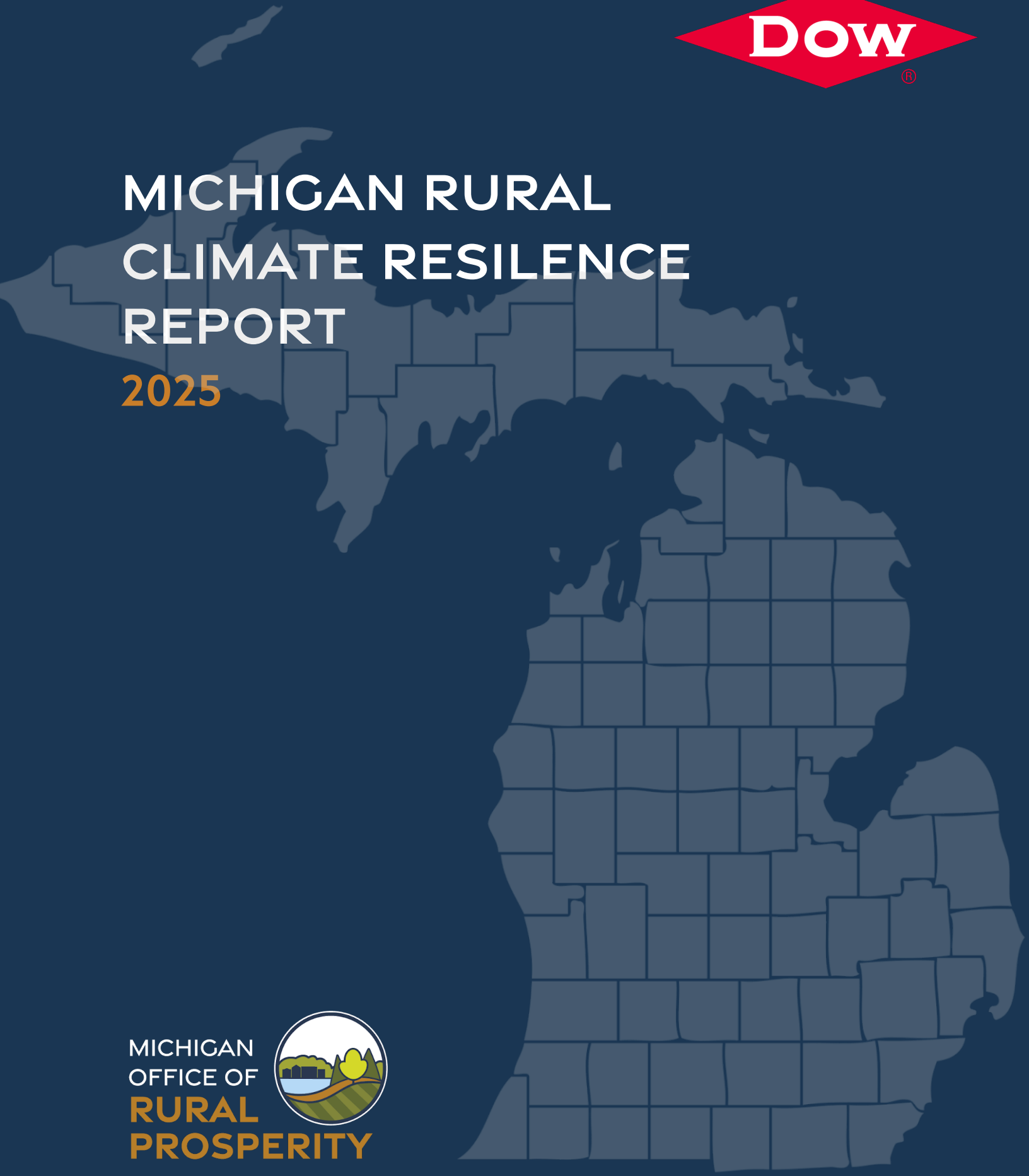
MICHIGAN RURAL CLIMATE RESILENCE REPORT

2025



MICHIGAN OFFICE OF RURAL PROSPERITY

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Thank you to the Dow for sponsoring the Dow Sustainability Fellowship. Without your support we would not have been able to do this work. Thank you.

We also would like to extend our heartfelt thanks to the Michigan rural community leaders who took time out of their busy schedules to meet with us and share their experiences. Your generosity and honesty in sharing your insights have been invaluable, and we are deeply appreciative of your willingness to engage with us. Your authenticity and commitment to your communities inspires us, and we are grateful for the opportunity to learn from you. Thank you.

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Executive Summary

Our Dow Fellowship project sought to assist Michigan's Office of Rural Prosperity in removing informational barriers that prevent understaffed managers in rural communities from planning climate-resilient development.

To do so, we researched the forecasted climate change impacts in Michigan, compiled theoretical best practices for climate resilience, and analyzed existing case studies across the U.S. to form actionable recommendations. We also attended statewide rural development conferences, roundtables with national experts, and conducted a series of interviews with local municipal planners across Michigan to ensure that our recommendations were current, responsive, and effective. The process and results of these research tactics were ultimately compiled into the following report. We also condensed our recommendations into a four-page toolkit for quick, actionable reference by local leaders.

We conclude that rural communities should build capacity by investing in youth leadership and regional partnerships, maintain readiness by keeping a list of "ready-to-go" projects, and build community buy-in by soliciting input and celebrating successes. Successful communities have also reframed potential climate challenges as opportunities for rural innovation, consistently communicated with community members, and built supportive relationships with peer communities to keep up to date on funding sources and best practices.

Overall, we hope to help lower the informational and psychological barriers to the daunting project of rural climate resilience. With strategic planning and community support, Michigan's rural communities can prosper through the 21st Century.

I. How will climate change impact rural Michigan?

A. Ecological Effects

Climate change will affect different regions around the world differently (IPCC, 2021, p. 10). Human activities have contributed to climate change in ways that will have lagging effects, meaning that the climate will continue to change at an accelerated pace for decades even if contributing activities ceased today (IPCC, 2021, p. 22). The Great Lakes Integrated Sciences and Assessments program (GLISA), a collaboration between the University of Michigan, Michigan State University, and the National Oceanic and Atmospheric Administration (NOAA) has developed a comprehensive overview of how climate change will affect the Great Lakes Region (GLISA, 2025). Below are the most relevant for rural communities.

