Community capacity and climate change in the Laurentian Great Lakes Region: the importance of social, human, and political capital for community responses to climate-driven disturbances

Joshua T. Fergen, Ryan D. Bergstrom, Alan D. Steinman, Lucinda B. Johnson & Michael R. Twiss

Published online: 15 Nov 2022.

Submit your article to this journal ⧉

View related articles ⧉

View Crossmark data ⧉

Community capacity and climate change in the Laurentian Great Lakes Region: the importance of social, human, and political capital for community responses to climate-driven disturbances

Joshua T. Fergen[a]*, Ryan D. Bergstrom[a] (iD), Alan D. Steinman[b], Lucinda B. Johnson[c] and Michael R. Twiss[d]

[a]*Geography and Philosophy, University of Minnesota Duluth, Duluth, Minnesota, USA; [b]Annis Water Resources Institute, Grand Valley State University – Muskegon, Michigan, USA; [c]Natural Resource Research Institute, University of Minnesota Duluth, Duluth, Minnesota, USA; [d]Department of Biology, Clarkson University, Potsdam, New York, USA*

The Laurentian Great Lakes region in North America is experiencing climate-driven disturbances that threaten the public safety of the region and is forcing communities to respond. Communities vary in their ability to respond to these disturbances based on their existing capacities and access to resources, but responses in the region are uneven and create vulnerabilities to disasters. A virtual workshop was conducted to understand the community responses to climate-driven disturbances in the Great Lakes and identify the essential capacities for effective responses. Results show that the region as a whole has not responded adequately, and although the resources exist to respond, they are not adequately organized, and inequalities between urban and rural communities can exacerbate these challenges. Community capacities identified as critical for resilience include leadership, scientific knowledge, and connection to broader regional networks to access additional resources, but there are challenges with the complacency of some communities and deficiencies in mental health services.

Keywords: Community capacity; Laurentian Great Lakes; social capital; human capital; political capital; climate change

1. Introduction

The Laurentian Great Lakes of North America (LGL) is a region where climate change is causing significant transformations to the environment, bringing new risks and challenges to the 35 million people who reside within it (Wuebbles *et al.* 2019). The LGL is significant because it contains 84 percent of the surface freshwater in North America and is considered the largest surface freshwater system in the world, covering 244,160 square kilometers across the US and Canada, with 17,017 km of shoreline (Environmental Protection Agency [EPA] 2021]. With that in mind, the uncertainty and unpredictability of climate-driven disturbances in the LGL can disrupt local and regional economies, damage infrastructure, and create social vulnerabilities that require communities to be more resilient to disturbances. However, the community capacities and resources necessary to transition to more sustainable futures are not evenly distributed across the basin, and the communities unable to

---

*Corresponding author. Email: ferge176@d.umn.edu

adapt will lead to further human suffering, economic hardship, and cascading environmental problems. Therefore, it is important to examine how communities have responded to climate-driven disturbances, while noting the essential community capacities that can lead to better management strategies that promote a more resilient and sustainable future for the region.

Climate-driven disturbances are becoming more unpredictable in the Great Lakes region, as increasing temperatures and changing precipitation patterns threaten communities with a suite of corresponding impacts (Wuebbles *et al.* 2019). The impacts of climate change have brought significant attention to how social and natural systems overlap to create emergent properties of vulnerability and resilience for communities and regions, as perturbations in one system create cascading effects across other systems (Adger 2006). These impacts are rarely one-off events, but rather a culmination of processes that contribute to increased likelihoods of these events occurring, which results in more significant damage over time in terms of financial cost, environmental condition, and human well-being (Intergovernmental Panel on Climate Change (IPCC) 2014; Cherp 2021).

Several prominent examples of disturbances can be found throughout the region that have forced communities to respond. Duluth, Minnesota, has rebuilt critical lakefront infrastructure, including roads and paved/wooden walkways several times as high water levels, intense storms, and high waves repeatedly damaged the infrastructure, resulting in a \$30 million loss before the infrastructure was re-designed to withstand these events (Minnesota Public Radio 2020). The Father's Day Flood of 2018 also wreaked havoc for communities in the western portions of Upper Michigan, where the community of Houghton faced road washouts and significant flooding. A 2016 flood significantly impacted the northern Wisconsin region, including several Indigenous communities around the Bad River Reservation, washing out vital transportation infrastructure, damaging personal property, leading to Declarations of Emergency and negative impacts on mental health and wellbeing (Fitzpatrick *et al.* 2017). Harmful algal blooms have repeatedly threatened the drinking water supply for millions of residents around Lake Erie, and are likely to continue in the future, as recent research shows that algal blooms may also become more prevalent in Lake Superior (Sterner *et al.* 2020). In the eastern part of the region, water levels have fluctuated so much on Lake Ontario that a former New York Governor attempted to sue the International Joint Commission to better regulate water levels; a sign of the frustration involved while managing environmental uncertainty (New York State Office of the Attorney General 2019).

The objective of this paper is to identify how coastal communities in the LGL have responded to climate-driven disturbances and identify the capacities that promote (or hinder) more efficient responses. This paper summarizes the findings from the 2021 Climate Governance Variability in the Great Lakes (CGVG) Workshop to better understand, 1) how communities have responded to climate-driven disturbances in the Great Lakes region, 2) whether communities have the capacity to respond effectively to climate-driven disturbances, and 3) to examine the essential community capacities needed to respond to disturbances effectively. Participants in the workshop discussed the evolving nature of climate-driven disturbances and the essential community capacities needed to address these issues. Findings emphasize the role of human, social, and political capitals that promote capacity and effective responses, and the need to address

equity and mental health issues associated with repeated experiences and trauma from climate-driven disturbances.

1.1. Community capacity and resilience

Research on climate change and societal change emphasize the critical link between resilient places and the political structures and social networks that influence adaptive and mitigative actions (Folke *et al*. 2010). Mobilizing resources for communities and social groups remains a critical challenge, as governments, market actors, and citizens have differential access, priorities, and uses for these assets (Wall and Marzall 2006). These assets are difficult to empirically measure, as they manifest and link at different spatial and temporal scales, creating complexity and unique circumstances specific to each community. As a result, community resources are often conceptualized as capitals and assets, or loosely defined banks of resources that can be accessed and transformed in order to maintain and improve livelihoods (Flora and Flora 2013).

