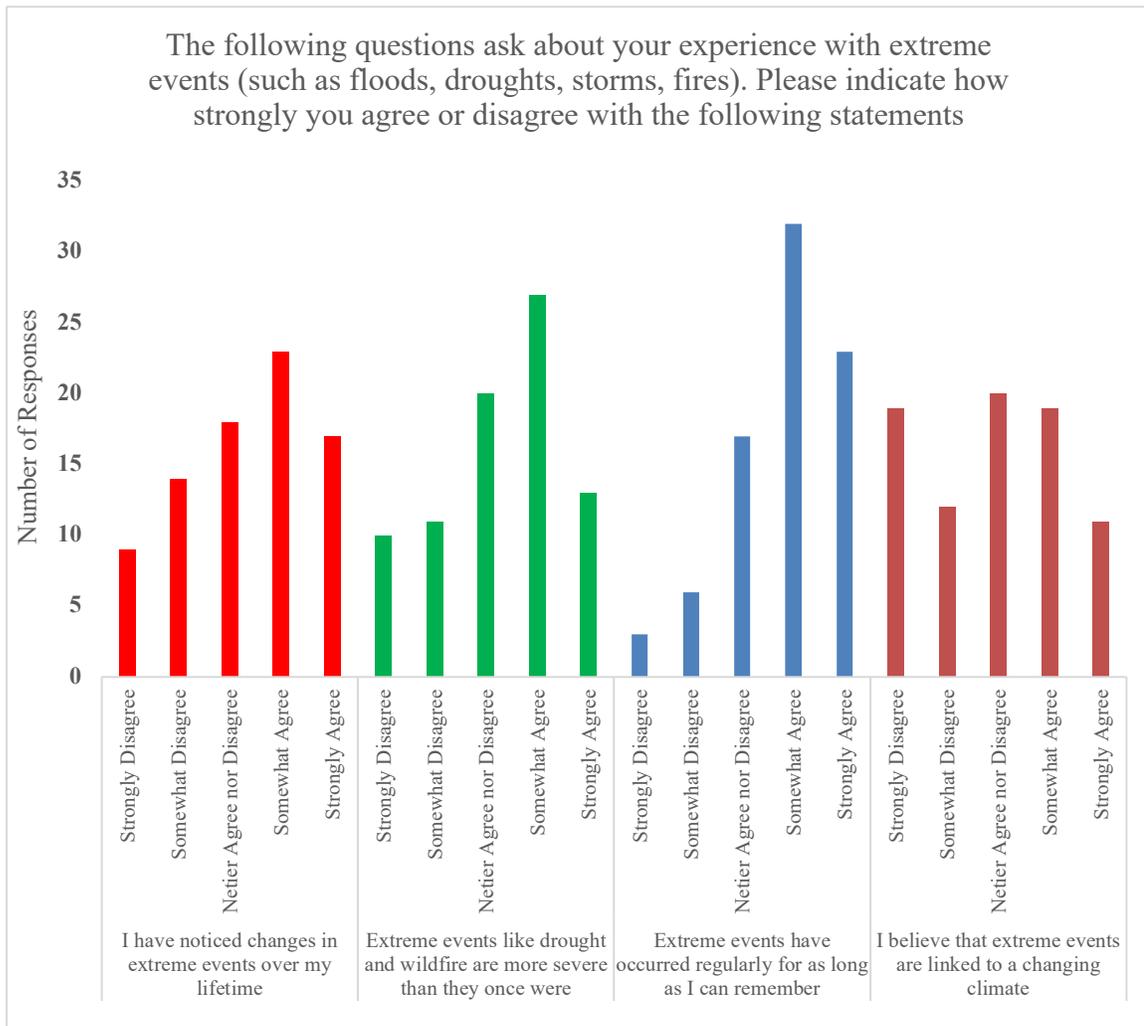


Figure 3.2: Responses to survey question regarding participant’s perceptions of extreme events

We subsequently asked respondents about their experience with the impacts of extreme events, such as floods, droughts, storms, and fires (see Figure 3.3). When asked to rank their agreement with the statement “I have been negatively impacted by extreme events,” 79.7% of those who responded either somewhat or strongly agreed. This reported incidence of negative impacts among participants is supported by statistical analysis. Responses to the first statement (“I have been negatively impacted”) showed a strong negative relationship with both the second statement (“I have experienced extreme events but have NOT been negatively impacted”) and the third (“extreme events have NOT impacted by livelihood or sources of income”) statements. These correlations

values were $r = -.66$ and $r = -.61$, respectively. The set of statements in this matrix also inquired about whether respondents had experienced grief or hopelessness as a result of extreme events, to which 40.0% somewhat or strongly agreed. Finally, 48.6% agreed to the final statement that, due to increasing severity of extreme events, impacts to respondents and/or their livelihoods have grown as well.

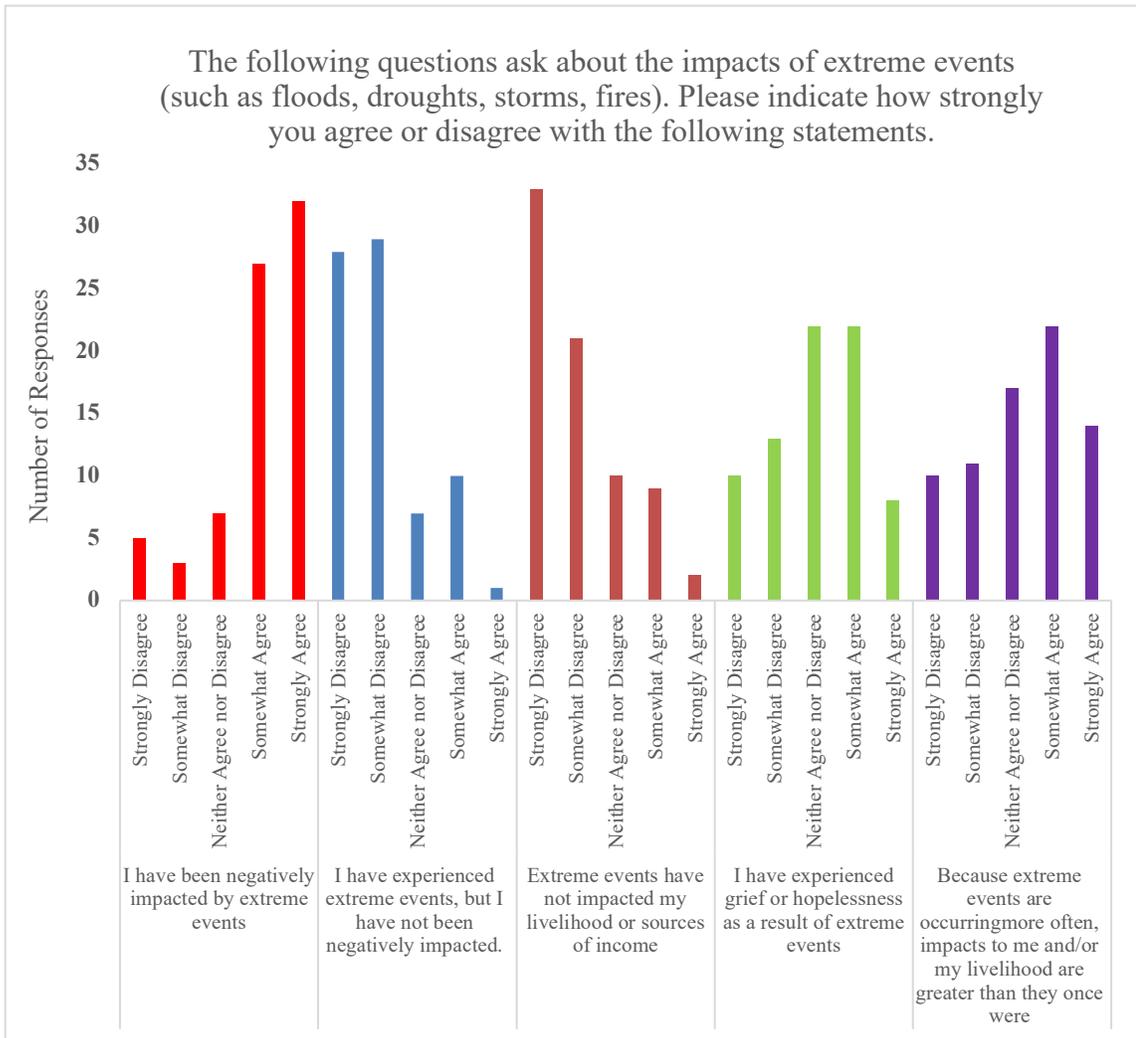


Figure 3.3: Responses to question set regarding the impacts of extreme events on individuals

Responses to a subsequent “check all that apply” question about the impacts experienced by respondents (see Figure 3.4) revealed “loss of income” and “loss of physical assets” (like property, crops or livestock) as the most frequent responses, together representing 63.8% of the total impacts indicated. Additionally, the survey results reveal distinct evidence that respondents are experiencing NELDs which can be described as psychological harms resulting from extreme events. In the same check all that apply question, “sense of loss or grief over environmental destruction” and “decreased mental health” followed closely in that order behind lost income and lost physical assets. Combined, these impact categories (environmental grief and mental health decline) represented just under 25% of the total responses to this question. Importantly, responses to the “select all that apply” question also indicated non-economic harms including physical injury or illness, death of friends or family, physical displacement, and loss of social networks due to extreme events.