1. Temperature

Overall, temperatures have increased by 2.3ºF in the U.S. Great Lakes Region since 1951, with the increase expected to rise to 3–6ºF by 2050. The changes are likely to be most extreme north of the state and the Upper Peninsula (meaning these places will warm above the historic average at a faster rate) (U.S. GCRP, 2014, p. 421). The rate of warming has also been fastest during the winter months, though southern counties have seen a steady increase in "extreme heat days" (days with a daily heat index above 90ºF).

Counties can track their individual trends through the MiTracking public database at https://mitracking.state.mi.us/. This state-operated site provides public, county-level data for a multitude of environmental factors, including extreme heat days, extreme precipitation days, air quality, and pest trends (rabies and ticks). Accessing data here will be especially helpful for individual counties to tailor resilience solutions to the harms that they face most directly. For many rural communities with limited staff capacity, the MiTracking dataset can be difficult to interpret.

Partnering with universities, regional planning commissions, or high school/college interns to translate this information into simplified maps or fact sheets could make these resources far more actionable for small-town decision-makers.

2. Precipitation

While precipitation (rain and snowfall) has increased by 14% across the Great Lakes Region since 1951, the exact amount varies widely by sub region (GLISA, 2025). Much of the Western Upper Peninsula, for example, has actually seen a slight *decrease* in precipitation in that time. However, much of the Lower Peninsula, especially in central parts of the state, has shared the significant increase in precipitation along with the greater Midwest. While most models suggest that the general trend of increasing precipitation will continue, the models vary widely, especially by season.

Annual snowfall is expected to continue to rise in the short-term along with the rise in total precipitation across the state. However, most models predict that by 2050 general warming will cause more precipitation to fall as rain during the winter months, leading to declining annual snowfall through the remainder of the century.

The last 70 years have also brought a marked increase in extreme rain events in the Midwest (GLISA, 2025). The total amount of rainfall in the heaviest 1% of precipitation days has increased by 35% across the Great Lakes Region. This means more damaging storm events and greater strain on rural storm water systems. Unlike urban areas with storm sewer systems, rural communities often depend on open ditches, undersized culverts, or gravel roads for drainage. These low-capacity systems are especially vulnerable to intense rain events, which can wash out road access, cut off emergency response, and require repairs that exceed local road budgets. Extreme

precipitation days can also be tracked at the county level using the MiTracking public database at https://mitracking.state.mi.us/.

3. Agriculture

The current trends in Michigan's climate will have mixed impacts on the state's agriculture (GLISA, 2025). For instance, longer warm-weather growing seasons and a higher density of atmospheric carbon dioxide may benefit some crops in the short term. By the mid-century, however, experts predict that damage from extreme weather events will more than offset the benefits from the longer growing season. This is especially true for row crops like corn and soybeans, which will suffer heat stress as the state experiences more 95- and 100-plus degree days throughout the century. Fruit crops will also be vulnerable to an increase in pests, and may suffer in quality from intensifying heat waves and sporadic, extreme rain events.

A consequence of the extended growing season from a greater number of frost-free days in the early spring is a rise in the number of spring freezes that occur after initial crop development. This will be especially harmful for grape, apple, cherry, and other fruit crops that experience spring freezes after early spring budding. This risk disproportionately affects rural communities where the local economy is often tied to one or two specialty crops. In these areas, a single freeze event can ripple into reduced tax revenues, layoffs in food processing facilities, and declining farm service demand.

4. Fish and Wildlife

Michigan's warming trend will have a harmful effect on the many native plants and animals that adapted to live in a colder climate. As a result, many species will continue to migrate north

for cooler temperatures. A warmer Michigan climate may also exacerbate harms from invasive species that prefer warmer temperatures, such as sea lamprey.

Lake ecosystems also depend on a sensitive "turnover" process, where warm, oxygen-rich water from the summer is pushed deeper in the fall and provides critical nutrients to deep water life. Warming water temperatures led to this process failing to occur in southern Lake Michigan in 2012 and 2017. This is especially damaging to both cold water fish as well as microfauna such as phytoplankton and zooplankton, which many other fish species depend on to survive. Declining coldwater fisheries such as trout and salmon directly impact rural tourism and recreation economies. In northern Michigan and the Upper Peninsula, fishing licenses, charter businesses, and hunting/fishing tourism are critical revenue streams. The loss of these species is not only an ecological concern but a threat to rural businesses and tax base.

B. Economic Effects

1. Extreme weather events

Per the National Centers for Environmental Information (NCEI), "From 1980-2024, there were 60 confirmed weather/climate disaster events with losses exceeding $1 billion each to affect Michigan" (NOAA, 2025). These statistics come from the U.S. Billion–Dollar Weather and Climate Disasters website which summarizes past severe weather/climate events and their economic impact as well as risk mapping on weather/climate risk and socioeconomic vulnerability based on state census tracts and provides county-level future risk data. Extreme weather events have increased in Michigan over the past 5 years, including disaster flooding (2), severe storm (18), tropical cyclone (1), and winter storm (2) (NOAA, 2025). Rural communities may find risk mapping from NCEI useful when considering potential projects that enhance climate resilience. While billion-dollar disaster figures convey the scale of impacts statewide, for rural communities

even smaller events, like a washed-out bridge or flooded high school can derail an entire year's budget. With fewer taxpayers to spread costs, rural municipalities face disproportionate financial strain from localized disasters. Highlighting these smaller-scale, but high-impact events can make climate resilience planning more relevant at the township and village level.

2. Shipping

Michigan ports handle approximately 51.7 million tons of cargo and contribute around 2.8 billion to the state's GDP (AWO, 2024). Over the past few decades, the water levels of the Great Lakes have been more variable than in the past, experiencing both extreme high and low levels. While increased water temperature and reduced lake ice may potentially extend the shipping season, low lake levels pose significant challenges. Low lake levels complicate the safe navigation of shipping routes and force cargo ships to lighten their load, making shipping more expensive (Wuebbles et al., 2019). For every inch of lost water depth, cargo ships have to reduce their load by 50-270 tons, costing approximately $10-30k per transit (*Climate Change in the Great Lakes*, 2019). In 2023-2024, the Great Lakes experienced lower-than-average water levels (2024 Climate Trends and Impacts Summary).