Social responses to climate change highlight the importance of community capacity to adapt to challenges using systematic and institutional practices, emphasizing the iterative processes that lead to social change (Cafer, Green, and Goreham 2019; Nelson, Adger, and Brown 2007). Community capacity refers to the ability of communities to act in ways that promote change and adaptations to social and environmental shocks, and is a critical component of communities that are more resilient to climate-driven disturbances (Chaskin 2001; Davenport and Seekamp 2013). Community capacity is considered a key feature of what promotes community resilience, or the development and mobilization of community assets and resources in ways that promote stability in socio-ecological relationships (Adger 2006; Magis 2010; Mayer 2019). Resilience is a much broader topic than community capacity, with a focus on system-level adaptations that provide the community capacity to adjust to changing and uncertain circumstances (Amadei 2020; Mayer 2019). Resilient communities with an actionable framework for organizing their community assets to systematically engage with problems (or their potential to occur) must simultaneously address existing inequalities to promote more sustainable socio-ecological systems, requiring stakeholders and actors to become adaptable to these changes (Magis 2010). Community capacity is a necessary ingredient for resilient transformations, but is not sufficient by itself to lead to more resilient places.

Community capacity contains several dimensions, including leadership, citizen participation, community sentiments, social networks, and political power, all of which evolve together as communities decide which assets to protect, maintain, and enhance (Davenport and Seekamp 2013). This highlights the importance of stakeholder engagement and the social learning approach in community capacity-enhancing initiatives, as these forms of interaction can have spillover effects for other domains of the community (education, human health, environmental health, economic development) (Eaton *et al*. 2021). Numerous frameworks exist on engagement strategies to build community capacity depending on the context, but all emphasize the role of social networks and the process of social learning for individuals, institutions, and communities (Eaton *et al*. 2021; Cafer, Green, and Goreham 2019). These elements are frequently cited as the critical local resources identified as an impetus to respond to environmental disturbances and promote resilience (Davenport and Seekamp 2013; Cafer, Green, and Goreham 2019).
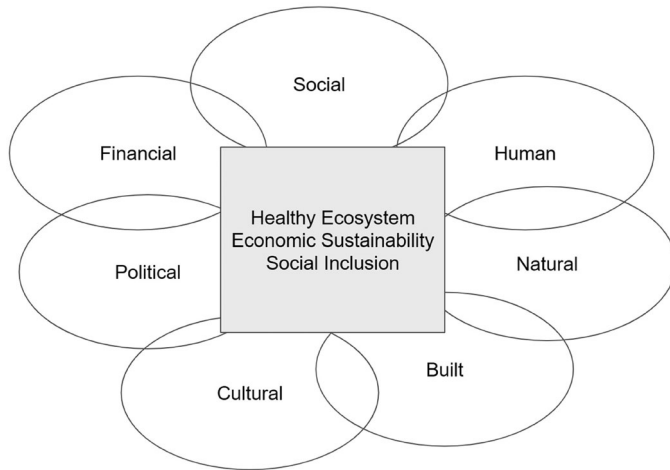
Figure 1.   Community capitals framework (Flora and Flora 2013).

1.2.   Community capitals

One way to envision community capacity is through the Community Capitals Framework, which conceptualizes communities of place as a system of assets or stocks that can be invested in and used to enhance other capitals in a community (Emery and Flora 2006). This framework identifies seven types of capitals, all of which can be leveraged and interact with one another when implementing community initiatives or creating long-term development initiatives: natural, cultural, built, financial, social, human, and political capitals. Therefore, community capacity can be conceptualized as the ability to leverage assets (capitals) for change, including adaptations to a changing climate and building resiliency to withstand the possibility of increasing incidents, as described above.

Natural capital refers to the environmental factors and conditions that provide possibilities and limits to community development. Cultural capital determines how a community sees the world and how its elements are valued; and can be used by one social group to impose its value system on another (Flora and Flora 2013). Built capital is human-constructed infrastructure and includes roads, technologies, and housing stock in a community. Financial capital includes all income-related generation and savings, and involves fees, loans, credit, philanthropy, and systems of taxation (and their exemptions). Community capacity refers to the resources and processes required to address a challenge or solve a problem with collective action, and this requires a specific focus on how the social, human, and political assets of a community are mobilized and interact with other capitals (Matarrita-Cascante *et al*. 2017; Cafer, Green, and Goreham 2019). In this framework, community capacity drives the interaction among a community's assets that lead to action (Figure 1).

Social capital is frequently conceptualized as glue that keeps communities together and consists of trust, solidarity, reciprocity, and shared values and norms that support collective action (Coleman 1988). The literature on community capacity stresses the importance of social and human capital, particularly bridging social capital and leadership skills, in transformative change (Emery and Flora 2006; Apaliyah *et al*. 2012). Bridging social capital refers to the resources and networks derived from formal memberships and forms connections for information sharing across different social groups and places, whereas bonding social capital refers to the close, dense network of

acquaintanceship held by family and close friends (Emery and Flora 2006). Bonding social capital is helpful when rights holders or stakeholders have to make decisions that are prone to high conflict or require high levels of trust due to the perceived impacts on communities and livelihoods (Hamilton and Lubell 2019; Fletcher *et al*. 2020). Bridging social capital is more effective at instigating social change that leads to better environmental outcomes as diverse social groups share information and resources to address a challenge, but this form of capital can remain latent until a disaster occurs (Kim, Marcouiller, and Woosnam 2020; Fletcher *et al*. 2020).

Community capacity and social capital include an equity component for marginalized social groups that lead to youth outreach, education, and pathways to decision-making processes, making a key asset in promoting resilience (Kim, Marcouiller, and Woosnam 2018). Equity refers to the ability for all individuals and social groups to access benefits and even distribution of costs with a focus on social justice for the most marginalized, which includes those at the intersections of race, class, gender, geography, and future generations (Magis 2010; Meerow, Pajouhesh, and Miller 2019). A dark side of social capital also exists in that high levels of social bonding could lead to sharp distinctions between in-groups and out-groups, and the implications for communities of place is that these dynamics may exclude certain social groups from key community networks, limiting their interactions with the communities and subsequent access to resources. Social capital is generally perceived as a critical asset for communities impacted by climate change, but it has differential effects depending on community contexts, particularly in natural resource-dependent and rural communities (Mayer 2019; MacGillivray 2018). Resource-dependent communities are particularly sensitive to climate change because of a dependence on the environment to sustain a livelihood and limited access to services due to the social cost of space, but they also contain numerous histories of adaptation and self-organization (Fletcher *et al*. 2020).

Human capital is a vital asset to successful community capacity initiatives, with the most common characteristics including leadership skills, workforce characteristics, local public health, knowledge of local attitudes and perceptions, competence, conflict management, and self-efficacy (Emery *et al*. 2007). Leadership is an important characteristic that can be used to address equity by opening up possibilities for the socially excluded to participate in decision-making processes and shape organizational learning (Chaskin 2001; Pasamar, Diaz-Fernandez, and de la Rosa-Navarro 2019). One of the critical aspects of human capital is its connection to social capital in the ability to be inclusive, participatory, and "lead across differences" (Emery and Flora 2006, 21).

