

11

CLIMATE CHANGE IS REAL

Critical Realism and the Unequal Social Impacts of Climate Change

Amber J. Fletcher

University of Regina, Regina, Canada

Introduction

Climate change is a pressing global issue, which has prompted a massive amount of research from a variety of philosophical, disciplinary, and methodological perspectives. Research on climate change impacts is often informed by a framework that views vulnerability—that is, the propensity to be negatively affected by climate change—as a product of exposure and sensitivity to climate change, minus adaptive capacity (Smit & Wandel, 2006). Exposure is primarily defined in climatological, geographical, and/or biophysical terms, and refers to the physical presence of a ‘system’ (e.g., a household, community) in an area that is likely to be affected by a hazard (IPCC, 2022); for example, someone living on a flood plain or farming in a drought-prone region is highly exposed. The concept of sensitivity adds more social and economic dimensions by considering, for example, how reduced access to resources might exacerbate the negative impact of a hazard (Wandel et al., 2016). While exposure and sensitivity increase vulnerability, adaptive capacity reduces it. Adaptive capacity refers to our ability to respond, make adjustments, and prepare for future extreme events (IPCC, 2022).

Social research on climate impacts and vulnerability has been variously guided by (post)positivist, interpretivist, poststructuralist, and critical philosophical paradigms. Although many authors do not state their philosophical orientation explicitly, positivist and post-positivist studies tend to focus on exposure—for example, identifying the biophysical effects of hazards on specific regions, developing measures and indices of vulnerability, or identifying correlations between socioeconomic variables and impacts. Interpretivist research, in contrast, has focused on diverse experiences, beliefs, and

DOI: 10.4324/9781032639130-11

meanings about climate change. Poststructuralist approaches deconstruct how climatic problems are discursively shaped and constructed.

From a critical perspective, there is increasing recognition that the impacts of climate change—which manifest as increased extreme events like heat-waves, droughts, wildfires, and floods—do not affect all communities and individuals equally, or the same (e.g., Sultana, 2021; Versey, 2021). Climate hazards are socially differentiated, and climate change has dramatic implications for human well-being, social welfare, and equity. Studies on the inequitable causes and consequences of climate change are often implicitly guided by a critical paradigm, although some authors do not engage fully with ontology or even causation directly. The purpose of this chapter is to demonstrate how Critical Realism (CR), as a ‘full-blown’ philosophy of science that addresses both ontology and epistemology (Brown et al., 2002, p. 3), can produce a distinctly different analysis of climate impacts than is offered by positivist or interpretivist approaches. Through its laminated ontology, CR facilitates critical engagement with the deeply rooted causal structures that shape our unequal experiences of climate change.

Using examples from the published literature on climate vulnerability, plus the results of a large-scale qualitative study in the Canadian province of Saskatchewan, this chapter illustrates how the social impacts of climate change can be understood through three philosophical orientations: (post) positivism, interpretivism/poststructuralism, and CR. Each approach produces a very different account of climate vulnerability, underpinned by different ‘conceptual architectures’—that is, different philosophical assumptions about reality, which are linked to different methodologies and, ultimately, different analyses (Nichol et al., 2023). All philosophical approaches can make important contributions to our understanding of climate change (see also Tufte, Chapter 9 in this volume); however, I argue that CR is well-positioned to identify and explain structural causes of vulnerability, which result in highly differentiated and context-specific impacts.

(Post)Positivist Approaches to Climate Impacts

Climate change research in the natural sciences has examined exposure to climate hazards through such disciplinary lenses as climatology, hydrology, and meteorology. Positivist and post-positivist research in these areas is guided by a realist ontology, which asserts a singular reality that can be known objectively (positivism) or probabilistically (post-positivism) through inductive or deductive logic (Howell, 2013). In this chapter, I use the combined term ‘(Post)Positivism’ when referring to work that is guided generally by a positivist *or* post-positivist philosophy. Although important differences exist between the two paradigms, such as the modified objectivist epistemology of post-positivism (Guba & Lincoln, 1994), the works referenced here

generally embody the values of both; for example, an emphasis on empirical-level analysis (e.g., seeking correlations between variables) as the best way to understand a singular, objective reality.

A large body of climatological research has demonstrated causal linkages between human activities, carbon dioxide emissions, and increased risk of climate hazards (IPCC, 2021). In climate science, methods primarily follow positivist principles of measurement, direct observation, and experimentation. In the case of future scenarios and projections, researchers also accept probabilistic, rather than deterministic, understandings of what should occur under certain circumstances, thus reflecting a more post-positivist epistemology (Ponterotto, 2005). Overall, climate science emphasizes conjunctions of events (Bhaskar, 2015): under X conditions, we expect that Y should follow.

Such scientific studies have informed successive reports of the Intergovernmental Panel on Climate Change (IPCC). Through its regular Assessment Report cycles, the IPCC accumulates the scientific evidence for climate change and has, on the basis of this evidence, expressed increasing concern about greenhouse gas emissions as the primary driver of anthropogenic climate change (IPCC, 2021). In this way, climatological research informed by (post)positivism has made important contributions to our understanding of climate change and provides an empirical basis for mitigation efforts. These scientific studies demonstrate the extensive aspects of climate change as a global problem through models (see Danermark, Chapter 4 in this volume, for more on extensive data). The realist ontology of positivism that underpins climate science—that is, a singular reality exists and is discoverable—is a necessary foundation for truth claims that climate change is, in fact, real and poses an existential planetary threat. Epistemologically, the subject matter of climate science lends itself to the measurement and identification of (potential) cause-and-effect relationships.

The application of positivist methods to the *social* dimensions of climate change proves more challenging. Human impacts of climate change occur within ‘open’ social systems, where numerous factors and dynamics can interact to produce unpredictable results (Danermark et al., 2002). Controlled conditions or formulae are often unfeasible for understanding human behaviour, and such attempts can ultimately prove overly reductionist—for example, by reducing adaptation actions to (predictable) rational choice, or heatwave fatalities to biology and exposure only.

Climate vulnerability indices are an example of a (post)positivist project to predict the social impacts of climate change. In vulnerability assessment, indices are used to develop empirical measurements of different aspects of climate change vulnerability using the ‘exposure + sensitivity – adaptive capacity’ formula. Social and economic indicators of vulnerability, often derived deductively from previous studies, are weighted to provide overall comparisons of vulnerability at national or sub-national levels.

As one example, Edmonds et al. (2020) describe a composite vulnerability index with six sectors (i.e., ecosystems services, food, human habitat, health, infrastructure, and water), which are indexed by averaging constituent indicators for each domain. These indicators are grouped into exposure, sensitivity, and adaptive capacity indicators—for example, in the case of the health sector, one exposure indicator is projected deaths from climate-related disease, a sensitivity indicator is slum populations, and an adaptive capacity indicator is access to improved sanitation (Edmonds et al., 2020). When comparing their composite index to another index, the Notre Dame Vulnerability Index, the two indices agreed on 11 of 15 of the most vulnerable countries (Edmonds et al., 2020). Despite this agreement, the comparison illustrates how such measures of vulnerability can return different understandings of the same reality. Countries' actual vulnerabilities have not changed, but the presented reality changes depending on the methods through which it is understood. Indeed, in some indices, simply changing the weighting of indicators can increase or reduce the level of vulnerability of a region or country.

Fernandez et al. (2017) demonstrated the shortcomings of indicators-based approaches through their study in New Zealand. The authors used sensitivity indicators like income, population density, and family structure, which were weighted and used to assess the overall vulnerability of New Zealand's administrative regions. Their objective was to quantitatively predict the differential impact of climate change on these regions to inform adaptation policymaking. However, in this case, the authors ultimately concluded that their indicators-based approach was not robust. The results varied significantly depending on how the indicators were substituted with other indicators, and depending on certain assumptions made during application. They concluded that, while indices are 'appealing because of [their] simplicity', this approach is 'at risk of oversimplification and of adding uncertainties' because changes to the parameters may significantly affect the results in unexpected ways (Fernandez et al., 2017, p. 400).

The philosophical position underlying vulnerability indicators is that measurements of observable aspects of vulnerability, often chosen deductively, can or should predict future vulnerability or impacts with some regularity. Epistemologically, the analysis remains at the empirical level, with a focus on quantifiable relationships between indicators and impacts. What we do not see, however, is what 'causes the causes' of climate vulnerability—that is, what lies beneath indicators like housing stress or deprivation. Instead, indicators may be treated as pre-existing and *a priori*. The resulting information is a description or prediction, but not an explanation of what causes the identified vulnerability.

Such (post)positivist approaches, and the descriptions or predictions they provide, play a useful role in climate change research. Taken collectively,

indices can provide a valuable nomothetic understanding of vulnerability at a high level, for example, across countries or regions. Indicator approaches constitute extensive data and identify demi-regularities (e.g., vulnerability hotspots) for further investigation. The risk is that one index may represent itself as a fulsome or transparent reflection of reality, which may then inform the allocation of crucial, but limited, resources for jurisdictions experiencing a climate hazard. Indices may reinforce a focus on immediate and proximal causes of vulnerability at the surface level (e.g., exposure).

Positivist vulnerability assessments may therefore reflect what Bhaskar called the ‘epistemic fallacy’, in which the real is reduced to what can be seen at the empirical level through statistical correlations and mathematical models. Such approaches may not consider the deeper and more causal dimensions, which may not be immediately visible to us, that lead to climate impacts occurring as they do. The (post)positivist approach could encourage technocratic or economistic approaches to climate adaptation (Kehler & Birchall, 2021), which suggest that the problem of climate change is best solved primarily through technology and infrastructure interventions, like higher bridges and larger dams. While infrastructure certainly can play a helpful role in climate change adaptation, such ‘reductionist’ interventions can have unpredictable social impacts, such as infrastructural ‘lock in’ (i.e., cementing communities into permanent adaptive infrastructure that may prove inadequate for unpredictable climate futures), ongoing maintenance issues, and establishing a false sense of security (Zeitoun et al., 2016).