3. Agriculture

Climate and severe weather events have already impacted crop productivity and are expected to continue doing so in the future expected to continue to affect crop productivity. Some projections estimate a crop yield loss ranging from 10-30% by 2050 or later (Wuebbles et al., 2019). For rural counties heavily reliant on agriculture, these yield losses represent more than reduced farm income, they can shrink township tax bases, stress local schools, and force small governments to cut services even as climate adaptation costs grow.

4. Renewable Energy

Rural communities across the country are increasingly interested in joining the renewable energy economy, recognizing the significant financial benefits offered by projects such as wind and solar farms and the cultivation of crops for biofuels. In 2023, clean energy sectors—including wind, solar, and energy storage—employed approximately 11,700 people and attracted $10 billion in capital investments (ACP, 2024). Foreign investors have also shown a keen interest in the U.S. renewable energy sector, with Canada and the Netherlands leading investments in Michigan. Much of the land owned by these foreign investors is forested and located in the Upper Peninsula. Despite Michigan experiencing a 28% increase in foreign investment in agricultural ownership in 2022, it was among five states that saw a decline in foreign agricultural ownership in 2023 (Munch, 2025). Decline in foreign agricultural ownership may be an opportunity for rural Michigan communities to invest in the renewable energy sector and potentially increase revenue to be used for essential infrastructure projects or community investment.

i. Solar

Solar energy has emerged as an increasingly significant source of income for rural farmland in the Midwest. In Indiana, solar lease payments can range from $900 to $1,500 per acre annually, far surpassing the average farmland rental rates for corn and soybean production, which are approximately $251 per acre. The field of agrovoltaics—integrating agricultural production with solar power generation—is rapidly developing. The largest agrovoltaics project to date is located in Ohio, with Michigan currently trailing in this sector.

Despite the promising economic incentives, expansion of solar energy infrastructure raises several concerns. These include potential adverse impacts on productive farmland, such as soil degradation and increased erosion during construction activities (Huffstutter & Walljasper, 2024).

Additionally, the improper disposal of solar panels poses environmental risks, including the leakage of toxic substances, with only about 10% of panels currently being recycled properly (Curtis et al., 2021). Therefore, it is essential that rural communities considering the adoption of solar energy projects ensure that decommissioning plans are incorporated into site proposals. Such plans help mitigate long-term environmental and economic risks, ensuring that communities are not left to manage the negative consequences associated with the eventual decommissioning of solar installations.

ii. **Wind**

Michigan ranks 15th in the U.S. for wind energy production. According to the International Renewable Energy Agency, wind energy is one of the fastest-growing renewable energy industries. Overall 11% of Michigan's in-state electricity in 2023 came from renewable sources, of which 64% came from wind power (ACP, 2024). The strongest winds, and consequently much of the wind energy infrastructure, are concentrated along the coastlines of Lake Huron and Lake Michigan, particularly in the Thumb region. As of 2022, $5.8 billion has been invested in wind energy in Michigan. The development of utility-scale wind farms has significantly contributed to the state's economy, creating approximately 12,330 construction jobs in 2022 and supporting around 435 long-term operations and management jobs (Hardy, 2022).

5. Infrastructure

Aging and inadequate infrastructure in Michigan, including power, transportation, water, and sewer systems, is particularly vulnerable to adverse weather conditions. Michigan received a C- rating for its infrastructure from civil engineers (Longley, 2024), highlighting the critical need for updates. The Sanford Lake Dam's failure in central Michigan due to overwhelming rainfall exemplifies the challenges associated with outdated infrastructure. Additionally, harmful algal

blooms are raising water treatment costs, increasing taxpayers' expenses by $10–18 per year per person. In 2023, a severe storm spawned seven tornadoes in Michigan, resulting in five fatalities. The storm caused widespread damage, including downed powerlines, road and bridge closures, damaged buildings, and overwhelmed stormwater infrastructure. Tornadoes in the state cost an average of $2.5 million per event, according to the National Weather Service and the National Centers for Environmental Information. Furthermore, with rising temperatures leading to more days over 90°F, Michigan is expected to need $2.3 billion by 2025 to install air conditioning in schools to maintain safe and comfortable learning environments (Michigan Climate Impacts and Costs, 2023). For rural Michigan, infrastructure stress is even more acute. Many villages manage aging water, sewer, and road systems with only a handful of staff. When a single culvert collapses or a dam fails, the recovery costs can consume an entire township's annual budget, leaving little capacity for proactive climate investment.

C. Climate Migration

In a world where natural disasters destroy homes in coastal areas like Florida and California at increasing rates, and where average annual temperatures are slowly rising nationally, Michigan has been branded as a "climate haven" (Whirter & Moore, 2023). Despite the aforementioned risks, Michigan's reliable access to fresh water and its positioning clear of some of the most destructive hazards, like hurricanes and wildfires, make it an attractive destination for people in at-risk regions seeking long-term stability. Experts predict that sea level rise alone could displace 13.1 million Americans (American Society of Adaptation Professionals, 2021). While an influx of "climate refugees" may generate mixed feelings from local communities, climate migration is already underway, and it is a reality that will be best-met with proactive planning.

1. Current Migration Trends

Rural communities in Michigan are already beginning to see an increase in domestic migration, including both from urban areas in Michigan and from other states. After consistent population decline throughout the 2010s, Michigan's state demographic research found that rural areas in Michigan saw a significant uptick in population gain from 2020–2023 (Butler & Leach, 2024). Despite rural populations representing only 16.5% of Michigan's population, they were responsible for 40.8% of the state's total population growth during this period. This reversal is especially significant for rural counties that have endured decades of population decline. New residents can revive school enrollment, expand the tax base, and keep small businesses afloat, but may also strain limited housing stock and social services.

This upward trend in population is likely to continue. Housing markets in at-risk areas of the country are currently supported by a delicate network of regulations and insurance subsidies, despite the number of disasters and cost of recovery in these areas continuing to climb (Craig, 2024). If, or when, these housing support systems become unsustainable, states like Michigan should already be prepared for a potential surge in people moving to seek stable long-term housing.

2. How rural communities can plan for climate migration

Because the nation still lacks a comprehensive plan to study and prepare for climate migration, much of the burden may fall on states and local communities to ensure that they are ready. In a perfect world, each community would stay on top of changes in migration patterns and consult with community members to build a vision for the area in a disaster-migrant world. Then, if the locality is willing to expand, it should act to access state and federal funding to build a range of housing options, amenities, and infrastructure to support a growing population, and if not, to

develop housing regulations that protect local residents from an early wave of (likely) wealthy climate migrants. (American Society of Adaptation Professionals, 2021).

The challenges facing rural communities are complex, with most having significantly fewer resources to proactively develop comprehensive sustainability plans. Many are compelled to focus on immediate crises, leaving limited capacity to pursue long-term initiatives. Insufficient organizational capacity and constrained funding—often stemming from a reduced tax base—frequently impede the design and implementation of sustainable infrastructure projects. Consequently, most support for infrastructure improvements is obtained through state or federal grant programs. In the absence of adequate funding and resources for long-term planning, communities may consider the following steps:

a. Discuss a plan with your communities

Starting the conversation is the strongest first step. Explain that disasters in at-risk states are already pushing people toward the Midwest, and that all communities in Michigan will have to confront how to receive them. Explain the opportunities posed by potential expansion, such as a greater tax base for infrastructure projects and new amenities, and the potential concerns, such as an evolving community identity. In rural Michigan, housing affordability is already challenged by second homes and short-term rentals. Without safeguards, climate in-migration could accelerate these pressures and price out long-time residents. With strong planning, economic development is possible without necessarily "urbanizing." In addition to traditional town halls, online surveys are an opportunity to receive input from residents that might not attend traditional in-person formats.

A major problem affecting Michigan right now is second homes and short-term rentals increasing housing prices and driving out local residents. While New York's outright ban on short-term rentals is being litigated right now (Zaveri, 2025), municipalities in Michigan have

successfully prohibited short-term rentals in domestically-zoned areas (*see Aldrich v Sugar Springs Property Owners Association, Inc.*, 345 Mich. App. 181 (2023)).

b. Coordinate with nearby communities and counties

Intercommunity transparency and planning allows local governments to pool scarce resources, share new ideas and their success rate, and avoid repeating errors. Nearby communities can discuss their respective approaches to disaster migration and coordinate to develop housing and infrastructure plans that work for everybody. This coordination is especially vital for small rural townships, which rarely have the resources to address housing or infrastructure needs on their own. Multi-township or regional planning allows rural areas to pool capacity and avoid fragmented approaches.

c. Continue pursuing state and philanthropic funding sources

Grant programs like the Rural Development Fund, the Rural Readiness Grant, and the Community Energy Management Program can help rural forward-looking infrastructure projects. One community leader we spoke to, successfully employed a high school intern who identified and won a $700,000 infrastructure development grant.

Even before funding arrives, it is important to maintain and keep updated a few infrastructure plans ready to proceed with. For rural governments, maintaining even a short list of 'shovel-ready' projects with basic cost estimates, preliminary designs, community backing, can make the difference between winning and losing funding opportunities when grants arise.

II. Best practices for mitigation, adaptation, and resilience in rural communities

A. Transitioning to green infrastructure

Green infrastructure refers to engineered or nature-based systems that manage water, reduce flood risk, and improve ecosystem function. While interventions such as rain gardens or bioswales are often associated with the urban setting, rural communities can benefit from similar strategies.

For rural Michigan, green infrastructure typically focuses more on larger scale water management systems and improvements along rural roads. Numerous structural practices exist which can reduce runoff and protect roadways and farmland during extreme precipitation events. A few examples include permeable pavements, expanded culverts, and vegetated swales. Restoring wetlands and reconnecting floodplains are powerful strategies in the rural context, due to ample land availability and the ability of wetlands to mitigate flood risks while preserving water-quality.

B. Developing emergency response systems in partnership with emergency management sector

These may include weatherization programs, heat-health early warning systems. A good example would be the Midwest Drought Early Warning System established in 2016. One important constraint involves the lack of robust metrics that capture the many social, economic, demographic, ecological factors that drive overall risk and resilience. In the absence of such data, it can be challenging for communities to gauge the extent of their own risk and preparedness in anticipatory and proactive ways. Some indices that have been developed to address this challenge include the Baseline Resilience Indicators for Communities (BRIC) and FEMA's National Risk Index. These metrics are accompanied by interactive tools that enable one to pinpoint areas of vulnerability down to the county level. Yet rural counties often lack dedicated emergency management staff. Many rely on volunteer fire departments or part-time responders, which means

early warning systems and emergency planning must be designed with low staffing capacity in mind.

C. Forest Management

Increasing the diversity of trees and introducing specific tree species suitable for a changing climate has the potential to bolster carbon storage and contribute to long-term mitigation. In northern Michigan, where forestry is a cornerstone of rural economies, strategies like mixed-species native planting and sustainable harvest cycles are especially relevant. These can protect both economic livelihoods and ecological resilience.

D. Climate-smart agriculture

UNFAO defines climate-smart agriculture as an agriculture that sustainably increases productivity and resilience, reduces/removes GHGs, and enhances the achievement of national food security and development goals. Agricultural and economic productivity are expected to decrease to levels of 1980s by 2050. There are many strategies for approaching this.

- **Increase use of cover crops**: Land managers can increase use of cover crops to better manage excess surface water, improve soil health, reduce erosion, and increase soil organic carbon. A key barrier here is that it results in reduction in short term yields for cash crops. Other strategies include reduced- or no-tillage operations.
- **Improving nutrient and manure management**: NOAA Runoff Risk Decision Support tool helps guide when to apply manure/fertilizers to reduce chemical entering into river systems. This helps to prevent algal blooms and hypoxia events as per GLWQA.

- **Nature-based solutions to decrease emissions**: increase carbon storage via conservation, restoration, land management of floodplains, wetlands, forests, grasslands, peatlands. Historically, peatlands have played a significant role in carbon storage. However, the drainage of wetland areas and rising temperatures have resulted in the substantial release of carbon previously sequestered in these ecosystems.
- **Agroforestry & bioenergy crops:** corn remains the major bioenergy crop in the US, providing ethanol as a biofuel with unclear climate impacts. Second-generation biofuels are thought to be better for reducing greenhouse gas emissions. These include dedicated energy crops, agricultural crop residues (materials left on land after crop harvest), and wood residues that have greater potential to reduce greenhouse gas emissions.
- **Agrivoltaics and renewable energy:** the integration of agricultural production activities and solar energy generation. MSU utilizing solar carports to power ~5% of electricity use on campus
- **Precision agriculture**: which maximizes the efficiency of input application (fertilizers and herbicides, e.g.) allows for homogeneously managed zones within the same field.

III. Case studies: approaches to rural climate resilience

Climate change is reshaping the physical and socio-economic landscapes of rural communities across the United States. Michigan's rural areas—many of which depend on agriculture, tourism, and natural ecosystems—are particularly vulnerable to rising temperatures, extreme weather events, and long-term shifts in climate patterns. However, states across the U.S.

are piloting climate resilience models that offer valuable lessons and guidance. This section explores in-depth case studies from different rural communities across the United States, focusing on strategies that enhance adaptation capacity in rural communities. Through the lens of these experiences, we outline a roadmap for rural Michigan to build climate resilience that is equitable, data-driven, and locally empowered.

To make this resource more actionable, the case studies have been categorized into four thematic areas: (1) economic revitalization; (2) clean energy; (3) health equity; and (4) land use practices. This structure helps to isolate strategies that may align more closely with some Michigan counties than others, depending on each county's specific priorities and vulnerabilities. By organizing examples in this way, local planners and policymakers can more easily identify relevant models and tailor their own resilience plans accordingly. For rural Michigan specifically, these examples provide tangible proof that small communities, often with limited staff and budgets—can still implement meaningful resilience strategies when they adapt models to local scale and capacity.

A. Economic Revitalization & Climate Migration

Theme: *Attracting newcomers while building local resilience*

Climate Haven Strategy: Buffalo, New York

- Marketed as a "climate haven" to attract new residents fleeing climate-vulnerable regions.
- **Resilience Features:** Affordable housing initiatives, inclusive city planning, immigrant services.

- **Relevance to Michigan:** Rural communities like Marquette or Alpena can benefit from positioning as climate-safe destinations if accompanied by inclusive planning, housing, and job strategies. For rural Michigan communities like Alpena, Petoskey, or Marquette, a 'climate haven' identity could be leveraged to attract residents, provided that safeguards are put in place to preserve affordability for long-time locals.
- Sources:

  https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4159394

B. Sustainable Land Use & Agriculture

Theme: *Balancing food production with climate and energy goals*

Agrovoltaics in Ohio

- Integrated solar energy with farming—largest agrivoltaic farm in the U.S. approved.
- Dual-use land = clean energy + continued crop production.
- **Innovation:** Supports pollinator habitats (ecovoltaics) and reduces erosion compared to traditional solar farms.
- **Relevance to Michigan:** installing agrivoltaics (solar panels + farming) or solar farms could be a good opportunity in Michigan's flat, rural regions where:
    - There's enough sunlight to generate energy
    - Farmland may not be as productive or profitable as it once was
    - Communities may be looking for new sources of economic activity or land use.

Examples in Michigan might include parts of southern or central Lower Peninsula, where farming is widespread but certain crops or rural economies are struggling. In Michigan, agrivoltaics could

provide a lifeline for rural townships where declining commodity prices strain farm economies and reduce local revenues. Framing dual-use solar as both an energy and farm preservation strategy may reduce opposition.

- Sources:

  https://blogs.law.columbia.edu/climatechange/2024/04/01/ohio-approves-nations-largest-agrivoltaics-project-finding-it-will-serve-the-public-interest/

  https://ohiocapitaljournal.com/2025/02/24/despite-a-federal-pullback-dual-use-solar-plus-farming-can-propel-clean-energy-forward-in-ohio/

C. Clean Energy & Energy Justice

Theme: *Local ownership and resilience through renewable energy*

Energy Transition in Nebraska's Sandhills

- Local co-ops and landowners co-developed wind energy projects.
- Kept revenue local, reduced opposition to renewables.
- **Relevance to Michigan:** Rural counties can explore cooperative ownership to prevent foreign investor dominance. In Michigan, cooperative ownership or local shareholding could help rural communities capture more of the revenue from wind and solar, reducing resistance and ensuring long-term community benefits.
- Sources:

  https://www.publicpower.org/periodical/article/municipal-energy-agency-nebraska-facilitates-solar-projects-communities

https://www.nature.org/en-us/about-us/where-we-work/united-states/nebraska/stories-in-nebraska/protecting-nebraskas-sandhills/

D. Climate-Resilient Infrastructure

Theme: *Adapting physical systems to withstand changing climate*

Climate-Proofing Infrastructure in Duluth, Minnesota

- Upgraded storm water systems and built flood-resilient roads and housing.
- Active civic input and long-term funding plans.
- **Relevance to Michigan:** Aging infrastructure (roads, sewers) can be retrofitted using similar public-private models in places like Alpena or Escanaba. For rural Michigan towns, infrastructure resilience may mean focusing on small but high-stakes assets: a single wastewater plant, one bridge connecting residents to hospitals, or outdated culverts along school bus routes. Tailoring infrastructure upgrades to these critical chokepoints can deliver outsized resilience benefits.
- Sources:

  https://duluthmn.gov/sustain/news-updates/climate-change-and-green-infrastructure/?itid=lk_inline_enhanced-template

  https://www.nytimes.com/2023/03/10/realestate/duluth-minnesota-climate-change.html

IV. Launching Climate Resilience Projects in Rural Communities Using the Steps to Resilience Framework

While climate change will reshape Michigan's rural communities in profound ways, the question for many local leaders is, *where do we begin?* Where staffing and capacity is limited,

many communities struggle to determine how to begin addressing the threats posed by climate change even where grants and evidence-based strategies for mitigation and adaptation may be available. Still, the experiences of rural leaders across the state suggest clear, practical steps to get underway.

The U.S. Climate Resilience Toolkit introduces the Steps to Resilience Framework to help bridge the gap between recognized best practices and practical implementation. This framework, consisting of six sequential steps, offers a structured and organized approach to designing and implementing solutions that strengthen climate resilience. This section focuses on key recommendations from the experiences of individual community leaders while simultaneously making references to this broader framework, which we hope can serve as a mental model for rural leaders trying to understand where they are in the process of tackling any particular dimension of climate change.

