# Climate and Demographic Change in the Great Lakes Region: a Narrative Literature Review of Opportunities and Opportunity Barriers

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# Climate and Demographic Change in the Great Lakes Region: a Narrative Literature Review of Opportunities and Opportunity Barriers

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# 1. Introduction

Under high carbon emission scenarios (RCP8.5), at least 4 million United States residents could be living on the fringe of extreme environmental degradation by 2070, where climate change has increased sea levels, temperatures, and water scarcity to inhabitable levels. By that time under the same scenario, most U.S. residents would most likely experience some climate-related local environmental degradation[1]. In response, millions of U.S. residents may engage in climate migration as an act of climate resilience in response to climate hazards like sea-level rise, wildfires, and extreme weather[2]. Sea level rise alone could displace 13.1 million Americans from coastal areas by 2100—a total including those fleeing the direct effects on inundation and those leaving unstable living and economic conditions resulting from indirect effects[3].

Questions arise—"Where will new populations of 'climate migrants' go?". A growing body of peer-reviewed literature, white and gray papers, and news media pieces has arisen to answer that question. Some attempt to explore and define a new conceptual class of "climate refuge" cities and regions, characterized by historically cool temperatures and mild projected climate change effects. The Great Lakes region possesses these qualities and other features, like rich natural amenities (especially freshwater), room for post-industrial population growth, and cities that say they are ready to make room for climate migrants.

With support from the Great Lakes Integrated Sciences and Assessments (GLISA), staff at the American Society of Adaptation Professionals (ASAP) assembled this narrative literature review as part of a larger project developing a typology of stakeholder issues, perspectives, and needs concerning climate migration in the Great Lakes region. This review provides a contextual perspective on the current state of knowledge concerning climate change and demographic change in the Great Lakes region, framed using the language of "opportunities" brought to the region and "barriers" that could prevent institutions and residents in the region from reaching those opportunities. Our goal is to provide insights that will inform research and policy agendas in the Great Lakes region to help Great Lakes states prepare for, if not thrive within, future climate and demographic conditions.

# 2. Methods

We conducted a narrative review which describes the current state of knowledge from a contextual perspective (as opposed to systematically identifying literature). We searched Google and Google Scholar search engines between October and December 2020 using search terms such as "Great Lakes," "human migration," "adaptation," "economy," "demography," "climate change," "policy," synonyms, and wildcard operators. We placed no restrictions on the age of each document. However, none were published earlier than 2014. We also collected resources through recommendations and submissions from project partners.

Our search included peer-reviewed literature, white and gray literature, and news media articles. Many of the resources referenced here are publicly available.  Though we value empirical evidence, this review is enriched by including a variety of perspectives and media. Additionally, peer-reviewed literature that intersect our topics of interest is relatively limited.

The literature is organized into four primary sections. Our preliminary literature searches found that work of interest to the project could be broadly categorized into these four domains. Each section contains information on the current condition of each domain as it pertains to climate migration or the Great Lakes region, opportunities that could emerge from future conditions, barriers to securing those opportunities, and recommended strategies for achieving those opportunities or avoiding barriers.

- **"Section 1: Knowledge & Learning"** focuses on the science of climate-informed demography and factors affecting the precision of this science and practices that could help promote equity and justice in research

- **"Section 2: Economy, Trade, & Industry"** describes economic conditions in the Great Lakes region and how climate change and demographic change might interact with those conditions.

- **"Section 3: Human Suffering and Well-Being"** describes socioeconomic factors including the experience of migration, community resilience, and social inequity.

- **"Section 4: Social, Political, and Cultural Factors"** describes policy-making from the local to national levels, including tribal government, and factors in the social, political, and cultural spheres that affect policy and the local experience of climate migration.

# 3. Results

## 3.1. Knowledge & Learning

This section summarizes factors weighing on the current state of demography and climate-informed demography, and opportunities, barriers, and recommendations to advance knowledge economies in the Great Lakes region in these sciences. There are opportunities to fill gaps in climate-informed demography research, migration research, and equity and justice research. Research institutions in the region bring local expertise and relationships with communities that could one day experience climate migration, if they have not already begun to do so. Thus, these institutions may be well-positioned to recruit around, fund, or collaborate on these opportunities. This section also describes barriers that could hinder research institutions pursuing these opportunities. Barriers include the availability of data needed for climate-informed demography, adequacy of available demographic methodologies, and issues defining common terms and scope in the literature on climate-informed demography.

### *Current Conditions*

### 3.1.1. The Value of Climate-Informed Demography
Demography research helps us more accurately model the range of potential future changes in population size and composition. Beyond demographic modeling, there is a need to study migration as a phenomenon within the physical and socioeconomic impacts of climate change. Such research is paramount to identifying potential climate migration hot spots. Climate-informed demography is an emerging science that endeavors to account for these phenomena. This type of research enables the appropriate agencies at different sectors and scales to better integrate migration-related issues into climate resilience planning and policy aimed at protecting lives and livelihoods[4]. Traditional

methodologies in demography that rely on historic trends, instead of future projections, are inadequate for, and sometimes misapplied to, climate migration questions. Future projections can do the work of evaluating the effect of new factors on migration and identifying new potential "hotspots" not previously studied[5].

### 3.1.2 The State of Climate-Informed Demography

As practitioners of a relatively nascent science, researchers of climate-informed demography are working to resolve issues that are common at this stage of development. These issues include standardization of terminology and methods and the creation of methods and data sources that are adequate for the questions that researchers take on. The science lacks well-established standard terminology and scoping practices that bring cohesion to more mature sciences.