Interpretivist and Post-Structuralist Approaches to Climate Impacts

Interpretivist approaches provide a very different lens on climate impacts. This philosophical paradigm eschews the positivist ontology of a singular, discoverable reality in favour of a relativist ontology and epistemology. Multiple realities exist, and all are valid by virtue of their social construction. Here, the objective is to gain intersubjective understanding of the social world, and this understanding constitutes explanation (Hay, 2011). Interpretivist analyses therefore focus on the (re)construction of social phenomena through interpretation; the focus is on transient perspectives (Bhaskar, 2015).

Can climate change be effectively understood by interpreting interpretations? This paradigm has informed a range of research on individual-level and shared values, beliefs, and narratives. As one example, Malena-Chan (2019) examined the narratives produced by young community leaders committed to social and environmental justice in Saskatchewan, Canada. The purpose of this interpretivist, narrative study was to examine how participants framed their experiences to gain a deeper understanding of how narrative dissonance—for example, feeling overwhelmed by the magnitude of the

problem of climate change impacts—could be overcome and inspire feelings of individual agency and capacity. Studies of the cognitive and discursive dimensions of climate change provide helpful insight into how issues are framed, understood, and interpreted, which can influence education and action. They have an important place in the analysis of social dimensions of climate change.

However, when climate impacts and solutions are understood *solely* through the lens of human experience, understanding, and interpretation, analyses may neglect the real level of causal structures that drive problems like narrative dissonance; for example, if a problem seems too overwhelming to be addressed through individual action, it may be a cue to investigate deeper causal structures that cause the problem to exist as it does, and tackle those causal structures alongside the empirical level of human understanding or discourse. Here, interpretivist and CR approaches can be mutually informative.

Interpretivism is well-positioned to examine the relatively subjective, relativist aspects of climate change, where reference to a singular truth or reality may not be necessary. From a CR perspective, the key issue is interpretivism's inherently relativist ontology and the associated epistemic fallacy this creates, which has significant implications in the context of climate crisis and ongoing climate change denial. According to the Yale Program on Climate Change Communication (Marlon et al., 2024), 16% of Americans do not believe in global warming at all, while 30% believe global warming is attributable only to natural, not human, causes. Simultaneously, the recent rise of alt-right, white supremacist, and anti-trans sentiment in places like the United States and Canada indicates the precarity of progress towards equity and social justice. In the context of climate denialism and anti-equity movements, relativism is risky. To make claims about more desirable conditions, research on climate injustice requires—as part of its conceptual architecture (Nichol et al., 2023)—a realist social ontology that acknowledges the reality of problematic social conditions and facilitates critical analysis of their causes through reference to real social structures. Climate change and social inequity are socially created, but they are also real, and acknowledgement of their reality—as well as the acknowledgement of other, preferable states of affairs against which to compare them—is a necessary precondition for change.

While interpretivist approaches elucidate multiple, contextual understandings and meanings about climate impacts, post-structuralism engages with the broader systems of representation that shape those understandings. In the climate change literature, post-structuralists have challenged objectivist epistemology, noting that we cannot step outside our human-constructed knowledge systems to view the totality of climate change objectively. In this way, post-structuralism challenges positivism, acknowledges multiple epistemologies aimed at understanding climate change (Nightingale, 2016), and

provides a helpful tool for engaging critically with dominant discourses about climate change (e.g., Bettini, 2013). The post-structuralist approach facilitates analysis of how our conceptual access to the problem of climate change, and our understanding of its impacts, is mediated by interpretation and diverse knowledge systems.

The issue here is that post-structuralism may conflate epistemology and ontology, with multiple ways of knowing (or multiple discourses about) climate change becoming the only reality of climate change at all. From a post-structuralist perspective, for example, Dujardin views the natural world as ‘produced discursively’ (Dujardin, 2020, p. 1061). If climate change is mostly a product of discourse, it becomes difficult to make ontological claims about its veracity and existence outside of discourse. If our engagement with discourses like climate denialism is also underpinned by ontological relativism, then all discourses—even the most problematic from a scientific or climate justice perspective—must count equally. The conflation of ontology and epistemology therefore opens the door to the view that ‘multiple measurements, understandings, and enactments of climate might be equally valid’ (Dujardin, 2020, p. 1067). Without the ability to reference an ontological reality, climate change denialism is given equal credibility to climate science.