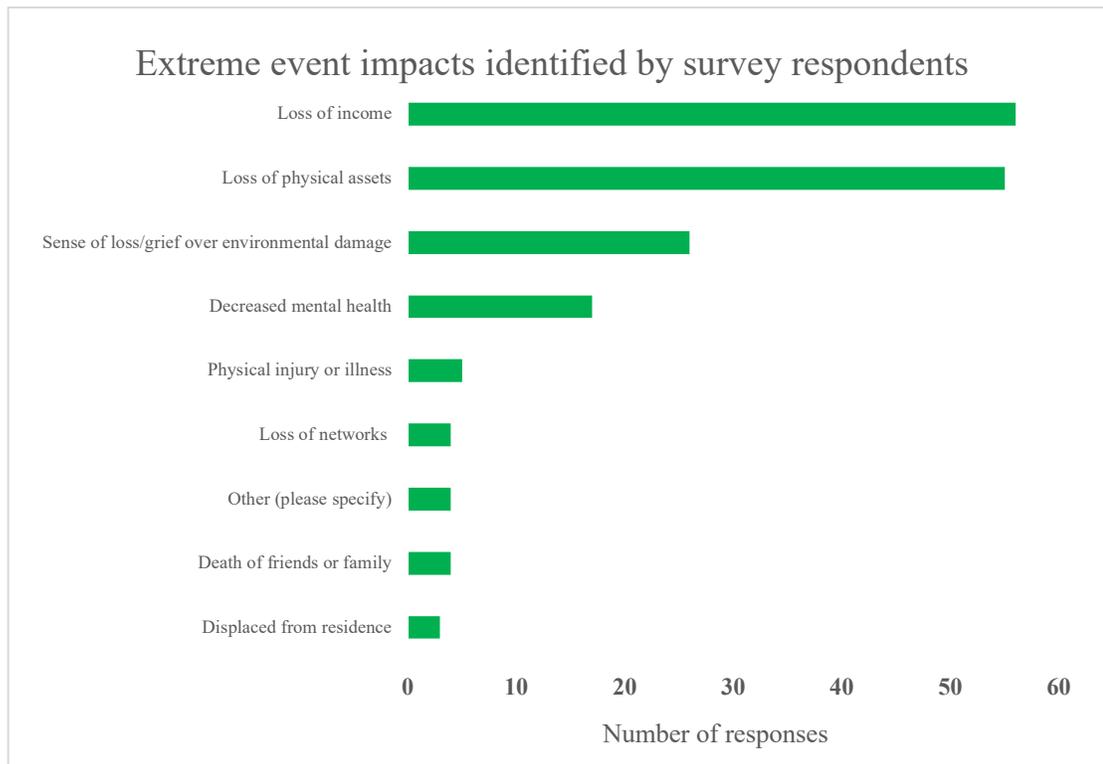


Figure 3.4: Responses to “check all that apply” question about types of impacts resulting from extreme events

We subsequently provided respondents with a list of commonly valued items (livelihood, income, community, family, mental health and local landscape/environment) which we asked them to rank on a 1-5 scale, with 5 being the most important (see Table 3.1). Respondents ranked family most highly (mean: 4.75), followed by livelihood/occupation (mean: 4.5), local landscape/environment (mean: 4.13), mental health (mean: 4.01), income (mean: 4.0), and community (mean 3.77).

Table 3.1: Table of results displaying respondent valuation of commonly valued items

Item Valued	Mean Respondent Valuation
Family	4.75
Livelihood	4.51
Local environment	4.13
Mental health	4.01
Income	4.00
Community	3.77

Next, we asked respondents to think about what they indicated as important in the previous question regarding valued items. Considering these things as "what [they] value," we provided another set of matrix statements regarding the impacts of extreme events on those valued items (see Figure 3.5). Many respondents affirmed that these valued things had been impacted negatively in the recent past (63.9% somewhat or strongly agreed), and many also anticipated that negative impacts from extreme events to those valued items to continue in the near future (57.5% somewhat or strongly agreed). A smaller percentage (47.9%) expected that extreme events would continue to impact those valued things for the rest of their lives.

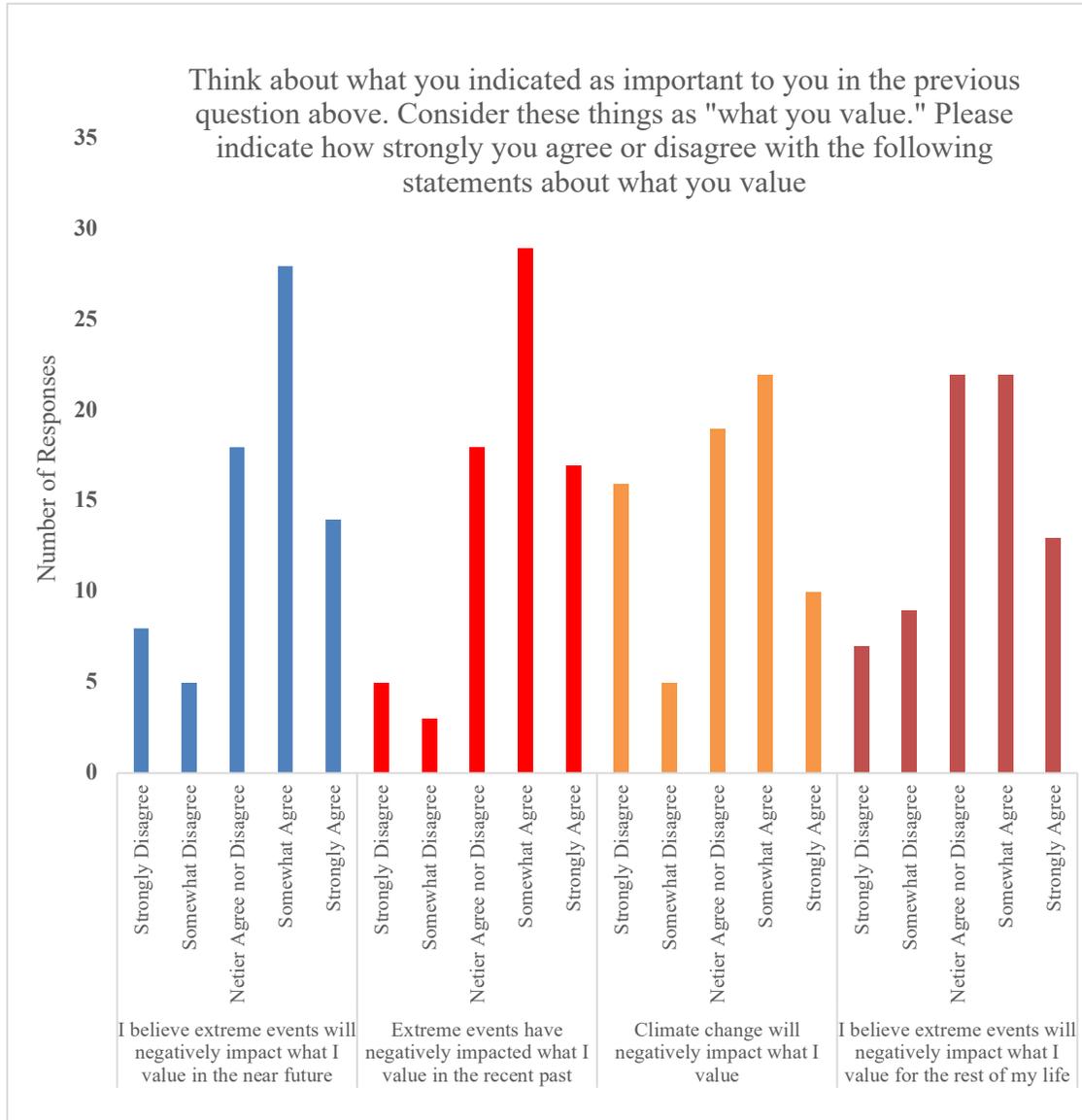


Figure 3.5: Results of question set regarding respondents’ perceptions of extreme event impacts to personally valued items

Subsequently, we asked respondents whether they had experienced livelihood-specific impacts due to changes in the climate (see Figure 3.6). To this question, 52.1% answered yes, 21.1% answered no, and 26.8% of respondents were uncertain. Respondents who selected “yes” to the livelihood impacts question above were directed to a follow-up question asking them to explain those impacts in detail, with “lost work hours/days,” “no or little labor available,” and “decreasing interest from young people in the profession” provided as examples. Of those who answered “yes” above, 73.0%

provided a response to the follow-up. A variety of livelihood impacts were mentioned in the responses to this question, but the most-referenced impacts include the increasing difficulty of growing feed for livestock, the hay purchasing necessitated by that shortfall in production, and the resulting sale of livestock (often at a reduced cost due to low animal weight) when the financial burden of purchasing feed became too much. Collectively, responses in these categories represented 85.2% of all the written answers.