Terminology and other language have a profound impact on both scientific communication and social discourse. One study describes the need to align or clearly differentiate important common terms used in the literature, like "climate-induced migration," that currently have varying definitions. The study also underlines variations in category definitions of climate migrants, such as "forced migrants" and "voluntary migrants." Clarification of terms can affect how projects are scoped, interpreted, and applied [4]. The Climigration Network, a national leader in community-led approaches to climate migration, recognizes the consequences that language has for how communities mobilize around climate change, especially for frontline communities. The Network is developing a "Playbook" to support productive community conversations on climate risk for practitioners and community leaders. (More on the Network's work on narrative-building [here](#)).

The science of climate-informed demography also needs innovative methods. Several studies identified a bevy of variables affecting migration decisions (including direct and indirect effects of climate change) that current demography methodologies cannot integrate, presenting barriers for climate-informed demography. For a single climate hazard, variables include:
- variation in the hazard across time and space;
- the effect of future greenhouse gas emissions;
- incomplete definitions of what constitutes exposure to the hazard;
- difficulty connecting the time scale of the hazard to human decision-making;
- relatively weak empirical links between the hazard and human migration;
- resettlement incentives;
- the effects of adaptation strategies;
- the effect of future policy actions; and,
- the effect of aging in the global population on migration behavior[6,7].

Variables more general to sticky problems in demography include dynamics like:
- feedback loops;
- interactions between in-migration and out-migration;
- influence from diverse socioeconomic, cultural, and political factors;
- population growth and redistribution;
- local climate outcomes; and,
- interactions between the above dynamics.

Finally, the science of demography and policy research suffer from a lack of data availability. The United States lacks comprehensive, consolidated national migration data, making it difficult to study cases of

climate migration events[4,8]. Policy research is hindered by large gaps of information on how demographic change will amplify or suppress the impacts of climate change, as the size of historically vulnerable U.S. populations change[5]. Demographic and policy research are held back by large gaps in research on the indirect effects of climate change on systems like labor markets, housing, and workforce productivity[9].

## *Opportunities, Barriers, and Recommendations*

### 3.1.3. Valuable Targets for Future Climate-Informed Demography Research

Several studies—all published in 2017 or later—underscored gaps in the literature as high value targets for future climate-informed demography research. There is a general need for more research to understand the complex and often indirect relationships between human migration behavior and climate hazards[8]. Institutions in the region could find ways to contribute to the growing body of work on the relationship between climate hazards and migration. For example, the relationship between sea level rise (SLR) and climate change is currently one of the best studied but issues remain in: the development of demographic modeling methods that can incorporate complex migration processes; measuring SLR-motivated migration; and, policy development around SLR-motivated migration. It will be important to support the development of the kind of rigorous, multidisciplinary data, methods, and research needed to understand and address the complex drivers behind climate migration[6].

In 2020-2021, ASAP is executing two multidisciplinary projects. The first, supported by the New York State Energy Research and Development Authority (NYSERDA), assembles collaborative applied research teams to develop models for predicting climate-induced migration to New York and throughout New York at a variety of scales. The second, supported by GLISA and in partnership with the City of Ann Arbor, Michigan and Dr. Matt Hauer (Florida State University), seeks to design a rigorous and replicable methodology for projecting migration that integrates future climate projections. For its part, the City of Ann Arbor is undertaking an exemplary public-academic research partnership to understand potential demographic shifts due to climate change and how those might influence local and regional social and physical infrastructure planning[10].

Other valuable research could include further investigation into factors affecting individual migration decisions including policy incentives, employment opportunities, socioeconomics, social and kin networks, perceptions of risk, individual preferences, institutional barriers and facilitators, and health of the local economy[6]. One study argues that climate-informed demography as a science should better integrate indirect climate effects--like labor markets and housing--into modeling because these can have impacts across the United States that feedback into the model. The authors pushed against a narrow focus on the direct effects of climate hazards in the areas in which they occur[7].

### 3.1.4. Advancing Inclusion, Equity, and Justice in Research

As the science, technologies, policy, and discourse of climate migration evolve, the need to center inclusion, equity, and justice grows with them. One study examining interactions between climate migration, climate change, and equity and justice issues calls for more research at a diversity of spatial and temporal scales to adequately study the intersection of environmental justice and climate migration. It highlights the value of multidisciplinary research using sociological frameworks to examine how

climate hazards and systemic social inequalities contribute to environmental inequalities, and how these environmental inequalities can be expected to interact over time and space with increased severity of climate hazards and future demographic change. For example, the authors examine the potential inequitable impact of sea-level rise on aging populations and communities of color in the coastal United States over space and time using climate-informed demographic modeling. The authors discuss how more traditional demographic methods that rely on historic data would fail to observe these inequities, underscoring the need for innovative, equity-informd methods[5].

Our research returned relatively few resources examining the impacts of climate change and demographic change on rural communities, when compared to literature concerning urban and peri-urban areas. Gaps in data and information help make rural areas vulnerable to climate change. This suggests that it would be valuable for future research agendas to include a focus on rural communities.

# 3.2. Economy, Trade & Industry

This section summarizes the current states of economy, trade, and industry in the Great Lakes region and opportunities, opportunity barriers, and recommendations to grow the size, capacity, and sustainability of these systems in the region. It references analyses of how economy, trade, and industry intersect with climate change and demographic change. Opportunities focus on the region's existing resources, strategies to revitalize the region's economy, and strategies to meet the economic challenges of potential climate-induced demographic change. Barriers include preparedness for growth in the region, economic justice, and the impacts of climate change.

*A Note on Terminology*

This section includes studies of U.S. states and Canadian provinces that comprise the Great Lakes-St. Lawrence River Basin. In this section, the terms "federal," "state," and "local" refer exclusively to U.S. institutions, unless otherwise specified.

This section also references resources that define the region in a variety of ways. We use whatever term was used by the authors of the source being referenced. References to the "Great Lakes" region or states in this section refer specifically to areas that fall, at least in part, within one of the lakes' watersheds. References to the "Midwest" region include all or most Great Lakes states but may also include more central states like Iowa or Missouri. References to the "Rust Belt" refer broadly to post-industrial cities and economics in the central, central-east, and northern parts of the United States, including many areas of the Great Lakes.

## *Current Conditions*

## 3.2.1. Economic Assets and Successes in the Great Lakes region

When weighed on its own, the Great Lakes-St. Lawrence River Basin encompasses one of the world's largest economies. The region's immense, historic economic capacity has been shaped by abundant natural resources, an efficient trade transportation system, binational economic integration of supply chains, a large domestic market, cultural centers, and high quality institutions of higher education[11,12]. Regardless of climate and climate migration conditions, the region already has opportunities to capitalize on these assets. For example, economic and trade policy in the region have created binational trade agreements and other successful government policies that maintain a "seamless" U.S.-Canada border, renewable energy opportunities, and water resource protections that also contribute to the region's economic success[11].

Immigration into the region—particularly from Asia, Africa, and Central and South America—has fueled revitalization as out-migration from historic Midwestern communities continues[12]. Some U.S. cities have helped demonstrate that pro-immigration policies promote inclusivity and economic benefits (e.g., stable local labor force, unique professional skill sets) which are both cornerstones of community resilience. Cities like Duluth, Minnesota and Buffalo, New York are already branding themselves as climate migration destinations, positioning themselves to take advantage of potential economic opportunities[2].

Finally, many Great Lakes communities provide access to a variety of amenities that attract migrants, immigrants, and relocating businesses. A number of news media pieces profile cities—like Duluth, Buffalo, and Ann Arbor, Michigan—as comfortable communities with freshwater access, reliable energy production, high quality of life, growing business communities, excess infrastructure, and high quality healthcare and education[10,13].

These cities also showcase a subset of "climate amenities."  Climate amenities, like mild seasonal weather, high elevation, inland location, abundant surface water, and minimal wildfire risk could be a potential draw for climate migrants. Climate amenities offset challenges presented by the climate crisis, are limited in supply, and are not limited to cities[14]. More and more, the Great Lakes region is seen as a place where the effects of climate change may be easier to manage. Relative to other parts of the United States, average temperatures are low, extreme climate hazards are few, and access to vital freshwater resources is less strained[15].

### 3.2.2. Economic Shortcomings of the Great Lakes region

Though the Great Lakes economy has rich assets, it also struggles with historic, persistent economic and governing issues that will shape the foundation upon which any future economic gains are built. The issues include low capital investment, worker education/skill economy mismatch, aging infrastructure, brownfields and pollution, outdated social security systems, racial segregation, political fracturing, and dwindling tax bases[12]. The manufacturing roots of Great Lakes economies are challenged by global competition and insufficient domestic demand, creating uncertainty about the basin's ability to unlock its economic potential[16]. These conditions need to be addressed prior to, or simultaneously with growth in order to take advantage of the opportunities climate migration can bring.

Governing structures and coordination also presents issues. The Chicago Council on Global Affairs (2020) describes how  the numerous small local governing units that characterize the Midwest have, historically, not adjusted to the growth of metropolitan areas as well as larger, more united governing units might[12].

### 3.2.3. Challenging Demographic Trends

Great Lakes communities also historically struggle with population decline, a stubborn feature of the region's post-industrial heritage. Overall, the region still loses more well-educated residents than it attracts, with migrants headed to the Sun Belt and east and west coasts. At the same time, within the region, larger towns drain talent from smaller ones[12]. Population decline in U.S. Great Lakes cities is a symptom of declining employment opportunities which feeds a cycle of brain drain and creates barriers to recruiting talented young workers[11]. Population decline and urban sprawl create low population densities that are difficult to serve efficiently with current infrastructure[17]. Aging populations and related declines in labor force participation rates could further reduce real gross domestic product per capita, slowing economic growth and limiting government capacity to finance growing public expenditures[17].

### 3.2.4. Current Lack of Economic Justice

Entrenched segregation in Midwest cities and inequitable development across the region create barriers to economic activity that could be exacerbated by climate change.  The Great Migration, discriminatory housing and education policies, and white flight are cornerstones in the legacy of the Midwest that have made it home to the most racially segregated cities in the United States. Segregation hinders regional

collaboration and employers' ability to tap talent in marginalized populations. This concentrated economic distress and inequity in opportunity should be urgent policy targets[12].

### 3.2.5. Key Industries on the Great Lakes

Analyses of 2018 economic data show that more than 1.3 million jobs are directly connected to the Great Lakes, generating $82 billion in wages[18]. The region makes tremendous contributions, and may be well known, through several key industries. Here, we highlight a unique set of analyses published by the Michigan Sea Grant in 2020, describing trends by sector in the 83 U.S. counties that cover the Great Lakes coastline.

In 2018, the following sectors contributed 97% of total employment (over 1.3 million jobs) in Great Lakes coastal counties: manufacturing; tourism and recreation; transportation and warehousing; and, agriculture, fishing, and food production. Each sector enjoys cost-effective transportation, high quality of life for employees, and abundant freshwater for their business needs. It's estimated that in 2018, each industry contributed the following fractions of total employment and grew since 2009:

- manufacturing contributed 59% of jobs after 8% growth;
- tourism and recreation contributed 17% of jobs after 10% growth;
- transportation and warehousing contributed 11% of jobs after 23% growth; and,
- agriculture, fishing, and food production contributed 10% of jobs after 11% growth[18].

Growth in each sector has been driven by one or more of the following: recovery from the 2008 Recession, a shift to lower-wage jobs, and the results of continued investment and growth in the sector and its related infrastructure.

Though Native American tribal nations contribute a small number of total jobs, they can still have a significant impact on local economies. We will highlight but a few in the food production and forestry sectors. It is important to note that some of these jobs also carry important cultural value. In food production, some Great Lakes tribal fisheries sustain large average catches and their own retail businesses and processing facilities[18]. Some tribal nations also cultivate wild rice annually in northern wetlands. Forest management on some tribal lands and ceded territory have integrated Traditional and Scientific Ecological Knowledges to great effect and produce a variety of wood and forest products[19].

## *Opportunities, Barriers, and Recommendations*
### 3.2.6. Current Opportunities to Revitalize the Great Lakes Economy

Regardless of climate change impacts, the Great Lakes region's robust economic foundation presents opportunities for revitalization and growth through strategic policy and investment. A 2020 report published by the Chicago Council on Global Affairs[1] describes how industry, federal, state, and local

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[1]The report scope is the "Midwest" region, including states mostly or entirely outside the Great Lakes watershed, including Iowa, Missouri, and Pennsylvania. Though the report is not a specific analysis of Great Lakes states, it does include them and speaks to economic characteristics seen across the Midwest.

partnerships can bring about more inclusive and broadly shared economic opportunity for the Midwest by supporting:

- emerging-sector innovation hubs;
- open doors and fair trade;
- green leadership;
- postsecondary credentialing for existing workforce;
- portable pensions and healthcare;
- community-based free college;
- increased federal subsidies for infrastructure; and
- regional capital investment[12].

To achieve a vibrant and sustainable future, the region must also invest in education, infrastructure, new high-growth manufacturing, and environmental restoration. These could help attract a young, talented, and innovative workforce to compete in emerging global markets. The investments will also bolster the region's exports[11]. The region's natural systems would benefit from investment in restoration, increases in green infrastructure, and targeted conservation efforts, especially for wetland systems. Each of these measures can help protect biodiversity and ecosystems (rich economic resources) around the Great Lakes and make them more resilient to climate change impacts. More targeted adaptation measures could help prevent or reduce loss of agricultural yields from climate change[19].

## 3.2.7. Preparing for and Attracting Labor and Employers

To prepare for the economic opportunities that climate change could bring to the region, decision-makers should leverage the region's assets, compensate for shortcomings, address economic justice issues, and institute policies that can help communities and economies prepare for migration.

Generally, policy-making in the region could better prepare for growth by investing in flexible social protection services and by including migrants in planning and decision-making. These can help secure well-managed in-migration, which in turn can create positive economic momentum in urban and peri-urban areas[20]. Investing in infrastructure that can support diverse economic growth will be particularly key to determining urban climate resilience[21].

The seminal 2018 *Groundswell* report from the World Bank Group offers strategies to channel a climate migrant workforce to prevent social and economic disparity. The authors claim that orienting incoming climate migrants to complement existing local labor forces and preparing local labor forces to receive migrants will have positive effects on wages and employment rates for current, local employees. The less effective alternative being competition between migrants and current employees[20]. Increased population pressure in climate migrant-receiving communities could also accelerate changes like increased workforce productivity[9]. The authors also advocate for economic and social policies that can create areas of low financial risk and high opportunities for migrants, including direct incentives like skills training and job creation programs[20].

To attract new residents and companies, some Great Lakes cities have begun to create local government programs, and they market their preparedness. Duluth, Minnesota and Buffalo, New York have both begun to include climate resilience in their marketing strategy and have seen some success gaining the attention of companies seeking to headquarter in "climate safe" areas with costs of living lower than coastal business centers[22,23]. Duluth also markets its climate migration strategy, exhibiting sustainable

urbanization programs and integrated climate mitigation, adaptation, and migration policies to depict the city as a safe destination and sound investment[13].

## 3.2.8. The Capacity of Great Lakes Cities

Physical, economic, and political features of Great Lakes cities create both opportunities and barriers to accommodate population growth from climate migration. Some "underutilized" Rust Belt cities have excess buildings and infrastructure that, if adequately prepared, could be used to accommodate population growth[22]. For example, there has been some speculation that Rochester, New York has sufficient excess infrastructure, housing, roads, and cultural institutions to accommodate substantial population growth[24]. However, poorly maintained infrastructure can become a liability. Some Great Lakes cities might deter migrants or struggle to accommodate them unless the cities address fundamental issues like aging infrastructure, pollution, and limited mass transit[21]. Continuing the example, large parts of Rochester's housing stock is old and unsuited for changing climate conditions that require efficient cooling in the summer[24]. Such infrastructure and regional/local management issues should be addressed to unlock opportunities for growth.

Funding may be another significant barrier for cities that would like to adapt. Climate migrants themselves could help contribute tax revenue and population densities to shrinking cities in the Rust Belt, reinvigorating the cities while sparing the need to develop rural areas which have their own set of natural amenities and economic value[14]. However, cities with historically small or shrinking tax bases resulting from population decline may struggle to build additional infrastructure needed to support population growth[22].

Precarious environmental and economic conditions elsewhere in the country could thrust unprepared Great Lakes cities into acute capacity crises. Environmental disasters, massive economic loss in key industries, or the collapse of structural financial incentives (e.g. insurance policies) elsewhere in the U.S. could suddenly send large waves of migrants to Great Lakes communities[1]. Geographically-tied incentives like pensions, access to public assistance, and homeownership may increase the risk of national migration crises, as these further discourage migration until conditions become dire[14].

## 3.2.9. Economic Injustice Exacerbated by Climate Change

Systemic inequities and injustices can interact with climate change and climate migration to exacerbate persistent issues, like gentrification. "Climate gentrification" describes differential impact on marketability and valuation of property based on environmental exposure, resilience function, and consumer preferences in housing and other property markets. Climate hazards and perceived risk can affect consumer preference and property valuation, potentially accelerating gentrification in cities where low income populations and communities of color live and work in less hazardous areas[25]. Without intervention, climate migration could make the issue worse. Some news media pieces speculate that high earning migrants moving to new cities could upset real estate markets, increasing housing demand, the price of housing, and, consequently, accelerating gentrification[15,26]. In Buffalo, the recent influx of millennials has reportedly spurred gentrification and increased property values, similar to climate gentrification seen in Miami. Local policies to create jobs and raise wages may not be sufficient in the long run to protect Buffalo's working class as climate change draws more high earners to the city[23]. There is broader concern that climate in-migration could undermine the Rust Belt's low cost of living and exacerbate income inequality[13].

## 3.2.10. Climate Change Impacts and Opportunities for Key Industries

The direct and indirect effects of climate change might not have a strong, apparent effect on all key Great Lakes industries, but the expected warmer and wetter climate is likely to harm some industries while creating new opportunities for others. The following includes information drawn from the Midwest chapter of the *Fourth National Climate Assessment, Volume II*, and a synthesis report that informed the assessment which includes the Great Lakes states of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Warmer and wetter conditions could have differential impacts between the agriculture and forestry industries. Agriculture might see increased yield of commodity crops as these conditions produce a longer growing season and increase farmable land in northern areas[19,27]. However, warmer, wetter, and more humid conditions provide challenges for field work and increase disease and pest pressure, to a degree that can only be partially overcome by technology. The forestry industry could also struggle with these conditions. Human activity has created greater homogeneity in tree species and ages, putting Midwest forestry at increased risks of widespread mortality and productivity decline from climate change. Ranges of tree species, like paper birch and black ash, will be pressured to migrate north or die off[19].

Climate change impacts on lakes and waterways could negatively effect both the maritime commercial shipping industries and recreation and tourism industries. There is a wide range of uncertainty regarding future water levels on the Great Lakes. Periods of both high and low water levels are likely to occur in the future, with an overall increase in variability[28]. Low water levels force commercial ships on the Great Lakes to lighten their loads, costing tens of thousands of dollars per inch of clearance gained. The problem is likely to recur in the future, increasing operating costs and potentially damaging port and marina infrastructure. Varying lake levels and heavy precipitation also challenges recreation and tourism industries that rely on water or coastal recreation, as would higher average temperatures and incidence of heat waves--all creating less reliable or hazardous conditions for tourists and outdoor recreation[29].

# 3.3. Human Suffering and Well-Being

This section summarizes the current state of equity issues, migrant experiences, and social programs across the United States and opportunities, opportunity barriers, and recommendations to improve community well-being and address long-standing social problems as they relate to climate and demographic change. Opportunities reside in migration policy, socioeconomic policy, stakeholder engagement in policy-making, and planning recommendations. Barriers include the interaction between social inequity and climate change, individual and local effects of migration, and institutional and environmental capacity.

## *Current Conditions*

### 3.3.1. Current Structural Inequities, Climate Change, and Climate Displacement

Economic growth and capital accumulation intensifies environmental degradation and the concentration of risk from climate hazards. The cost of environmental degradation and the risk of environmental inequalities are distributed along structural social inequalities, reproducing them along lines of race and class. Climate change is expected to make these inequalities more numerous and more intense over time and space[5].

Globally, migration is often a reflection of relative wealth. Managed and unmanaged retreat often suffer from equity issues, differentially affecting people through historic institutional bias and discriminatory practices based on age, class, race, and property ownership[6]. Low income populations, Black communities, and Indigenous communities already bear a disproportionate burden of risk and harm from environmental hazards. Even when hazards are severe, systemic inequities create barriers that make it more difficult for these populations to evacuate, relocate, and return from a disaster event[1]. Historic and modern unjust lending, education, and housing practices can impose limits on these populations' housing options, increasing their vulnerability to climate gentrification, particularly in coastal cities[14].

### 3.3.2. Experiences of Migrating Individuals and Communities

Individual migrants, especially those experiencing additional intersections of social marginalization, often face worse social and economic conditions following a resettlement that relocates them to another, already established community. Relocation efforts that focus on individuals (as opposed to efforts that focus on entire communities) contribute to these adverse conditions by neglecting the physical stress and loss of social safety nets caused by loss of community. Displacement can incur social, psychological and cultural heritage loss and damage as a consequence of severing a community's attachment to a place-based identity[30].

### 3.3.3. Current Consequences of Climate Migration for Unprepared Communities Receiving Migrants

Though, as described in previous sections, communities may benefit from well-planned in-migration, they may also suffer if unprepared. People displaced by disasters, like severe wildfires in the western U.S. and hurricanes in the south, have been considered climate migrants. We have summarized two cases

that help illustrate this issue. Housing in Butte County--which includes Paradise, California and retained most of the people displaced by the 2018 Camp Fire--is experiencing a housing affordability crisis. The crisis grew from a loss of housing units destroyed by fire, increased pressure on remaining housing stock as displaced residents stayed in the county, and consequent increase in housing prices and cost of building. The demand for affordable housing remains high[31].

Vital community programs and services, like those provided by local schools, have also been stressed in some communities from a sudden influx of migrants. People displaced by 2017 hurricanes Irma and Maria, specifically from the U.S. Virgin Islands and Puerto Rico, resettled in almost every state and region of the United States, introducing hundreds to thousands of new children into some states' school systems[32]. Massachusetts gained around 3,000 new students enrolled in K-12 schools. To help prevent further stress on classrooms and support new students resettling from displacement, the state passed a bill making an extra $15 million in local aid available to support the cost [33].