Interpretivism and post-structuralism acknowledge the plurality of knowledges, understandings, and diverse experiences that are important to socially inclusive adaptation planning. However, there is here a risk of (perhaps inadvertently) de-politicizing both climate change and its unequal impacts by denying their ontological reality, particularly in an era of ongoing climate scepticism and anti-equity backlash. Relativist approaches may be guided by the good intentions of embracing epistemological pluralism and challenging the epistemic dominance of, for example, Western technocratic understandings of climate adaptation, thus creating space for multiple ways of knowing. However, the associated embrace of relativist *ontology* means that equal validity is provided to those perspectives we should *not* accept—such as environmental racism or climate change denialism, for example. While epistemological relativism enables valuable critiques of the dominant approach to adaptation policymaking—an approach that is, currently, technocratic, economic, and detached—ontological relativism nonetheless positions the firsthand knowledge of hazard-affected community members, who understand their own needs and strengths, on equal footing with advocates of the dominant technocratic approach and those who deny climate change altogether. It is unclear how this can lead to climate solutions and justice.

Acknowledging the reality of climate change and social inequity need not imply an omniscient ‘god’s eye view’ or completely objectivist epistemology; rather, a separation of ontology and epistemology is required, which recognizes multiple ways of knowing and representing climate change but accepts that some of these ways of knowing (e.g., climate denialism) are likely less

accurate, and that some states of being (e.g., injustice, inequity) are less desirable. Making such claims requires the acceptance of a singular ontological reality against which various claims and states can be evaluated. From a CR perspective, acknowledging that climate change is real does not necessitate reductionism to only biophysical causes or technocratic solutions. Complex natural and social causes of climate change are real—and so, too, are the unequal impacts of climate change.

Beyond the Empirical: A Critical Realist Approach

In CR philosophy, our understandings and discourses can be real and causal because they can have an effect on the world (Sayer, 1992), but such claims require the acknowledgement of an ontological reality that is, then, affected by them. Like (post)positivism, CR adopts a realist ontology: there is a real world that is not only ideational, but also exists independently of conceptualization and interpretation. Even if we lacked the language or understanding of what carbon emissions are and how they affect the environment, we would still be emitting carbon by travelling on airplanes and driving cars. However, the real world is theory-laden and conceptualization is our only choice for knowing reality—we cannot understand the world from outside our knowledge systems. In this way, CR draws its epistemology from interpretivism.

What makes CR specifically critical is that our interpretations can reference, as much as possible, a real world. This provides an ontological basis for claims about what is problematic, desirable, or just, based on evidence. CR encourages social critique and explanation of social problems (see Solem, Chapter 3 in this volume, on social critique in CR) (Danermark et al., 2002); it facilitates questioning of dominant ideologies and discourses through reference to alternative explanations based on evidence and causal analysis. Knowledge about the world is transitive and can be changed (Bhaskar, 1979), which means that dominant explanations can be challenged. In CR, causal analysis occurs through retroduction, which involves identifying the real, causal structures that are necessary for a situation or social problem to exist as it does. Using retroduction to go beyond the identification and description of problems is necessary because ‘criticism becomes critique when we not only show that certain beliefs are false but explain why they are held, and what produces them’ (Sayer, 1997, p. 474).

Therefore, for Critical Realists, knowledge cannot be gained only through either empirical observation or pure conceptualization (Sayer, 1992), and causal analysis is more complex than identifying regular, recurring patterns between variables. CR is underpinned by a laminated notion of reality, in which multiple levels of reality exist, each level containing causal mechanisms (Bhaskar, 2010)—but due to the principle of emergence, we cannot reduce complex social phenomena to basic mechanisms alone. Therefore,

seeking out structural causes does not necessitate essentialism or reductivism (Danermark, 2002). From a CR perspective, social inequities like gender cannot be reduced to biology (e.g., sexed bodies), just as the problem of climate change is much more complex than excess carbon emissions. CR instead acknowledges that social phenomena are emergent and therefore not reducible to their constituent parts. Complex social phenomena have powers to cause other, further phenomena to happen; therefore, the social can be causal.

The following section presents a CR-informed analysis of a study on climate hazard impacts in rural Saskatchewan, Canada. The data were collected in four study areas as part of a community-engaged, qualitative project entitled ‘The Social Dimensions of Climate Hazards: Adapting to Wildfire and Flood in Saskatchewan’s Farm, Forestry, and First Nations Communities’. A CR approach allows us to identify and critically interrogate the complex causes of unequal climate impacts within and across four rural and Indigenous communities in this hazard-prone part of the world.

Study Context and Methodology

Located in the semi-arid Canadian Prairie region, the province of Saskatchewan has one of the most variable climates in the world (Sauchyn, 2010), with a long history of hazards like flooding and drought. These climatic extremes are being amplified by anthropogenic climate change, leading to increased unpredictability and more severe floods, droughts, and wildfires (Sauchyn et al., 2022). The ‘Social Dimensions of Climate Hazards’ project explored the lived experience of these hazards and identified how people are differentially affected because of factors like gender, culture, age, and location. In this section, I present several key findings from four of the study areas in the project: Maple Creek, La Ronge, Ochapowace First Nation, and Hafford. Each study employed a different combination of qualitative methods, as determined by the unique context and preferences of community collaborators.

The first study was conducted in Maple Creek, a ranching community located in the driest part of the Prairie region. Maple Creek area residents are accustomed to drought and demonstrate strong adaptive capacity through ranching practices and grassfire preparation; however, in 2010 the community experienced an unprecedented flood event, which posed an unexpected challenge and caused significant damage to housing and infrastructure throughout the town and surrounding rural areas. The Maple Creek study involved 62 participants, 46 of whom participated in in-depth interviews and 16 in a Participatory GIS (group mapping) activity.

The La Ronge ‘tri-community’ is located in the northern boreal forest region of Saskatchewan, and includes the town of La Ronge, the Lac La Ronge Indian Band (an Indigenous Nation), and the village of Air Ronge. In 2015, the region

experienced the largest evacuation in provincial history as more than 700 wildfires burned across the north. A member of the research team lived in the La Ronge area for 16 months, completing interviews with 44 community members and a participatory Photovoice activity with 21 participants.

The third community in the study, Ochapowace First Nation in southeastern Saskatchewan, has experienced repeated flood events, including in 2011 and 2014, resulting in the evacuation of community members to nearby communities. The Nation continues to grapple with the impacts of a dam placed by a federal government agency on nearby Round Lake in 1941 to reduce flooding downstream; the Nation's members indicate that the dam has negatively affected the local landscape. A total of 35 members of Ochapowace participated in interviews and Photovoice to share their experience of the floods. An additional video documentary film project was carried out alongside the flooding study, responding to the community's desire to record the knowledge of their Elders for intergenerational preservation.

Finally, the fourth study area included the towns of Hafford, Radisson, Borden, and their surrounding areas, a group of farming communities in central-west Saskatchewan. In addition to the challenges of climatic variation characteristic to Saskatchewan, Radisson and Borden experienced a flood event in 2014. The Hafford and area study included an ethnographic observation component, which involved a researcher living in the community for six months, along with 44 interviews with community members.

Findings and Analysis

Taken together, the key findings from the four studies demonstrate that the social dimensions of climate hazards cannot be fully understood only through empirical-level engagement with exposure, sensitivity, and adaptive capacity. Dominant explanations of the communities' vulnerability and adaptive capacity—often coming from outside the communities themselves—reveal an emphasis on biophysical, economic, and techno-infrastructure factors as both the cause of, and solution to, climate vulnerability. In-depth engagement with community members' experiences, particularly when analysed retroductively, instead suggests the ongoing relevance of social-structural factors causing differentiated and inequitable experiences of climate hazards.

At the empirical level, our study findings did show significant biophysical and economic impacts of climate hazards in these communities. The wildfires in La Ronge and the floods in Ochapowace and Maple Creek damaged homes, destroyed infrastructure like roads, and caused the evacuation of residents to nearby communities or even far-away cities. In La Ronge, participants explained how the evacuation effort seemed to be guided primarily by economic and biophysical priorities, like preserving the most economically valuable places and evacuating people as efficiently as possible to avoid loss of life (Walker et al., 2021a, 2021b). The emergency response efforts were, in

this sense, guided by the same kind of priorities as vulnerability indices would suggest: observable, quantifiable priorities.

However, participants in the La Ronge study described how some of the most important places and spaces were not the most expensive or ‘valuable’ in market terms. Cabins, traplines, and areas of forest had both livelihood and cultural value to residents, and the loss of these places caused significant pain (Walker et al., 2021a). Despite the undeniable importance of preserving life during an evacuation, La Ronge residents perceived a lack of attention paid by external authorities to community members’ agency and well-being as well. As we described in Walker et al. (2021a), participants relayed how Indigenous Elders were placed in large urban evacuation centres located hundreds of kilometres from their homes. For some Elders, the experience was reminiscent of past trauma experienced in the notoriously abusive residential school system during their youth. Some became physically ill from lack of access to their traditional foods. Some community members felt that these significant social and cultural impacts were under-recognized in ex-post analysis of the disaster, due to an overriding emphasis on proximal, observable priorities dictated by colonial and capitalist logics (Walker et al., 2021b).

In Ochapowace First Nation, residents experienced extreme housing damage from the floods, with some homes washed away entirely. Six years after the flood, some participants told us about how they continued to live in homes contaminated by black mould and were experiencing the physical impacts, such as respiratory problems. An empirical-level explanation suggests, simply, exposure as cause: housing infrastructure was damaged by the floods and should be repaired. However, local leaders explained how a protracted dispute with the Canadian government had led to years of absent funding for housing infrastructure on the Nation, leading to less resilient housing infrastructure when the floods hit. At the empirical level, housing damage was caused by the flood. At the level of the real, housing damage was caused by a complex of colonial institutional structures that affected funding for housing.