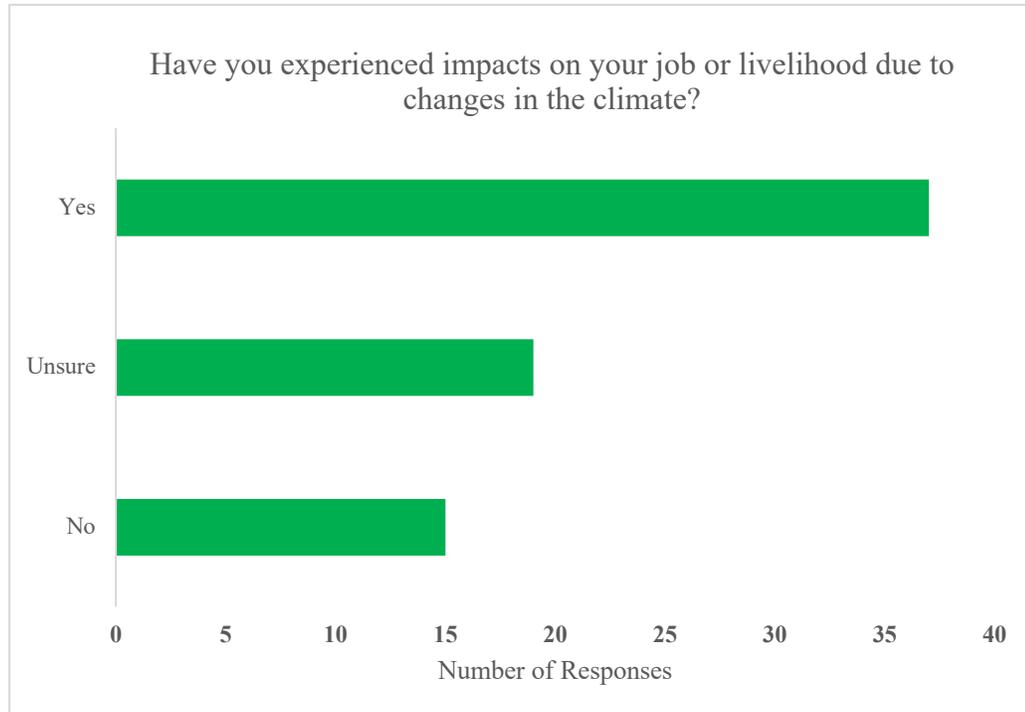


Figure 3.6: Results of yes/no question about climate impacts to respondent livelihoods

One rancher commented that if “...droughts like 2021 become more common I am not sure how ranches like ours will survive and that scares the hell out of me. I wake up everyday and try to come up with a way our ranch will survive if it does not rain this year.” Another wrote “...if the drought conditions continue the majority of the cattle producers will be out of business next year.” Responses specifically mentioning crop loss made up 18.5% of the written answers, with one farmer mentioning the inadequacy of crop insurance for ensuring the profitability of their operation. Water shortages associated increases in operational costs (18.5%), as well as increased workload and stress on the part of producers are both well-represented responses (14.8%).

Respondents that selected “unsure” when asked whether they had experienced livelihood impacts due to changes in the climate were asked to explain their uncertainty. Of those who marked “unsure,” 84.2% provided a written follow up explaining why. Most of the uncertainty regarding whether producers have been impacted by climate change hinges on uncertainty around human impacts on the climate, with (81.3%) either directly stating disbelief in climate change explicitly or less explicitly referencing historic climate variability --or their own experiences with fluctuations in wet/dry cycles-- as reasons for skepticism. A few others were uncertain about impacts to their livelihoods given that factors other than climate change may have played a role in impacting their livelihoods (18.8%).

Another page of questions in the survey presented several statements about the impacts of extreme events on respondents’ livelihoods (Figure 3.7). When asked whether they would change livelihoods given the occurrence of a drought comparable to 2021 at a frequency of every five years, only 18.3% of those who responded somewhat or strongly agreed. Conversely, asked the same question under an annual drought occurrence scenario, the percentage of respondents that would change livelihoods jumped to 57.1%. Respondents largely disagreed to a statement about extreme events influencing their past somewhat or strongly disagreed to a statement that past extreme events had influenced a decision that led them to relocate, while only 8.6% agreed. In a final statement, 71.4% of respondents somewhat or strongly agreed that making a transition out of their job or livelihood would be difficult for them.

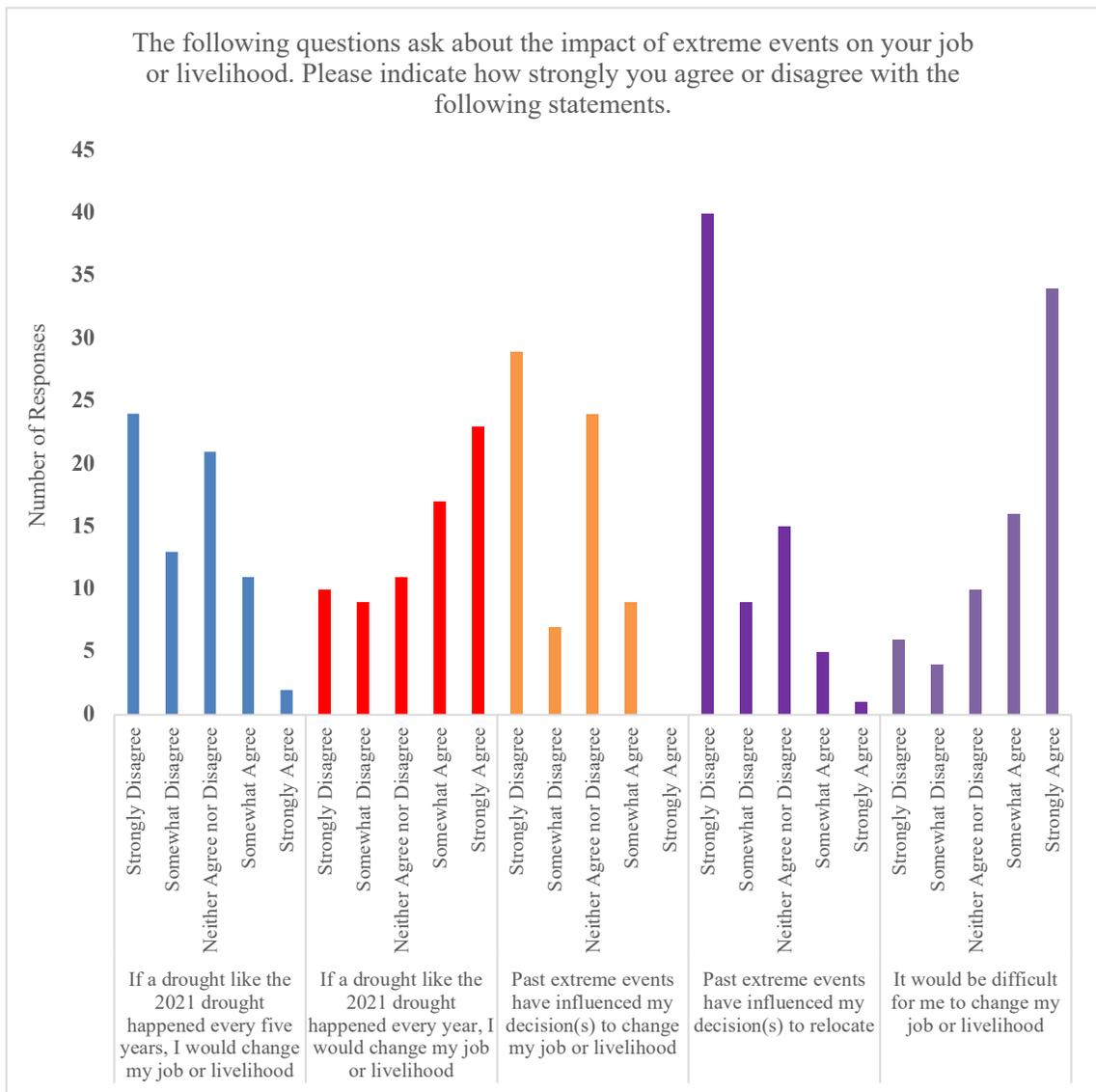


Figure 3.7: Results of question set regarding specific extreme event impacts to respondent livelihoods

The final survey question presented statements about respondents' perceptions about potential future impacts of extreme events (Figure 3.8). In response to the first matrix statement: "I feel hopeful about the future, even if extreme events such as drought or wildfires continue to affect my region," 74.3% somewhat or strongly agreed. In contrast, only 12.9% somewhat or strongly disagreed to the same question. Many respondents (61.4%) disagreed when asked if they lacked confidence in their capabilities to cope with extreme event impacts. On the other hand, 50.7% agreed when asked

whether they felt concern about the ability of others within their communities to cope. When asked to rank their agreement with the statement “I feel helpless and unable to control my responses to extreme events,” only 10.3% agreed, none strongly. On the other hand, 76.5% somewhat or strongly disagreed.