US Climate Resilience Toolkit: Steps to Resilience	
Step 1	**Identify stakeholders** including champions and **build buy-in** through establishing open lines of communication and engaging community members
Step 2	**Identify exposures** (rising temperatures, flooding, crop loss) using local data and community stories
Step 3	**Assess vulnerabilities and risk** to help prioritize specific exposures to tackle
Step 4	**Investigate options** to compare various potential interventions based on estimated costs and feasibility.
Step 5	**Develop a plan**
Step 6	**Take action** and track progress toward your goal

Getting started on climate resilience is less about launching perfect plans and more about taking visible, community-rooted first steps. By combining local data, community engagement, small pilots, and strategic partnerships, rural leaders can move from awareness of climate risks to tangible action. This foundational process sets the stage for deeper capacity building, ensuring that projects not only launch but also endure and grow over time.

A. Getting started and building buy-in

Prior to jumping in and tackling any given challenge, it can be helpful to identify key stakeholders and build buy-in. The Climate Resilience Toolkit advises identifying a champion, a trusted leader who has the knowledge, expertise, and relationships in their community to get a project done. This can be an individual within the community or government, who works with a broader planning committee to better understand the nature of the problems faced by a specific community. This stage also involves doing the background research on what work may already be in motion.

Before drafting plans, it is critical to engage local champions and generate trust. In small communities, this often means starting conversations not in government buildings but in schools and neighborhood events. Leaders in Brown City and Peck described how distributing surveys through schools or speaking directly at community gatherings drew more input than formal council meetings. In many rural areas, schools and churches serve as the true gathering spaces for residents across generations. Leveraging these institutions for surveys, meetings, and dialogues can significantly increase participation. Transparency also matters. Sharing updates openly—via social media, mailers, or town halls—helps residents feel included and reduces misinformation.

Key questions to consider at this stage are:

- What are the key existing documents and plans that provide context for any new work in this space? Does the community have a Comprehensive Plan or Hazard Mitigation Plan in place?
- Who are the key individuals that need to be at the table for developing a climate resilience strategy? Is there an individual most well-positioned to "lead" or "champion" this work?
- What are the channels for communicating forthcoming initiatives to the broader public and soliciting their feedback?

B. Identify exposures

Once it is clear who will be spearheading this work, the next challenge is clarifying the specific local challenge a community wants to address. A helpful way to begin brainstorming is by identifying *assets* and *hazards*. Assets refer to the people, systems, and infrastructure a community wishes to protect. Hazards are the events or conditions that could damage assets. The goal is to identify *exposures*, defined as the overlap between the two.

Example exposure matrix (adapted from US Climate Resilience Toolkit)

Example Potential Impacts Matrix

Community Assets	Hazards			
	Flooding	Landslides	Wildfire	Extreme Heat
City-owned facilities	X	X		X
Commercial properties	X	X	X	
Residential properties	X	X	X	
Critical facilities		X	X	X

Assets can be highly tangible objects, such as historic sites, attractions, natural features, or

elements of infrastructure (e.g. roads that communities depend on). They can also be less tangible goods, such as vital industries, jobs, or health. It can be useful to construct an exposure matrix: a visual representation of the intersection between assets and hazards, in which assets are on one axis and hazards the other, with "x's" marked for each cell in which there is overlap. In rural settings, an exposure matrix could be particularly useful for visualizing how hazards like flooding overlap with critical but limited assets, such as a single bridge, a small water treatment facility, or one key employer, that the community cannot afford to lose.

In thinking through hazards and assets, rural leaders consistently emphasized the importance of grounding projects in both data and lived experience. There are several reliable data-driven tools for identifying hazards. For example, the MiTracking public database provides county-level environmental data on hazards including extreme heat and precipitation days, while the NOAA National Centers for Environmental Information's Climate Mapping for Resilience and Adaptation (CMRA) portal offers spatially detailed projections of climate hazards such as extreme precipitation, flooding, and heat helping rural leaders visualize future risk patterns at the county level. (NOAA, 2025).

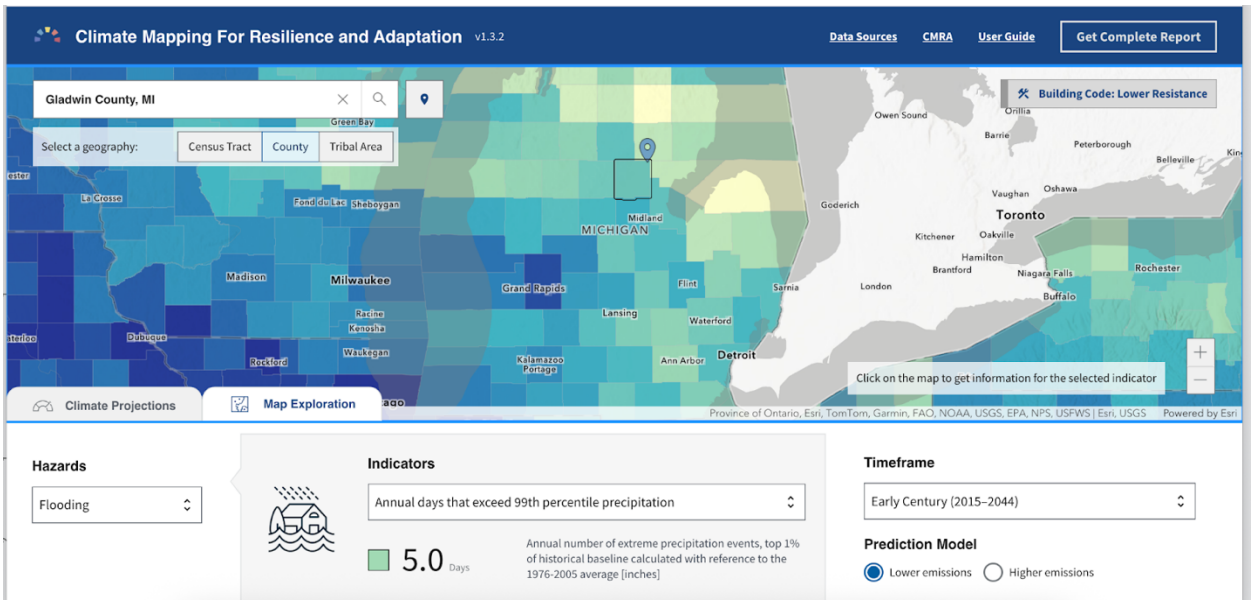

Figure 1. *Example of NOAA's Climate Mapping for Resilience and Adaptation (CMRA) interactive risk map showing projected flooding risk and extreme precipitation frequency for Gladwin County, Michigan (Source: NOAA Climate Resilience Toolkit, CMRA Portal, 2025. (https://livingatlas.arcgis.com/assessment-tool/explore/map)*

Pairing these statistics with community stories—such as farmers losing crops to late freezes or residents navigating flooded roads—helps ensure projects reflect both science and daily realities. For rural leaders, connecting climate data with lived experiences, such as farmers losing crops to late freezes or gravel roads washing out, builds stronger community buy-in than abstract statewide statistics.

