Lac du Flambeau Tribe Hazard Mitigation Plan

Draft for Public Comment
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The Lac du Flambeau Tribe and Ojibwe People

Before Columbus made his voyages, Cortes conquered Mexico, and Samuel de Champlain searched for a series of lakes he believed would link the Pacific with the Atlantic, the Anishinabe (Original People) lived near the mouth of the St. Lawrence River on the east coast. From there, they migrated slowly to the west guided by 7 prophecies that their journey would end where they found food growing on water. The prophecy was fulfilled after a centuries-long migration when they found manoomin (wild rice) in the waters of Lake Superior. By 1600 they had settled where the water of Lake Superior enters Lake Huron.

"Since their early history, the Ojibwe have called themselves Anishinabe, meaning spontaneously created or original man, and many prefer this name today. Thus, man was the last form of life to be placed on the Earth. From the Original Man came the A-nish-i-na'be people. - Edward Beton-Banai"

The Lac du Flambeau Band of Lake Superior Chippewa (Ojibwe) Indians have inhabited the Lac du Flambeau area since 1745 when Chief Kishkemun (Sharpened Stone) led the Band to the area. This was three decades before the birth of the United States and more than a century before Wisconsin became a state. The Band acquired the name Waaswaagoning (Lac du Flambeau) from its gathering practice of harvesting fish at night by torchlight. The name Lac du Flambeau, or Lake of the Torches, refers to this practice and was given to the Band by the French traders and trappers who visited the area.

The Ojibwe had minimal impact on the ecology of the area. They lived in harmony with the land and lakes, using only what they needed to live and survive. They used the lakes for travel, trade, communication, hunting, trapping, fishing, and during times of war. The fur trade era had opened the Lake Superior region, including Lac du Flambeau, to settlement, and as more and more settlers moved in the demand for the region's natural resources expanded accordingly. In response, the United States government expropriated vast tracts of Ojibwe land through cession treaties, promising small amounts of money, schooling, equipment, and the like in exchange for land.

The Lac du Flambeau Indian Reservation was established through the Treaties of 1842 and 1854 with the United States. In 1863, three townships were set aside to serve as the Lac du Flambeau Reservation, and another township was added in 1866, increasing the Reservation to its current size. The area was continually logged in the following years and became a tourist destination for families from southern Wisconsin and Illinois around the turn of the century. The Reservation consists of 260 lakes with 17,897 surface acres of water, which is believed to be the third highest concentration of lakes in the world. In addition to the lakes, there are approximately 71 miles of creeks, rivers, and streams and 24,000 acres of wetlands; altogether, surface waters cover nearly one-half (48%) of the Lac du Flambeau Reservation. Finally, 41,733 acres of forested upland leave only 3,000 acres for residential, manufacturing and commercial development.

The Lac du Flambeau Band of Lake Superior Chippewa Indians is governed by a twelve-member Tribal Council elected by tribal membership. The Tribal Council follows an established Constitution and By-laws that gives the Tribe the right to regulate through adopted codes and ordinances and negotiate with federal, state and local governments or agencies. The Lac du Flambeau Band recognizes the following vision, mission and value statements:

"We shall strive to improve the quality of life for the Lac du Flambeau Band of Lake Superior Ojibwe Nation."

Vision Statement

The Lac du Flambeau Tribal Council shall have the constitutional duty, working together to maintain a sustainable community for tribal members, descendants and future generations. The tribal government shall improve the quality of life by following a cultural and well-balanced approach within all tribal programs and entities. Healthy lifestyles, wellness, family values and spirituality shall guide our long-range planning and implementation. The tribal government shall protect our sovereignty and treaties, while moving forward for present and future generations.

Value Statement

The Lac du Flambeau Band of Lake Superior Chippewa Indian's are committed to following our ancestors seven teachings. These values will be used to carry out our mission and vision for our community so that we can move forward in a good way for the seventh generation. They are:

Honesty- to walk through life with integrity is honesty
Humility- to know that you are a sacred part of creation is to know humility
Love- to know love is to know peace
Wisdom- to cherish knowledge is to know wisdom
Courage- to face life with bravery is to know courage
Respect- to honor all creation is to have respect
Truth- is to know all of these things

In order to fulfill the obligations to our treaty resources, community members and property, the Lac du Flambeau Band of Lake Superior Chippewa Indians must develop mitigation strategies to effectively reduce impacts from natural and man-made events.

Part 1: Planning Process (Element A)

Introduction

For the Lac du Flambeau Tribe, water is part of their daily existence. About half of their reservation is open water or wetlands and water nourishes both the people and the natural resources on the reservation. For the Ojibwe people, natural resources are cultural resources and water plays a vital role in ensuring that the community continues to thrive with a changing climate.

The development of this plan brought the tribal community, tribal staff members, and the tribal leadership together to identify key hazards of concern for the Lac du Flambeau Reservation, assess the relative risk of those hazards, and develop the mitigation actions. The extensive engagement occurred over the course of the project to help ensure that the actions are both effective and represent the goals, priorities, and perspectives of the tribal community. This lengthy and multi-faceted engagement approach also helped build the tribal staff capacity to implement the actions identified in this plan and continue to identify and implement mitigation actions in the future.

The 18-month planning process culminates in this document, an update to the 2006 plan that the Lac du Flambeau Tribe completed in collaboration with Villas County. Since that initial plan, the State of Wisconsin, Vilas County, Iron County, and a number of Native American Tribes in the region have completed hazard mitigation plans. As determined by the federal Disaster Mitigation Act of 2000, mitigation plans must be completed and updated on a five-year cycle with the goal of ensuring that approved tribal mitigation plans meet the requirements of the Stafford Act and Title 44 of the Code of Federal Regulations (CFR)[1]. An adopt FEMA-approved hazard mitigation plans is a condition receiving certain types of non-emergency disaster assistance.

DISASTER MITIGATION ACT OF 2000

The Lac du Flambeau All Hazards Mitigation Plan has been developed in accordance with the Disaster Mitigation Act of 2000 (DMA2K). On October 30, 2000, DMA2K was signed into law by the U.S. Congress in an attempt to stem the losses from disasters, reduce future public and private expenditures, and to speed up response and recovery from disasters. This Act (Public Law 106-390) amended the Robert T. Stafford Relief and Emergency Assistance Act. The following is a summary of the parts of DMA2K that pertain to local government and tribal organizations:

- The Act establishes a requirement for local governments and tribal organizations to prepare an All Hazards Mitigation Plan in order to be eligible for funding from FEMA through the Pre-Disaster Mitigation Assistance Program and the Hazard Mitigation Grant Program.

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[1] FEMA. Tribal Mitigation Plan Review Guide. 2018. FP 206-112-01 OMB Collection Number: 1660-0062

- The Act establishes a requirement that natural hazards such as tornados, floods, and wildfires need to be addressed in the risk assessment and vulnerability analysis parts of the All Hazards Mitigation Plan. Manmade hazards such as hazardous waste spills are encouraged, but not required, to be addressed.
- The Act authorizes up to seven percent of Hazard Mitigation Grant Program funds available to a state after a federal disaster to be used for development of state, local, and tribal organization All Hazards Mitigation Plans.
- The Act establishes November 1, 2004 as the date by which local governments and tribal organizations are to prepare and adopt their respective plans in order to be eligible for the FEMA Hazard Mitigation Grant Program and Pre-Disaster Mitigation Program.

Planning Process

The 18-month planning process included the following four key phases.

- Phase I: Community Engagement and Identification of Key Hazards (Months 1-6);
- Phase II: Analysis of Current and Future Risk (Months 7-11);
- Phase III: Development of Mitigation Actions (Months 12-14); and
- Phase IV: Plan Review and Adoption (Months 15-18).

Phase I: Community Engagement and Identification of Key Hazards – This phase focused on broad and deep community engagement. This included a multi-faceted approach that reached out to community members for their input in identifying key hazards of concern.

- The Tribe began the process by conducting department interviews to initially scope the hazards that are most relevant to the Tribe. This included interviews with the following departments: Emergency Management, Natural Resources Program, Land Management, Water & Sewer, State of Emergency Coordinator, Public Health, Tribal Historic Preservation Office, and Water Resources.
- The Historic Preservation Office, with support from the natural resource and emergency management departments, conducted interviews with tribal elders. These interviews provided an opportunity for the elders to share local and traditional knowledges with the office about historic conditions, observations of extreme weather and how changing climate conditions were already affecting the reservation, the natural resources, and the people that depend on those resources.
- The project coordinator also hosted two talking circles with tribal youth focused on extreme weather events and climate change.
- The project team developed and distributed a community survey (see Appendix B) that was shared both electronically through the tribe's social media channels and website, but also physically at a large annual community festival on April 26th. This presentation helped generate interest in being a part of scoping the plan(s). The tribe received 54 completed

surveys from the community and eleven completed surveys tribal staff (Appendix B). The project team then reviewed and analyzed these concerns along with historic climate and weather data to develop a list of key hazards to be analyzed in detail for the community.

- In a unique synergy with an ongoing and separately funded climate change vulnerability and adaptation planning process, the Tribe invested in working with one of the tribe's spiritual leaders to develop a logo for the project. The Tribe's *Resilience Initiative* Logo helps the community understand current and existing conditions can threaten the community and the value of investing in hazard mitigation to both reduce the potential impacts of those events, but also consider the hazard mitigation plan as part of a broader and holistic approach to enhance the resilience of the community.

Figure 1: The Lac du Flambeau Tribal Resilience Initiative Logo symbolizing how protecting the community from hazards and changing climate conditions can ensure a resilient future for the tribe.

- The project team held monthly meetings with the Tribal Emergency Planning Committee. Most of these meetings were 2-3 hours long and involved discussion and advice on both the Hazard Mitigation Plan and the broader Resilience Initiative. The workshops brought together both TEPC members and some other key stakeholders to discuss prioritization of hazards, identification of risk, and development of mitigation actions. These included meetings on the following dates:
    - January 25th, 2018
    - February 15th, 2018
    - March 22nd, 2018
    - May 24th, 2018 (full-day workshop)
    - June 21st, 2018
    - August 23rd, 2018
    - September 27th, 2018
    - October 25th, 2018
    - November 14th, 2018 (full-day workshop)
    - January 24th, 2019
    - February 28th, 2019
    - March 28th, 2019 (full-day workshop)

- The project team provided updates to the Tribal Council throughout the process. These included presentations on December 5th, 2017; May 24th, 2018; and March 28th, 2019.

- A one-day workshop was used to bring the members of the Tribal Emergency Planning Committee together to review the results of the survey and provide other input in the final identification and selection key hazards to be included in the hazard mitigation planning process.

Phase II: Analysis of Current and Future Risk

The analysis of current and future risks relied on a combination of data sources. The project team brought in and utilized historic weather observations as well as future climate projections provided by the University of Wisconsin and analyzed by the Great Lakes Integrated Sciences and Assessment Center (GLISA), one of NOAA's Regionally Integrated Sciences and Assessment Centers, located at the University of Michigan. This explicit qualitative and quantitative consideration of future conditions, including long-term changes in weather patterns, will help ensure that the tribe is preparing for not only the hazards of the past, but also the hazards of the future (see Part 2: Changing Climate Conditions for more details).

Phase III: Development of Mitigation Actions

Development of hazard mitigations actions started with the collection and review of existing tribal programs, projects, and initiatives as well as a review of the actions identified in the Tribe's 2008 Hazard Mitigation Plan. The project team then compiled lists of actions being used in other communities to address similar hazards. These actions were reviewed by the Tribal Emergency Response Committee and updated to ensure relevance and effectiveness within the community. The project team used a day long workshop with tribal staff and key community members to further refine those actions, identifying the lead departments, project costs, and key opportunities for implementation.

Phase IV: Plan Review

A complete draft of the hazard plan was provided to tribal staff, the tribal leadership, and the community as a whole for review. Comments received during that review period were reviewed and the plan was updated, as appropriate, to respond to or address the comments. The updated plan was submitted to FEMA for review and approval before being presented to Tribal Council for adoption.

Tribal Emergency Planning Committee

The Tribal Emergency Planning Committee (TEPC) consisted of 36 staff members. This group served as the core advisors for this project, as well as a separately funded climate change resilience project. The TEPC met monthly throughout the project and provided input and guidance during each phase of the development of the Hazard Mitigation Plan. Once the key hazards were identified, the group split into four sub-committees focused on hazards related to one of the following areas.: 1) community safety and security; 2) extreme weather events, wildfire, and infrastructure; 3) public and community health; and 4) natural and cultural resources. These sub-committees reviewed and helped update the draft descriptions of the hazards and were closely involved in the development of hazard mitigation actions to reduce the potential impacts of each of these hazards. They were also, as a larger group, involved in the final review of the completed hazard mitigation plan.

Table 1: Members of the Tribal Emergency Planning Committee (TEPC) that were involved in the preparation of the all-hazard mitigation plan. Sub-committee involvement is shown in the final four columns.

Lac du Flambeau TCRP Members						
Last Name	**First Name**	**Position/Department**	**Sub-committee #1: Community Safety and Security**	**Sub-committee #2: Natural Resources**	**Sub-committee #3: Community and Public Health**	**Sub-committee #4: Extreme Weather Events and**
Able	Lauren	Historic Preservation		X		
Allen	Dee	Natural Resources (Water Resources)			X	X
Chapman	Eric	Tribal Council, Emergency Management Coordinator, and Natural Resources	X	X	X	X
Coy	Emerson	Planning				
De Vries	Jason	Roads				X
Ford	Shawnee	Land Management				
Gauthier	Brian	Planning/UW Extension	X			X
Gauthier	Ryan	Conservation Law				
Giebudowski	Mark	Tribal Police	X			
Graveen	Jason	Facilities				
Graveen	Joe	Wild Rice Program		X		
Green	Bill	Housing Authority Modernization				X
Hanson	Kristen	Brownfields/Environmental Response				
Hraban	Cheryl	Purchasing				X
Hawking	Celeste	Natural Resources		X		
Johnson	Greg	Ojibwe Language Program		X		
LaBarge	Jerry	Cultural Activities Coordinator		X		
Mayo	Zoya	Land Management				X
Meizer	John	Housing Authority Maintenance				X
Peterson	Sandy	Water and Sewer				
Poupart	David	Community Health			X	
Risingsun	Elliot	Head Conservation Warden		X		
Sennet	Ethan	Forestry		X		
Soulier	Jackie	Housing Authority Executive Director				
Stiles	Cythida	Historic Preservation				
Stone	Stacey	State of Emergency Mgmt Coord.	X			
Supinski	Sandra	Community Health			X	X
Thompson	George	Tribal Roads/Tribal Council				X
Valier	Lee Ann	GLITFC			X	
Valliere	Scott	Water and Sewer				X
Virden	Andre	Natural Resources		X		
Wawronowicz	Larry	Natural Resources Director		X		
Wilke	Mark	Safety Manager	X			
Wolfe	Sue	School	X			
Wolfe	Wayne	Wildlife		X		
Zimmerman	Mike	Fire Dept				X

Public Engagement Process

For this planning process, the "Public" is defined as anyone living in and around the reservation. The focus of the engagement was on three key audiences, tribal membership (representing the community), tribal staff members in key departments (as represented by the TEPC), and tribal leadership (as represented by the Tribal Council). The broader public was given numerous opportunities to participate in the development of this plan. All opportunities were advertised through the Tribe's active social media channels; the tribe's website, newsletters, and flyers; and presentations to the Tribal Council. Key opportunities for engagement included:

- Survey of key hazards of concern (see http://www.ldftribe.com/resilience, the on-line survey and responses (Appendix B), and the booths and presentations at the 2018 youth forum);

- Interviews with department leads and tribal elders (notes from the meetings are considered confidential tribal information – but relevant summaries were incorporated into the identification of hazards);
- Invitation to participate in the relevant sub-committees;
- Opportunities for public comment at Tribal Council meetings; and
- Review of the draft hazard mitigation plan (see survey questions/responses, Appendix B).

The Tribal Emergency Management Coordinator also made himself available to receive comments outside of these prescribed opportunities.

Involving Neighboring Jurisdictions

There was a two-way channel of communication and participation with neighboring jurisdictions. Tribal staff members were invited to and participated in the recent update of the Vilas County hazard mitigation plan. At these events, Tribal Staff promoted and discussed the development of this hazard mitigation plan and requested input. The surrounding jurisdictions were invited to participate in the community forum around the release of the draft plan and encouraged to provide input on the draft plan through the use of either an on-line survey or by providing direct comments to the Tribe's Emergency Management Coordinator.

Building off Existing Conditions and New Research

Local, state, and national datasets for existing hazards were reviewed and analyzed for inclusion in this hazard mitigation plan. Local knowledge was used to ground truth, validate, refine, and update the local data sets and the relative frequency of hazards based on the Tribe's historic experience with those risks. In addition, the team, led by the Great Lakes Integrated Sciences and Assessment Center at the University of Michigan analyzed new downscaled climate projection from the University of Wisconsin for watersheds within 40 miles of the reservation boundaries. The ensemble average for projections under the "business-as-usual" climate scenario[2] was used to inform the future risk profile for each hazard. Each hazard was individually scored based on a number of factors and the overall risk score was weighted based on whether that hazard is likely to become more frequent or intense in the future, remain the same, or decrease in frequency, severity, or magnitude (see Part 3: Assessment Approach/Methodology for details). One basic example is that the frequency of extremely cold conditions is projected to decrease while the frequency of extreme heat events is projected to increase. Funding for this specific and detailed analysis of climate data was provided primarily as part of a simultaneous but separate project evaluating the climate related vulnerability and options for adaptation.

In an effort to leverage other on-going planning activities and programs, the project team reviewed a number of existing tribal policies and programs. This review included: the State

[2] "Business-as-usual" is defined as the higher climate change scenarios currently in use termed RCP 8.5. Emissions of greenhouse gasses in this scenario continue to rise at current rates and result in a radiative forcing of 8.5 Watts per Meter squared by the end of the century.

of Wisconsin's 2016 Hazard Mitigation Plan; the Vilas County 2006 and 2013 All Hazard Mitigation Plans; Iron County's 2018 Hazard Mitigation Plan; the Lac Courte Oreilles Band of the Lake Superior Ojibwe Hazard Mitigation Plan; the Sokaogon Chippewa Community All Hazards Mitigation Plan; the Town of Lac du Flambeau's Comprehensive Plan; It also included Tribal Ordinances and Plans such as:

- State of Emergency Coordination plan;
- Emergency Management Ordinance;
- Wetland Management Program;
- Code Compliance Ordinance;
- Land Use Ordinance;
- Emergency Operations Plan;
- Zoning Ordinance;
- Forest Management Plan; and
- Wild Rice Restoration Plan;

Keeping the Plan Current and Future Updates

The Tribe is committed to implementing these actions as funding and other resources become available.

Monitoring - Each member of the TEPC committee and her/his department has committed to moving forward with at least one hazard mitigation action (see Part IV: Priority Actions). For every action identified in the plan, the Tribe has identified a departmental lead as well as the implementation timeframe. The departments identified, who helped create the actions will be responsible for monitoring their progress on implementation.

Evaluation - The Tribe is committed to maintaining funding for a Tribal Emergency Management Coordinator position. This position will work with the department leads to monitor and track progress on implementing each of the identified actions (with a focus on the actions that were identified as immediate and near-term priorities). With the continued support of the cross department TEPC, the Emergency Management Coordinator will work closely with the department leads to evaluate the opportunities and barriers to implementing actions. The Natural Resources, Public Health, Roads, Water and Sewer, Housing, and Historic Preservation departments will report annually to the Tribal Council on progress and on-going funding needs as part of the annual budgeting and appropriations process of the Tribe. These presentations will also provide an opportunity for on-going public comment and engagement.

Updating – The Tribe commits to reviewing and updating this plan in its entirety every five years with the next update to be completed in 2024. Through the monitoring and evaluation process, each department responsible for implementing the hazard mitigation actions will maintain a current list of on-going progress on implementing actions. Each department also commits to refining and adding to that list as projects are completed and new actions are added. In addition, if and when a disaster does occur, the Tribe is committed to reviewing the conditions that led to the disaster, determining how the investment in existing actions helped reduce the extent of the disaster, and identifying additional actions that could be used to further reduce the magnitude of those impacts in the future. Now that the Tribe has invested in developing its first Climate Smart Hazard Mitigation Plan, future updates will be more efficient and easier to complete.

Public Participation- The public will be included through the ongoing use of social media to be informed of progress on actions implementation as well as provide an avenue for identifying additional and locally specific areas of concern. Annual presentations to the Tribal Council as well as updates that the large community Youth Forum will provide opportunities for community engagement and for on-going education and outreach to the community on hazard preparedness. The Emergency Management Coordinator will also be available to receive input from the community.

Part 2: Planning Area

Geography and Climate

The Lac du Flambeau Tribal Reservation is the focus for the development of the hazard mitigation plan. The Reservation (black square Figure 2 and Figure 3) is 86,630 acres (144 square miles) located in North Central Wisconsin primarily in Vilas County.

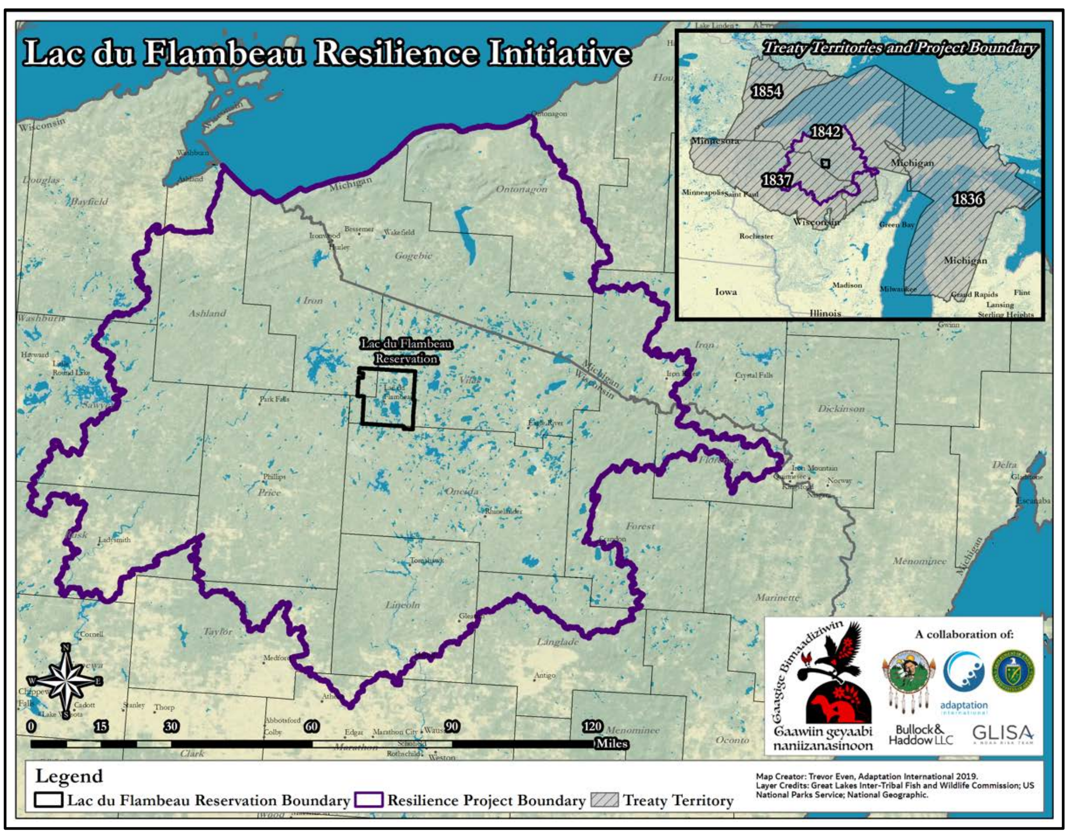

Figure 2: Location of the Lac du Flambeau Reservation in North Central Wisconsin. Reservation shown as the black square. Resilience Initiative planning area designation shown in purple. Relevant treaty areas shown in map inset.