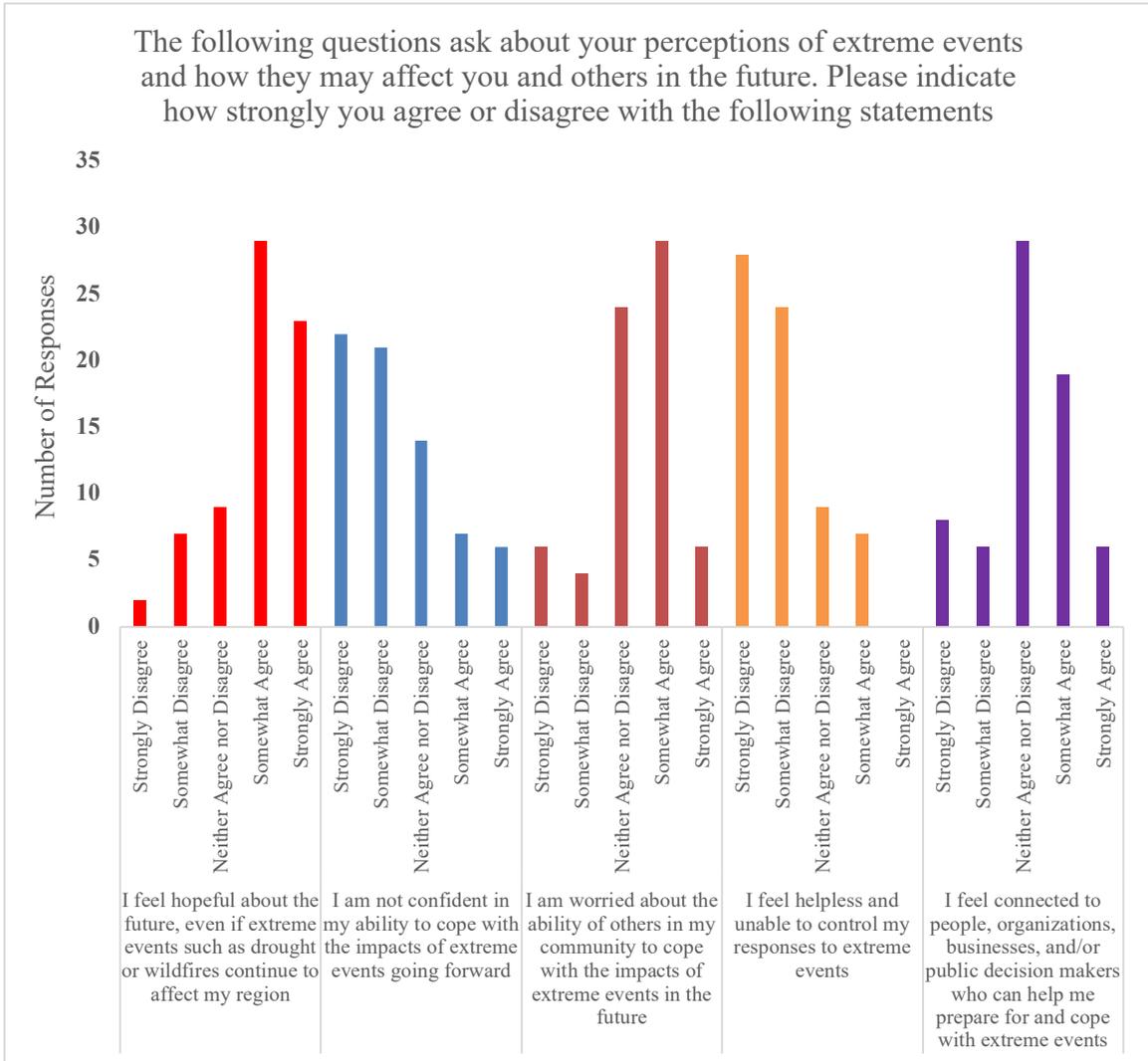


Figure 3.8: Results of survey question set regarding respondents’ perceptions of extreme events and potential future impacts

3.5 DISCUSSION

3.5.1 PERCEPTIONS OF LOSSES AND DAMAGES AMONG RESPONDENTS

The research questions of this study ask whether and how Montana ranchers and farmers are experiencing and perceiving losses and damages, including NELDs, resulting

from extreme events. The answers of respondents to the survey questions are a strong statement of negative impacts experienced, and clearly characterize those negative impacts as being both economic and non-economic in nature. As noted above, the majority of respondents identified having been negatively impacted by extreme events, with “loss of income” and “loss of physical assets” (like property, crops or livestock) being the most-selected responses from a provided list. When asked to describe the impacts of extreme events on their livelihoods, participants’ responses had several consistent themes. Many noted struggles with loss of pasture and hay production, leading livestock feeding costs to increase considerably. For many, this leads to selling off livestock, or decreased income due to lower animal weight at time of sale or harvest. “If the drought conditions continue,” one respondent wrote, “the majority of the cattle producers will be out of business next year.” Crop loss and decreasing water availability due to drought were commonly noted, while others described labor shortages and other increases in production cost.

The primarily economic impacts noted above, however, are accompanied by the distinct presence of non-economic harms among respondents, of which the most common can be described as psychological impacts. For example, “sense of loss or grief over environmental destruction” and “decreased mental health” followed closely in that order behind lost income and lost physical assets when respondents were asked to select the impacts they had experienced. Combined, these impact categories (environmental grief and mental health decline) represent under 25% of the total responses to this question. Importantly, these were *not* the only non-economic harms identified by the survey. Respondents also noted non-economic harms including physical injury or illness, death of friends or family, physical displacement, and loss of social networks due to extreme events. Although the discussion below focuses on psychological impacts among respondents, the multitude of NELDs resulting from extreme event occurrences and other socio-cultural factors is potentially limitless (Boyd et al., 2021). The relevance of these additional NELDs to respondent experiences should not be understated.

The finding of psychological NELDs among respondents is striking, given that this type of climate impact, particularly as it affects ranchers and farmers, appears thinly discussed in the academic literature. In a systematic review of risk factors that affect

farmers' health, for example, Yazd et al. (2019) found that only 5% of U.S.-based studies investigating psychological distress among farmers explored climate change as a stressor. Grounding our survey findings in the broader literature on psychology and climate change, however, suggests that grief and decreased mental health among ranchers and farmers should be anything but surprising. Empirical evidence demonstrating both the acute and chronic mental health effects of climate change has risen sharply over the past decade, and an array of studies have begun emerging which examine the psychological and mental health effects of climate-related hazards (Cunsolo et al., 2020). Several new terms for climate-induced psychological distress have recently emerged, including "ecological grief," "solastalgia," and "eco-anxiety" (Comtesse et al., 2021, p.3). Psychological harms related to climate change have been conceptualized as occurring both "directly" and "indirectly" (Berry et al., 2010; Cianconi et al., 2020; Comtesse et al., 2021), with direct harms including traumatic stress reactions to events like wildfire or floods, and indirect harms being incurred via longer-term, secondary stressors like crop failure, decreasing availability of water resources, or permanent landscape changes (Comtesse et al., 2021). As such, these impacts can be both acute and chronic, affecting individuals in the short term time frames surrounding the occurrence of extreme events, but importantly in the longer term as well (Comtesse et al., 2021). Cunsolo et al. (2020) note that these impacts are particularly pronounced among people with close relationships with the natural environment, such as Indigenous Peoples, farmers, foresters, etc. Because of this heightened vulnerability, there is reason to believe that incidences of psychological NELDs like those present in the survey responses are likely to increase rapidly, rendering this a legitimate concern for ranchers and farmers across the region.

Additionally, a large volume of research has explored the general mental health stresses frequently experienced by those in agricultural professions. Available evidence shows that the agricultural sector globally has long experienced higher rates of psychological distress, depression, anxiety and suicide than the general population (Bjornestad et al., 2021; Henning-Smith et al., 2022). Among agricultural populations in the U.S., many studies have focused on the Midwest. Rudolphi et al. (2020) found that, among a sample of young Midwestern farmers and ranchers, approximately 71% of

respondents met the criteria for generalized anxiety disorder, compared to the U.S. adult average of 18.1%. Within the same sample, the authors found that 53% of study participants met the criteria for depressive disorder, which has an average frequency of annual occurrence among U.S. adults of 6.7% (Rudolphi et al., 2020). As mentioned above, however, few studies investigating mental health challenges among agricultural producers specifically looked at climate change as a stressor (Yazd et al., 2019).

The disconnect between climate change and the psychological well-being of agricultural producers in the academic literature makes our survey findings, which provide empirical evidence of a direct connection, particularly salient. Our findings also suggest that valuable avenues for future research include deeper qualitative exploration of how psychological NELDs manifest among ranchers and farmers, including who is impacted, and how. As noted above, a thorough empirical understanding of non-economic harms is essential to formulating appropriate responses. To this point, our study's explicit framing of psychological impacts as *losses and damages* resulting from extreme events raises important questions about potential policy responses in the context of the Loss and Damage agenda.

Given that psychological harms like grief and decreased mental health represent both losses and damages already incurred and also those that will continue to affect ranchers and farmers in the future, responses from the Loss and Damage policy perspective would entail actions both to mitigate and address existing harms and also to avert future harms. This might include (but is certainly not limited to) providing subsidies for and increased access to mental health services for producers both to address existing harms and avert those potentially resulting from lengthier experiences with climate-driven grief and anxiety. An improved understanding of the problem, coupled with an informed, effective policy response drawing from the Loss and Damage perspective, may provide a meaningful response to NELDs—a body of climate impacts likely to rise in frequency among ranchers and farmers in Montana and beyond.

3.5.2 WHEN IS ENOUGH, ENOUGH? EVIDENCE OF A LIVELIHOOD TIPPING POINT

Alongside the explicit evidence of psychological NELDs in the survey data is a second finding with important implications for Montana ranchers and farmers. That is,

there appears to be a tipping point at which, given a high enough frequency of extreme event occurrences (the survey asked specifically about recurrence of the 2021 drought), many respondents would opt to change their livelihoods. This finding was accompanied by strong indications that respondents are averse to making such a shift: the majority claim to have weathered previous extreme events without changing livelihoods, and a similar majority acknowledged the significant difficulty that such a transition would represent for them. These potential thresholds present within the state's agricultural systems are acknowledged in the Montana Climate Assessment (Whitlock et al., 2017), which states that "the masked and messy shifts that are underway may reach tipping points that enable and/ or force rapid, transformational change in our food systems" (Whitlock et al., 2017, p.235). Importantly, the authors suggest that although many factors have buffered against these tipping points to date including surplus harvests, crop insurance, disaster assistance, off- farm income, on-farm ingenuity, market flexibility, and the intrinsic resilience of our landscapes, the capacity for buffering against accelerating climate change is finite (Whitlock et al., 2017). The survey finding, combined with the Montana Climate Assessment's suggestion that agricultural "buffers" may be reaching their limits to help producers cope, has implications for individual ranchers and farmers, communities, and society more broadly, and also for policymakers.