## *Opportunities, Barriers, and Recommendations*
### 3.3.4. Preparing Communities to Receive Climate Migrants

Communities that are adequately prepared to receive climate migrants may benefit in a number of ways, and communities that are not prepared may experience new or exacerbated problems. Relocations of climate migrants that follow principles of equitable adaptation and retreat can increase the success of a retreat program and build social capital, deepen civic engagement and networks, and build resilience in areas receiving climate migrants[6]. Flexible social protection services and migrant inclusion in planning and decision-making can help secure well-managed in-migration, which in turn can create positive economic momentum in urban and peri-urban areas[20]. Our research found very little analysis of rural communities.

Several white and gray papers offered general planning recommendations for communities anticipating demographic and climate change. At a high, national level, planning and early action could help shape the formation of climate in-migration and out-migration hotspots. Well-planned migration to viable areas can help avoid stressing the limits of local adaptation[20]. National, regional, and local planners should build or seek out mechanisms to anticipate the characteristics and population structure of migrants coming into their areas to better identify which services are most critical and what new patterns of climate-related vulnerability might emerge from climate in-migration[4]. Urban and peri-urban areas can better prepare for an influx of new people through improved housing and transportation infrastructure, social services, and employment opportunities[20].

To help prevent internal climate migration from becoming a crisis, states and cities should support immediate cuts to greenhouse gas emissions, embed climate migration in development planning, and invest now to improve understanding of internal climate migration[20]. Climate migration measures can be a natural extension of climate adaptation, pro-immigration policy, and equity policies for local communities[2].

If not adequately prepared, communities receiving populations displaced by climate change can experience increased strain on housing, social institutions, and local politics, exacerbating existing problems and creating new ones[34]. Large population growth will require large changes in energy,  land management, industry, and housing density or risk increasing unemployment, underemployment, environmental degradation, housing instability, service scarcity, haphazard development, energy

shortages, and community health problems[1,9,35]. There is some speculation that population growth without adequate planning could even strain local water resources[26].

At a larger scale, in international contexts, unanticipated mass human movement can have potentially detrimental effects on poverty eradication efforts[4]. Cross-border movements can present a variety of challenges, especially when they are large, rapid, or cross sensitive border spaces[20].

### 3.3.5. Stakeholder Engagement and Collaboration

Private, philanthropic and nonprofit sectors must be engaged in the relocation of American communities displaced by climate change. It is particularly critical given the current relative lack of United States federal action[30]. Councils and collaborations between city leaders that support coherent international migration policy can help build robust responses that are commensurate with local conditions[2]. Partnership-building help secure expert support and cross-sector contributions to address a breadth of issues particularly stressful to climate migrants, including:

- economic and cultural heritage plans for communities, especially tribal communities, experiencing challenge to place-based identity;
- engineering designs for the move and construction of community and cultural facilities;
- public health considerations for the strains of the move; and,
- access to adequate and specialized legal advice[30].

Stakeholder-driven policies offer exceptional insight into and preparation to support Great Lakes ecosystems and economies through climate and demographic change, including water resource management, infrastructure, water-dependent business, ecosystem based management, and land use planning, zoning, and governance[36].

### 3.3.6. Addressing Structural Inequities Exacerbated by Future Climate Change and Displacement

Climate hazards are expected to continue to have differential impacts on populations based on age, race, ethnicity, and gender. Marginalized populations are likely to experience compounding risk and harm from climate change, which will exacerbate existing inequalities and accelerate the formation of new inequalities, saddling future generations with environmental and social harm[5].

Structural inequities made worse by climate change will also affect how marginalized populations experience climate migration. If low income populations or communities of color permanently relocate, they are likely to face similar structural barriers in their new communities. They could also face new issues related to climate migration.

Community leaders and local policy makers both in areas sending and receiving climate migrants must address community legacies of inequitable policies and practices to eliminate the compounding burdens of a continuum of injustice that low income populations and communities of color are likely to experience as climate migrants.

Several white papers and news media pieces encourage decision-makers to smooth the socioeconomic transition of migrants resettling in new communities and reduce the potential for disparity to develop, especially around migrants who experience other types of race, age, or class marginalization. Local and state governments can prepare incentives, policies, and plans to alleviate or prevent the differential formation of environmental inequalities along lines of race and age[5]. A proactive policy framework for climate migration would account for the disparity in resources available to people whose home communities and livelihoods are harmed by climate change[2]. Cities that already have a history of immigration may be well positioned to embrace these necessary changes and benefit from diverse economic growth. Such communities tend to achieve material benefits like low-rent, high turnover neighborhoods[21].

Planning to support existing marginalized and aging residents in receiving areas through investment in affordable housing, transportation access, healthcare, and other services and amenities could lower the risk of negative impacts from climate in-migration[13].

# 3.4. Social, Political, and Cultural Factors

This section summarizes the current state of political and policy development around climate migration in the United States. It also features various social, political, and cultural issues influencing the Great Lakes region and institutional responses to climate change and demographic change. This is a diverse and growing area of work describing complex phenomena with much room for further investigation and description. The sources we summarize here did not readily lend themselves to the dichotomies of "Current Conditions" and "Opportunities, Barriers, and Recommendations" used to organize previous sections. Rather, we have organized this literature into a set of sections addressing different levels of government and the social/cultural sphere. We were unable to find much literature on social and cultural issues intersecting climate migration and the Great Lakes region. There may be opportunities in this area for further research and description.

## 3.4.1. The State of U.S. Climate Immigration and Climate Migration Policy

With no dedicated funding, lead agency, or community policy framework, the U.S. federal government is ill-prepared to deal with the immense and undeniable human security challenge that climate-induced displacement presents[30]. Unclear federal leadership is the key challenge to climate migration as a resilience strategy. Because no federal agency has the authority to lead federal assistance for climate migration, support for climate migration efforts has been provided on an ad hoc basis[37]. Legislators and executives both lack appreciation for the magnitude of population and wealth transfer likely to occur between regions of the U.S. as a result of climate change and climate migration. This too presents a major barrier to policy-making[38].

