How we RESPOND | AAAS

Community Spotlight:

MARQUETTE, MICHIGAN

Gray sky and stormy waters crash on the cliffs of the black rocks along the shores of the Lake Superior coast. Presque Isle Park. Marquette, Michigan.

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As the Great Lakes Warm, Marquette Plans for a Healthier Future

With its stunning natural beauty by the shores of Lake Superior, low cost of living and proximity to good medical facilities and a state university, Marquette, Michigan has made several lists of top U.S. cities in which to retire. Local officials and residents agree. Clean air and water and the towering forests of Michigan's Upper Peninsula make Marquette a healthy place to live.

But local, state and federal officials say health threats are not far off. Scientists report[1] higher temperatures, greater flooding and increased water- and vector-borne illnesses will pose rising threats to residents in Michigan and the Great Lakes area. The Great Lakes and the Midwest could attract more people as southern and western regions of the U.S. are impacted by climate change. That could put even more stress on local resources. "Marquette has a large hospital and a university and has amenities that people are looking for," says Brad Neumann, a Michigan State extension service expert who is working with the city and county to plan for climate change impacts. "A big part of the conversation is how this place can be more resilient, so we don't diminish our resources [as more people move here]."

Changes are already happening in the Great Lakes today, and there is growing concern for the health of the current population. Average air temperatures in

FACT BOX

Overview: Located on the shores of Lake Superior, Marquette is a thriving city and county facing dramatic environmental changes that will impact the health of local residents. A warming climate and variable lake levels are contributing to flooding, pollution runoff and infectious diseases that officials say will present increasing challenges to the community. Over the past five years, Marquette officials have worked closely with scientists from federal and state agencies as well as local stakeholders to develop a series of climate and health guidebooks that will allow them to better prepare for the future.

Location: Marquette, MI

Community characteristics: Small city

Major Climate Threats: Increasing heat, water quality issues, health risks

Response: Develop climate/health adaptation plan and community health guidebooks; implement recommendations

Project status: Ongoing

Key stakeholders: City and County of Marquette, Michigan Department of Health and Human Services, Michigan State Extension Service, U.S. Centers for Disease Control and Prevention

Key resources: Marquette Area Climate and Health Adaptation Guidebook, Marquette Climate Adaptation Task Force

[1] Cameron, L., *et al.* (2015). Climate and health adaptation profile report: Building resilience against climate effects on Michigan's health. www.michigan.gov/climateandhealth.

the region have risen about 2.3˚F from 1951 to 2017, and they are expected to climb an additional 3-6˚F by 2050.[2] Precipitation has jumped 14% since 1951, while Great Lakes ice cover has dropped since the 1990s. Local leaders say they are worried about myriad rapid changes taking place in Lake Superior, the largest and coldest of the Great Lakes – which together hold 20% of the world's fresh water. In summer 2019, Lake Superior water levels were at record highs,[3] straining docks and shorelines and flooding roads, while violent storms are becoming more common. "The increase in extreme precipitation is one of the clearest climate changes observed in the Great Lakes," the National Ocean and Atmospheric Administration (NOAA)'s Great Lakes Integrated Sciences and Assessments Program reports,[4] noting that in some areas 50% of total annual rainfall can occur during just 10 days of the year.

Lighthouse along the shores of Lake Superior in Marquette, Michigan.

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Meanwhile, septic tank releases are threatening the safety of water supplies in the region, and toxic algal blooms may worsen with a warming climate. Lake Superior is one of the fastest-warming major lakes in the world, warming at three times the average global rate.[5] All of these changes have impacts not only on the local economy, but on people's health.

In spring 2019, the Environmental Law and Policy Center released a comprehensive report[6] on climate change impacts in the Great Lakes region, based on research by dozens of scientists. For anyone who has visited the area's pristine lakes, beaches and idyllic lakeshore towns, the report paints an alarming portrait of the future, documenting the ways climate change could impact people's health in the region. Heat waves and summer air pollution are projected to increase heat-related illnesses and deaths, including higher rates of respiratory diseases that threaten elderly and young populations, who are more vulnerable. Warming temperatures can increase the number of mosquitoes and ticks that carry vector-borne diseases like Lyme Disease. Greater flooding and drought can harm drinking water supplies and cause more water-borne disease outbreaks. In addition, the social, demographic and economic disruption caused by climate change may threaten psychological well-being and mental health.