Regarding implications for individuals, the survey's questions about what respondents value become relevant. Interestingly, although the mean valuation of livelihood ranked second highest, income ranked second lowest. Although the difference between the two means is not large in general terms, the discrepancy suggests that livelihoods are valued by respondents for reasons that are *not* strictly financial in nature. This is not entirely surprising; Serdeczny et al. (2016) note the close connection of land-based livelihoods like ranching and farming to individual identities, suggesting that livelihood disruption and dislocation from the land can therefore represent significant personal losses for individuals. Given that agriculture plays a dominant role in Montana's land use and its people's sense of place (Whitlock et al., 2017), a large-scale livelihood transitions driven by climate change would undoubtedly have significant impacts at the level of individual ranchers and farmers.

Climate-driven shifts away from agricultural livelihoods have obvious implications, both for local communities and for society and food systems more broadly. Climate change already poses a significant threat to agriculture by means of reduced production, a challenge which will likely be compounded population growth drives increased food demand (Loboguerrero et al., 2019). Decreasing numbers of producers has the potential to worsen the compounding strain on food systems. Additionally, however, a climate-driven shift away from ranching or farming livelihoods in the region may lead to larger-scale losses of knowledge and ways of thinking that are integral to those livelihood systems (Morrissey & Oliver-Smith, 2013)

These findings present an indicator of a potentially imminent threshold. Given the importance of agriculture to individuals and communities in Montana, as well as its significance as the state's top industry (USDA, 2021), our finding merits serious consideration among policymakers. How can policy responses help prepare for this eventuality as climate change continues to drive temperature and precipitation shifts across the region? Insights from the global Loss and Damage policy perspective may help inform potential responses by suggesting how targeted policy strategies might both address existing harms and prevent those with the potential to occur in the future.

The livelihood threshold finding suggests a climate-related impact which is impending for some and may have already occurred for others. As such, the Loss and Damage policy perspective might suggest two response avenues: supporting ranchers and farmers in coping with the effects of climate change pre-threshold and supporting their subsequent livelihood transitions once that shift was no longer preventable. Pre-threshold policy actions might include stepping up financial and technical support for producers' climate adaptation efforts. Post-threshold actions would likely entail mitigating harms incurred through the transition—potentially via financial compensation—while additionally providing support and capacity building for individuals navigating transition away from ranching or farming.

3.5.3 A PARADOX OF GRIEF AND HOPE

Given the experiences of respondents with psychological NELDs and the existence of a threshold at which many anticipate changing their livelihoods, a third and unanticipated survey finding emerged: that most respondents look to the future with

hope. Interestingly, having experienced negative impacts from extreme events does not appear to be a predictor of whether a respondent feels hopeful about the future or not. Similarly, experiences with grief or decreased mental health do not appear to preclude hope among respondents, indicating that some alternate factor or factors underly this finding. Aside from this potentially paradoxical finding in the survey data, the concept of hope itself is interesting in the context of Loss and Damage.

Li & Monroe (2019) describe hope as “not only a pleasant feeling, but also a motivational force” (p.936). To this point, it seems that hope may be relevant to Loss and Damage by way of providing ranchers and farmers with motivation to adapt to changing climatic conditions and to prepare themselves and their livelihoods to cope with future impacts. For example, past research has linked hope in individuals to improved adaptive responses under adverse conditions (Marlon et al., 2019), increased problem-solving capabilities, and recovery from depressive symptoms (Li & Monroe, 2019). If this is the case, an investigation of what fosters hope among individuals coping with the impacts of climate extremes may be extremely relevant, and should be pursued

Additionally, Marlon et al. (2019) point out several distinctions between *types* of hope which may also prove relevant when considering how to leverage this finding in favor of preventing or addressing losses and damages. The authors suggest the existence of what they call “false hope” and “constructive hope,” describing false hope as the belief that a problem (i.e., climate change) will resolve without the need for human intervention. Constructive hope, on the other hand, may arise from seeing others act or believing that collective awareness of climate change is rising (Marlon et al., 2019). It seems that these different types of hope, if present among ranchers and farmers, might serve as predictors regarding the efficacy of various Loss and Damage policy options. Depending on the type of hope most prevalent among ranchers and farmers, individuals might be more or less likely to take adaptation actions in preparation for future climate impacts. A hope that collective efforts—including policy efforts—can help producers cope with climate change, for example, may provide a more receptive starting point for effective policy action than a widespread hope that climate change will resolve itself.

Following from the potential of hope to motivate adaptive responses among agricultural producers or foreshadow opportunities for effective Loss and Damage policy

responses, an important question arises: what allows respondents to have hope, even when they may have incurred losses and damages stemming from climate extremes? Although the survey's finding of hope is both surprising and relevant to discussions of Loss and Damage, our limited statistical analyses revealed no strong relationships that explained hope's presence among respondents. A combination of our limited results with a review of relevant literature offers a few speculative insights, but no concrete explanations for the survey's hope finding-- or a firm basis for potential policy responses. An explanation of hope, therefore, provides a valuable starting point for future research.

One potential explanation of hope among respondents concerns their feelings of agency, or ability to control their responses to extreme events. We found a very slight positive correlation between respondents' perceived agency and feelings of hope for the future. Although the relationship is not strong enough to draw firm conclusions, there is some conceptual support for the finding. In much of the climate-related research surrounding hope as a motivator, hope is often discussed in tandem with efficacy, termed by some as "the foundation of agency" (Bandura, 2000). A frequent conclusion is that feeling effective --or personally able to do something about a problem-- is a significant and direct path to hope (Li & Monroe, 2019). This may be applicable to the challenges faced by Montana ranchers and farmers: if producers feel a sense of efficacy regarding their responses to extreme events (via the ability to make on-farm drought adaptations, for example), they may feel a broader sense of agency and a corresponding hope for the future. A second explanation may arise from the buffering effect discussed by Whitlock et al., (2017). As previously discussed, the effects of coping tools/policy instruments like subsidies, insurance, and disaster assistance, as well as the resilience of landscapes have played a role to date in buffering climate-driven changes in Montana's food systems and agricultural livelihoods (Whitlock et al. 2017). It is possible that given the past adequacy of these buffering factors in blunting the worst impacts of climate extremes for some ranchers and farmers, there may be reason to feel hopeful that they would continue to do so in the future, regardless of the realistically finite capacity of these buffering factors. Finally, many respondents voiced skepticism (or complete disbelief) regarding the role of climate change in the increasing severity and frequency of extreme events. An illustrative response from one participant stated that "what is being called climate change may be

normal climate in the big picture. There has always been ‘climate change.’” Given the frequency of such views, it is worth asking whether or not this perspective might contribute to a hopeful outlook on the future. If increasingly frequent and severe droughts, wildfires, and/or floods are viewed as part of natural climatic cycles rather than a steadily worsening trend, might these individuals be predisposed to hope?

As previously stated, the suggestions above are speculative and reflect the limited explanatory power of our survey findings regarding respondents’ feelings of hope for the future. Given the potential relevance of hope to motivating adaptive action among producers (and therefore potential policy actions to leverage that hope-driven motivation), this finding is worthy of additional study. The potential explanations mentioned above represent possible considerations for such future research, which may provide beneficial insights into relationships between climate extremes, agricultural producers, and perceptions of hope for the future.

3.6 CONCLUSION

This chapter aimed to answer questions about how losses and damages resulting from extreme events, including non-economic losses and damages, are experienced and perceived by farmers and ranchers in the developed-nation context of eastern Montana. Through a survey of this population and their experiences with extreme events, we provide empirically based insights into how both types of climate-related harm are manifesting. We found that both economic and non-economic losses and damages resulting from extreme events are experienced and perceived among respondents. We additionally found evidence of an apparent threshold at which, given increasing frequency of extreme events, many respondents anticipate changing their livelihoods. Finally, we found that, despite impacts from extreme events, many respondents retain hope for the future.

Our results underscore the conclusions of recent research that losses and damages are occurring globally and across all development contexts. Importantly, this survey’s clear finding of losses and damages including grief and decreased mental health among respondents indicates that, although historic framings of losses and damages as developing world occurrences may preclude developed-world climate impacts from being

framed as such, climate-related harms—both economic and non-economic in nature—are clearly and currently affecting agricultural producers in eastern Montana.

These findings suggest that continued work to frame climate-related harms within developed nations *as losses and damages* can productively contribute to a holistic global understanding of loss and damage. They additionally suggest that the Loss and Damage perspective may be valuable by providing an alternate framing of climate impacts than is currently being employed, with potential implications for policy.