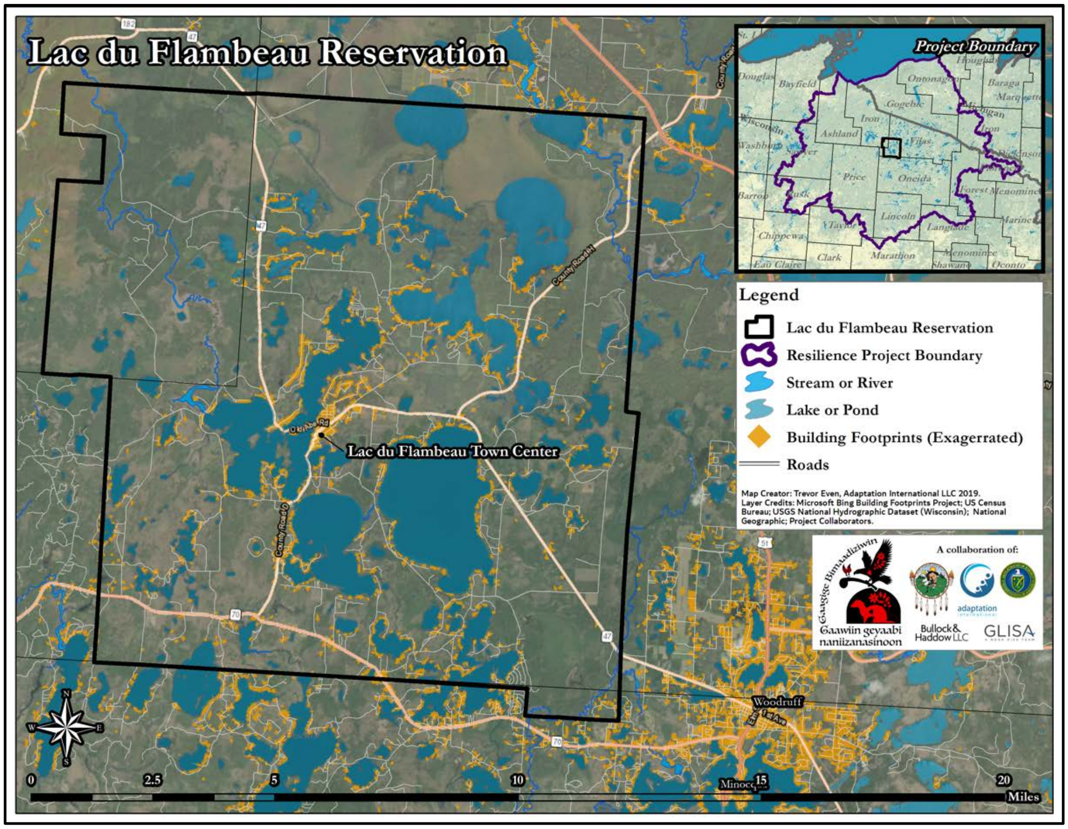

Figure 3: Lac du Flambeau Reservation area (black square) and surrounding landscape. The reservation boundary is the focus of the Hazard Mitigation Planning effort.

Figure 4: Land cover by type for the Lac du Flambeau Reservation. Values listed are total number of acres by land cover type in 2011. All Data from the 2011 National Land Cover Dataset (2014 version). Found at: https://www.mrlc.gov/data.

Table 2: Land cover by type for the Lac du Flambeau Reservation. Values listed are total number of acres by land cover type in 2011. All Data from the 2011 National Land Cover Dataset (2014 version). Found at: https://www.mrlc.gov/data

Class	Acres	Percent of Total
Woody Wetlands	24,395	28.18
Open Water	18,395	21.25
Forest Deciduous	17,319	20.00
Forest Mixed	12,143	14.03
Emergent Wetlands	4,720	5.45
Dev. (Open)	3,799	4.39
Forest Evergreen	2,461	2.84
Shrub/Scrub	2,433	2.81
Dev. (Low)	298	0.34
Cultivated Crops/Fields	284	0.33
Grassland/Herbaceous	246	0.28
Dev. (Med)	56	0.06
Dev. (High)	14	0.02
Pasture/Hay	11	0.01
TOTAL	**86,573**	**100**

On the reservation, 39,403 acres are tribally owned, 18,532 acres are individually allotted, and 28,665 acres are fee land. Nearly 50% of the reservation is open water or wooded wetlands that include 260 lakes, 65 miles of streams, lakes, and rivers. The remaining land cover is primarily forest with some cultivated or lightly or moderately developed areas.

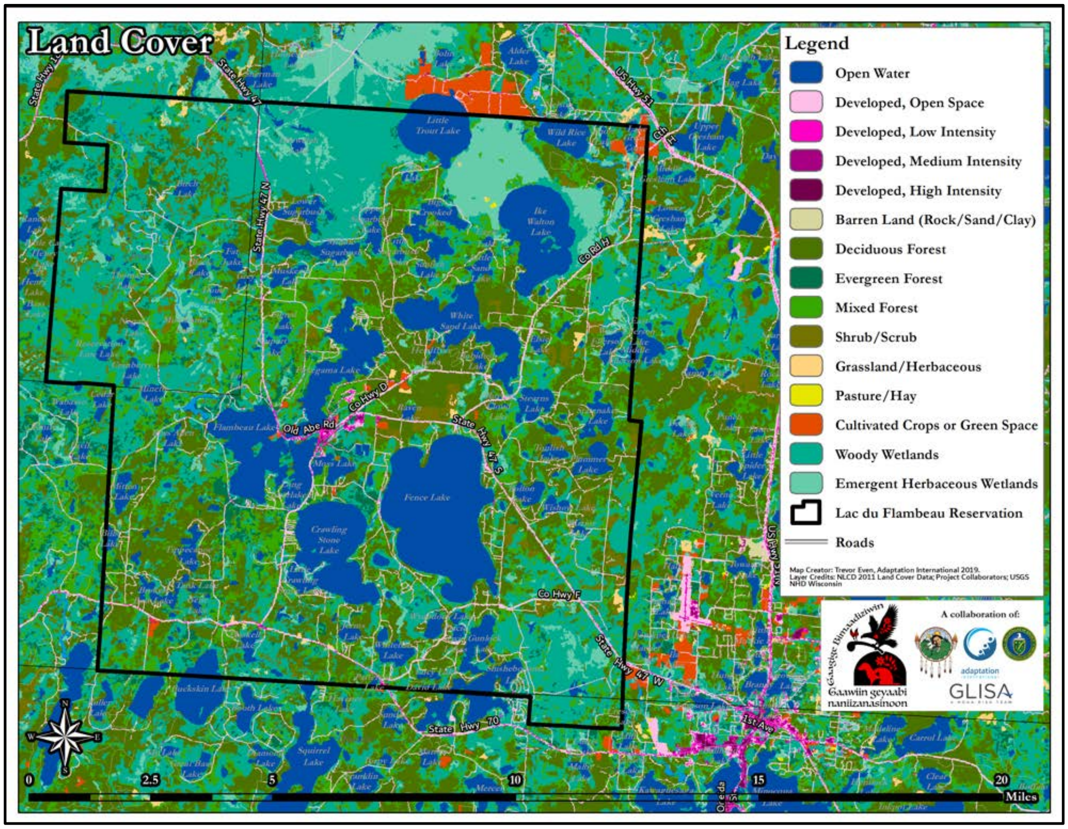

Figure 5: Land Cover and Land Use in the Lac du Flambeau Region, 2011.

Population

People

For the most part, tribal members live in and around the Town of Lac du Flambeau or the "town center". Though there are tribal residences scattered throughout the reservation. The highest density of development is in the Town area or immediately southeast of the reservation in Minnequa.

There are currently 3,415 tribal members. There are 860 tribal members under the age of 18 and 2,555 are 18-years old or older. Based on the American Community Survey 5-year Estimates (2013-2017), the Lac du Flambeau Reservation, WI has a total population of 3,406 (1,634 Male, 1,772 Female)[3], 1,761 identify themselves as American Indian or Alaskan Native. Approximately 17% of the population has some sort of disability, 24% are over 65 years old, and 8% both have a disability and are over 65 years old, all of which can enhance vulnerability to hazards.

[3] https://www.census.gov/tribal/?aianihh=1825

Employment, Economy, and Education

Of the estimated 2,783 people over 16 years old on the reservation, 1,522 are considered in the labor force (about 55%) with an estimated 13.3% unemployment rate. More than half (about 800 people) are employed by the Tribal Government[4] or another government agency or service. More than 50% of the estimated 1,682 households make less than $35,000 a year. For all families, 17.8% fall below the poverty level for income and 45.2% of families with children under the age of 18 fall in this category. Though lower incomes are known to decrease preparedness for and increase the impacts of disasters on families with lower socio-economic status[5], this does not however factor in the tribal cultural connections to the landscape and use of natural resources for food. About 13% of the population does not have health insurance coverage. Approximately 700 members of the school-aged community (3 years and older) are enrolled in school and 88% of the community (25-years and older) has attained at least high school degree with 25% having completed a bachelor's degree or higher.

Historic Climate Observation

Northern parts of Wisconsin experience frigid winters and generally cool summers with a few days of hot temperatures. The area experiences a variety of different air masses ranging from continental polar from the north and maritime tropical from the south. These air masses contribute to the bitterly cold temperatures in the winter (i.e., continental polar climate) as well as warm and humid summers (i.e., maritime tropical climate). These conditions determine the temperatures and amounts of precipitation in the region.

In Lac du Flambeau, WI, the historic monthly average temperatures vary from 10.9°F in January to 65.8°F in July. In winter (December, January, February), the monthly average temperature is 13.6°F with an average of 190.2 days per year days below 32°F. The monthly average temperature is 63.8°F in the summer (June, July, and August), with an average of 2.3 days per year above 90°F. The total annual precipitation for Lac du Flambeau is 32.1 inches, with majority of the precipitation occurring from June to August. Snowstorms are the main winter hazard in the area, with an average of 108 inches of snowfall (all numbers based on the period 1980-2010)[6]. High winds, excessive precipitation, and electrical storms can cause occasional damage to infrastructure around the area.

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[4] http://witribes.wi.gov/docview.asp?docid=19082&locid=57

[5] SAMHSA. 2017. Disaster Technical Assistance Center Supplemental Research Bulletin. Greater Impact: How Disasters Affect People of Low Socioeconomic Status. July 2017. Substance Abuse and Mental Health Services Administration. Available: https://www.samhsa.gov/sites/default/files/programs_campaigns/dtac/srb-low-ses.pdf

[6] Frankson, R., K. Kunkel, and S. Champion, 2017: Wisconsin State Climate Summary. *NOAA Technical Report NESDIS 149-WI,* 4 pp. https://statesummaries.ncics.org/wi *Local Climatological Data Publication for Green Bay, WI (KGRB).* National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) https://www.ncdc.noaa.gov/IPS/lcd.html Global Historical Climatology Network Daily (GHCN-D) Station Observations for Minocqua, WI. NOAA National Centers for Environmental Information. https://www.ncdc.noaa.gov/ghcn-daily-description; http://glisa.umich.edu/station/C00475516

Table 3: Summary of key historic climate variables for the Lac du Flambeau Region. Based on the current NOAA Climate Normal time period (1981-2010), source: https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data.