U.S. policy concerning migration in other countries does not currently have the means to integrate international climate migrants and refugees into migration frameworks. The United Nations also has not adopted measures to support climate refugees. Regarding immigration to the United States, the U.S. does not have a visa category or immigration status that accommodates immigration resulting from climate change. It instead channels climate refugees into channels intended more broadly for persons displaced by issues like conflict[2].

Of additional concern is the historical U.S. federal framing of human migration and immigration in other countries as a potential national security issue with respect to U.S. international interests. It is still uncertain whether climate migration will generally cause or exacerbate violent conflict[39]. It is also unclear how federal authorities will frame human migration within U.S. borders.

Signalling a potential change, on February 4, 2021, the Biden Administration issued an Executive Order concerning refugee resettlement programs that included an order for a report on climate change and its impact on migration, including forced migration, internal displacement, and planned relocation. The report is to be delivered by early August 2021 and address international security implications, options to protect and resettle individuals, mechanisms to identify individuals, implications for U.S foreign assistance concerning climate change mitigation, and collaboration opportunities.

## 3.4.2. Using the Strengths of Federal Programs for Climate Migration

Though the U.S. federal government is not capable of bearing the cost to relocate all U.S. residents who may be displaced by climate change, some policy researchers are optimistic that the federal government can wield a diverse set of financial tools and create new programs that could still make a difference. There are experts and authors, like those referenced below, who are ready to propose bold policy agendas. The authors are secure in their perspective that large-scale U.S. federal policy has the potential to have a major impact on the trajectory of international and intranational climate migration[3]. Some highlight the federal government's unique capacity to:

- promote coordination across agency missions and sectors;
- help decision makers identify and combine available funding streams;
- help leverage the expertise of nonfederal partners; and,
- synthesize disaster risk information across agencies, governments, and sectors[37].

Some analysts point out that federal programs are well-suited to run financial programs, such as buyouts of individual high-risk properties, and respond in the aftermath of extreme events[37]. Some also speculate that federal interventions could develop enough to one day be capable of providing preemptive support to decrease concentrated loss of life, health, and property[14]. The federal government could help develop a number of climate migration programs that cover all Americans, especially those offering financial incentives. One author offers the following. The federal government could adapt housing tax credit programs to extend them to people who move to areas with less climate risk and Rust Belt cities with declining populations. It could also sustain a voucher program for people in public housing to migrate. Federal government could offer grants to allow larger groups of people to move as a unit, sparing disruption of community bonds, which can be especially important for Indigenous communities[14].

Another author offers their own framework which outlines three priority logistical aspects that, if addressed, could provide a solid foundation for national climate migration planning:
- financial and logistical guidance through a chief relocation officer to lead cities' resilience efforts;
- access to expertise, solutions, service providers, and partners from private, public, and non-governmental sectors to help develop and implement retreat strategies; and,
- a national network of member towns who can learn from and support each other[30].

## 3.4.3. Binational Coordination

U.S. states and Canadian provinces have forged and enjoyed binational trade agreements and could stand to benefit from binational coordination over climate-related migration into and around the Great Lakes region. However, existing binational agreements do not adequately address current issues and challenges in the basin[16]. Binational efforts to improve governance across all levels in the Great Lakes region could focus on becoming more adaptive and responsive to changing societal needs as population size, distribution, and composition changes. A major effort to better coordinate governance processes across levels and boundaries would help the region navigate challenges like climate change and climate migration[17].

### 3.4.4. Barriers and Recommendations for State-Level Climate Migration Policy

Political organization and coordination in the Great Lakes region may be a barrier to establishing effective, comprehensive policy in the region. However, policy researchers offer recourse for state governments ready to take action. Broadly speaking, Great Lakes policies are fragmented vertically and horizontally across scale and jurisdiction. Many federal, state, provincial, and municipal policies for the Great Lakes-St. Lawrence River Basin do not align to produce a cohesive approach. There is no policy space to accommodate both top-down and bottom-up perspectives. Challenges to governance in the region include institutional fragmentation, changing relationships between federal and sub-national scales of government, lack of capacity to implement decisions, and the effects of geopolitics on governance in the basin. Governance in the basin must be reformed in order for the basin to thrive[40].

Participating in effective managed retreat programs requires the Great Lakes states and governments in other regions to do work with which states generally struggle, such as centralized planning, including considerations for infrastructure and service provisions (e.g., roads, schools, housing, health facilities). Governments generally struggle with the cost and difficulty of resettling private land, coordinating regulatory approaches to identify vulnerable populations, and deciding when and where to relocate[6].

States have their own set of financial tools that could help facilitate climate migration and even produce benefits at the state and local levels. States can explore:
- offering tax incentives to encourage homeownership;
- eliminating incentives for homeownership in areas of high climate risk;
- starting statewide land banks;
- helping coordinate cities and city programs; and,
- offering in-state higher education tuition benefits for people displaced by climate crisis[14].

As data becomes available and climate migration discussions develop in the Great Lakes region, institutions and researchers engaged in policy development must engage in ways that promote inclusion and equity. For example, one applied research project engaged a diverse group of stakeholders in scenario planning to produce policy recommendations for a holistic set of state and local policies designed to sustain Lake Ontario's ecosystems, communities, and economies through climate change. The authors recommend scenario planning as a policy research tool for its ability to help identify potential issues, opportunities, and priorities for preparing for population growth or decline. It can also help develop a sense of ownership in a plan for increasing the likelihood of its implementation[36]. Scenario planning may help combat barriers to policy-making, such as lack of understanding of potential future problems, for the Great Lakes by supporting public and stakeholder education, economic studies of proposed interventions, and partnerships between researchers, the private sector, and governments [36].