First, starting to frame climate impacts like grief and anxiety as losses and damages, and viewing them through this alternative lens, might encourage valuing those harms in a manner consistent with those of economic harms such as loss of property and/or life. Second, taking a loss and damage perspective would also encourage deeper thinking about the disproportionality of harm *within* a place like the United States, in addition to disproportionality across nations and development contexts. Important questions follow from such a reframing of harms as losses and damages, including how is intra-national disproportionality of climate impacts addressed in national- and/or global-level climate policy, and how are non-economic harms addressed, as they are having an impact on individuals despite their intangible nature? Such questions might provide an in-road into discussions of liability and compensation domestically, e.g., whether and how to hold industries and corporations accountable for their historic and contemporary contributions to these impacts. Despite the likely contention over discussions of liability and compensation within countries like the United States, these possibilities are important ones to consider and will inherently evolve as a focus on climate justice continues to emerge from civil society across the globe as evidenced by the increasing number of civil and criminal climate lawsuits, and increasing frequency, intensity, and focus of public protests. The losses and damages we find evidence of in this survey will likely worsen in coming years; finding ways to grapple with these domestically is imperative for the well-being of vulnerable populations and is responsibility of nation states to their people.

In closing, the results of this survey both empirically demonstrate occurrences of loss and damage and offer insights for addressing these harms through future research and policy actions. They represent incremental but useful progress toward an improved global understanding of where climate-related harms are manifesting and how.

4. CONCLUSION

In every corner of the world, humanity is faced with a sobering reality: the earth's climate is changing rapidly, and there is no certainty that collective global action will happen fast enough to prevent the worst effects of these changes, particularly for the world's most vulnerable people. Loss and Damage policy, in this context, responds to the poignant global question: "what happens when the best we can do is no longer enough?" Many knowledge gaps remain regarding how the world will respond to the inevitable losses and damages occurring today despite mitigation and adaptation efforts.

The broad questions that drove this research were framed around two perspectives from which Loss and Damage research has not been commonly approached. My first question and chapter adopted the perspective of the emerging "national turn" in Loss and Damage research (Calliari & Vanhala, 2022), specifically considering whether and how the global Loss and Damage agenda is incorporated into national-level climate policy in the country of Chile, which currently has no explicit Loss and Damage mechanisms. My second question took the perspective that historic framings of Loss and Damage as a largely developing-world occurrence may prevent losses and damages in developed world contexts from being framed or recognized as such. Recent research has documented climate-related harms (including NELDs) across every inhabited continent (Tschakert et al., 2019), underscoring the need for continued empirical research on the impact and assessment of losses and damages across all geographic and development contexts. As such, I leveraged survey data to explore whether and how losses and damages, including non-economic losses and damages, are manifesting in the rural, developed-world context of the U.S. state of Montana.

4.1 LESSONS LEARNED

The research perspectives and questions outlined above guided my exploration of Loss and Damage across two national contexts and from the level of individual experiences to the level of national climate policy. From this broad research scope, several lessons regarding Loss and Damage emerged. First, in the context of the "national turn," it seems that the applicability of certain elements of Loss and Damage likely vary from country to country. Depending on national climatic, historical, and political

economic contexts, some components of the global agenda may be easier or more challenging for individual nations to incorporate into their existing national frameworks, and thus may be variably represented. As highlighted in the Chilean policy analysis, event attribution may be significantly less relevant to individual nations than it is to the global agenda, where questions of assigning liability for harm (and therefore compensation) are of central concern. Given that individual nations may be preoccupied by simply coping with climate impacts, a national-level focus on attribution may *detract* from more strategic priorities like reducing structural inequities that underly uneven vulnerabilities to climate change. The attribution example highlights that Loss and Damage cannot be a “one size fits all” policy template for countries grappling with climate-driven harms. This in turn suggests the need for improved articulation and feedback between the international agenda and existing national-level climate policy frameworks.

Second, and related to the lesson above, it appears that for implementation of Loss and Damage strategies to be undertaken, nations must be both *aware* of inevitable climate impacts and *motivated* to do something about them. A simple awareness of the Loss and Damage agenda may not provide sufficient motivation to render implementing Loss and Damage strategies feasible. Motivation (or lack thereof) may stem from many sources, including national climate impacts which are not yet existential or a lack of perceived need to place blame and secure compensation for climate impacts. With this understanding, if facilitating the implementation of national mechanisms is an objective of Loss and Damage actors at the global level, the factors which motivate national policymakers (or not) must be better understood.

Finally, the actual impacts of climate change, both physical and immaterial, are a global reality, the manifestation of which depends largely on who is vulnerable and what is valued. Currently, these impacts are affecting every inhabited continent on earth, even though historically the concept has largely been focused on developing nations due to their relative vulnerability. Importantly, as illustrated in Montana through our finding of psychological climate impacts among agricultural producers, losses and damages in some contexts are certainly occurring which are not being framed as such. This suggests that disconnects between lived experience, research and policy on Loss and Damage still

exist, and that developing approaches to address actual harms as contexts dictate will be central to building a cohesive response to climate-related harms worldwide.

4.2 LIMITATIONS

As with all research, both studies contained in this thesis have limitations. In the first chapter specifically, several limitations exist. First, given my time constraints, I focused this analysis narrowly on Chile's large national-level climate policies. It is possible, however, that elements of the global Loss and Damage agenda are present within other areas of Chilean policy. Responses mirroring the global agenda might manifest within public health policy, disaster response policy, or sub-national or sectoral climate policies that are tailored to the contexts of specific locations or sectors. Therefore, there may well be components of the country's response to losses and damages that are not captured here, meaning that my results may not provide a comprehensive understanding of Chile's approach to losses and damages. Additionally, two of the Chilean policies analyzed have not been updated in several years. As such, evolutions in Chile's national thinking (and subsequent administrative policy) on Loss and Damage may have occurred in recent years which are not reflected in the documents analyzed. On a similar note, the draft framework climate bill analyzed is currently being debated in Chilean Congress and may include different provisions relevant to Loss and Damage if it is signed into law. Finally, the addition of qualitative interviews with Chilean ministry officials would have provided valuable context and grounding for the policy analysis.

Concerning the survey of Montana farmers and ranchers, time and financial constraints necessitated a non-probability, opportunistic sampling strategy, and as such the results cannot be generalized to any broader population beyond our sample. Additionally, we conducted the survey primarily by electronic means, meaning that many ranchers and farmers who lack computer or internet access were potentially excluded who may have participated in a paper, phone, or in person survey.

4.3 FUTURE RESEARCH DIRECTIONS

The findings of this study suggest that the applicability of the global Loss and Damage policy agenda will vary from one national context to another, and that a “one size fits all” approach to addressing losses and damages ignores the very different national and sub-national realities that shape how climate-related harms manifest. As such, supporting and expanding the “national turn” in loss and damage research will require scholars to develop a more thorough understanding of what works and what doesn’t across different national contexts. This research effort will be important in fostering the success of national actors pursuing strategies to address losses and damages and may entail several different research avenues. First, scholars should continue developing the global understanding of national approaches for averting, minimizing and addressing loss and damage, which is still nascent.. Second, future research must work to understand whether and how existing national strategies are working, whether are they effective, and how efficacy is determined by different national actors.

Collective knowledge about which Loss and Damage policy responses work and which don’t must be supported by an improved understanding of the actual impacts of climate change. This research direction echoes the calls noted earlier for additional empirical research on different kinds of loss and damage. As suggested by the results of the Montana survey, future empirical research should consider losses and damages occurring across all national and development contexts, explicitly framing climate-related losses and damages as such across developed and developing contexts alike.

Finally, future research must consider the numerous drivers of vulnerability to climate-related harm. Climate change is “a conundrum of politics and justice,” not solely an environmental phenomenon (Tanner et al., 2015, p.23). Future research must therefore aim not only to examine harms incurred and strategies to address those harms, but the structural inequities and marginalization that underly disproportionate losses and damages. An extension of this research should lead to consideration of possibilities for systemic transformation. There is a growing interest in the intentional transformation of social-ecological systems in pursuit of both human and ecological well-being (e.g., Blythe et al., 2018; Chaffin et al., 2016; Moore et al., 2014). Regardless of this growing interest, however, Tschakert et al. (2013) suggest that analyses explicitly addressing the

structural drivers of vulnerability (including but not limited to marginalization, poverty, and constraining social-ecological dynamics) are urgently needed. The authors also point out that focusing on the underlying capacity for transformative change is critical at a time when incremental adjustments to a changing world are too slow or ineffective, especially for millions of poor and marginalized people.

In the context of Loss and Damage, transformative change provides an opportunity to rethink the systems that inherently predispose certain individuals and population to climate-related harm. Loss and Damage policy focuses inherently on *addressing losses and damages*; assuming that such harms will happen and considering policy responses to address them. A transformative approach to addressing loss and damage, on the other hand, would surpass “avert, minimize, address,” and consider instead how forced changed to social-ecological systems could ensure that losses and damages either do not manifest, or fail to impact human and ecological communities because underlying vulnerabilities such as poverty, uneven development or inequitable access to resources have been addressed. By framing future research on loss and damage in a manner that shines a light on institutional structures which underly vulnerability to climate change, scholars can reveal both the need for and the opportunities to pursue transformative solutions in the face of accelerating climate change.

4.4 POLICY RECOMMENDATIONS

The findings of this thesis underscore the assertions of recent research: that climate-related harms are exceeding the coping capacities of individuals and communities around the world. As revealed by the survey of Montana farmers and ranchers, this includes impacts occurring domestically in the United States, suggesting that national Loss and Damage policies may have relevance even in developed nations of the global north. The recommendations below may prove relevant for addressing Loss and Damage in the context of a country like the U.S. and may become increasingly relevant as climate-related impacts continue to multiply.