Variable	Value
Annual Mean Temperature	39.9°F
Annual Minimum Temperature	28.4 °F
Annual Maximum Temperature	51.4°F
Days above 90°F	2.3 days
Days below 32°F	190.2 days
Total Precipitation	32.1”
Average Number of Days per Year that Exceed 1” Precipitation	4.5 days
Average Snowfall	108”

Changing Climate Conditions

The climate of the region is already changing. Average annual temperatures have increased 3.1 ℉ since 1951. Temperature observations show increases in temperatures during all seasons. Projections under the “business-as-usual” climate change scenario (RCP 8.5) downscaled, averaged, and averaged specifically for the area that includes watersheds within 40 miles of the reservation boundaries show projections of increasing temperatures annually and in all seasons (Table 4). Average annual temperatures, as well as spring, summer, and fall temperatures, may increase by more than 10 degrees Fahrenheit. Annual precipitation has decreased in the summer but increased in the other three seasons. Projections under the “business-as-usual” climate change scenario (RCP 8.5) for the same area show a general trend towards increasing annual precipitation with high variability (Table 4). Projected increases in average annual temperature (

Figure 6) and precipitation (Figure 7) are shown below.

Table 4: Summary of observed changes in temperature and precipitation for the region (column 2) along with projected changes (mid-century column 3; end of Century column 4) for the resilience project boundary under the "business-as-usual" climate scenario (RCP 8.5)..

Variable	Observations (1951-2017)	Mid-Century (2040-2059)	End of Century (2080-2099)
Annual Temperature	**+ 3.1°F**	**+3.0°F to +5.3°F**	**+5.4°F to +10.0°F**
Winter Temperature	+ 4.7°F	+2.2°F to +4.8°F	+5.1°F to +8.6°F
Spring Temperature	+ 3.2°F	+1.9°F to +5.6°F	+5.2°F to +10.9°F
Summer Temperature	+ 1.9°F	+5.0°F to +7.1°F	+8.4°F to +12.4°F
Fall Temperature	+ 2.5°F	+2.3°F to +5.9°F	+4.2°F to +12.3°F
Annual Precipitation	**+ 1.8 in.**	**-17% to +103%**	**-1% to +239%**
Winter Precipitation	+0.8 in.	0% to +103%	-95% to 200%
Spring Precipitation	+0.6 in.	-26% to +69%	-1% to +129%
Summer Precipitation	-1.0 in.	-23% to +16%	-31% to +44%
Fall Precipitation	+1.5 in.	-19% to +22%	-1% to +50%

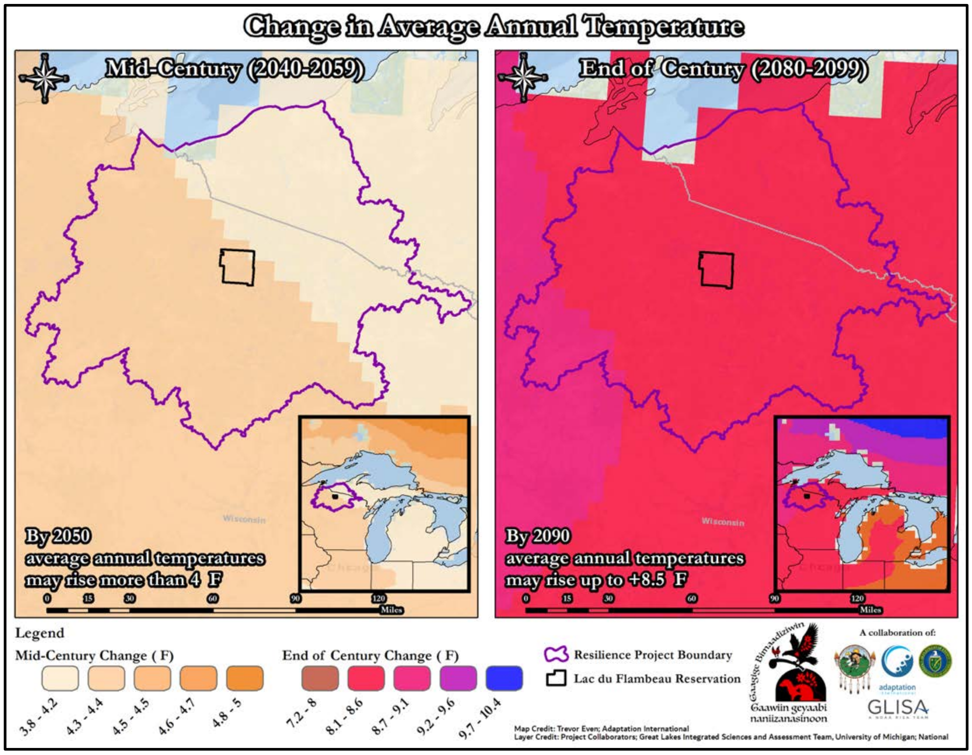

Figure 6: Projected changes in Average Annual Temperature for the region around the Lac du Flambeau Region based on the "business-as-usual" climate scenario (RCP 8.5) for the middle of the century (left panel) and end of the century (right panel).

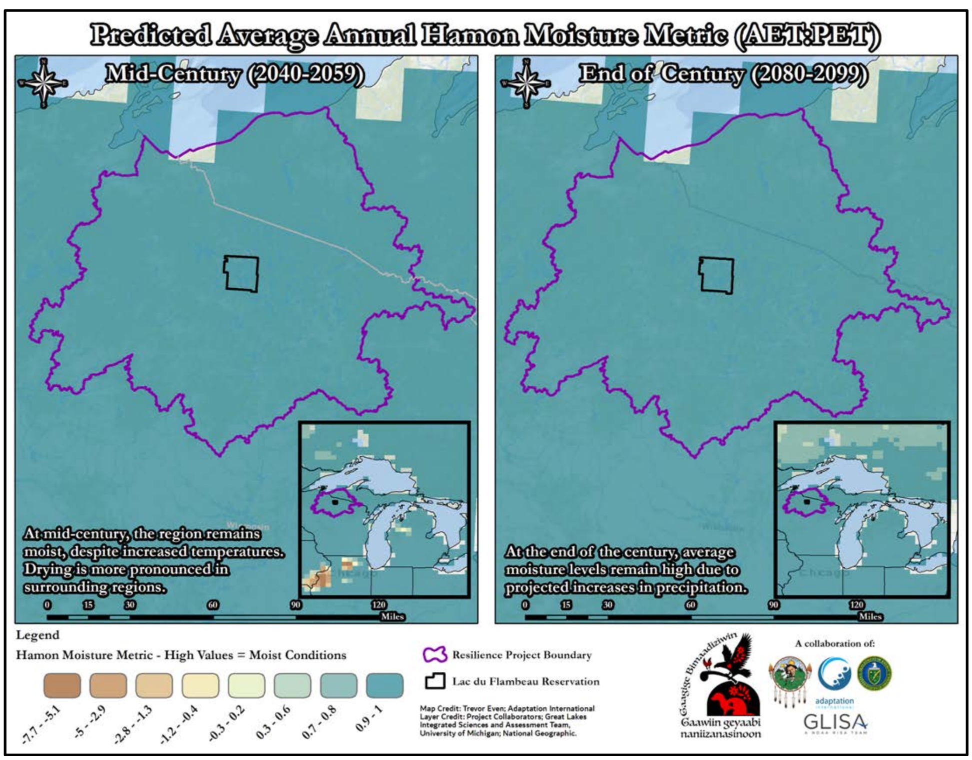

Figure 7: Projected changes in Average Annual Precipitation for the region around the Lac du Flambeau Region based on the "business-as-usual" climate scenario (RCP 8.5) for the middle of the century (left panel) and end of the century (right panel).

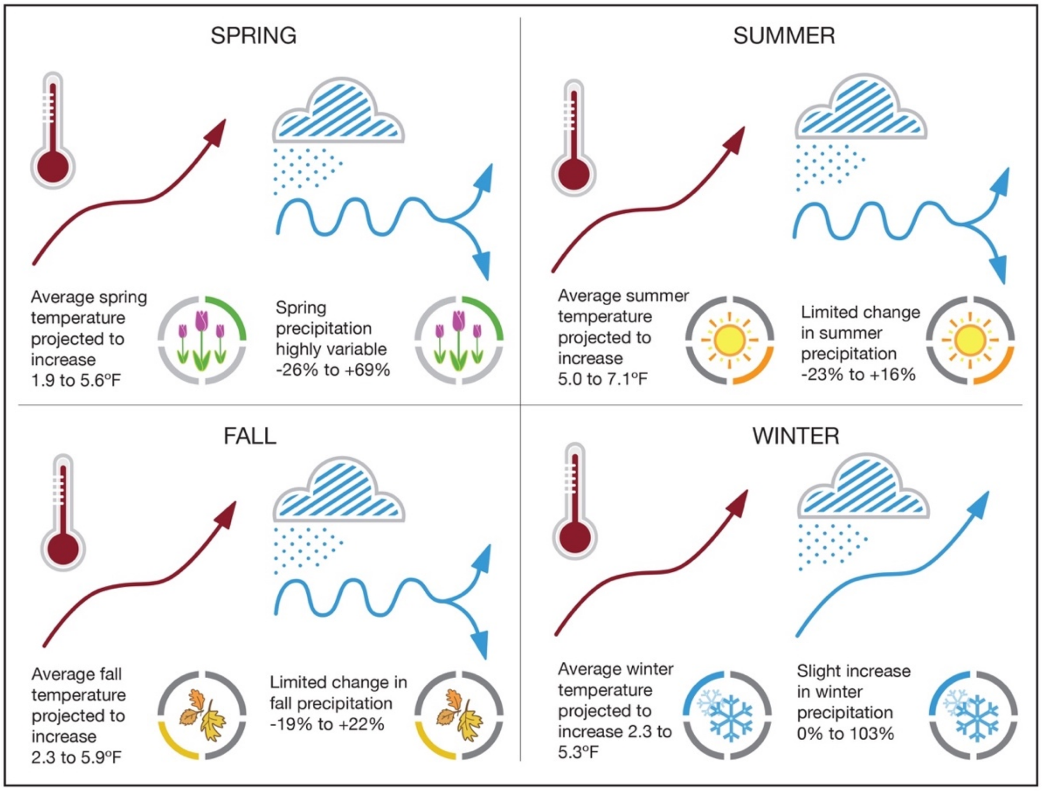

Figure 8: Summary of projected changes in temperature and precipitation by season by the 2050s (2040-2059) using the "business-as-usual" climate projections (RCP 8.5). Data is based on downscaled climate projections developed by the University of Wisconsin and analyzed by the Great Lakes Integrated Sciences and Assessment Center at the University of Michigan. The range of values represent the highest and lowest projections average change from the ensemble of climate models.