Many programs are designed to address community capacity by developing these human capital characteristics through training and leveraging social capital networks to implement change with other assets (financial, political, natural environment, etc.) (Chaskin 2001; Emery and Flora 2006; Maclean, Cuthill, and Ross 2014). This emphasizes the role of leadership as a relational feature that can mediate across different social groups, connecting human capital to bridging and bonding social capital, and suggests these investments make significant contributions to building resiliency, because it influences how things get done within a local community context (Emery and Flora 2006). However, places with lower levels of human capital face more burdens in navigating state actors, particularly cognitive resources critical for obtaining information, knowledge, and funding (Christensen *et al*. 2020).

There has been increasing attention to how the trauma of experiencing climate-driven disturbances affects human capital and creates negative psychological and social

impacts, including depression, post-traumatic stress, and paralysis of community action to adapt (Berry *et al*. 2018). Mental health is a critical component of the World Health Organization's definition of health and refers to the ability to think, learn, and live with emotions and the reactions of others (Berry *et al*. 2018). Research has shown that impacts to mental health can occur before, during, and after a disaster, and is more pronounced in the social groups that are more socially vulnerable (minority, elderly, children, women) (Berry *et al*. 2018; Gifford and Gifford 2016). As a result, new terms such as "eco-anxiety", "eco-guilt", and have been used to characterize this phenomenon (Cianconi, Betro, and Janiri 2020).

Political capital refers to the ability of communities or groups to translate norms, values, and standards into enforceable rules, regulations, and the distribution of resources (Flora and Flora 2013). It shapes the ability of communities to get stuff done and be able to institutionally enforce or change governance functions by the ways in which power is distributed through the decision-making process (Utami and Cramer 2020). Furthermore, when combined with other assets, such as bridging social capital (connections to outside networks) and human capital (individual leaders/local champions), political capital can be mobilized to enhance community capacity by using cross-level linkages to redistribute resources, develop new assets during times of need, and implement new agendas on how to use available resources (Chaskin 2001).

One aspect of political capital is the ability to form new structures of governance from the ground up when it is recognized that current governance structures need to evolve in order to grapple with current challenges (Meerow, Pajouhesh, and Miller 2019). This capacity to organize refers to the planning and implementation of adaptive governance policies for a common goal, in this case, resiliency building, and is critical. However, the process of engagement and implementing policies, and organizing governance structures frequently leads to conflict, as diverse stakeholders and social groups can differ on the desired response based on local, regional, and global contexts, goals, engagement processes, and outcomes (Meerow, Pajouhesh, and Miller 2019; Eaton *et al.* 2021).

Furthermore, the continuing impacts of over 500 years of colonialism have led to significant environmental destruction and political disparities between settlers and Indigenous and First Nation communities, and despite being critical rights holders, Indigenous communities and social groups are frequently excluded and minimized in the decision-making process, or only included on a project-by-project basis compared to long-term regional planning (Lukawiecki *et al*. 2021). Boundary and trans-national organizations can mobilize political capital and have produced more equitable outcomes by redistributing political power and have been a key resource for Indigenous scholars and communities that must engage, work within, and against these institutions and structures, yet more work remains (Dhillon 2022; Lukawiecki *et al*. 2021; Jordan 2020).

2. Materials and methods

The Climate Governance Variability in the Great Lakes Research Coordination Network (CGVG RCN) hosted a virtual World Café workshop on climate-driven disturbances in the Great Lakes Basin on March 25th-26th, 2021. The originally-planned World Cafe was for an in-person event, but the COVID-19 pandemic and its variants led to the CGVG RCN converting to a virtual World Cafe workshop. All workshops

were filmed and transcribed for analysis. A thematic coding schema was developed based on existing community development literature that focused on the community resources or capitals that spur communities to act and respond to challenges, with an emphasis on social, human, and political capitals (Flick 2009; Flora and Flora 2013; 2006).

The broad goals of this workshop were to characterize the types of climate-driven disturbances facing communities in the region, identify the community responses to these events, and characterize the synchronicity of these natural and social systems to identify the essential community capacities that led to successful implementation. The workshop included 31 participants that represent government agencies and researchers from the natural and social sciences. Participants were selected to represent various disciplines, geographies, and social groups, and included experts in limnology, ecology, biochemistry, natural resource management, environmental justice, governance, human geography, community development, and included both natural and social sciences (Table 1). Participants were active in governance through their employment or through advisory roles related to the dissemination and interpretation of their research to inform policy. All participants are working within and across academic, local, federal, and Indigenous/First Nations governments and are fluent in English. Therefore, participants may also be more likely to focus and speak on issues related to policy-making, the range of skills needed to effectively adapt, and the social impacts such policies have across communities than other research professionals within disciplines.

The first day of the workshop included four presentations on case studies to provide an overall summary of key issues. Three case studies covered a specific challenge to managing risks from climate-driven disturbances. The first case study covered hydrological changes and responses; the second case study focused on biological changes and responses; a third case study focused on community responses; and a final case study on general data limitations. The second day of the workshop included four World Cafe-style breakout sessions, each focused on a specific theme or research question. The questions were delivered in a semi-structured format, where each session consisted of a conversation facilitator and note-taker, and was later reviewed by the CGVG committee.

Table 1. List of participant disciplines and foci.

Environmental	Social Sciences and Governance
Microbiology	Adaptation
Water Balance	Governance & Policy
CHABs	Environmental Anthropology
Wetlands	Human Geography
Climatology	Political Ecology
Hydrology	Economics
Fisheries	Environmental Justice
Landscape Ecology	Rural Sociology
Geomorphology	Community Development
Limnology	Urban Planning

3. Results

Responses from the workshop are organized into several themes. Participants spent most of their time discussing community characteristics related to the social

organization of a community (social), individual attributes of people working with and in government organizations (human), and the political power to create and enforce policies that promote local community resilience (political). These resources were frequently cited as the assets that best address these disturbances, and how their uneven distribution across communities and social groups exacerbates social vulnerability to climate change. Furthermore, these capitals contain elements of agency, or resources that are more or less activated to implement change (Davenport and Seekamp 2013). Therefore, this paper focuses on how these capitals are organized and support community capacity to change and adapt to new environmental conditions. As such, these findings suggest that communities are capable of responding, but their response is enabled and constrained by current community resources and the capacity to leverage them for meaningful change.

3.1. *Factors affecting community capacity building*

Overall, workshop participants indicated there has been a failure of the government (at all levels) to adequately respond to, and prepare for, future events. The uncertainty of climate change was frequently cited as a primary driver as to why communities demonstrate an unwillingness to commit to expensive adaptation plans, and the need for coordinated planning and adaptation strategies is more critical now that federal funding for infrastructure is forthcoming (Infrastructure Investment and Jobs Act (IIJA)) 2021). One participant stated that witnessing other cities' struggles with climate-driven disturbances can spur proactive action for other places; however, others may not have the capacity to carry out these initiatives. This highlights how interwoven resources are to a community, in that when one is impacted, it has the momentum to affect other assets. When organizations and governments do suggest best practices and implement standards and regulations, participants frequently noted they lacked "bureaucratic teeth" to enforce them through monitoring efforts and fines/penalties. As a result, the best efforts and planning at the regional levels can have failures at the local level, leading to delayed actions that undermine large-scale approaches across multiple communities. Additionally, it was noted that there is "a lack of sophistication and capacity to understand what a strategic plan would actually look like to address an emergency."

3.2. *Social capital*

One frequently cited challenge related to social capital and effective community responses to climate change discussed in the workshop are issues centered on equity and access to resources for marginalized populations. Equity (or the lack of it) was frequently brought up around issues related to the inequitable access to resources held by private interests and landowners, and the relationship between Indigenous and non-Indigenous governments in the policy-making process. Participants noted that private interests are often protected by municipalities, which provide a wide range of incentives for development that come with costs for local taxpayers. Furthermore, it is often the wealthy private landowners who are more able to navigate the bureaucratic structures to receive government assistance to rebuild after a disaster. This tension is also felt among environmentally degrading industries that rely on tax dollars for remediation. Noting this irony, one participant stated,

"The public paid to have areas damaged by private industry restored, only to have private development come back on these newly favorable locations and develop again, limiting public access and utility of the area. City leadership then emphasizes private homeownership and development on the coastlines."

This demonstrates a unique way in which the social capital of certain social groups can be utilized to limit access to the decision-making processes that can translate social capital to political capital.

Bridging social capital was identified as a critical component for community resilience across contexts of limited assets. While having individuals with strong leadership skills helps communities organize, many rural areas end up relying on their connections to extra-local networks to import tools and resources for informed decision-making. It was frequently discussed that while there is a lack of adaptation policies generated at the local level, but "it's happening from other folks coming in and pushing it from a different direction." Furthermore, strong bridging social capital is important in identifying what is transferable to other places from the success stories. On this point, one participant stated,

**"Each individual community does not need to provide for themselves if communication can improve. It might require more funding, but each area does not have to develop each capacity and these bridging organizations can help."

One of the identified structures that benefit community capacity building in the US is the Sea Grant extension network, particularly in rural areas. These networks were perceived to be more effective due to their ability to maintain local offices across geographies and connect with larger university systems for scientific research. Additionally, the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) was identified as a regional organization in the upper Great Lakes with success working across boundary organizations, Indigenous communities, and other federal agencies that promote Indigenous involvement in policy making. Echoing this sentiment that bridging social capital can elevate these communities, one participant bluntly put it: "Every lake needs a GLIFWC." Similarly, the The Great Lakes Restoration Initiative and Nature Conservancy were also identified as organizations that enhance community capacity by funding projects that benefit shoreline communities through conservation and restoration in places with limited local resources.

When asked what made these organizations and structures most effective, participants frequently pivoted back to a specific situation where GLRI worked with the St. Regis Mohawk Tribe to clean up a designated Area of Concern. In this example, participants cited that it became a success, not because of the effectiveness of remediation efforts, but because they put money directly into the hands of local decision-makers to restore critical habitats rather than funneling it through other bureaucratic agencies. By doing this, it gave local decision-makers the political capital to decide what would work best in their circumstance, bridging social capital to the GLRI network and leadership capacities.

3.3. Human capital

One topic that frequently came up was the human capital characteristics (leadership, knowledge of topics) that are necessary for enhancing community capacity to grapple

with these disturbances. Participants most frequently stressed the importance of human capital characteristics of leadership and knowledge of local staff and agencies, the need to address mental health issues for communities impacted by disturbances; and incorporating a youth education component. Leadership skills and knowledge of the climate sciences were critical human capital skills that were most effective for efficiently responding to climate change in the short and long term. As one participant noted, "a huge driver is leadership, either directors or local officials, but we also see public pressure from below as well to do things." The magnitude, frequency, and intensity of climate-driven disturbances have significant financial and social costs for Great Lakes communities, particularly for places that face repeat disturbances. One participant noted the urgency for many of these places, stating "coastal communities that get impacted over and over again by similar disturbances, don't have a choice but to step back." However, there are warning signs for other communities who have not experienced these events, and several participants noted that they will feel less compelled to respond.

While there is optimism that institutional learning can occur and promote resilience for the region writ large, participants frequently circled back to the social and psychological impacts of repeat experiences. Several participants described how repeat trauma, particularly in areas where there is no recovery time between events, can significantly impact the mental and social health of a community. As one participant stated, "when you repeatedly get kicked, it gets harder and harder to recover and build resilience." On a similar point, another participant noted many of these communities are still struggling to recover from previous disasters, suggesting that there are "so many issues that we want to think about for the future, but we can't right now because we are dealing with too many other things, including the current disaster."

Incorporating youth in the process of social learning and decision-making was identified as an essential component to educate and excite the next generation of resource managers on issues that will impact their future. Re-learning skills in hunting, foraging, and gardening has the potential to develop values in the general public and youth that prioritize more sustainable relationships with the environment. However, participants also noted that public education can be a hit-or-miss thing; often dependent on other organizations for funding for continuation or locals volunteering time. Interestingly, one participant noted that it may be the agencies and their staff that need education more than the general public, highlighting the perception that there are significant discrepancies across communities when it comes to knowledge on climate change phenomena and their impacts on places.

3.4. *Political capital*

Intra- and intergovernmental organization is frequently identified as a problematic feature of natural resource management, and the unique context of the Great Lakes was frequently discussed as one of the major challenges to organizing community capacity. A number of organizations exist and operate at different scales and different places across the basin, but they do not always interact with each other. Participants also described communities of complacency, where places with limited experience of climate-driven disturbances are less willing to engage in regional efforts. Discussing this disconnect, one participant stated,

"Planning happens at a regional scale, but the governance and management is at a smaller scale and there is nothing to bring those things together. Effects and funding for climate change adaptation are at the basin scale, but there is no way to compare or prioritize communities."

One of the problems is that city and community decision-makers have goals and objectives that prioritize built environments and economic development over natural environments (although several organizations such as GLIFWC, The Nature Conservancy, and GLRI were identified as counter-examples). The organization of governance structures in the Great Lakes contains a number of jurisdictions and organizations at different scales, all of which can have different priorities in managing climate change adaptation and mitigation efforts. Participants noted that the hodge-podge of approaches, goals, and standards increases complexities and can prevent meaningful action from being done. The lack of coordination is "not very effective at best; and working across goals at worst."

Long-term planning and policy development in natural resource and economic development often happens at a regional scale, but it was frequently noted that the organizations involved are structured around a rigid bureaucratic system that prevents systemic change from occurring. Furthermore, when funding is available at the basin scale from various organizations and governments, it becomes difficult to compare and prioritize communities to triage. Several statements reflect these challenges, with one participant stating "When a set of rules is written at the federal level, it's hard to make it effective across communities that vary in their capacities and needs." Adding to this point, another participant offered a specific example with FEMA, noting,

"FEMA won't allow counties to get money to expand culverts at the same size that ultimately led to failure, rather than build them larger to handle more capacity."

While specific to FEMA in the US, this example demonstrates how any federal, top-down policy measures can have stipulations that prevent more flexible measures that are needed at the local level to achieve regional goals of resilience.

Participants expressed a general notion that local (community) initiatives were more effective than larger state and regional efforts, because they take into account local context, but there were several concerns raised when this would occur. For example, one participant mentioned that some communities can be overpowered and outmatched:

"Wealthy shoreline owners can hire architects that will promise the moon in terms of environmental impacts, build the armor and save the beach too, but you can't do that. But how do local officials evaluate that? … Low capacity rural communities can't hire engineering firms to question whether that's really true or not."

Following up on this point, a participant noted that local governments are hesitant to impose regulation on private property owners, as they tend to be socially, financially, and politically well-connected to the local community.

Indigenous communities continue to face institutional barriers from exercising their rights as resource managers, indicating a significant need from a political capital standpoint. The workshop sessions frequently mentioned the compounding impacts of climate-driven impacts and increasing unpredictability of seasons on rural Indigenous

communities, who rely on harvesting natural resources for sustenance, cultural identity, and ecosystem relationships important to health and wellbeing. When access to these resources is disrupted from climate-driven disturbances, or seasonal processes become spatially or temporally mismatched, it disrupts ways of life and can significantly threaten wellbeing. Indigenous communities have taken a lead in adaptation efforts, and participants identified bridging organizations as agents capable of promoting a more healthy and equitable relationship with Indigenous communities and governments.

Rural areas may also face structural deficits when it comes to organizing local assets into an actionable development plan related to the inability to attract new businesses and people. This limits a community's ability to collect and access needed data for planning adaptive measures to climate-driven disturbances. The data used to inform decision-making from larger federal datasets does not provide the same level of detail to make meaningful decisions at the local, rural level, and many of these places do not have the funds to afford sophisticated downscaled projections. Relatedly, this uneven distribution in the capacity to access and interpret data into decision-making leads to further uncoordinated efforts, particularly if places are unaware of various datasets and tools. Furthermore, these structural deficits make it harder to build a local tax base and formulate plans to adapt to new disturbances. This lack of political capital stemming from less populated places can limit the ability to develop other assets, which in turn may limit the number of young people and high-salary professionals. One person discussed the challenge of attracting talent to these places, stating that in rural areas,

> "Some of the expertise needed for the most vulnerable is just not around and many of these places do not attract the expensive homeowners and research professionals associated with other areas doing things."

Local industry plays a role in shaping the types of responses communities pursue (adaptation, mitigation, transformation) and have political sway over decisions local governments make, and this point was brought up throughout the workshop. About communities proximate to extractive industries, one participant notes that these local industry clusters that extract and process these commodities "shape identifiable solutions and prevent other sustainable economic transitions from occurring." Indeed, there was recognition that communities in the region are thinking about climate change and resilience, but the limited predictability of the timing and place of events leaves communities to respond only to the economic costs of events rather than what is happening in the environment, while regional efforts lack coordination in distributing the resources needed to enhance resilience. Despite this lack of response, one participant noted that "people are at least thinking about sustainability and make an influence, even if we are hesitant to fully jump off the dock."

Several participants mentioned that many places can respond appropriately, but it is not coordinated enough to make a difference, starting with a common goal and purpose. Distributive governance structures were also frequently mentioned by participants as an effective way to utilize assets to build resilience. In these descriptions, participants describe a framework where practitioners work with the research communities as an advisory decision-making body that listens to constituents by talking to those on the front lines. Adaptation planning is another aspect of political capital that is an essential component of the community's capacity to develop more resilient futures, but

this was perceived to be deficient for much of the region. Behind these approaches is the idea that scientists and natural resource managers work with end-users as an advisory board compared to a decision-making body.

4. Discussion

Overall, the region has not always responded adequately to the challenges from climate-driven disturbances, although several communities have been more successful than others. While participants noted that many places have the capacity to respond appropriately, the lack of coordination across communities and governance structures, starting with a common purpose, stymies attempts to build resiliency at larger scales. Furthermore, participants noted how some Great Lakes communities are characterized more by complacency. Complacency can be a political factor preventing communities from preparing for future climate-driven disturbances, particularly if no such event has occurred (yet) or if it is a lower priority issue. Table 2 below highlights the ways in which these critical resources interact and influence a community's response to climate-driven disturbances.

The community capitals framework highlights how each community resource can be leveraged to enhance another asset and these interactions are often conceptualized as a community's capacity to address a challenge. Because of this agentic quality in community capacity, the workshop conversations focused on how social, human, and political capital have been used to leverage other resources. Consequently, findings focus on how these three assets form an emergent element of community capacity that becomes activated when a community needs to address an emerging climate-driven disturbance. While each asset has unique contributions to the community capacity process, the ways in which they interact can shape how communities respond and how that response distributes risks and benefits across different social groups within communities. Therefore, two levels are at play that shape impacts to climate-driven disturbances: the distribution of these three assets across communities in the Great Lakes region that situate places with differential abilities to respond, and how these three assets interact to drive community capacity and the social impacts of decision-making locally.

While the interaction of human, social, and political capital is what leads to significant change, it appears that a lack of human capital is particularly detrimental to effectively responding to disturbances. This may indicate that human capital has the potential to enact more meaningful change in the face of an ever-changing and dynamic political landscape. An essential political component identified by the participants included the use of more distributive governance structures that are appropriately funded, which may also be used to address inequity in responses. The importance of equity was stressed throughout the workshop, acknowledging that resiliency planning for these climate-driven disturbances that do not center equity further entrench the inequalities that already exist within and across places. This connects to human and social capital in that strong leadership (human) is needed to ensure that the most marginalized groups (social) gain input on and access to decision-making and the distribution of resources (political).

It is also important to note the role of extra-local support from governments and non-profit organizations (bridging social capital) that can provide critical funding and the expertise needed to implement efficient responses to climate-driven disturbances,

Table 2. Challenges, opportunities, and interactions of social, human, and political capital in the Great Lakes region.

Capital	Challenges	Opportunities	Interactions in the GLR
Social	Can be exclusive to other social groups High bonding social capital can lead to strong barriers to interaction and participation in community initiatives Extra-local control of decision making (bonding)	Foster new shared identities around a collective issue Diversify how interactions occur within and across communities Interacting with other communities and organizations on how to best address a climate threat	**Political:** Excludes participation in forming new agendas and the distribution of their risks and benefits (e.g. excluding Indigenous rights holders from policy) Connections to outside organizations can bring in skills and tech needed for adaptation (e.g. local presence of Sea Grant Extension) **Human:** Different social groups maintain different knowledge on how to access and utilize resources that promote resiliency for their social group (e.g. Landowners on the shore)
Human	Leadership and organization skills not always present Knowledge of climate-driven disturbances, their causes, and impacts Collective mental health of dealing with repeated disasters	Communities can learn from their past and by others Incorporate youth in addressing emerging challenges so they develop knowledge for future generations Re-train natural resource managers and community decision-makers on emerging technology, science, and people management skills	**Social:** Incorporating youth to address the rising frequency of climate-driven disturbances can create a shared identity and norm of adaptation and resilience Bridging social capital can link environmental researchers and communities to share knowledge, strategies, and tactics that promote resilient and healthy places **Political**: Institutional learning of how to best address reoccurring issues (e.g. Duluth building lakewalk with natural breaks)
Political	Planning occurs at a regional level, but implemented at local levels Differential access to decision-making	Community boards based on representing all social groups on equitable terms (not votes based on	**Social**: Local community government can be leveraged to promote and protect private interests and industry and their use of the

Table 2. (*Continued*).

Capital	Challenges	Opportunities	Interactions in the GLR
	and control over political tools and institutions Disorganization across government scales and entities (US, Canada, Indigenous Governments) Complacency and difficulty in changing community trajectories	numbers) Organizations working within culturally relevant contexts (GLIFWC) Promote and support bridging organizations working on goals across communities Partnering with local organizations and putting money directly in the hands of local decision-makers	shoreline over local community needs and interests **Human:** Strong local governments can attract new development opportunities, which brings in new professionals and people with new skills Co-opting of safety net resources for wealthy landowners occurs because they have the specific knowledge and experience navigating bureaucratic structures that others are unaware of

particularly for smaller rural communities. Several organizations were identified that can bring these needed resources into other communities with fewer resources, particularly for rural communities in the region. While bridging social capital between communities, organizations, and governments can help to provide some of the financial and human capital in the form of scientific knowledge that can enhance community capacity, the ways in which knowledge is produced, shared, and acted on has the potential to generate conflict. This issue is evident in many cases where local knowledge and values may clash with scientific assessments, projections, and research activities, particularly in Indigenous communities.

The uneven distribution of social, human, and political capital between urban and rural places limits the ability to collectively address these disturbances in a coordinated effort. Rural communities appear to be particularly disadvantaged, as their capacity to respond efficiently is hampered by limited resources when compared to urban areas in the Great Lakes that have clearly articulated goals and organizations that are leading the way in resiliency planning. Uncoordinated efforts can create contradictory goals across scale; and rigid bureaucratic barriers can limit the ability of regional and federal funding sources to distribute resources on time. Deficiencies in local leadership were identified as a primary reason why communities fail to respond, either as a result of overconfidence in their ability to manage disturbances, lack of adequate resources, and in some cases political beliefs about strategies of resilience.

Inequality within social and political institutions creates different barriers to the access of resources that mitigate exposure to harm from climate change and economic globalization, and these processes contribute to the reproduction of the same inequalities (Davenport and Seekamp 2013; Kim, Marcouiller, and Woosnam 2018). When institutions exclude and marginalize social groups in decision-making processes and the distribution of services, it has a cascading effect on other community dynamics

that prevent meaningful engagement to overcome future challenges, creating disempowered communities and people (Sovacool, Tan-Mullins, and Abrahamse 2018). Privileged actors in communities can disproportionately access the social safety net for extreme climate-driven disturbances, with greater knowledge on how to navigate these bureaucratic structures to have the resources (time, money, internet) to apply for aid. This can lead to increased economic inequality in areas where natural hazard damage is occurring (Howell and Elliot 2019).

5. Conclusion

The objective of this study was to identify how coastal communities in the Laurentian Great Lakes respond to climate-driven disturbances and to identify the community capacities and governance structures that promote (or hinder) more efficient and effective responses. The findings have several implications for capacity building and future research.

First, the mobilization of human, social, and political community capitals can enhance community capacity to climate-driven disturbances; and developing these resources can also address equity issues in decision-making processes. Leadership capacities at local levels, social ties across and within communities, and agreement that climate-driven disturbances are substantial enough to promote new ways of thinking about existing human-environment relations are needed for successful regional adaptation. This is not to suggest that other capitals (natural, cultural, financial) are not important, but that the most-used assets to combat climate-driven disturbances across places are the ways in which human, social, and political assets are developed to translate into the addition of other assets. In many cases, the focus on human, social and political capital came as a discussion to address an issue related to a communities' natural and financial capital. For example, human capital is based on the characteristics of local populations and frequently viewed as an asset that can be enhanced (i.e. skills, training, health) that can be used to solve persistent climate-driven disturbances. Similarly, because social capital is dependent on people and interaction, it is frequently viewed as an avenue that facilitates interaction and action when multiple social groups must organize and work together on a common goal. Finally, political capital was almost always raised with a community's ability to have their voice heard and be able to work with the government after a natural disaster, which in turn provides financial capital to address the disaster.

Second, complacent communities can have certain dynamics (low human capital, high social bonding capital, low social bridging capital, low political capital) that maintain their vulnerability, but there are ways to improve these conditions before a disaster strikes. Many of these features were described in our workshop, including an emphasis on youth education (human capital), training programs for agencies and staff (human capital), and strong network ties to other communities and outside organizations that have transferable knowledge and experiences (bridging social capital). Furthermore, participants in the workshop have multiple advisory roles on local, binational, and multi-national governance structures who have identified these issues, but further inquiry is needed as to who takes the final decision and who is held accountable regarding the intended and unintended consequences. Future research should investigate the influences of decision-making at these higher levels of governance, which are not uniform in their impacts across the region.

Third, future workshops/meetings need to continue to increase Indigenous outreach and engagement within co-management frameworks that emphasize Indigenous needs and benefits, and better recognition of these communities as critical and elevated rights-owners. Simultaneously, it is important to recognize that Indigenous organizations and communities are inundated with requests; and it is not uncommon for Indigenous researchers and practitioners to hold multiple roles in the community; and respecting the work demand for these individuals is necessary for better collaboration. Indigenous and First Nation/Metis communities have continued to build resilience despite institutional barriers to participate as rights-owners, in part due to the evolving nature of colonizer-Indigenous boundary organizations (Dhillon 2022). These hybrid governance structures may be more nimble and apt to address vulnerabilities to enhance resiliency and could be a catalyst for improved settler-Indigenous/First Nation relationships in the region.

Fourth, addressing issues of inequity and more inclusive governance structures still faces institutional barriers and more inclusion of specific social science disciplines beyond economics and policy are necessary to produce a better understanding of the variety of community responses to climate-driven disturbances. Participants in the workshop also noted that many natural resource management agencies lack in-house social science specialties that are more equipped to analyze concepts such as inequity, power, and vulnerability, leading to missed opportunities, and can lead to lower prioritization for incorporating these aspects into natural resource management and neglect some of the organizational, community-specific dynamics that occur that jeopardize resiliency efforts for the region.

Finally, there is a significant need to address the mental health impacts of disaster experience and the ongoing, pervasive risk of climate-driven disturbance while promoting core knowledge of the environmental changes occurring in the region. Although there are more federal funds available to improve water and transportation infrastructure, developing capacities to deal with the social impacts of these disturbances, such as mental health and access to essential needs should also be a priority. Furthermore, mental health services are frequently left out of emergency response planning and foreshadow the need to provide a social support structure to deal with these unique mental health states. There is growing evidence on community paralysis regarding adaptive planning, because repeated experiences have produced feelings of dread and helplessness, which impacts other community dynamics and limits opportunities to build resilience.

5.1. Limitations

There are several limitations to this study. First, there was no set, clear definition of terms, which can result in misinterpretation and misrepresentation across participants from different backgrounds. While this limitation can affect interpretation, the nature of the World Cafe allowed participants to elaborate on issues and concepts to come to a mutual understanding. Findings were reviewed by members of the CGVG who participated and managed World Cafe sessions to ensure validity. Second, there was limited representation of Indigenous communities at the workshop, indicating that more effective outreach is needed to incorporate these rights holders into adaptation planning, co-management of resources, and research geared to culturally relevant questions and issues regarding climate-driven disturbances. Third, there was also limited participation from people in major cities and practitioners; therefore results may be more

rural-centric and more rooted from an academic perspective. Fourth, the conversion of an in-person event to an online workshop may have affected participants' ability to participate in different ways, and the lack of an in-person event prevented other forms of interaction and participation to occur, limiting the true potential of the World Cafe-style workshop. Finally, the focus on social, human, and political characteristics may be the result of the makeup of the workshop members and their roles in community engagement and policy development, which tend to support government and science-driven interventions and, thus, have greater experience and knowledge on these subject matters.

ORCID

Ryan D. Bergstrom http://orcid.org/0000-0002-6167-3730

References

Adger, W. N. 2006. "Vulnerability." *Global Environmental Change* 16 (3): 268–281. doi:10.1016/j.gloenvcha.2006.02.006

Amadei, B. 2020. "A Systems Approach to Building Community Capacity and Resilience." *Challenges* 11 (2): 28. doi:http://dx.doi.org/10.3390/challe11020028

Apaliyah, G. T., K. E. Martin, S. P. Gasteyer, K. Keating, and K. Pigg. 2012. "Community Leadership Development Education: Promoting Civic Engagement through Human and Social Capital." *Community Development* 43 (1): 31–48. doi:10.1080/15575330.2011.645043

Berry, H. L., T. D. Waite, K. B. G. Dear, A. G. Capon, and V. Murray. 2018. "The Case for Systems Thinking about Climate Change and Mental Health." *Nature Climate Change* 8 (4): 282–290. doi:10.1038/s41558-018-0102-4

Cafer, A., J. Green, and G. Goreham. 2019. "A Community Resilience Framework for Community Development Practitioners Building Equity and Adaptive Capacity." *Community Development* 50 (2): 201–216. doi:10.1080/15575330.2019.1575442

Casimir, G., H. Tobi, and P. A. Tamás. 2021. "How to Present the Analysis of Qualitative Data within Interdisciplinary Studies for Readers in the Life and Natural Sciences." *Quality and Quantity* 56: 967–984. doi:10.1007/s11135-021-01162-2

Chaskin, R. J. 2001. "Building Community Capacity: A Definitional Framework and Case Studies from a Comprehensive Community Initiative." *Urban Affairs Review* 36 (3): 291–323. doi:10.1177/2F10780870122184876

Cherp, A. 2021. "Cost of Non-Uniform Climate Policies." *Nature Climate Change* 11 (9): 722–723. doi:10.1038/s41558-021-01133-3

Christensen, J., L. Aarøe, M. Baekgaard, P. Herd, and D. P. Moynihan. 2020. "Human Capital and Administrative Burden: The Role of Cognitive Resources in Citizen-State Interactions." *Public Administration Review* 80 (1): 127–136. doi:10.1111/puar.13134

Cianconi, P., S. Betro, and L. Janiri. 2020. "The Impact of Climate Change on Mental Health: A Systematic Descriptive Review." *Frontiers in Psychiatry* 11: 74. doi:10.3389/fpsyt.2020.00074

Coleman, J. S. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 94 (Supplement): S95–S120. doi:10.1086/228943

Davenport, M. A., and E. Seekamp. 2013. "A Multilevel Community Capacity Model for Sustainable Watershed Management." *Society & Natural Resources* 26 (9): 1101–1111. doi:10.1080/08941920.2012.729650

Dhillon, C. M. 2022. "Indigenous-Settler Climate Change Boundary Organizations Contending with US colonialism." *American Behavioral Scientist* 66 (7): 937–973. doi:10.1177/2F00027642211013389

Eaton, W. M., K. J. Brasier, M. E. Burbach, W. Whitmer, E. W. Engle, M. Burnham, B. Quimby, *et al.* 2021. "A Conceptual Framework for Social, Behavioral, and Environmental

Change through Stakeholder Engagement in Water Resource Management." *Society & Natural Resources* 34 (8): 1111–1132. doi:10.1080/08941920.2021.1936717

Emery, M., E. Fernandez, I. Gutierrez-Montes, and C. B. Flora. 2007. "Leadership as Community Capacity Building: A Study on the Impact of Leadership Development Training on Community." *Community Development* 38 (4): 60–70. doi:10.1080/15575330709489819

Emery, M., and C. Flora. 2006. "Spiraling-up: Mapping Community Transformation with Community Capitals Framework." *Community Development* 37 (1): 19–35. doi:10.1080/15575330609490152

Environmental Protection Agency (EPA). 2021. "Facts and Figures about the Great Lakes." Last updated April 6, 2021. //www.epa.gov/greatlakes/facts-and-figures-about-great-lakes.

Fitzpatrick, F. A., E. D. Dantoin, N. Tillison, K. M. Watson, R. J. Waschbusch, and J. D. Blount. 2017. *Flood of July 2016 in Northern Wisconsin and the Bad River Reservation: USGS Scientific Investigations Report 2017–5029*. USGS. doi:10.3133/sir20175029

Fletcher, A. J., N. S. Akwen, M. Hurlbert, and H. P. Diaz. 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. doi:10.1007/s10113-020-01645-2

Flick, U. 2009. "Chapter 23: Coding and Categorizing." In *An Introduction to Qualitative Research*. 4th ed, 305–328. London: Sage Publications.

Flora, C. B., and J. L. Flora. 2013. *Rural Communities: Legacy and Change*. 4th ed. Boulder, CO: Westview Press.

Folke, C., S. R. Carpenter, B. Walker, M. Scheffer, T. Chapin, and J. Rockström. 2010. "Resilience Thinking: Integrating Resilience, Adaptability and Transformability." *Ecology and Society* 15 (4): 20. http://www.ecologyandsociety.org/vol15/iss4/art20/

Gifford, E., and R. Gifford. 2016. "The Largely Unacknowledged Impact of Climate Change on Mental Health." *Bulletin of the Atomic Scientists* 72 (5): 292–297. doi:10.1080/00963402.2016.1216505

Hamilton, M. L., and M. Lubell. 2019. "Climate Change Adaptation, Social Capital, and the Performance of Polycentric Governance Institutions." *Climatic Change* 152: 307–326. doi:10.1007/s10584-019-02380-2

Howell, J., and J. R. Elliot. 2019. "Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States." *Social Problems* 66 (3): 448–467. doi:10.1093/socpro/spy016

Infrastructure Investment and Jobs Act (IIJA). 2021. Infrastructure Investment and Jobs Act (IIJA), H.R. 3684, 117th Cong. https://www.congress.gov/bill/117th-congress/house-bill/3684.

Intergovernmental Panel on Climate Change (IPCC). 2014. "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects." Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, edited by C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, *et al.* https://www.ipcc.ch/report/ar5/wg2/.

Jordan, P. A. 2020. "Hands across the Water: Climate Change and Binational Cooperation in the Great Lakes Basin." *Climatic Change* 161 (3): 479–497. doi:10.1007/s10584-020-02676-8

Kim, H., D. W. Marcouiller, and K. M. Woosnam. 2018. "Rescaling Social Dynamics in Climate Change: The Implications of Cumulative Exposure, Climate Justice, and Community Resilience." *Geoforum* 96: 129–140. doi:10.1016/j.geoforum.2018.08.006

Kim, H., D. W. Marcouiller, and K. M. Woosnam. 2020. "Coordinated Planning Effort as Multilevel Climate Governance: Insights from Coastal Resilience and Climate Adaptation." *Geoforum* 114: 77–88. doi:10.1016/j.geoforum.2020.05.023

Lukawiecki, J., R. Gagnon, C. Dokis, D. Walters, and L. Molot. 2021. "Meaningful Engagement with Indigenous Peoples: A Case Study of Ontario's Great Lakes Protection Act." *International Journal of Water Resources Development* 37 (4): 603–618. doi:10.1080/07900627.2019.1681261

MacGillivray, B. H. 2018. "Beyond Social Capital: The Norms, Belief Systems, and Agency Embedded in Social Networks Shape Resilience to Climatic and Geophysical Hazards." *Environmental Science & Policy* 89: 116–125. doi:10.1016/j.envsci.2018.07.014

Maclean, K., M. Cuthill, and H. Ross. 2014. "Six Attributes of Social Resilience." *Journal of Environmental Planning and Management* 57 (1): 144–156. doi:http://dx.doi.org/10.1080/09640568.2013.763774

Magis, K. 2010. "Community Resilience: An Indicator of Social Sustainability." *Society & Natural Resources* 23 (5): 401–416. doi:10.1080/08941920903305674

Matarrita-Cascante, D., B. Trejos, H. Qin, D. Joo, and S. Debner. 2017. "Conceptualizing Community Resilience: Revisiting Conceptual Distinctions." *Community Development* 48 (1): 105–123. doi:10.1080/15575330.2016.1248458

Matin, N., J. Forrester, and J. Ensor. 2018. "What is Equitable Resilience?" *World Development* 109: 197–205. doi:10.1016/j.worlddev.2018.04.020

Mayer, B. 2019. "A Review of the Literature on Community Resilience and Disaster Recovery." *Current Environmental Health Reports* 6 (3): 167–173. doi:10.1007/s40572-019-00239-3

Meerow, S., P. Pajouhesh, and T. R. Miller. 2019. "Social Equity in Urban Resilience Planning." *Local Environment* 24 (9): 793–808. doi:10.1080/13549839.2019.1645103

Minnesota Public Radio. 2020. "Duluth Rebuilds Lakewalk to – Hopefully – Withstand Future Storms." 22 December 2020. Written by D. Kraker. https://www.mprnews.org/story/2020/12/21/duluth-rebuilds-lakewalk-to-hopefully-withstand-future-storms.

Nelson, D. R., W. N. Adger, and K. Brown. 2007. "Adaptation to Environmental Change: Contributions of a Resilience Framework." *Annual Review of Environment and Resources* 32 (1): 395–419. doi:10.1146/annurev.energy.32.051807.090348

New York State Office of the Attorney General. 2019. Press Release: AG James and Governor Cuomo File Expanded Lawsuit Against International Joint Commission Over Substantial Flooding Damages. 15 November 2019. Accessed September 10, 2021. //ag.ny.gov/press-release/2019/ag-james-and-governor-cuomo-file-expanded-lawsuit-against-international-joint.

Pasamar, S., M. Diaz-Fernandez, and M. D. de la Rosa-Navarro. 2019. "Human Capital: The Link between Leadership and Organizational Learning." *European Journal of Management and Business Economics* 28 (1): 25–51. http://www.emeraldinsight.com/2444-8494.htm

Sovacool, B. K., M. Tan-Mullins, and W. Abrahamse. 2018. "Bloated Bodies and Broken Bricks: Power, Ecology, and Inequality in the Political Economy of Natural Disaster Recovery." *World Development* 110: 243–255. doi:10.1016/j.worlddev.2018.05.028

Sterner, R. W., K. L. Reinl, B. M. Lafrancois, S. Brovold, and T. R. Miller. 2020. "A First Assessment of Cyanobacterial Blooms in Oligotrophic Lake Superior." *Limnology and Oceanography* 65 (12): 2984–2998. doi:10.1002/lno.11569

Utami, A. W., and L. A. Cramer. 2020. "Political, Social, and Human Capital in the Face of Climate Change: Case of Rural Indonesia." *Community Development* 51 (5): 556–574. doi:10.1080/15575330.2020.1804956

Wall, E., and K. Marzall. 2006. "Adaptive Capacity for Climate Change in Canadian Rural Communities." *Local Environment* 11 (4): 373–397. doi:10.1080/13549830600785506

Wuebbles, D., B. Cardinale, K. Cherkauer, R. Davidson-Arnott, J. Hellmann, D. Infante, L. Johnson, *et al.* 2019. "An Assessment of the Impacts of Climate Change on the Great Lakes." Environmental Law and Policy Center. https://cardinale.seas.umich.edu/wp-content/uploads/2020/06/Wuebbles-et-al-Great-Lakes-Climate-Change-Report.pdf.