1. *Anticipating harms*: To avoid those losses and damages that *are* preventable, national actors will require strategies to anticipate the likely geographic and

contextual distribution of losses and damages. Such policy strategies, which might include funding academic research or national task forces to understand vulnerabilities, may already be underway in many nations, but will be essential to develop in nations where they are not. Anticipatory strategies will be central to averting harm before it occurs-- ideally incorporating considerations of both economic and non-economic losses and damages.

2. *Avoiding loss and damage:* Avoiding loss and damage necessarily leans on an understanding of potential harms developed through the anticipatory strategies above. Considering the findings of the Montana survey, strategies to avoid climate-related harms like grief or decreased mental health might entail establishing better access to (and funding for) mental health services for agricultural producers. Regarding the livelihood threshold finding, avoidance strategies might entail efforts to allow producers to remain in their livelihoods despite the occurrence of extreme events, such as provision of adaptation assistance for farmers working to transition to drought-tolerant crops.
3. *Mitigating loss and damage:* Provision of frameworks and funding to address and, when necessary, compensate for inevitable losses and damages represents a final component of a potential national Loss and Damage policy. National funding for Loss and Damage might potentially be obtained by means of holding individual companies accountable for emissions, however this strategy might face steeper challenges in countries without a history of holding industry accountable. Mitigating incurred losses and damages could entail a wide variety of strategies. Examples might include establishing a national fund to compensate for damages to personal property or public infrastructure. It might entail funding for and expanded access to mental health services for populations vulnerable to climate-related grief and anxiety. And finally, it might also include funding and services for helping individuals navigate climate-induced changes to livelihoods or locations.

4. *Use knowledge of losses and damages to inform transformative processes:* The previous policy recommendations, although aimed at minimizing climate-related harms, are limited by their operation within systems of inequity and marginalization. Adopting a Loss and Damage perspective could encourage pushing for structural transformation to address the inequities and systemic marginalizations that perpetuate disproportionate losses and damages. The adoption of a Loss and Damage perspective among policymakers must be accompanied by a move toward structural transformation to dismantle systems that perpetuate disproportionate drivers of vulnerability such as poverty, corruption, and uneven access to resources. An improved collective knowledge about losses and damages and uneven vulnerabilities must be linked with policy responses in pursuit of transforming systems that perpetuate disproportionate susceptibility to climate-related harm.

These recommendations are only a starting point, and many alternate policy responses to Loss and Damage could be conceptualized to meet the needs and contexts of various nations. As acknowledged above, part of establishing national-level Loss and Damage strategies must be a recognition of the threat posed by unavoidable climate harms, however recognition of harms must be accompanied by the motivation to address them. Given that developed countries like the U.S. have historically been hesitant to address Loss and Damage outside the context of adaptation globally, the motivation to address it domestically may or not yet exist. In closing, the two chapters of this thesis, together offer insight into how the global Loss and Damage agenda may be conceptualized and leveraged across disparate global contexts. Although much remains to be learned, I hope that this work will make a small contribution as the world's nations, communities and individuals move together towards a climate future that is anything but certain.

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APPENDIX A: FULL POLICY ANALYSIS SEARCH TERM COUNTS

Framework Category	Identifier	Search Term Totals	Identifier Totals	Framework Category Totals
Event Attribution	N/A	"Attribut-," (2) "Caused by"(2)	N/A	4
Losses and Damages	<i>Losses and damages (general)</i>	"Loss," (52) "Damage," (47) "Loss and damage/damage and loss," (6) "Losses and damages/damages and losses," (4) "Adverse effects," (28) "Impact-," (158) "Disproportion-" (1) "Projected /expected impacts," (10) "Projected/expected effects," (41) "Irreversib-" (6)	353	510
	<i>Non-economic loss and damage</i>	"Non-economic," (0) "Intangible" (0), "Human li-," (2) "Mobility" (2) "Death" (6), "Biodiversity loss/loss of biodiversity" (3), "Spiritual-," (1) "Religio-," (1) , "Heritage" (20), "Identity," (1) "Value" (3), "Well-being" (19), "Emotion-" (1), "Migration" (2), "Mental health" (7), "Quality of life" (19)	87	
	<i>Slow-onset events</i>	"Slow onset," (0) "Desertification," (10) "Biodiversity loss/loss of biodiversity" (3), "Degradation" (14), "Glaci-" (14), "Acidification" (4) "Sea level," (11) "Salinization" (0), "Rising temperatures" (0) "Warming" (14)	70	
Risk Management	<i>Risk management (general)</i>	"Risk Management," (32) "DRM" (104)	136	475
	<i>Risk assessment</i>	"Risk assessment," (11), "Map-" (27) "Assess-," (16) "Analy-" (27)	81	
	<i>Risk reduction</i>	"Risk reduction," (29) "Reduc-," (41) "DRR," (139) "Structural," (7) "Non-structural," (4) "Awareness," (5) "Education," (13)	238	
	<i>Risk transfer</i>	"Risk transfer," (1) "Insurance," (2) "Financial protection" (7)	11	
	<i>Risk retention</i>	"Risk retention," (1) "Fund," (1), "Financial protection" (7)	9	
Social Development	<i>Education</i>	"Education-" (107)	107	444
	<i>Gender equity</i>	"Gender," (35) "Gender equity," (4) "gender perspective," (1) "women" (6)	46	
	<i>Health</i>	"Health," (74) "health care," (1) "health system" (2)	77	
	<i>Poverty</i>	"Poverty," (12) "Poor," (2)	14	
	<i>Vulnerability</i>	"Vulnerab-" (200)	200	

APPENDIX B: SURVEY DISTRIBUTION MATERIALS

(1) Preliminary outreach email to Conservation District Managers/Administrators:

Dear _____,

My name is Libby Tobey and I am a graduate student in the University of Montana's Resource Conservation MS program. As part of my thesis research, I am exploring how Montana agricultural producers east of the Rocky Mountains are affected by drought and/or other extreme events such as fires, floods, or storms. Specifically, I am interested in what losses and damages they may have experienced. I have designed a survey on this topic with my advisor, Dr. Brian Chaffin, and we will be ready for distribution shortly.

Is it possible for you to assist us in getting this survey into the hands of producers within your district? The survey is hosted online using Qualtrics, and can be taken on a desktop, tablet or smartphone. We also hope to follow up with producers via email after 2-3 weeks to request that those who have not yet completed the survey do so.

If you're able to help us with distribution, I would greatly appreciate it! I will follow up with an email you can forward to producers in your district. Please don't hesitate to reach out with questions or clarifications. Thanks so much for your time and I look forward to connecting!

(2) Email providing Conservation District Managers/Administrators with outreach text and survey link for Producers:

Hello _____,

Thank you so much for your willingness to help distribute this survey to producers within your district!

I've provided the text of an email (**see 2a below**) for you to forward to producers. The email explains a bit about the survey, clarifies that it comes from the University of Montana and NOT the Conservation District, and provides the link to the survey itself. I will follow up with you in 2 weeks to provide a second email to be forwarded to producers. This second email will be a simple reminder to complete the survey if they haven't done so already.

If you as the district administrator have concerns before, during or after sending the survey link to your producer list, you may also contact the research team or UM IRB.

Thanks so much for your assistance, and please don't hesitate to reach back out to me with questions.

(2a) Text to be forwarded from Conservation District Managers/Administrators to producers:

Hello,

I am reaching out with information on (and a link to) a new survey from the University of Montana. The research team behind the survey hopes to learn how extreme weather events such as drought, fires, floods or storms are impacting crop producers in Eastern Montana, and would greatly appreciate your participation! More information is provided at the beginning of the survey, which can be taken on a desktop, tablet or smartphone.

Responses to the survey will be completely anonymous, so no one (including the research team) will ever be able to link your identity to your response. If you have questions or concerns about the survey, you can contact the research team or the University IRB as directed in the survey's introductory text.

Link to survey:

(3) Follow-up email to providers (via Conservation District Managers/Administrators):

Hello,

This email is a reminder to please complete the University of Montana survey if you have not already done so. The survey link is below.

If you have already completed the survey, you may disregard this message. Sincere thanks for your time and participation in this study!

APPENDIX C: SURVEY INSTRUMENT

SURVEY: Impacts of Extreme Events on Montana's Agricultural Producers

The University of Montana is conducting a study on the experience of Montana's agricultural producers with extreme weather events, such as droughts, floods, and wildfires. Specifically, we hope to learn how individuals like you have experienced extreme events over time, and to better understand any impacts these events have had on you, your family, and/or your businesses. Your responses are important and will help inform our understanding of the impacts of extreme events on Montana's farmers and ranchers. Your responses will also help a graduate student complete their degree!

Please have the adult (age 18 or over) who is most involved with operation-related decisions and management complete this 10-15 minute survey. More information about this survey will be presented on the next page. Thank you in advance for your time, your participation is sincerely appreciated!

Dr. Brian Chaffin, Associate Professor
W.A. Franke College of Forestry & Conservation
University of Montana

Q1)

Montana Impacts of Extreme Events Survey Information

Why did this survey come to my inbox or house?

We sent this survey to a small number of agricultural producers in Montana. Survey results will represent producers across the state.

Who should take the survey?

The adult age 18 or older who is most involved with operation-related decisions and management.