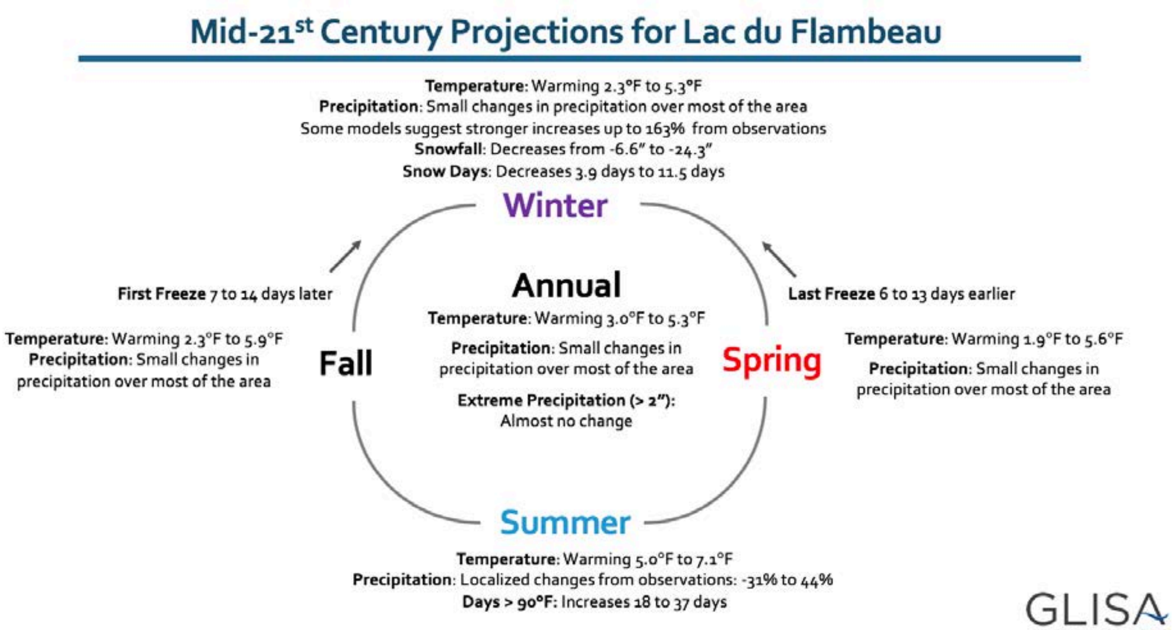

Figure 9: Summary of projected seasonal climate changes by 2050 including increases in temperatures, varying precipitation patterns, decreases in snowfall, a longer growing season, and more hot summer days. Calculations completed by the Great Lakes Integrated Sciences and Assessment Center at the University of Michigan for the Resilience Initiative Project Boundary.

Natural and Cultural Resources

The natural resources in and around the reservation play an important role in the community's physical, emotional, mental, and economic health and vitality. ***For the Lac du Flambeau Tribe, natural resources are cultural resources and an integral part of what supports the community and helps it thrive.*** Throughout the community engagement process, tribal members, staff, and leadership determined that the survival and continued existence of the habitats and key plant and animal species that have been part of the Lac du Flambeau culture for thousands of years are more than a critical resource, they are part of the identity and health of the community. Extreme weather events and changing climate conditions, in particular extended periods of drought and more extensive or intense wildfires, have the potential to create plant and animal epidemics that may increase in the prevalence of invasive species on the landscape and lead directly to the loss of these species.

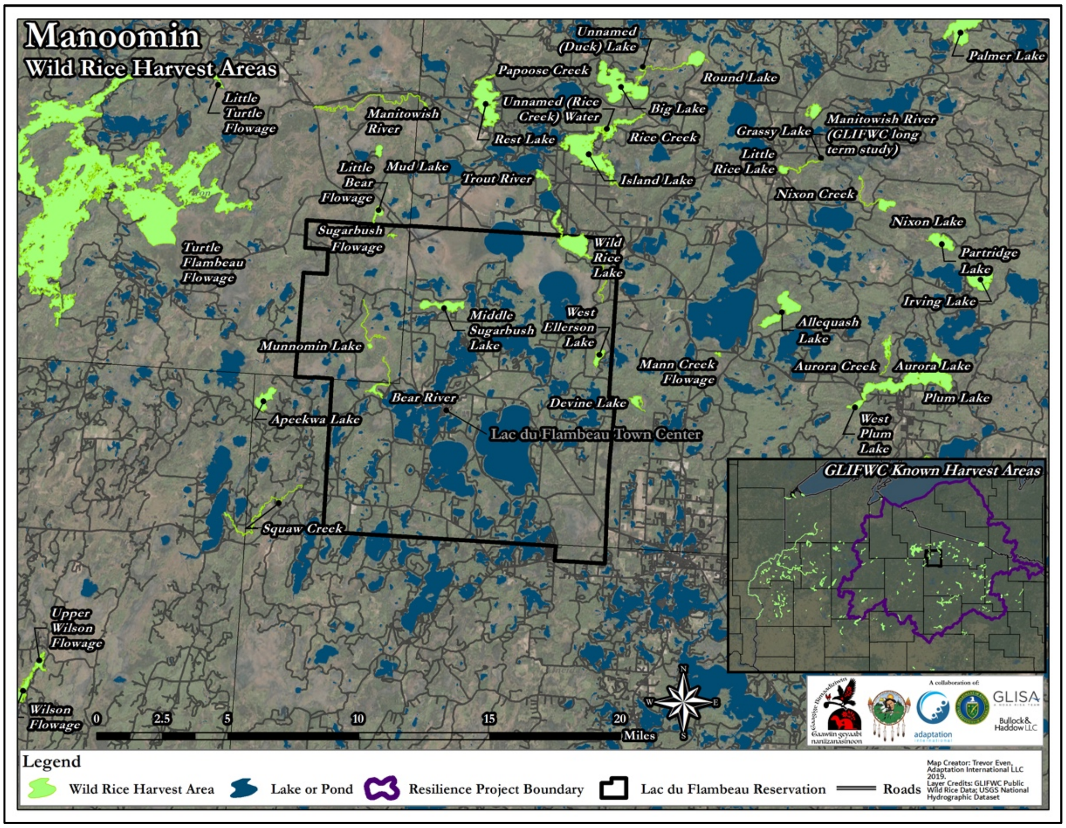

Figure 10: Manoomin (Wild Rice) harvest areas in and around the reservation. Extreme weather events, changing climate conditions, and human development have affected the location and abundance of wild rice crops in recent years (data from the Great Lakes Inter-Tribal Fisheries Council (GLIFWC).

The potential reduction and loss of key natural resources, such as *Manoomin* (Wild Rice- Figure 10) is a key hazard facing the Lac du Flambeau Tribe.

Critical Facilities

Critical community facilities include both emergency response facilities such as the Fire Station, police headquarters and health clinic, but also significant buildings such as the Casino and Tribal Center that provide a variety of services to the community including acting as shelter hubs and warming and/or cooling centers during extreme weather events. Facilities also include the Headstart building, dental clinic, school, and nursing home that provide critical services to the community.

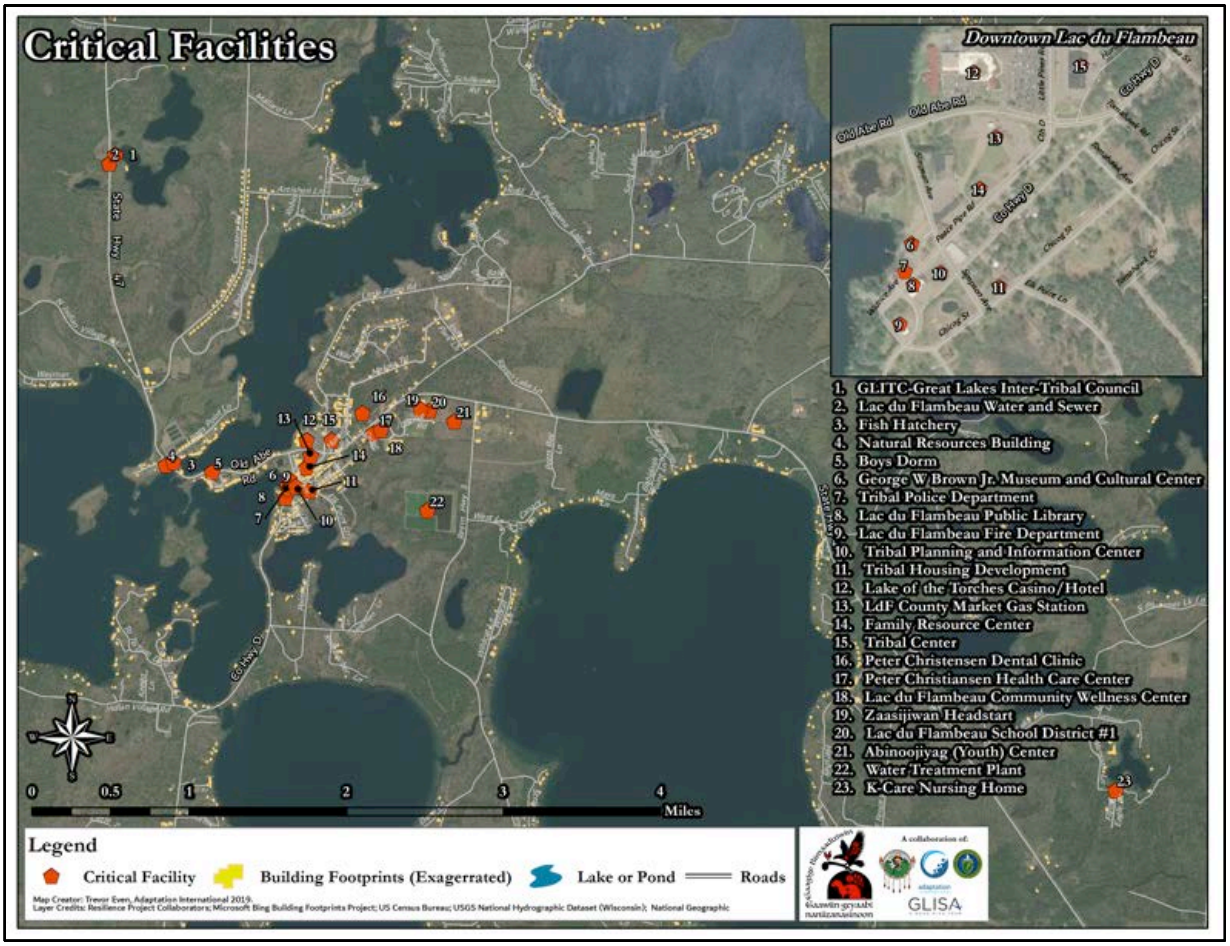

Figure 11: Critical facilities within the Lac du Flambeau Reservation.

Table 5: Critical facilities within the Lac du Flambeau Reservation.

Name	Address	Estimated Value
Abinoojiyag (Youth) Center	13708 Youth Center Lane	$375,000
Boys Dorm	873 Old Abe Road	
Family Resource Center	533 Peace Pipe Road	$280,000
Fish Hatchery	2500 Old Abe Road	
George W Brown Jr. Museum and Cultural Center-	603 Peace Pipe Road	$3,000,000
GLITC-Great Lakes Inter-Tribal Council	2952 Wisconsin State Highway 47	$500,000
K-Care Nursing Home	12399 Warpath Lane	
Lac du Flambeau Community Wellness Center-	125 Old Abe Road	$6,000,000
Lac du Flambeau Fire Department	614 Wild Rice	
Lac du Flambeau Public Library	622 Peace Pipe Road	
Lac du Flambeau School District #1	2899 HWY 47S	
Lac du Flambeau Water and Sewer	2650 Cemetery Rd.	
Lake of the Torches Casino/Hotel	510 Old Abe Rd	$100,000,000
LdF Country Market Gas Station	509 Old Abe Road	
Natural Resources Building	1101 Old Abe Rd	
Peter Christensen Dental Clinic	128 Old Abe Rd	
Peter Christiansen Health Care Center	125 Old Abe Road	$1,300,000
Tribal Center	418 Little Pines	$4,000,000
Tribal Housing Development	554 Chicog St	
Tribal Planning and Information Center	602 Peace Pipe Road	$500,000
Tribal Police Department	623 Peace Pipe Road	$500,000
Water Treatment Plant	2450 Thorofare Road	
Zaasijiwan Headstart	2899 Wisconsin State Highway 47	$280,000

Part 3: Hazard Identification and Risk Assessment (Element B)

Hazard Identification Overview

The hazard identification process began with the extensive community engagement process (described in Section X.X). It started with consideration of the continued relevance of the hazards identified in the 2006 Vilas County All Hazards Mitigation Plan that included the Tribe. Those hazards, along with a number of new and emerging threats such as loss of natural resources, school and workplace violence, and the illegal drug crisis were evaluated based on their current relevance to the Tribe.