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[2] Great Lakes Integrated Sciences and Assessment (2019). Climate Change in the Great Lakes Region. http://glisa.umich.edu/media/files/GLISA%202%20Pager%202019.pdf.

[3] International Lake Superior Board of Control. Update on Lake Superior Outflows and Expected Conditions – July 2019. https://www.ijc.org/en/lsbc/update-lake-superior-outflows-and-expected-conditions-july-2019.

[4] Great Lakes Integrated Sciences and Assessment. Extreme Precipitation. Retrieved August 2019. http://glisa.umich.edu/climate/extreme-precipitation

[5] Van Cleave, Katherine, *et al.* (2014). A regime shift in Lake Superior ice cover, evaporation, and water temperature following the warm El Niño winter of 1997–1998. *Limnology and Oceanography 59:6*, 1889-1898. https://doi.org/10.4319/lo.2014.59.6.1889.

[6] Environmental Law and Policy Center (2019). An Assessment of the Impacts of Climate Change on the Great Lakes. http://elpc.org/wp-content/uploads/2019/03/Great-Lakes-Climate-Change-Report.pdf.

Fortunately, the residents of Marquette have been preparing for the effects of climate change for years, thanks to a network of nonprofit environmental organizations and forward-thinking government officials. They have watched the lake levels change and witnessed damage from growing storms and extreme weather events. Officials are acutely aware that newly formed algal blooms and polluted water runoff could damage the environment and their health. "Throughout the county... people know it's happening and we have to do something," says Neumann.

As climate science and climate change impacts have become clearer, local organizations such as the Superior Watershed Partnership Land & Trust have worked together with local leaders to create a Climate Adaptation Task Force. The group relies on the expertise of state and federally-funded science programs including the Great Lakes Integrated Sciences and Assessments.

The Michigan Department of Health and Human Services' Climate and Health Adaptation Program has been responding to these current and expected health threats using grants from the U.S. Centers for Disease Control and Prevention (CDC) Climate Ready States Initiative[7] and the Building Resilience Against Climate Effects (BRACE) framework.[8] BRACE is helping grantees from 16 states and two cities use its five-step framework to identify likely climate impacts in their communities, potential health effects associated with these impacts, and their most at-risk populations and locations. The BRACE framework then helps states and cities develop and implement health adaptation plans and address gaps in critical public health functions and services.

Marquette, Michigan is a port city on the shores of Lake Superior.

Credit: Shutterstock

"[Michigan is] a good example of how states and the Federal government can work together on these issues," Schramm says. "We've had great feedback so far and great collaboration among the states... We plan to expand these programs in the future."

Paul Schramm, a health scientist in CDC's climate and health program, says Michigan was one of the first states to receive federal health funding to work with local communities. In Michigan, the grants ranged from small cities such as Marquette to major urban areas such as Detroit, all designed to develop climate and health adaptation plans. Schramm says these plans can become models for the rest of the country. "It's a good example of how states and the federal government can work together on these issues," Schramm says. "We've had great feedback so far and great collaboration among the states...We plan to expand these programs in the future."

Lorraine Cameron, a senior environmental epidemiologist with the Michigan Department of Health's Division of Environmental Health, has been a key player in coordinating efforts to get climate health funding to Marquette and the surrounding county. Using funds from the CDC and working with state universities, extension services and local and regional organizations, the program came up with a series

[7] Centers for Disease Control and Prevention. Climate-Ready States & Cities Initiative. Retrieved August 2019. https://www.cdc.gov/climateandhealth/climate_ready.htm.

[8] Centers for Disease Control and Prevention. Building Resilience Against Climate Effects (BRACE) Framework. Accessed August 2019. https://www.cdc.gov/climateandhealth/BRACE.htm.

of innovative and comprehensive climate adaptation guidebooks[9] that build on the extensive climate adaptation plans[10] already adopted by the city and county of Marquette.