What should this person do?

Answer the questions online using the provided link. If you do not have internet access or would prefer to take a paper version of this survey, please contact the researchers listed below and we will mail you a copy of the survey within the next three weeks.

Who is asking these questions?

Researchers at the University of Montana's College of Forestry & Conservation. This research is funded by the University of Montana in partnership with Lund University in Sweden.

Has this study been approved by the University?

The UM Institutional Review Board has approved the survey (IRB approval #71-21).

Is this voluntary?

Yes. Your participation is voluntary and will not affect your relationship with UM. You may stop the survey at any time or skip any question you do not wish to answer. We will not pay you to take part in this study.

What are the possible benefits to you?

Your participation will help inform research on the impacts of extreme events on Montana's farming and ranching families. However, you may not get any direct benefit from participating in this research study.

Will my answers be kept confidential?

Yes. Any responses you provide to the online survey will be anonymous. If you request a mail survey, your responses will never be linked with your mailing address or name. Your answers will be combined with others' answers in all reports, papers, presentations, and analyses with no indication of who gave any particular answer. No identifying information will be reported. Thus, there are no known risks to participating.

Who uses this information?

The primary users are the researchers who designed the survey. The information from this study may be published in scientific journals or presented at scientific meetings.

Who do I contact if I have questions about the survey?

Contact: Elizabeth Tobey, Graduate Research Assistant (801) 680-1238, elizabeth.tobey@umontana.edu; or Dr. Brian Chaffin, Principal Investigator (406) 243-6575, brian.chaffin@umontana.edu.

Who do I contact if I have questions about my rights as a research participant?

Contact the Institutional Review Board at the University of Montana at (406) 243-6672 or irb@umontana.edu.

You are voluntarily making a decision whether or not to participate in this research study. By filling in the "I agree" bubble below, your consent to participate is implied. You should photocopy a copy of this page for your records. If you do not agree, you may stop the survey now.

I agree

Q2)

The following questions ask about your experience with extreme events (such as floods, droughts, storms, fires). Please indicate how strongly you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I have noticed changes in extreme events over my lifetime	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme events like drought and wildfire are more severe than they once were	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme events have occurred regularly for as long as I can remember	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that extreme events are linked to a changing climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3)

Where do you get your information about the impacts of extreme events beyond what you experience personally? (Select all that apply)

- Television, radio, newspapers
- Social media
- Scientific articles/publications
- Government websites or publications
- Friends and family
- Community members
- Other (please specify)

Q4)

The following questions ask about the **impacts of extreme events** (such as floods, droughts, storms, fires). Please indicate how strongly you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I have been negatively impacted by extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have experienced extreme events, but I have not been negatively impacted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme events have not impacted my livelihood or sources of income	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have experienced grief or hopelessness as a result of extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because extreme events are occurring more often, impacts to me and/or my livelihood are greater than they once were	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5)

If you indicated above that you have (or may have) been negatively impacted by an extreme event (by marking 3, 4, or 5 in the first row of Q4), please indicate the types of impacts you have experienced. (Check all that apply)

- Loss of physical assets (including property, crops, livestock, etc.)
- Physical injury or illness
- Lost income
- Death of friends or family
- Decreased mental health
- Displaced from residence (i.e., had to move)
- Loss of networks (i.e., removed from friends, family)
- Sense of loss or grief over environmental damage or destruction
- Other (please specify)

Q6)

Below is a list of common things that people care deeply about. Because the sliders are only used in the electronic version of this survey, **please write the number which indicates each item's importance to you at the end of each itemized line**, with 5 = "very important" and 0 = "not important."

	0 = not important	5 = very important				
	0	1	2	3	4	5
Livelihood / occupation						
Income						
Community						
Family						
Mental health						
Local landscape and environment						

Q7)

Think about what you indicated as important to you in the previous question above. Consider these things as "*what you value*." Please indicate how strongly you agree or disagree with the following statements about what you value.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I believe extreme events will negatively impact what I value in the near future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme events have negatively impacted what I value in the recent past	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climate change will negatively impact what I value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe extreme events will negatively impact what I value for the rest of my lifetime	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8)

What is your job or livelihood? In other words, how do you describe what you do for work, for example, farmer, rancher, mechanic, teacher, etc.?

Q9)

Have you experienced impacts on your job or livelihood due to changes in the climate?

- Yes
- No
- Unsure

Q10)

If you marked “Yes” to Q9 above, please explain these impacts to your job or livelihood (e.g., lost work hours/days, no or little labor available, decreasing interest from young people in the profession, etc.).

Q10 a)

If you marked “Unsure” to Q9 above, please briefly explain why you are unsure if you have experienced impacts on your job or livelihood due to changes in the climate.

Q11)

The following question asks about potential **impacts to your ability to make a living** under various climate conditions. Please indicate the level of impact each climate condition *could have* or *has had* on your ability to make a living.

	Extremely negative impact (1)	Somewhat negative impact (2)	No impact (3)	Somewhat positive impact (4)	Extremely positive impact (5)
Above average annual precipitation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Below average annual precipitation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above average annual temperatures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Below average annual temperatures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12)

The following questions ask about the **impact of extreme events on your job or livelihood**. Please indicate how strongly you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
If a drought like the 2021 drought happened every five years, I would change my job or livelihood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a drought like the 2021 drought happened every year, I would change my job or livelihood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Past extreme events have influenced my decision(s) to change my job or livelihood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Past extreme events have influenced my decision(s) to relocate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It would be difficult for me to change my job or livelihood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13)

The following questions ask about **how the impacts of extreme events are distributed across society**. Please indicate how strongly you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I feel that I have been negatively affected by extreme events more so than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Generally, I think certain people have been more affected by extreme events than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The effects of extreme events I have experienced are commonly experienced by others in my profession	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have access to support, resources, and information to help me cope with the impacts from extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14)

Only ***three more sets of questions like this***. Thank you for sticking with us!

The following questions ask about the **impacts of COVID-19 on you and your community**. Please indicate how strongly you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Generally, I think that COVID-19 has made my community stronger and more prepared for the impacts of extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe I am more vulnerable to the impacts of extreme events because of COVID-19	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Myself and/or my household has been worse off, generally, since the onset of COVID-19	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15)

The following questions ask about your **perceptions of extreme events and how they may affect you and others in the future**. Please indicate how strongly you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I feel hopeful about the future, even if extreme events such as drought or wildfires continue to affect my region	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not confident in my ability to cope with the impacts of extreme events going forward	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am worried about the ability of others in my community to cope with the impacts of extreme events in the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel helpless and unable to control my responses to extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel connected to people, organizations, businesses, and/or public decision makers who can help me prepare for and cope with extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q16)

Which of the following factors **have decreased or could decrease** your ability to cope with the impacts of extreme events? (Check all that apply)

- Market price of crops, livestock, and/or feed
- State and/or federal policies
- Demographic and property ownership change around me
- Land prices
- Increase in operational costs
- Changes in local values
- Political turmoil and/or instability
- Crop choice
- Labor availability and/or cost
- Other (please specify)

Q17) This is the ***last set of questions*** like this. Thank you for sticking with us!

The following questions ask about your **perceptions of responsibility for responding to extreme events**. Please indicate how strongly you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewh at agree (4)	Strongly agree (5)
The Federal government should bear primary responsibility for responding to negative impacts of extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
State government should bear primary responsibility for responding to negative impacts of extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Individuals or families should NOT bear primary responsibility for responding to negative impacts of extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Responsibility for responding to the impacts of extreme events should depend on if the extreme events are linked to a changing climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have personally taken action to prepare for and/or adapt to extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am part of a group taking action to prepare for and/or adapt to extreme events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18)

If you indicated above that you have either *personally* taken action or *are part of a group* taking action to prepare for and/or adapt to extreme events (**by marking 4 or 5 in the last two rows of Q17**), please briefly describe the actions you and/or your group have taken.

We will now ask you a few basic demographic questions before concluding the survey.

Q20)

What year were you born?

Q21)

Roughly how many years have you worked in your current agricultural operation?

Q22)

In what county or counties is your agricultural operation located?

Q23)

Which of the following best describes your gender?

- Female
- Male
- Non-binary
- Other

Q24)

What is the highest level of education you have completed?

- Grade School
- High School / GED
- Some College or Vocational Training
- 2-Year College
- 4-Year College
- Postgraduate

Q25)

Which of the following best describes your racial identity?

- White / Caucasian
- Black or African American
- Hispanic, Latino or Spanish
- American Indian or Alaska Native
- Asian
- Native Hawaiian or other Pacific Islander
- Other (please specify)

Q26)

Roughly what percentage of your household income comes from agriculture?

- 0-19%
- 20-39%
- 40-59%
- 60-79%
- 80-100%

Q27)

What is your estimated gross annual household income before taxes?

- < \$50,000
- \$50,000-\$100,000
- \$100,000-\$250,000
- \$250,000-\$400,000
- > \$400,000

Q28)

How did you find the link to this survey?

- It was sent to me directly by my local conservation district
- It was provided in a conservation district newsletter
- It was posted to a conservation district website or social media page
- I received an email from someone other than conservation district staff
- A friend or colleague sent it to me
- Other (please specify)

Thank you for taking the time to complete this survey! Please use the pre-addressed envelope enclosed to return it to the research team.

If you are willing to be interviewed by a member of the research team about your experiences farming and/or ranching in Montana, please provide your contact information below:
