Planning for climate migration in Great Lake Legacy Cities

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Abstract

The possibility that climate change might make the Great Lakes region (GLR) a more attractive place for people to live has gained traction and attracted media attention. Compared with the dry Southwest, the storm-ridden Gulf region and the sea-level rise exposed East and West Coasts, the GLR may fare relatively favorably due to an abundance of natural resources and projected climate amenities. While the emergence and character of such migration is still uncertain, it is essential that GLR urban communities proactively prepare and plan for such a potential future. Understanding how these shifts might affect residents of GLR communities will be critical for a just and sustainable future and for avoiding exacerbating existing inequalities and climate vulnerabilities. Here we propose new scalable methodologies for inclusive engagement that enable wide-reaching knowledge co-creation (e.g., web-based engagement) that can meet the emergent and diverse challenges communities will face. These methodologies have the potential to not only broaden participation and improve practitioners' understanding of different GLR communities' preferences, but also to anticipate emerging tensions and potential synergies associated with increased population pressures.

Plain Language Summary

Many are wondering whether the Great Lakes region (GRL) will become a place where people choose to live due to the impacts of climate change. Drought in the Southwest, hurricanes in the Gulf region and sea-level rise on the East and West Coasts might push people to move there. While we do not know if people will come, how many, who they might be, and where they might settle, it is important that GLR communities prepare and plan for a potential future that includes new residents. This is necessary to prevent further negative impacts on the current residents of cities that may already be living in conditions that are unequal, unjust, and vulnerable to climate and environmental impact. We believe that if we work together to envision a future for the GLR that is just and sustainable, we will increase opportunities for both people coming and currently living in the GLR. We propose a new set of methods to engage with different GLR communities using web-based tools for building scenarios that both better captures the diversity of knowledge and perspectives of these communities and supports conversation about how to better prepare for the future while improving conditions for current residents.

In 2021, a new report from the World Bank estimated that around 200 million people may migrate in the next few decades because of displacement and compounding stressors exacerbated by climate impact (Clement et al., 2021). While migration as an adaptive response to climate-related stressors is not new – people have been seasonally and permanently migrating around the world because of drought and flooding for centuries – the sheer magnitude of the number of people moving is unprecedented. Not surprisingly, climate migration has emerged as an area of acute interest. The scholarly literature focusing on climate migration has rapidly increased (Hauer, 2017; Robinson et al., 2020; Von Uexkull & Buhaug, 2021) reflecting the fact that climate related mobility has arrived as an academic, public and policy issue. Although the role of climate change driving migration remains a somewhat unsettled research question, there is a widely recognized need for developing a greater understanding of how to facilitate appropriate political responses to migration in the face of existing uncertainty (Blake et al., 2021; Boas et al., 2019; Shi & Moser, 2021).

In the US, scholarship related to managed retreat, government buyouts of climate exposed land and government funded relocation of vulnerable communities (Mach et al., 2019; Siders, 2019) shows that internal climate-driven migration is an idea whose time might already have come. Yet to date, much of the attention regarding migration has rested with those who are expected to irretrievably lose their livelihoods and lifestyles due to exposure to climate impact. In this view, migration is an undesirable outcome for those migrating and a public policy challenge for the places where they relocate. While scholars have mostly framed migration as a hazard, practitioners in a few US cities have openly wondered whether climate driven migration can also be an opportunity.

In the Great Lakes region (GLR) – which comprises eight US states and the province of Ontario in Canada, the possibility that climate change might make the GLR a more attractive place for people to live has gained traction and attracted media attention (Lustgarten, 2020; Schneider, 2021). Climate change is expected to severely impact the GLR (USGCRP, 2018). However, compared with the dry Southwest, the storm-ridden Gulf region and the sea-level rise exposed East and West Coasts, it may fare relatively favorably due to an abundance of natural resources such as fresh water and projected climate amenities (Stephens, 2021; Stephens Partridge, 2015). According to FEMA's national risk index (USFEMA, 2021; ATSDR, 2018), the majority of GLR neighborhoods face exposure to natural hazards below the national average (Figure 1a.). Similarly, the GLR is relatively less socially vulnerable compared to other US states, although this varies considerably (Figure 1b.). Given these apparently favorable environmental and social conditions, the tantalizing possibility that the GLR may experience renewed population growth relative to other US regions has emerged as an important question that can critically affect how GLR urban communities prepare and plan for the future (Angel et al., 2018; Hauer, 2017). Coastal cities such as Duluth and Buffalo have already openly discussed their potential as landing spots for 'climate refugees' (Pierre-Louis, 2019).

Yet, the potential influx of migrants can be complex as it interacts with other stressors/hazards. Historically, population change has played a major role in defining the GL region. The rapid loss of manufacturing and labor force in the past five decades has profoundly affected the region's economic sustainability and social equity (Hawthorne, 2018; Strait, 2001). In many cities, historical socioeconomic disparities have deepened prevailing vulnerabilities to environmental hazards as demonstrated by the Flint water contamination crisis (Clark, 2018; Pauli, 2020). The COVID-19 pandemic has offered another reminder that emerging challenges can have more negative health (Gaynor & Wilson, 2020; Karaye & Horney, 2020) and economic (Montenovo et al., 2020) impacts on disadvantaged communities in the region. Hence, in the GLR, the intersection between race, gender and class is a critical consideration in any planning context, given past environmental injustice (Josephs et al., 2021; Schneider, 2021).

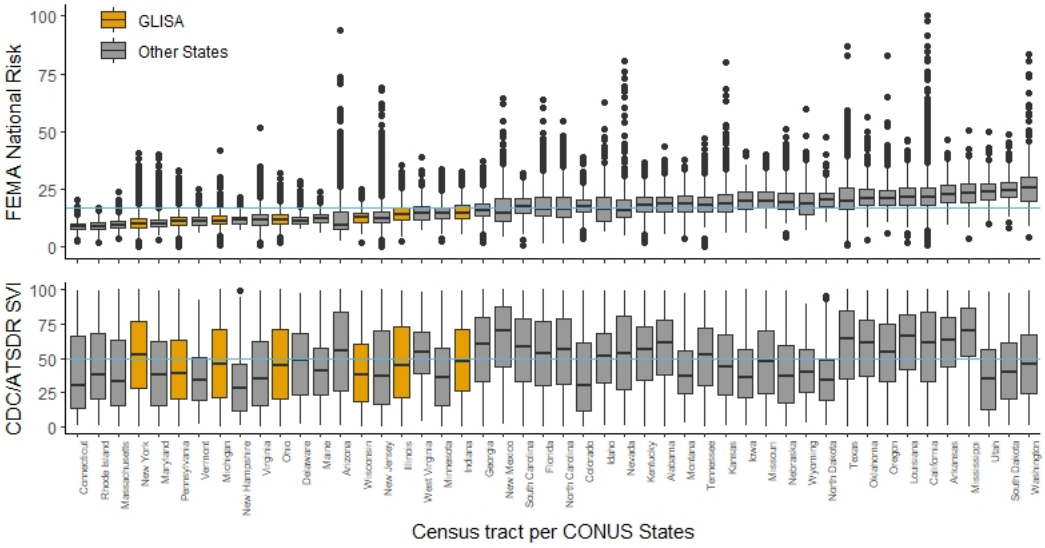

Figure 1. Above: The FEMA National Risk Index ranks(USFEMA, 2021) total community exposure to 18 natural hazards including avalanche, coastal flooding, cold wave, drought, earthquake, hail, heat wave, hurricane, ice storm, landslide, lightning, riverine flooding, strong wind, tornado, tsunami, volcanic activity, wildfire, and winter weather. GLR census tracts, which can roughly be described as neighborhoods, rank well below the national risk average (blue line). Below: The CDC SVI ranking system (ATSDR, 2018) combines 15 social factors, including poverty, lack of vehicle access, and crowded housing to assess total social vulnerability per census tract. GLR neighborhoods are on average, with the exception of New York, below the national social vulnerability average as well.

Population-wise, the GLR has experienced both decrease and increase, with markedly different outcomes. Once the recipient of numerous black migrants from the South in the Great Migration (Tolnay, 2003), legacy manufacturing cities such as Detroit, MI, Youngtown, OH, Gary, IN and Milwaukee, WI, have now experienced population decline due to "white flight (Audirac, 2018) and suburbanization that has hollowed out downtown cores, reduced the tax base for funding community services and left abandoned properties to manage (Méthot et al., 2015; Pijanowski & Robinson, 2011). In contrast, many GLR coastal cities with an 'amenity pull' of attractive tourism destinations and desirable residential areas have seen increases in population and second-home development (Stephens, 2021; Stephens & Partridge, 2015). These conditions and possible climate change induced migration have raised expectations about a new "blue economy" of growth and redevelopment based on climate-resilience and livability (of the Great Lakes Region, 2020; Commission, 2020). However, it is still not clear how future populations will respond to future climate hazards: where they will move; who these people will be (i.e., socioeconomic status, race/ethnicity, and/or age/sex); and how this migration will affect those already living in both legacy and coastal lake cities. Climate projections suggest that GL temperatures in the next 60 years will resemble the milder conditions of the upper Southern states (Kansas, Tennessee) and coastal New York today (Fitzpatrick & Dunn, 2019). Combined with its abundant water availability and favorable agricultural conditions, GL cities with advantageous locations (i.e., access to local and international markets) could see increased in-migration (Burton et al., 2010; Hackworth, 2018). There is some evidence that climate-migrants from Puerto Rico (Meléndez & Hinojosa, 2017) and Louisiana (Graif, 2016) have already relocated to the GL region in the aftermath of major hurricanes. Prospective residents are likely to be attracted to near-shore amenities as developers respond to sun, beach, nature, and water demands in more remote areas, while moderate housing prices in declining areas and/or economic opportunities from newly-relocated water intensive industries are likely to increase opportunities in denser urban areas (Pendall et al., 2017).

But is this a good idea? Many doubt it and caution that without careful recognition of how responses to migration might further exacerbate inequality and climate vulnerability affecting GLR urban communities, cities may move even farther from realizing a sustainable and just future for both current residents and future in-migrants. How can we make climate-migration a moment to right past wrongs? How can we move towards present and future sustainability and resilience? One way is by treating climate migration as a long-term adaptation rather than a hazard. As such, the possibility of climate migration should be an opportunity to explore how planning ahead can holistically consider risks and opportunities of responding to climate impact in a context of sustainable and just solutions. To accomplish this goal, GLR practitioners, researchers, communities and policy-makers must work together. This vision must forge a pathway that addresses current inequities while accounting for different preferences, capabilities, technologies and solutions across different actors, geographies and levels of vulnerability in the region. Such discussion can be aided using web-based tools that communicate social and environmental vulnerabilities. For example, webmaps (figure 2) can broaden and structure discussion on how existing clusters of social vulnerabilities in GLR cities might be impacted by influxes of people and how this might shape neighboring communities that may not suffer from these challenges at all (figure 2). Similarly, information on natural stressors that vary in cities depending, for example, on floodplain or coastline proximity or being located in forest fire prone areas (USFEMA, 2021; ATSDR, 2018) can help in deciding locations of new urban growth or infrastructure needs necessary for in-migrants. The scalability of such tool allow for accounting for varying conditions with, for example, rural areas having greater exposure to high wind events in the US Midwest.

We write as a group of researchers and practitioners working together to design participatory interventions in support of GLR cities leveraging resources from a long-term research initiative funded by the US National Atmospheric and Oceanographic Admin-

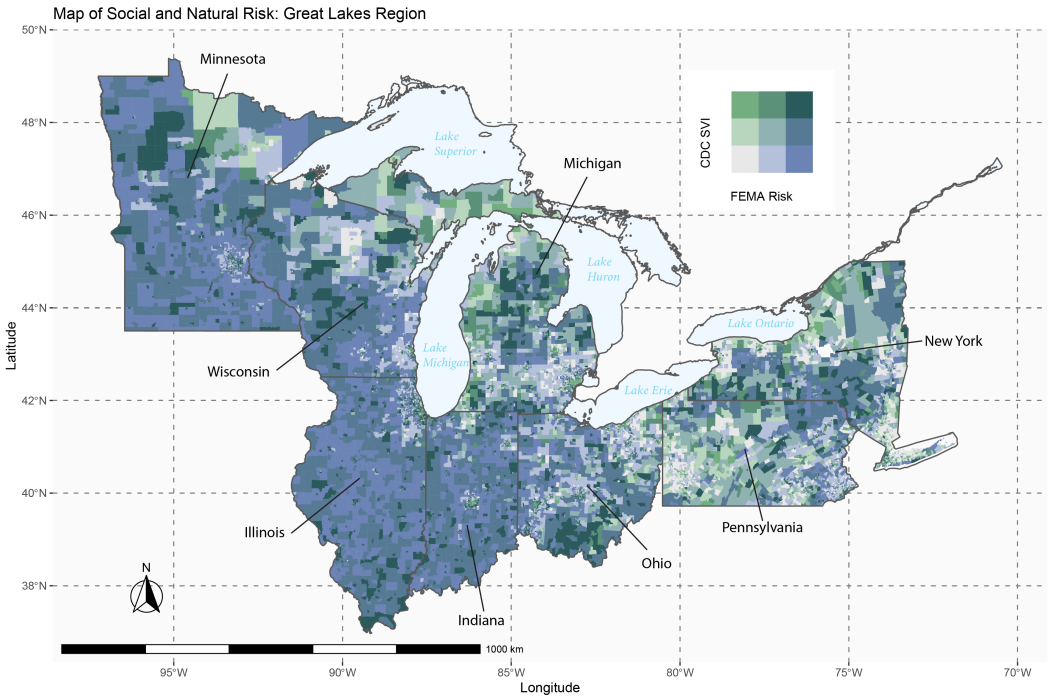

Figure 2. Bivariate choropleth visualizing FEMA National Risk Index ranks and The CDC Social Vulnerability Index (SVI)(See above for description) for the Great Lakes Area. We use quartile intervals for defining 3 vulnerability classes. Dark green represents high vulnerabilities in both FEMA risk and SVI, and gray indicates low for both. Blue indicates high FEMA risk, while Green indicates high SVI. An interactive webmap can be accessed here https://derekvanberkel.github.io/GreatLakeRegionRisk/

istration (NOAA) to increase the use of climate information in adaptation decision-making in different US regions, and specifically within the scope of the Great Lakes Integrated Climate and Assessment (GLISA), which serves the Great Lakes region and has worked with GLR cities for the past ten years. We argue that one intervention that might contribute to better preparing the GLR for climate-migration *is engaged research that allows for communities, practitioners, and researchers to co-create actionable knowledge to inform planned migration*. This includes participatory spatial and temporal analysis, scenario building, understanding perceptions of risks and capacities among practitioners and GLR communities, surveying residents' preferences through web-based crowdsourcing and feedbacking these preferences into infrastructure design and planning for urban growth. For example, through participatory scenario building communities and practitioners can foresee and discuss different options for green infrastructure to manage future flooding risk; or how choices about urban form and city planning now can address concerns and resource deficits among vulnerable residents (e.g., exposure to flooding and heatwaves, lack of affordable housing, access to safe water) and make cities more welcoming for future climate-migrants and current residents.

Envisioning a sustainable and just GLR through co-creation of knowledge and broadening participation. Through broad actionable societal engagement cities and stakeholders might better anticipate challenges associated with increased population pressures and chart preference for growth. In this context, engaged research can play an important role in planning for climate induced migration and other climate impacts. Yet, the high costs associated with interactive and sustained engagement (e.g., time, logistics, financial resources, credibility, and legitimacy) are a critical deterrent (Lemos et al., 2018). New digital tools that bring this information to stakeholders in interesting ways such as online geospatial land change models (LCM) that describe, explain, and project complex spatiotemporal dynamics of urban change may structure these discussions and add to community learning through interactive scenario development. These can, moreover, reveal preferences in the face of different context-specific stressors (in-migration) when done in an equitable way that considers and overcomes digital divides.

We believe that this approach can be applied to other problems and communities much beyond the GLR and the US. It can also support decision making about different types of migration worldwide. Participatory workshops where practitioners and communities can come together not only to discuss their aspirations and challenges but also to collaborate in the parameterization of realistic models that reflect their preferences and knowledges can simulate discussions on future vulnerabilities and potential solutions. To meet the emergent and diverse challenges that communities will face, new scalable methodologies for broadening engagement are necessary to enable wide-reaching knowledge co-creation. Web-based games that allow different stakeholders to voice their community preferences for development and provide a platform for co-creating scenarios of change that can inform decision-making and provide plausible visions for the future we as a society want. Realizing these potential for a truly inclusive process will require designing systems for digital engagement that reduce barriers to participation through, for example, providing monetary incentives, designing tools that incorporate knowledge of differing digital literacies (Martínez-Alcalá et al., 2018) and by formulating strategies for including those with limited access to broadband (Reddick et al., 2020), and information and communications technologies (Huang et al., 2022)

Moreover, if migration is treated as an adaptation strategy - incorporated in community climate action and planning - rather than a hazard, there are several ways that such efforts can cultivate more desirable and just outcomes for both current and potential future residents. First, these approaches have the potential to strengthen the relationship between city level decision makers and the communities they serve and to scale up and broaden the participation of residents in city level decision-making processes about their future. Second, these interventions allow for communities and individuals to ex-

press their preferences and perceived vulnerabilities in their own voices, including how race, gender and class might shape how vulnerable they feel about climate change impact now and in the future. Third, especially in communities where residents might be wary of future climate-migrants, these processes provide a venue to express concerns and begin dialogues about how public policy can encourage more positive impressions of future immigration.

1 Open Research

Our analysis uses county level spatial data from the FEMA National Risk Index (USFEMA, 2021) and the CDC SVI ranking system (ATSDR, 2018) in the form of shapefiles(.shp). To create the geovisualization, we used shapefiles of the Great Lakes and boundaries that are published by the https://www.glc.org/greatlakesgis. All analysis was conducted using R (2020), and the code that can be found here: https://derekvanberkel.github.io/Planning-for-climate-migration-in-Great-Lake-Legacy-Cities/

All data for the analysis can be obtained from zenodo using the DOI: 10.5281/zenodo.7038935. This data is licensed under a Creative Commons Attribution 4.0 International Public License.

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