Engaging critically with limited empirical-level explanations or solutions to climate change—for example, the most valuable homes should be saved from wildfire; housing should be more resilient to flooding—allows us to produce deeper, alternative explanations that account for the lived experience of participants. A CR analysis considers relatively ‘distal’ aspects like well-being, colonialism, and market logics. These have causal impacts on the lives of community members experiencing a climate hazard. As Bhaskar noted

...for the critical realist, everything is real, everything, which is a causal agent, is real. Thus, for a critical realist, beliefs, which are faults, are also, in virtue of being causally efficacious, real. For critical realists, language is real, mathematics is real, materiality is real; whatever has a causal effect is real and that gives a critical realist a maximally inclusive ontology.

(Bhaskar, 2017, p. 49)

In these cases, the dominant approach to hazard response—based on a particular set of (relatively narrow) beliefs and values—was causal, resulting in particular social and cultural ramifications as distal aspects causing vulnerability at a deeper level (also causal) were not always considered.

In Maple Creek, like many other rural communities in Saskatchewan, our data show that agricultural work remains structured along gender lines, with historically engrained gendered divisions of labour shaping men's and women's roles on the farm or ranch (Mbuli & Fletcher, 2021). These roles have subsequently produced gendered responses to drought and flood, with men seeing themselves as mainly responsible for the farm's survival and women taking responsibility for holding their families and communities together during the crisis (Fletcher, 2017). Both roles have psychological impacts in agricultural contexts, but in different ways. Our research shows that farm men felt a deeply engrained personal responsibility when the farm 'failed' due to a drought, whereas women reported the stress and burnout of supporting others with their emotional and physical labour—sometimes to the detriment of their own well-being (Fletcher, 2017). In this way, the experience of a climate hazard exacerbated socially constructed gender ideologies and roles, leading to gender-differentiated impacts and vulnerabilities. Further, adaptation was also gendered: because men are more likely to be positioned as the key farmers or ranchers, they may be more likely to make daily production decisions, while women may be relatively distanced from adaptive decision-making due to their other responsibilities with off-farm work, domestic work, and caregiving (Mbuli & Fletcher, 2021).

In Hafford and area, participants were less concerned about the direct implications of a grassfire or flood—that is, exposure—than they were about the ongoing loss of community and depopulation trends they had experienced in recent decades (Campbell-Gale et al., 2023). Participants spoke of how family farms in the area had grown larger and larger, taking advantage of economies of scale as an adaptive response to international market unpredictability and rising production costs. Those unable to expand and compete had dropped away, leading to a loss of small-scale family farms (Campbell-Gale et al., 2023). Resulting depopulation caused loss of local infrastructure, businesses, and social services. From a climate vulnerability perspective, these trends also mean that neighbours, who often constitute the main source of assistance during a flood or grassfire in rural Saskatchewan, are further and further away (Fletcher et al., 2020).

What causes the gendered mental health impacts for farm women and men in rural Saskatchewan? Why are farmers in Hafford more concerned about depopulation and loss of social infrastructure than climate hazards? Are these findings explainable through a relativist reality constructed through interpretation, in which vulnerability exists primarily in the perceptions and understandings of the participants? CR analysis considers the widespread and relatively perseverant social structures and causal mechanisms that drive

these emergent experiences at different levels. These trends are not only experiential or ideational, but also are the emergent result of a confluence of material, ideological, and perceptual factors caused by interacting structures. In Maple Creek, people's experiences of farm-destroying droughts and floods are shaped by engrained gendered structures that cause different impacts for women and men. Drought and flooding are the proximal cause of mental health impacts, but gendered structures cause these impacts to manifest as they do. The results from Hafford clearly demonstrate the limitations of empirical-level analysis of climate change, particularly from an interpretivist perspective. Participants were not particularly interested in discussing climate hazards; for the most part, community members do not see themselves as vulnerable to flooding and drought. Climate hazards continue to pose a risk, recognized or not, but participants' concerns also point towards deeper political-economic aspects that shape how these risks will manifest and, importantly, what supports are, or are not, available in times of crisis.

Conclusion

In the four community case studies described here, climate change vulnerability is the product of perseverant social structures that cause sensitivities, interact with exposures, and shape adaptive responses—ultimately resulting in context-specific, heterogeneous, and unequal impacts of climate hazards. Vulnerability is not an essential, inherent condition of communities or social groups; it is a social construct but cannot be understood simply as a product of discourse, interpretation, or biophysical exposure alone. Rather, vulnerability emerges from political, economic, and social structures and their associated contextual conditions and responses, like depopulation or institutional governance arrangements. Adaptive responses that reinforce dominant ideologies and practices—for example, gendered responsibilities or market-defined notions of what is 'valuable'—contribute to the reproduction of vulnerability and disproportionate climate impacts.

CR analysis can provide the necessary ontological foundation for critiquing these complexes of structures, conditions, and outcomes. As anthropogenic climate change continues to exacerbate the frequency and intensity of hazards, a CR approach provides us with the intellectual and analytical freedom to go beyond empirical-level correlations and interpretations, to make claims about the structures and mechanisms that cause social problems. Unlike relativist approaches, which risk opening the door for climate denialism and anti-equity arguments, CR allows us to assert that the social problems we identify are real and problematic (see Østerud, Chapter 8 in this volume, on evaluative ethics). Climate change is real. Social inequity is real. However, they are changeable. Given the ontological basis for making claims about the world, we can move forward to more desirable states and suggest solutions for meaningful social change and climate justice.