The guidebooks are designed to be comprehensive reference tools for community groups, technical experts and decision-makers who are implementing local climate adaptation plans. The guidebooks were distributed to nearby local governments and other interested organizations and have been used to guide decision-making about infrastructure investment and local planning and ordinance updates. For example, communities can use the guidebooks when designing riparian overlay districts, which provide buffers around waterways in order to protect their water quality, such as the one Marquette recently put in place in its new zoning ordinance.[11]

Marquette Michigan Downtown Waterfront District.

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Officials see these guidebooks serving as examples for other communities around the country as well. "We wanted to work at the local level, and Marquette city and county had strong local buy-in to coming up with health adaptation plans," Cameron says. "We came up with guidebooks as an effective and unique visual way to communicate the impacts of climate change...people can actually see what we are talking about."

The guidebooks were designed around four public health actions: educating diverse groups to help identify and develop solutions for vulnerable populations; developing community landscape and land use projects that take into account climate and health impacts; improving coordination of climate adaptation and public health policies with existing planning initiatives and ordinances; and improving surveillance and analysis of local environmental health and climate data to create risk analyses and health impact assessments.

The first guidebook was created following a series of meetings with 25 stakeholder groups that used multimedia before-and-after visualizations to assess priorities and health concerns in the community. Participants discussed health actions and solutions related to vector-borne disease, air quality, water-related issues, emergency response and extreme events.

The second guidebook took these community recommendations and added a professional literature review of science-based climate and health adaptation policies, including best practices and evaluation metrics that decision-makers could use to draft a comprehensive plan. The second guidebook provides a list of possible policy solutions involving the four main health threat areas, such as enhancing and

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[9] Michigan State University (2018, 2019). Marquette Area Climate and Health Adaptation Guidebooks. https://www.canr.msu.edu/resources/marquette-area-climate-and-health-adaptation-guidebook-volume-i-stakeholder-engagement-and-visual-design-imaging.

[10] Superior Watershed Partnership and Land Trust. Climate Adaptation Planning and Implementation. Retrieved August 2019. https://superiorwatersheds.org/projects/climate-energy-conservation.

[11] City of Marquette Land Development Code Chapter 54 Code of Ordinances (February 2019). https://www.marquettemi.gov/wp-content/uploads/2019/02/Marquette-Adopted-Land-Development-Code-Effective-2019_02_23-1.pdf.

maintaining buffers between humans and tick habitats, promoting wildfire prevention programs, expanding clean energy use, enhancing green and gray infrastructure, improving extreme weather preparedness and reducing risks of contaminated surface and groundwater.

The third volume prioritized the community and expert recommendations and suggested a plan for implementation. Some of the priority goals included increasing awareness and education for tick prevention, engaging residents in fire prevention programs, cutting greenhouse gas emissions through clean energy policies, reducing flooding by implementing better road and infrastructure projects, and protecting water quality through improved green infrastructure and water conservation measures.

Marquette is well on its way, having overhauled its city masterplan in 2015[12] and by taking climate change and health issues into account – for example, by improving environmental sustainability zoning and access to safe food and water resources. Working with state and federal science agencies, the city has moved to support building ordinances that promote rain gardens and green roofs, as well as stormwater capture projects that reduce erosion and pollution runoff. By reducing runoff, Marquette officials can cut pollutants that contaminate drinking water wells or drain into Lake Superior and impact fisheries and contribute to algal blooms.

Emily Leach, coordinator of Marquette's Climate Adaptation Task Force, says as a member of the Superior Watershed Partnership, she is aware of the health and environmental challenges that lie ahead in a changing climate. The science is becoming clearer, and she says communities need to work together to protect themselves. "It's been great working with CDC and the different partners and groups all thinking about climate adaptation," Leach says. "It's been a very public process with different stakeholders and open to the general public....I see us moving forward in the right direction."

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[12] City of Marquette (2015). Community Master Plan. https://marquettemi.gov/wp-content/uploads/2017/07/master_plan.pdf.

Sunny autumn day in the Upper Peninsula of Michigan.

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