> *Lesson Learned:* Communities that frame projects around a concrete, widely understood issue (e.g., flooding of local roads, repeated crop losses, power outages) build consensus faster than those starting from abstract climate goals.

C. Assess vulnerability and risk

Inevitably, resources and capacity are limited which will necessitate prioritizing some efforts to bolster resilience over others. Understanding and estimating risk is therefore the next step. Risk is determined by both the probability of a given climate-related hazard and the degree of associated consequences of such a hazard. Thus, risk is a complex variable that helps capture

why some assets are more likely to be damaged than others. In rural Michigan, this often means weighing risks to agricultural economies, tourism, and natural resources, which are usually more concentrated and less diversified than in urban areas. The loss of one harvest season or one tourist season can have outsized consequences. To further break down these variables, think about how assets differ in their sensitivity, or inherent capacity to withstand a given shock to the system, and adaptive capacity or the ability of an asset to adjust or cope with change.

D. Investigate options

After weighing the various risks associated with exposures, begin brainstorming strategies that can mitigate risk for a given exposure. One way to go about this is to think through a prior weather or climate-related disaster, considering how events unfolded and the conditions present that enabled or led to the negative impacts that resulted. As other ideas are being brainstormed, it is worth considering how effective these might have been in improving the outcomes previously observed. What unintended consequences might result from the intervention? Are the ideas feasible and sustainable? For rural governments, feasibility often hinges on staff time and small budgets. Brainstorming should therefore include strategies that leverage volunteers, interns, and partnerships to overcome these constraints.

Rural leaders stressed the value of starting small but planning ahead. Rather than attempting to tackle all resilience challenges at once, successful projects often begin with a narrowly scoped pilot that can address a single high-risk exposure. At the same time, communities should maintain a "project wishlist", a running list of ideas with basic cost estimates and community support that allows them to act quickly when funding becomes available. This concept of being "shovel-ready" is particularly important in rural Michigan, where federal and state grants often reward communities that can demonstrate readiness.

E. Develop a plan

This stage involves getting more in the weeds of what a given intervention or action might entail. What are the steps and order of operations required to implement each idea? What are the relative costs and benefits of each intervention? How do they stack up against one another in terms of "value"? Think about costs broadly in terms of not just money but also time constraints, capacity, etc. Where does that leave you in terms of what projects you can take on in a reasonable timeframe and what things to put on the back burner? After weighing these various considerations, it is crucial to create a detailed timeline with clear milestones.

This is also the time to begin thinking about what strategic partnerships might be worth leveraging. Early collaboration can significantly lower the barriers to getting started. Universities (e.g., University of Michigan and Michigan State) and regional organizations often bring expertise and student capacity that rural towns cannot afford in-house. Similarly, multi-county collaborations, such as regional hazard mitigation plans in the Western Upper Peninsula, help communities reach funding thresholds that they would not qualify for on their own.

Engaging consultants or contracting specialists for technical tasks—such as engineering assessments, hazard mitigation planning, and grant writing—can be an effective strategy to bridge initial knowledge gaps and bolster local capacity. In rural contexts, these external partners often play an outsized role. A single contracted grant writer, engineer, or regional extension agent can provide essential technical expertise and serve as a critical resource for small communities.

F. Take action

As implementation begins, it's important to have a strategy in place for monitoring outcomes and tracking progress. Having process and outcome measures in mind helps inform future iterations

and adjustments if need be. The first months of a project in particular often present the toughest challenges. Common barriers include:

- **Limited capacity:** small staff with leaders working 12-hour days.
- **Funding gaps:** no dedicated grantwriter or planning resources.
- **Community skepticism:** concerns about cost, relevance, or change.
- **Data gaps:** especially acute in rural Upper Peninsula communities.

Practical solutions observed in Michigan include recruiting high school interns for grant writing support (Peck & Brown City), reframing projects to align with local identity (e.g., "work-from-home hub" or agritourism), and leaning on peer networks for advice and morale.

Hosting Community Listening & Dialogue Sessions

- **Format:** Small-group workshops in schools, or community centers, co-facilitated with local leaders.
- **Focus:** Identify the immediate climate-related problems residents experience most directly (e.g., flooding, crop losses, power outages, health risks from extreme heat).
- **Outcome:** A shared "problem map" that reflects both local stories and scientific data.

Prioritizing Key Focus Areas

Based on both climate projections (GLISA, 2025; NOAA, 2025) and local concerns, initial sessions would focus on:

1. **Extreme Weather & Infrastructure:** Flooding, stormwater, and aging utilities.
2. **Agriculture & Land Use:** Heat stress, spring freezes, pests, and soil management.

3. **Health & Vulnerability:** Extreme heat, emergency response, and impacts on seniors/children.
4. **Economic Opportunities:** Renewable energy, agrivoltaics, work-from-home potential, tourism.

Co-Designing First Projects

Together with community members, scope 1–2 "starter projects" that are realistic, visible, and build momentum. These might include:

- Piloting a school-based outreach program (surveys + education) to broaden engagement beyond the "same ten people."
- Drafting an initial project wish list with cost ranges to prepare for future funding.

Building Resources Alongside Communities

As part of this first phase begin developing:

- **Engagement templates:** survey instruments, town hall facilitation guides.
- **Data briefs:** simplified climate risk summaries tailored for each community.
- **Funding trackers:** lists of relevant state/federal grants with requirements.
- **Peer learning networks:** linking leaders across regions to share practices.

V. Capacity Building

Rural communities encounter significant challenges when seeking to engage in climate readiness initiatives, including limitations in staffing, funding, and resources. This section will review common obstacles that rural communities face in building the necessary capacity to

develop ideas, plan strategically, and initiate projects. Additionally, it will provide strategies and recommendations for enhancing local capacity to support successful climate action efforts.