For each hazard, the descriptions below include discussion of the background on the hazard, an analysis of historic conditions, and a vulnerability and risk assessment.

Assessment Approach/Methodology

A multi-factor quantitative risk ranking system that incorporated local expert risk knowledge and experience was used to calculate the severity of identified hazard risk in the Lac du Flambeau planning area. Hazard risks selected for inclusion in this plan have been priority ordered in keeping with the results of this assessment system and process.

Assessment Factors

Assessment factors and the descriptions of relevant scoring for assessment and ranking of hazards.

Probability
Assesses the likelihood of future occurrence based on historical experience. Measures include:

- 0 = not possible
- 1= Rare (<1 event per 100 years)
- 2 = Low (1 event every 21 to 100 years)
- 3 = Moderate (1 event every 6 to 20 years)
- 4 = High (1 event every 1 to 5 years)
- 5 = Severe (1 or more events per year)

Trend
Assesses whether hazard likelihood is expected to change over time, and whether that change will be an increase or decrease in frequency. This factor is based on an analysis of increasing or decreasing probability trends, tribal staff experience and knowledge, changes in demographic and development patterns, climate change projections, and other information as available. Measures include:

- 1 = Frequency or Impacts will likely decrease
- 2 = Frequency or impacts will likely stay the same
- 3 = Frequency or impacts will likely increase

Health and Public Safety
Assesses the number of people who will likely be sickened, injured, or killed during an average occurrence of the hazard, or that will suffer some form of post-traumatic stress. Measures include:

- 0 = No health or safety impacts
- 1 = Low (<20 sick/injured/PTSD; <3 dead)
- 2 = Moderate (21-50 sick/injured/PTSD; 3-9 dead)
- 3 = High (>50 sick/injured/PTSD; >10 dead)

Home and Property Damage
Assesses the percentage of homes and private residences likely to be damaged or destroyed during an average occurrence of the hazard. Measures include:

- 0 = No homes impacted
- 1 = Low (1-10 homes impacted)
- 2 = Moderate (11-35 homes impacted)
- 3 = High (>35 homes impacted)

Livelihood Impacts
Assesses the number of people who will likely lose household income as a result of the event. Measures include:

- 0 = N/A
- 1 = Low (<10 people)
- 2 = Moderate (10-35 people)
- 3 = High (>35 people)

Cultural and Historical Impacts
Assesses the potential loss of culturally-important resources that contribute to individual and community culture, history, medicinal plants, and spirituality. Measures include:

- 0 = No impacts
- 1 = Low (limited losses, short-term losses)
- 2 = Moderate (moderate losses, long-term losses)
- 3 = High (broad-reaching losses, permanent losses)

Environmental Harm
Assesses the potential monetary and nonmonetary impacts on natural systems and habitats, including lakes, rivers, streams, flora, and fauna. Includes both short and long-term impacts. Measures include:

- 0 = No environmental impacts
- 1 = Low (<$50,000 remediation/recovery)
- 2 = Moderate ($50,000-$500,000 remediation/recovery costs)
- 3 = High (>$500,000 remediation/recovery costs; permanent environmental damage)

Damage to Infrastructure
Assesses the number of people likely to be impacted by critical infrastructure loss; and the number of days critical infrastructure outages are likely to persist. Measures include:

- 0 = N/A
- 1 = Low (<35 people affected; <1 day)
- 2 = Moderate (35-100 people affected; 1-3 days)
- 3 = High (>100 people affected; >3 days outage)

Recovery Costs
Assesses the uninsured public sector losses associated with recovery, reconstruction, and rehabilitation in an average occurrence of the hazard. Measures include:

- 0 = N/A
- 1 = Low (<$50,000)
- 2 = Moderate ($50,000-$500,000)
- 3 = High (>$500,000)

Government Services

Assesses the potential extent of impacts to government services and operations, including closure of the public school system. Measures include:

- 0 = No impacts
- 1 = Low (<1 day)
- 2 = Moderate (1-5 days)
- 3 = High (>5 days)

Damage to Facilities / Agriculture

Assesses the number of businesses likely to be closed for 1 or more days or receive physical damage during an average occurrence of the hazard and measures the cost of damage to livestock and crops. Measures include:

- 0 = None
- 1 = Low (<1-5 SMEs, no major employers; <$50,000 in agriculture loss)
- 2 = Moderate (6-10 SMEs; no major employers; $50,000 to $500,000 in agriculture loss)
- 3 = High (>10 SMEs, 1 or more major employers; >$500,000 in agriculture loss)

Risk Acceptability

Assesses of relative hazard importance assigned by Tribal members and leaders (at a May 2018 risk assessment workshop). Measures include:

- 1 = Low
- 2 = Moderate
- 3 = High

Mitigation Potential

Assesses the availability and cost-benefit potential of mitigation action for the particular hazard. A higher number represents a greater ability to control risk through investment of funds or effort. Measures include:

- 0 = Little or no expected return on investments
- 1 = Standard return on investments
- 2 = High expected return on investments

Assessment Formula

The assessment formula allows for the weighting of different factors in a manner that recognizes the vision, goal, and objectives of Tribal mitigation planning efforts. The formula is as follows:

RISK = ((1+0.2*(RELEVANCE-1))*((PROBABILITY+(TREND-2))/3)*(((HEALTH&PUBLICSAFETY^2)+(HOME&PROP+LIVELIHOOD)+(CULTURE&HISTORY+ENVIRONMENT)+((INFRASTRUCTURE+RECOVERYCOSTS)/2)+((GOVT+BUSINESS)/2))/40))*((2*MITIGATION)/(MITIGATION+1))

The following explains how this formula calculates risk in the Lac du Flambeau Planning Area:

- There are 9 factors that together assess hazard consequences. They are each weighted and added together to give a factor that ranges from 0 to .675. All other factors act to increase or decrease this number within a range from 0 to 1 to achieve the relative risk rating. These consequence factors and their weighting are as follows:
    - Health & Public Safety: This is the most heavily-weighted consequence factor, representing up to 33% of the consequence factor.
    - Home & Property and Livelihoods fields together contribute up to 22% of the consequence factor.
    - Environment and Culture & Historical Impacts fields contribute up to 22% of the consequence factor.
    - Infrastructure Loss and Recovery Expenses together contribute up to 11% of the consequence factor.
    - Government Services and Business Impacts fields contribute up to 11% of the total consequence factor.
- All other factors increase or decrease this measure as follows:
    - Probability has the greatest influence. It is increased or decreased according to Trend, which indicates whether the hazard likelihood is expected to increase or decrease over time. The greatest combination of these two factors (5+3) would result in a doubling of the risk factor, while the lowest combination would negate the risk by zeroing it out entirely.
- Local Relevance, which is a measure of how community members have characterized the importance of managing the hazards, has the potential to increase the total risk calculation by up to 40%.
- Mitigation Potential boosts the ranking of those hazards for which expected return on investment is high by up to 33%, while zeroing out those hazards for which there are few to no effective mitigation options.

Hazard Profiles and Assessment

The hazard identification process identified many hazards that exist in the Lac du Flambeau planning area. The risk assessment process enabled ranking of these hazards according to mitigation priority. The fifteen highest-ranking hazards are included in this plan and are profiled below. They include (in order of relative risk):

LDF Hazard Risk Assessment Tool	PROBABILITY	TREND	Health and Public Safety	Home and Property Damage	Livelihood Impacts	Cultural Wellbeing	Environmental Harm	Damage to Infrastructure	Recovery Costs	Government Services	Damage to Facilities / Agriculture	Risk Acceptability	Mitigation Potential	Relative Risk Ranking
All Hazards														
Plant and Animal Epidemic / Invasive Species / Species Loss	5	3	1	2	2	3	3	0	3	0	3	3	1	0.98
Illegal Drug Crisis	5	2	2	1	2	3	0	0	2	1	0	3	2	0.89
Severe Thunderstorms / Lightning / Hail	5	3	1	3	0	2	2	3	3	1	2	3	1	0.88
Epidemic / Pandemic / Vector-Borne Disease	2	3	3	0	3	3	0	0	2	2	2	3	2	0.84
Flood (flash flood, lake, river, stormwater)	4	3	0	2	1	3	3	1	3	1	2	2	2	0.83
Severe Winter Storms / Ice Storms	5	3	1	1	0	1	1	3	3	2	3	2	2	0.76
Forest / Wildland Fire	5	2	1	3	2	2	1	2	3	1	2	1	2	0.72
Hazardous Materials Release / Contamination / Run-off	4	3	1	0	0	3	3	0	3	0	0	3	2	0.66
Tornado / High Wind	2	2	2	2	2	2	2	2	3	1	3	2	2	0.44
Extreme Heat	5	3	1	0	0	1	2	1	0	2	0	2	2	0.44
Extreme Cold	4	1	2	2	1	0	0	3	1	2	1	1	2	0.35
School Violence / Armed Attack / Workplace Violence	2	2	3	0	0	1	0	0	1	2	0	2	2	0.31
Dam Failure	1	2	2	3	0	3	3	3	3	1	3	1	1	0.15

Figure 12: Ranking of the top 13 key hazards and their overall hazard ranking as determined by the Tribal Emergency Preparedness Committee, historic risk data, and future climate projections.

1. Plant and Animal Epidemic / Invasive Species / Species Loss

Background: Plant and animal epidemics threaten to inflict environmental, cultural, and economic damage. Plant epidemics can be caused by a number of factors, many of which are not dependent on an external biotic organism like pathogens, insects, or animals. For instance, climate change (including changes in rainfall, temperature, sunlight, relative humidity, and wind) will likely lead to or accelerate the loss of certain plant species.

Drought: As temperatures increase and precipitation patterns change, there is the potential for more drought, which could affect the survival of local plant and animal species. While average annual precipitation is projected to increase in the region (See Figure 7) this does not preclude the possibility of droughts. Drought is the result of a natural decline in expected precipitation over an extended period of time and occurs in virtually every climate on the planet, including areas of both high and low precipitation. The severity of drought can be aggravated by other climatic factors such as prolonged high winds, low relative humidity, and extreme heat. The following four definitions are commonly used to describe different types of drought and demonstrate the complexity of the hazard:

1. Meteorological drought: Degree of dryness, expressed as a departure of the actual precipitation from the expected average or normal precipitation amount, based on monthly, seasonal, or annual time scales.
2. Hydrological drought: Effects of precipitation shortfalls on streamflows, and reservoir, lake, and groundwater levels.
3. Agricultural drought: Soil moisture deficiencies relative to water demands of crops.

4. Socioeconomic drought (or water management drought): Shortage of water due to the demand for water exceeding the supply. The severity of a drought depends on several factors: duration, intensity, geographic extent, water supply demands for both human use and vegetation.