Acknowledgements

The ‘Social Dimensions of Climate Hazards’ study was supported by funding from the Social Sciences and Humanities Research Council (SSHRC) and the Queen Elizabeth Scholars Program. The La Ronge area study was led and conducted by Dr. Heidi Walker, with Dr. Maureen Reed. The Maple Creek and area study was conducted by Angela Culham, Dr. Mbuli Shei Clodine, Dr. Amber Fletcher, and Dr. John Boakye Danquah. The Ochapowace study was conducted by Dr. Amber Fletcher, Dr. Nancy Sah Akwen, and Nicholas Antonini in collaboration with Headman Tim Bear, Cortney Bear, and Cassandra Taypotat of Ochapowace First Nation. We also gratefully acknowledge the support of Headman Albert Bear. The Hafford and area study was led and conducted by Dr. Holly Campbell-Gale, with Dr. Amber Fletcher. We are grateful to all community members who shared their time and knowledge with us. Special thanks to the community partners, local leaders, and Elders for their guidance and commitment to these projects.

References

- Bettini, G. (2013). Climate barbarians at the gate? A critique of apocalyptic narratives on ‘climate refugees’. *Geoforum*, 45, 63–72. <https://doi.org/10.1016/j.geoforum.2012.09.009>
- Bhaskar, R. (1979). *The possibility of naturalism: A philosophical critique of the contemporary human sciences*. Humanities Press.
- Bhaskar, R. (Ed.). (2010). *Interdisciplinarity and climate change: Transforming knowledge and practice for our global future*. Routledge.
- Bhaskar, R. (2015). *The possibility of naturalism: A philosophical critique of the contemporary human sciences* (4th ed.). Routledge.
- Bhaskar, R. (2017). *The order of natural necessity: A kind of introduction to Critical Realism* G. Hawke (Ed.). CreateSpace Independent Publishing Platform.
- Brown, A., Fleetwood, S., & Roberts, J. M. (2002). The marriage of critical realism and Marxism: Happy, unhappy or on the rocks? In A. Brown, S. Fleetwood, & J. M. Roberts (Eds.), *Critical Realism and Marxism* (pp. 1–22). Routledge.
- Campbell-Gale, H. K., Fletcher, A. J., & Reed, M. G. (2023). “A heart attack away from boarding up Main Street”: How neoliberalization of farming shapes adaptive capacity to climate change in rural and small-town Saskatchewan, Canada. *Journal of Rural Studies*, 97, 365–374. <https://doi.org/10.1016/j.jrurstud.2022.12.031>
- Danermark, B. (2002). Interdisciplinary research and critical realism: The example of disability research. *Journal of Critical Realism*, 5(1), 56–64.
- Danermark, B., Ekström, M., Jakobsen, L., & Karlsson, J. C. (2002). *Explaining society: An introduction to Critical Realism in the social sciences*. Routledge.
- Dujardin, S. (2020). Planning with climate change? A poststructuralist approach to climate change adaptation. *Annals of the American Association of Geographers*, 110(4), 1059–1074. <https://doi.org/10.1080/24694452.2019.1664888>
- Edmonds, H. K., Lovell, J. E., & Lovell, C. A. K. (2020). A new composite climate change vulnerability index. *Ecological Indicators*, 117, 106529. <https://doi.org/10.1016/j.ecolind.2020.106529>