Constraints in Rural Michigan

- **Capacity**: Community leaders in rural areas often shoulder multiple responsibilities, frequently working extended hours with limited support. Many communities experience what is informally referred to as "Same Ten People Syndrome" (STPS), where a small group of individuals consistently manage a disproportionate share of the workload. This staffing shortage is especially pronounced in rural Michigan, where township clerks or managers are often required to fulfill several roles simultaneously, highlighting the challenges of limited administrative capacity in these regions.
- **Funding Dependency**: Due to a decreased tax base, rural communities are often heavily reliant on securing grants, typically from state and federal sources, to fund projects. (Peck's budget 90% grant-funded).
- **Leadership Turnover/Education**: New managers with little municipal experience; volunteer/part-time governance.
- **Community Engagement**: "Same ten people syndrome" (STPS), apathy, or single-issue turnout; generational divides.
- **Access to Programs**: small towns struggle to meet thresholds for state/federal initiatives designed for larger municipalities.
- **Planning Fatigue**: complex, resource-intensive planning required for grants/hazard mitigation, often with little reward.
- **Change Resistance**: communities torn between desire for growth and fear of change (e.g., cannabis store debate, opposition to development).

- **Data Gaps**: particularly in the UP, lack of robust planning data.

What's Worked Well

- **Role Definition:** Clearly defined roles and responsibilities: having a single individual who can be a point person championing this work, and others who are brought on for specific needs (e.g. applying for grants, GIS, etc.)
- **Interns/Youth Engagement**: Infusing new energy and talent into rural communities is critical for fostering future local leadership. Internships and youth leadership programs are especially valuable in rural Michigan, where population decline makes cultivating the next generation of leaders essential for long-term community resilience.
- **Peer Networks:** Regional support and resource sharing. This may look like regular multi-community manager meetings, text/slack threads, or cross-town mentorship.
- **School Partnerships:** Engage the broader public, especially families and youth. Making a presence at back to school nights, homecoming events, etc.
- **Prioritization:** having a clear focus and scope based on demonstrated needs
- **External Consultants:** Leverage expertise for complex or unfamiliar projects as well as fill in the capacity gap.
- **Ownership and Identity**: Reframing local development goals (work-from-home appeal, eco/agritourism).
- **Transparency and Trust Building**: Leaders who are visible and communicate openly about challenges and wins. In rural communities, this kind of transparency is especially critical. Rumors can travel quickly, and visible, trusted leaders who share both successes and setbacks help counter misinformation.

- **Celebrating Small Wins**: Highlighting grant successes, infrastructure upgrades, community events to keep momentum.
- **Regional Planning:** Western UP's collaborative approach to hazard mitigation, research, and communication strategies.
- **Leadership Pathways:** Encouraging underrepresented voices to step into leadership.
- **Regional Training Events:** Help leaders with less experience learn skills that will be helpful for job

Examples of Capacity Building in Practice

- Village of Peck
    - Hiring interns for grant management, leveraging consultants for planning/upgrades, and collaborating monthly with other managers.
- Brown City
    - Recruiting high school interns for administrative/grant writing, using school networks for engagement, reframing community identity (work-from-home hub), encouraging younger citizens to serve.
- Barry County
    - Navigating between agricultural and lake district needs, maintaining close Chamber partnership, focusing on unique, local pathways to growth rather than urban expansion.
- Western UP

- Developing region-wide hazard mitigation plans, innovative outreach (workshops, public events), and building a local research consortium to address unique data needs.

Element	Constraints/ Challenges	Local Example	What Works
Staffing/Capacity	Overburdened leaders, few staff	Managers in office 8am-8pm (Brown City)	High school/college interns, youth recruitment
Grant Dependency	Need more capacity to apply/manage	90% budget from grants (Peck); no grantwriter (Barry County)	Training, consultants, ready-to-go project lists
Community Engagement	Low turnout, "complainer" dominance	Surveys at school events (Brown City), Council bias	School partnerships, direct outreach, celebrate wins
Training	Aging leadership, few training ops	Political council, volunteers untrained (Brown City)	Thumb Economics Summit, university resources
Regional Cooperation	Isolation, duplication of effort	Managers meeting monthly (Peck/Thumb), WUPPDR	Peer networks, regional hazard plans, toolkits
Innovative Framing	Resistance to change, split opinions	Opposition to urbanizing, cannabis (Barry, Brown City)	Reframe to local values (remote work, eco-tourism)
Data & Planning	Hard to gather local data, overwhelming paperwork	WUPPDR struggle to produce mitigation plans	Partner with universities, develop local research
Communication	Misinformation, echo chambers	Facebook rumors, church influence (Brown City, Peck)	Direct communication, visible leaders

Key Recommendations in Capacity Building

1. Invest in people - via youth engagement, ongoing training, and support for overworked managers. In rural areas, this means targeted training for clerks, supervisors, and volunteer board members who often carry climate work without formal staff support.
2. Develop “shovel-ready” projects and build skillsets to pursue grant funding.
3. Leverage partnerships: both horizontally (peer communities) and vertically (universities, state).
4. Tailor engagement - through schools and targeted outreach—meet people where they are.
5. Embrace regional solutions - for challenges too big for a single community.
6. Be transparent and consistent—small wins matter in building trust.
7. Advocate for rural-adapted funding models at the state and federal levels.

VI. Funding

For rural governments, funding challenges are often magnified by population thresholds and match requirements embedded in state and federal programs. Many rural townships struggle to qualify for grants designed with larger municipalities in mind. Expanding rural-adapted funding models, like the Michigan Office of Rural Prosperity's Rural Readiness Grant, would help small communities access resources without being penalized for size.

The City of Cadillac was slated to receive about $4 million from the Solar for All program to install solar arrays at its water and wastewater facilities, with projected annual savings of $200,000—half of which would have helped residents struggling to pay utility bills. Recently, however, the EPA rescinded the funding, forcing the city to halt the project and consider raising utility rates, which is a significant burden for a community with high poverty rates and limited financial resources.

Cadillac also struggles with the growing trend of second home purchases, particularly near the central lake. While these lakefront second homes can drive up property values, they do not support the local tax base or year-round economic stability for permanent residents. The city's already low tax revenue limits its ability to self-fund critical infrastructure improvements, making it heavily dependent on external grants and aid. The loss of federal funding, in combination with increasing costs and project delays, underscores the vulnerability of rural communities like Cadillac to changes in grant availability and housing market pressures. Reliable funding and strong local partnerships remain essential for maintaining vital services and infrastructure in the face of these challenges.

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