Drought is difficult to define in exact terms, due in part to the ways it differs from other hazards:

- The onset and end of a drought are difficult to determine because of the slow buildup of effects and the lingering impacts after its apparent end;
- There is no exact and universally-accepted definition, adding to the confusion of existence and severity; and
- The impact of drought is less obvious and may be spread over a larger geographic area.

These characteristics have hindered the preparation of drought contingency or mitigation plans and can make it difficult to perform an accurate risk analysis. The magnitude of a drought is measured using the Palmer Drought Severity Index. Factors like temperature, soil moisture, and precipitation are entered into an algorithm that returns results between -4 (extreme drought) and 4 (extremely moist) with zero being normal conditions. The index is effective at determining drought over a period of months, but less effective over shorter time frames. Droughts are rated by the U.S. Drought Monitor into the following categories based on five indicators including the Palmer Index and streamflow data:

- D0: Abnormally Dry
    - Going into drought: Short-term dryness slowing planting and growth of crops or pastures
    - Coming out of drought: Some lingering water deficits; Pastures or crops not fully recovered
- D1: Moderate Drought
    - Some damage to crops and pastures
    - Streams, reservoirs, or wells low, some water shortages developing or imminent
    - Voluntary water-use restrictions requested
- D2: Severe Drought
    - Crop or pasture losses likely
    - Water shortages common
    - Water restrictions imposed
- D3: Extreme Drought
    - Major crop and pasture losses
    - Widespread water shortages or restrictions
- D4: Exceptional Drought
    - Exceptional and widespread crop and pasture losses
    - Shortages of water in reservoirs, streams, and wells creating water emergencies

The Crop Moisture Index was developed to measure soil moisture over shorter periods, up to four weeks, and has values between -3 (severely dry) and 3 (excessively wet), again with zero as normal conditions.

Periods of drought have been common in Wisconsin, occurring about once every ten years. As such, drought has been a common and often extended occurrence in Vilas County, and likewise the Lac du Flambeau Reservation. Since the turn of the 21st century, drought conditions have existed in almost one of every two years, including 2005, 2006, 2007, 2008, 2009, 2010, 2012, and 2013. An almost continuous period of drought persisted from 2005 until the end of 2010. Lake levels throughout the county were affected by these prolonged conditions, and both recreation and agriculture were affected.

Other years of notable drought in Vilas county include 1929-1934, 1948-1950, 1955-1959, 1976/77, 1987-1989. The 1976/77 event resulted in $624 million in agricultural losses across Wisconsin, including in Vilas County.

Diseases: Another way that plant and animal species may be affected is through diseases. There are five basic categories of plant diseases:

1. New diseases: diseases introduced on a new host within the past five years in a new geographic area
2. Emerging diseases: diseases whose incidence has increased within the past 10 to 15 years
3. Reemerging diseases: diseases previously known in the area but that are gaining importance
4. Threatening diseases: diseases not reported or with limited distribution in a new geographic area
5. Chronic/spreading diseases: diseases whose presence has been known for a long period and that are still causing outbreaks

Plant and agricultural outbreaks can be spread by a number of means, including (but not limited to) the following:

- Vectors (insects, such as aphids, are common vectors);
- Propagation of diseased plants;
- Planting of infected seeds;
- Use of contaminated cattle manure;
- Movement of crops in contaminated equipment;
- Wind, including hurricanes and tornadoes; and
- Human transportation of infected plants and fruits (intentional and unintentional).

The Bureau of Plant Industry, DATCP, monitors for plant pests and diseases in the state. The Bureau uses scientific surveys and routine inspections of licensed businesses to monitor for pests and diseases. It also enforces regulations to control and prevent introduction and spread of pests and diseases. Growers in Wisconsin can subscribe to the weekly Pest Bulletin to stay informed.

Livestock and animal epidemics are those that affect the life of any animal other than humans. Animal epidemics often strike livestock on a large scale given the dense living environments, and control may require culling of all animals in the affected area. Epidemics can cause a loss of confidence in food supplies, and even non-contaminated products can be rendered valueless.

Veterinarians are legally required to report suspected cases of certain diseases to the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) or the U.S. Department of Agriculture. When veterinarians report these diseases, a state or federal veterinarian will investigate and, if necessary, submit samples to either the U.S. Veterinary Laboratory in Ames, Iowa, or to Plum Island Research Center in New York (for suspected foreign animal diseases). Until test results are available, the premises are likely to be quarantined.

Invasive species are species that are: 1) non-native (or alien) to the ecosystem where they are found, and; 2) likely to cause economic or environmental harm or harm to human health as a result of their introduction. Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions.

In 2001 the Wisconsin Legislature directed the Department of Natural Resources (DNR) to establish a statewide program to control invasive species. The program and regulations are aimed at preventing new invasive species from getting to Wisconsin and enabling quick action to control or eradicate those here but not yet established. The Lac du Flambeau Tribe has its own monitoring programs for both aquatic and terrestrial species.

The Wisconsin Department of Natural Resources lists hundreds of regulated and non-regulated aquatic, terrestrial, and wetland invasive plants and animals that are impacting the state. Animal and plant epidemics are less common, yet have the potential to cause grave economic and environmental damages in a relatively short time span.

Vulnerability and Risk Assessment: Outbreaks of foreign animal diseases not previously occurring in the United States, such as avian influenza H5N1; or that have been previously eradicated, such as FMD; or that the United States is attempting to eradicate, such as pseudorabies and bovine tuberculosis, are very rare in Wisconsin. The state is, however, currently engaged in efforts to address a number of other well-known threats such as avian influenza (poultry), chronic wasting disease (deer and elk), and the destructive invasive species emerald ash borer, gypsy moth, and zebra mussel. The on-going local, state, and federal management efforts seek to control and minimize these and other threats.

Table 6: Vulnerability and risk assessment for Plant and Animal Epidemic summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Based on the historical prevalence of invasive species and plant and animal epidemics, the Lac du Flambeau tribe should anticipate the presence of invasive species at all times, and the introduction of new and emerging epidemics and/or invasive plant or animal species on a regular basis averaging approximately 1 or more instances per year. This equates to a 100% probability in any given year.	5
Trend	Increased temperature variability and increased precipitation result in shifting plant and animal ranges, and result in expansion of areas impacted by plant and animal diseases. Species loss occurs as a result of disease, habitat loss, contamination, habitat or climate incompatibility (as a result of climate change), development pressures, and other factors.	3

Health / Public Safety	The loss of key plant and animal species has the potential affect both the physical health of tribal members as they shift away from traditional diets to more processed foods and the mental health of community members.	1
Home and Property Damage	Invasive species can cause significant damage to homes and property because mechanisms for protection are often weak or nonexistent (due to a lack of experience managing the invasive species).	2
Livelihoods	Invasive species can cause widespread and even total loss of certain crops, livestock, and trees, impacting those whose livelihoods depend on these resources.	2
Infrastructure	No likely impact.	0
Recovery Costs	Public expenditures related to the control of invasive species and/or plant or animal epidemics can extend into the millions of dollars even for small communities.	3
Environment	Forests and endemic plant and animal species are at significant and constant risk from invasive species and plant and animal epidemics.	3
Cultural / Historic	The Lac du Flambeau way of life is closely interlinked with the plants and animals native to the planning area. Damage to or loss of any natural resources will have profound impacts on Tribal culture. Assigned by workshop participants.	3
Government Services	No likely impact.	0
Business / Agriculture	The economic cost of invasive species and/or plant and animal epidemics on agriculture and business reaches into the billions of dollars nationwide. Crop loss, culling of animals, and costs associated with vaccination, testing, public relations, and other actions can and have been very high in past events in the United States including in Wisconsin.	3
Risk Acceptability	Assigned by workshop participants.	3
Mitigation Potential	Standard expected return on investment	1

2. Illegal Drug Crisis

Background: Illegal drugs are a perennial public health issue and a constant strain on public resources. Opioids, which are a class of drugs that interact with receptors on nerve cells in the body and brain, producing euphoria and pain relief (NIH, 2017), are notable in terms of their severe social and medical impacts on society and represent the most pressing drug-related concern in Lac du Flambeau at the present time. Methamphetamine use and distribution also threatens the public health and life safety of tribal members.

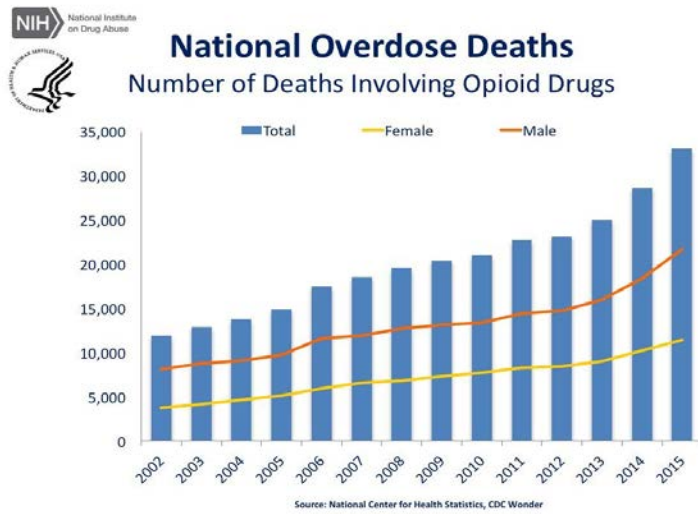

Figure 13: National Overdose Deaths from Opioid Drugs in the United States by Year. (Source: National Center for Health Statistics.

Examples of opioids frequently abused include heroin, oxycodone, hydrocodone, morphine, codeine, fentanyl, and carfentanyl. While several of these are commonly prescribed for patient pain relief, all may lead to severe addiction in a short timeframe and are thus abused for recreational uses. Opioids become deadly when taken in high doses, used in combination with other drugs, or given to people with certain pre-existing medical conditions. The misuse and abuse of opioids is presently declared a public health crisis in Wisconsin (http://bit.ly/2FoarGl). Mirroring nationwide trends, the Lac du Flambeau Tribe and Vilas County at large continue to face an epidemic of opioid addiction and abuse. This has resulted in an increasing number of emergency calls related to overdose, often time accompanied or followed by death of the affected individual(s) (see Figure X - US Opioid Deaths 2002-2015 ([NIH, 2017])).

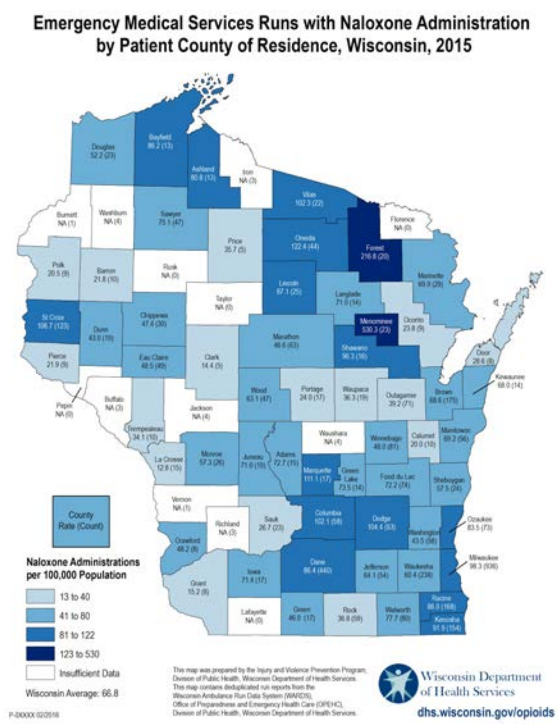

Figure 14: Emergency Medical Services Runs with Naloxone Administration by Patient County of Residence, Wisconsin 2015.