- Fernandez, M. A., Bucaram, S., & Renteria, W. (2017). (Non-) robustness of vulnerability assessments to climate change: An application to New Zealand. *Journal of Environmental Management*, 203, 400–412. <https://doi.org/10.1016/j.jenvman.2017.07.054>
- Fletcher, A. J. (2017). “Maybe tomorrow will be better”: Gender and farm work in a changing climate. In M. G. Cohen (Ed.), *Climate change and gender in rich countries: Work, public policy and action* (pp. 185–198). Routledge.
- Fletcher, A. J., Akwen, N. S., Hurlbert, M., & Diaz, H. P. (2020). “You relied on God and your neighbour to get through it”: Social capital and climate change adaptation in the rural Canadian Prairies. *Regional Environmental Change*, 20(2), 61. <https://doi.org/10.1007/s10113-020-01645-2>
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105–117). SAGE Publications.
- Hay, C. (2011). Interpreting interpretivism interpreting interpretations: The new hermeneutics of public administration. *Public Administration*, 89(1), 167–182. <https://doi.org/10.1111/j.1467-9299.2011.01907.x>
- Howell, K. E. (2013). *An introduction to the philosophy of methodology*. SAGE Publications Ltd. <https://doi.org/10.4135/9781473957633>
- IPCC. (2021). In V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, & B. Zhou (Eds.), *Climate change 2021: The physical science basis. Contribution of working group 1 to the sixth assessment report of the intergovernmental panel on climate change*. Cambridge University Press. <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>
- IPCC. (2022). In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate change 2022: Impacts, adaptation, and vulnerability. Contribution of working group II to the sixth assessment report of the intergovernmental panel on climate change*. Cambridge University Press. <https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/>
- Kehler, S., & Birchall, S. J. (2021). Social vulnerability and climate change adaptation: The critical importance of moving beyond technocratic policy approaches. *Environmental Science & Policy*, 124, 471–477. <https://doi.org/10.1016/j.envsci.2021.07.025>
- Malena-Chan, R. (2019). A narrative model for exploring climate change engagement among young community leaders. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice*, 39(4), 157–166.
- Marlon, J., Goddard, E., Howe, P., Mildenerberger, M., Jefferson, M., Fine, E., & Leiserowitz, A. (2024). *Yale climate opinion maps 2023* [dataset]. <https://climatecommunication.yale.edu/visualizations-data/ycom-us/>
- Mbuli, C. S., & Fletcher, A. J. (2021). “I still want her to do the Mom duties”: Gender and climate change adaptation in a Canadian agricultural community. *Academia Letters*, 2079. <https://doi.org/10.20935/AL2079>
- Nichol, A. J., Hastings, C., & Elder-Vass, D. (2023). Putting philosophy to work: Developing the conceptual architecture of research projects. *Journal of Critical Realism*, 1–20. <https://doi.org/10.1080/14767430.2023.2217054>
- Nightingale, A. J. (2016). Adaptive scholarship and situated knowledges? Hybrid methodologies and plural epistemologies in climate change adaptation research. *Area*, 48(1), 41–47. <https://doi.org/10.1111/area.12195>

- Ponterotto, J. G. (2005). Qualitative research in counseling psychology: A primer on research paradigms and philosophy of science. *Journal of Counseling Psychology*, 52(2), 126–136.
- Sauchyn, D. (2010). Prairie climate trends and variability. In D. J. Sauchyn, H. P. Diaz, & S. Kulshreshtha (Eds.), *The new normal: The Canadian Prairies in a changing climate* (pp. 32–40). CPRC Press.
- Sauchyn, D., Davidson, D., & Johnston, M. (2022). Chapter 4: Prairie provinces. In *Canada in a changing climate: Regional perspectives report*. Natural Resources Canada. <https://changingclimate.ca/regional-perspectives/>
- Sayer, A. (1992). *Methods in social science: A realist approach*. Routledge.
- Sayer, A. (1997). Critical realism and the limits to critical social science. *Journal for the Theory of Social Behaviour*, 27(4), 473–488.
- Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, 16(3), 282–292. <https://doi.org/10.1016/j.gloenvcha.2006.03.008>
- Sultana, F. (2021). Climate change, COVID-19, and the co-production of injustices: A feminist reading of overlapping crises. *Social & Cultural Geography*, 22(4), 447–460. <https://doi.org/10.1080/14649365.2021.1910994>
- Versey, H. S. (2021). Missing pieces in the discussion on climate change and risk: Intersectionality and compounded vulnerability. *Policy Insights from the Behavioral and Brain Sciences*, 8(1), 67–75. <https://doi.org/10.1177/2372732220982628>
- Walker, H., Reed, M. G., & Fletcher, A. J. (2021b). Pathways for inclusive wildfire response and adaptation in northern Saskatchewan. In M. Gunnhildur Lily & A. Kronsell (Eds.), *Gender, intersectionality and climate institutions in industrialised states* (pp. 226–244). Routledge. <https://www.routledge.com/Gender-Intersectionality-and-Climate-Institutions-in-Industrialised-States/Magnusdottir-Kronsell/p/book/9780367512057>
- Walker, H. M., Reed, M. G., & Fletcher, A. J. (2021a). Applying intersectionality to climate hazards: A theoretically informed study of wildfire in northern Saskatchewan. *Climate Policy*, 21(2), 171–185. <https://doi.org/10.1080/14693062.2020.1824892>
- Wandel, J., Diaz, H., Warren, J., Hadarits, M., Hurlbert, M., & Pittman, J. (2016). Drought and vulnerability: A conceptual approach. In H. P. Diaz, M. Hurlbert, & J. W. Warren (Eds.), *Vulnerability and adaptation to drought: The Canadian prairies and South America* (pp. 15–36). University of Calgary Press.
- Zeitoun, M., Lankford, B., Krueger, T., Forsyth, T., Carter, R., Hoekstra, A. Y., Taylor, R., Varis, O., Cleaver, F., Boelens, R., Swatuk, L., Tickner, D., Scott, C. A., Mirumachi, N., & Matthews, N. (2016). Reductionist and integrative research approaches to complex water security policy challenges. *Global Environmental Change*, 39, 143–154. <https://doi.org/10.1016/j.gloenvcha.2016.04.010>