### 3.4.5. Framing Policy at the Local Level

In lieu of a robust federal response, several authors of gray papers and news media pieces emphasize and center local planning. By including displacement in their planning, city governments of areas sending and receiving climate migrants can rise up to proactively address the mass migrations of climate change and bring the country closer together in the process[41]. There's an opportunity to consider climate migration as an issue interrelated with public health, racial equity, and climate action as communities build back from COVID-19[2]. By example, the Duluth Climigration project set out to prepare the city for a

climate-driven population shift while preserving its authenticity and community-driven values. The final product synthesized physical planning and climate imaginaries and complemented these with a marketing effort that could target mobile market segments to project Duluth as a "climigrant friendly city"[13].

### 3.4.6. Tribal Governments and Communities

Institutional barriers, such as federal programs that do not account for the unique context of tribal communities and tribal sovereignty, may constrain tribal communities' ability to pursue self-determined management of their resources and built environment[37].

### 3.4.7. Cases of Local Resistance to Climate Migration

Some parts of the United States are already experiencing climate migration. In some cases, local reactionary resistance to migration may foreshadow problems that could emerge elsewhere in the country. Cases in western U.S. cities—such as Chico, California, which swelled in population with wildfire evacuees—demonstrate how inadequate preparation and response by governments contributes to frustration as population swell continues to overwhelm local capacity long after a wildfire. Local leaders in Chico struggle to communicate the importance of prioritizing action on climate change to residents who are feeling beset by problems on a more immediate timescale.  Chico residents become politically and socially frustrated by the stress within their city, swelled beyond its limits with people seeking refuge from wildfire. Residents have gone so far as to seek to recall city council members, stirring movements that could shift balances of liberal and conservative representation in local leadership[34].

### 3.4.8. Addressing Social and Cultural Resistance

To better understand and prepare for adverse local reactions to climate migration beyond cases such as Chico, California, communities must prepare for the influence that racism and other pervasive biases will have. There is potential for social hostility towards climate migrants in receiving communities, especially toward people of color and people with low income[42]. Increased social and economic stress on migrant-receiving cities could result in social conflict as inequalities intensify. Cities with neglected social systems and populations that are highly segregated along race and income--like Atlanta, Philadelphia, Chicago, Washington D.C., and Boston--may be exceptionally  vulnerable to heightened social tension [1]. Similar phenomena have been observed in international settings, where climate migrants experience discrimination, exclusion from employment, exclusion from access to social services and systems, and less access to robust housing[20].

Legacies and modern practices of racism and settler colonialism in the United States may also affect how people of color, Black people,  and Indigenous people choose to engage with government programs and other initiatives intended to facilitate climate migration. Residents may view efforts from government and other institutions with distrust, particularly among populations that have experienced historic marginalization and mistreatment from the institutions involved[6].

Efforts to build preemptive climate migration policy at any level might have to contend with the reality of American complacency around climate change. It is common for Americans to feel insulated from climate change impacts and thus to not prioritize it in decision-making or consider migration as a

potential response to climate change. Decisions are made under the assumptions that money, technology, or the federal government will alleviate most situations[1].

# 4. Discussion & Conclusion

## 4.1. Short-term recommendations

Realistic targets for short-term action include advancing the science of climate-informed demography and working through policy barriers at the local government levels.

Though funding and some valuable, complex elements of climate-informed demography methodology may be elusive, the science of climate-informed demography and the sciences of human migration are growing and could accelerate in years to come. The state of knowledge described here suggests there is purchase for sure and steady progress. There is also a need for multidisciplinary perspectives and fundamental conversations on how to build the science. Where climate migration cannot be the center of a project, let it be at least a consideration in projects concerning climate adaptation, demographic change, and climate change.

Local institutions have both a heightened burden and opportunity to prepare for climate migration. Local institutions may attempt to work through barriers like low resources and knowledge through partnerships with other cities or peer institutions, academic institutions, and philanthropic and for-profit organizations. Local institutions in the Great Lakes region may poise themselves to gain back population and economic growth while reinforcing larger climate resilience efforts and addressing historic, entrenched issues--like economic segregation--that harm growth. Local, regional and academic entities can also begin to address substantial gaps in the literature concerning the impacts of climate change and demographic change on rural areas. Local institutions will be the first to feel the sharpest impacts of climate change and climate migration.

## 4.2. Long-term recommendations

Federal, state, and provincial policy and entrenched social, political, and cultural barriers may be the most appropriate long-term targets for policy and research agendas.

The U.S. federal government has yet to produce impactful, large scale action capable of addressing the magnitude of a looming domestic climate migration crisis. The institution itself may not currently even be capable of such a feat. However, steady, heightened effects of climate change and attention turned toward opportunity in the Great Lakes region may help induce political will over time. At that time, federal and sub-federal governments may tap into the financial tools available to them to make creative, meaningful impact.

Political factors such as social fragmentation, cultural factors like climate complacency, and social factors like institutional racism and xenophobia already bring friction and uncertainty into climate migration research and planning at all levels. Transformational policy and perspective shifts will be important to successfully relocate communities in a way that supports personal, community, and economic health for receiving communities and migrants

## 4.3. Conclusion

This review highlights the robust knowledge base available on the opportunities and opportunity barriers concerning climate and demographic change in the Great Lakes region. Additionally, we discuss various priorities for policy and research agendas on short- and long-term horizons. The implications of this work are that institutions local to the Great Lakes region, namely GLISA, will continue to grow their bodies of work concerning climate migration with greater insight into issues of high priority and those on the leading edge of available knowledge. Additionally, GLISA's partners and other stakeholders in the region may see their interests reflected in this body of work and begin to consider or advance their own climate migration agendas.

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