Opioid overdose results in death when an excessive dose slows breathing. This risk is exacerbated when opioids are combined with alcohol or antianxiety drugs. While generally prescribed with good intentions, opioids are often over-prescribed in a manner that results in addiction.

There opioid crisis influences community vulnerability in a number of ways as a result of the following common response and recovery requirements. Examples include:

- Increased calls to emergency medical services related to overdose;
- Requirement for law enforcement officers to carry drugs that help reverse the effects of opioid overdose (Naloxone) both for victims and to address their own job-related exposure risks;
- Unemployment and job loss related to addiction;
- Higher burden on foster care and other related services for children of addicted individuals (including children born with opioid addiction); and
- Increase in violent crime, robberies, and burglaries.

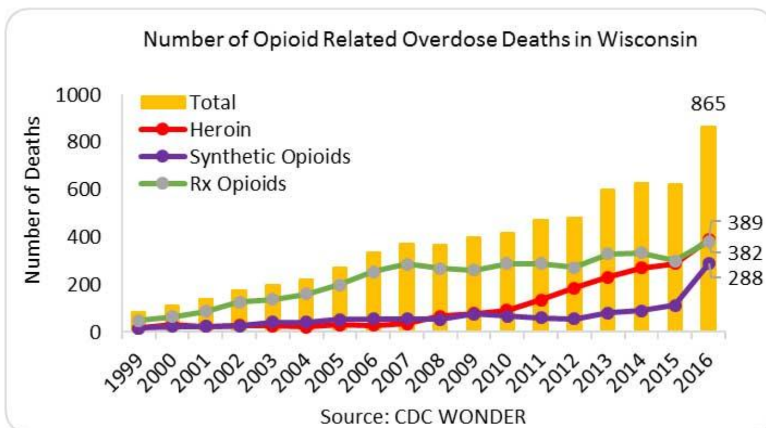

Figure 15: Number of Opioid related overdose by type in Wisconsin.

The U.S. Centers for Disease Control and Prevention (CDC) reports that more than 115 people die every day in the United States from an opioid overdose (CDC, 2018). Between 2015 and 2016, the death rate associated with opioid abuse in Wisconsin rose 41%, to 15.8 per 100,000 people or 827 total deaths (Wisconsin DHS, 2018; see Figure 15). Measured as a factor of Naloxone administration by patient county of residence, Vilas County experienced a rate of 102.3 per 100,000 calls requiring Naloxone, placing it just under the most severe ranking (see Figure 14).

Methamphetamine, also known as “speed," "crank," "ice," and "meth", is a powerful, illegally-produced stimulant that attacks the central nervous system. Use of methamphetamine can quickly result in nervousness, compulsive behavior, irritability, anger, aggressiveness, hallucinations, paranoia, depression with suicidal tendencies, heart attacks and strokes.

Methamphetamine has spread throughout the United States, particularly in the West, Midwest, and Southeast. Although most of the methamphetamine in Wisconsin is manufactured outside of the state, clandestine methamphetamine labs have also been set up on kitchen tables or workbenches in sheds, garages, barns, homes, apartments and motel rooms. Manufacturing methamphetamine under these conditions poses dangerous risks for public health and the environment.

Methamphetamine production, distribution, and use endangers the community on multiple levels including the tearing apart of families, incarceration and job loss for users, pollution of the natural environment, and strain on local governments burdened by the requirements of fighting the meth problem.

The impact of methamphetamine use and distribution is also increasing across Vilas County, including in Lac du Flambeau. A recent (February 2018) murder of a 22-year old Lac du Flambeau resident that has been linked to distribution of methamphetamines highlights the public safety threat associated with this drug. While much of the methamphetamine found in Vilas County is trafficked from Mexico, the discovery of local production labs indicates a growing complexity of this problem. Fatalities associated with methamphetamine overdose are less common than with opioids, however the impact on the lives and livelihoods of those addicted to methamphetamines and their immediate family members is nonetheless significant.

Future Occurrence: Rates of opioid prescriptions fell in 2017 by 12 percent, representing the largest drop in a quarter century (CNBC, 2018). While this represents progress towards controlling the crisis, opioid overdoses still take more lives than automobile accidents.

Risk factors for opioid overdose include:

- Tolerance: Tolerance can decrease rapidly when someone takes a break from using an opioid. Restarting at the same dose puts individuals at risk for an overdose.
- Physical Health: Opioids can impair breathing. Individuals with asthma or other breathing problems are at a high risk for overdose. Individuals with liver and/or kidney problems or those who are HIV positive also are at increased risk.
- Previous Overdose: An individual who has had a nonfatal overdose in the past has an increased risk of fatal overdose in the future.
- Mixing Drugs: Many overdoses occur when opioids are mixed with alcohol, sedatives/anti-anxiety medicines, or other substances.

In the event of an opioid overdose, death can sometimes be prevented with the use of Naloxone. Emergency medical responders have access to the treatment, and by standing order Naloxone is available without a prescription in Wisconsin. Methamphetamine use continues to rise throughout Wisconsin, especially in rural areas.[7] Police surveys indicate that law enforcement officials consider its use and distribution their primary drug problem.

Vulnerability Assessment: Deaths from prescription opioid drugs like oxycodone, hydrocodone, and methadone, as well as those from synthetic opioids like heroin, have increased by a factor of more than four since 2010 (NIH, 2018). In Wisconsin, emergency room visits for suspected opioid overdoses more than doubled just between July of 2016 and September of 2017 (Wisconsin State Journal, 2018). Vilas County is particularly hard-hit by the crisis, with Lac du Flambeau most significantly affected (Vilas County News

[7] Gibson, Gary. 2018. Meth Rates Still on Rise, Despite Efforts Combating Usage. The Badger Herald. March 13. http://bit.ly/2miXLcx.

Review, 2018). While opioid addiction is often viewed as a criminal or social problem, it must also be addressed in light of its community vulnerability implications.

Table 7: Vulnerability and risk assessment for the Illegal Drug Crisis summarizing assessment and scores for each measure.

Measure	**Assessment**	**Value**
Probability	The illegal drug crisis is an ongoing problem in Vilas County, including in Lac du Flambeau. Vilas county ranked among the counties most severely affected by the opioid crisis in the state. There is currently a 100 % probability of occurrence in any year.	5
Trend	Public health statistics indicate that while the rate of opioid prescription peaked in 2017, the number of overdoses and associated fatalities remains high. Risk remains high and is unlikely to wane in the near future without intense intervention.	2
Health / Public Safety	The illegal drug crisis threatens the public health and life safety of residents as a result of overdose risk, risk from accidental contact or ingestion, and safety risk from violence associated with the illegal drug trade.	2
Home Damage	Contamination and damage can occur in homes used for the creation, processing, and consumption of illegal drugs such as methamphetamines.	1
Livelihood	The ability to maintain employment among Individuals impacted by the illegal drug crisis, whether users, caregivers of users, or dependents of users, is significantly impacted.	2
Infrastructure	n/a	2
Recovery Costs	The costs of managing the public health and safety response and recovery requirements, including treatment of overdose victims, care for dependents, increase demands on law enforcement, and other costs, are moderate.	2
Environment	Environmental harm associated with methamphetamine production is typically limited to private property where production labs operate. While broader contamination is possible (syringes/needles being left on the landscape or washed into water bodies) there is limited likely impact.	0
Cultural / Historic	The illegal drug crisis continues to have profound impacts on tribal life and tradition.	3
Government Services	Some additional strain on law enforcement agencies as well as community health and medical programs.	1
Business / Agriculture	No likely impact.	0
Risk Acceptability	Assigned by workshop participants.	3

Mitigation Potential	High expected return on investments.	2

3. Severe Thunderstorms / Lightning / Hail

Background: Thunderstorms are local storms accompanied by lightning and thunder. They are produced by cumulonimbus clouds and are usually accompanied by gusty winds, heavy rain, and occasionally hail. They require moisture in the form of water vapor that lies in the lowest atmospheric levels; a rapid cooling of air above these low, wet levels, decreases in temperature with altitude; and a force strong enough to lift the low moist air to the higher, colder atmospheric layers (e.g., a cold front).

Thunderstorms are classified as non-severe and severe. Non-severe thunderstorms rarely last longer than two hours. A typical non-severe thunderstorm life cycle has three stages:[8]

7. Cumulus stage. Warm, moist air rises (updrafts) and condenses into tiny water droplets that make up the visible cloud. Outside air is pulled into the cloud. Supercooled droplets of water are carried far above the freezing level.
8. Mature stage. The cloud grows above the freezing level; precipitation forms and becomes heavy enough to fall back to the earth. Friction caused by the falling precipitation generates downdrafts of cool air that reach the earth's surface. Very heavy rains are associated with this stage. The cloud extends upward to the tropopause, causing a characteristic flat (anvil) top to form. Periods of strong lightning are likely during this stage, which typically lasts from 10 to 20 minutes.
9. Dissipation stage. The downward motion of air overcomes the storm, depriving it of moist air. Precipitation begins to subside, and the cloud evaporates.

Thunderstorms become severe when their wind speeds exceed 58 miles per hour and hail forms in balls greater than three-quarters of an inch in diameter. Several different kinds of thunderstorms can form:

- Single cell. These uncommon short-lived storms, lasting only 20 to 30 minutes from formation to dissipation and generally covering only a limited area of a few square miles.
- Multi-cell. The most common type of thunderstorms consist of an organized cluster of two or more single cells. The storm cells fuel each other with the air that flows between them and cause new cells to form in succession on the flank or rear sides every five to 15 minutes.
- Supercell. These storms are always severe. Supercells cause significant damage, last for a long time (typically one to six hours) and travel great distances (200 miles or more). These storms can cause hurricane-force winds, giant hail (two inches in diameter or more), and significant tornado activity. A supercell produces updrafts of 56 to 112 mph that combine with sustained downdrafts to extend the storm's duration.
- Squall lines. These are lines or bands of active thunderstorms that can extend more than 500 miles, can be 20 miles wide, and consist of many laterally aligned cells that do not interact or interfere with one another. The cells involved in the squall line may be a combination of types. These phenomena often form along cold fronts, but they also can form

[8] Coppola, Damon P. 2015. Introduction to International Disaster Management. Elsevier. Burlington. https://amzn.to/2w3haWF.

as far as 100 miles ahead of an advancing cold front, in the warm sector of an extratropical storm. They often trail a large, flat cloud layer that brings significant rain after the storms pass.

Thunderstorms cause most of their damage through the rain and wind they generate. Flash floods are common because of the rapid precipitation, which cannot be absorbed by the ground and quickly accumulates as runoff. Hail can cause damage to buildings and crops. Lighting can cause fatalities and generate fires. Less common but very damaging are tornadoes that can form as a result of these storms.

Historical Analysis: There have been 32 recorded severe and potentially-damaging thunderstorm, lightning, and/or hail events in Lac du Flambeau since 1993. This equates to an average frequency of 1.28 events per year. In 1993, a particularly severe storm resulted in the downing of over 100,000 trees and the death of two people. Over 50,000 people were left without power, approximately 150 to 200 homes were damaged, and many major highways and secondary roads were blocked.

Vulnerability and Risk Assessment: Geographic exposure is relatively uniform across the Lac du Flambeau Reservation. Those living or working in structures that are not resistant to high winds are more vulnerable, including prefabricated classrooms and mobile homes. Those in living or working in structures with large overhanging trees are also at risk. Personal, business, and government property risk is extreme in the event of large hail, especially automobiles that are not garaged. Livestock and crops are at risk from hail and lightning. The risk to residents from lightning is severe, as lightning strikes are often fatal and are second only to flooding in terms of disaster-related fatalities in the United States.

Table 8: Vulnerability and risk assessment for the Severe Thunderstorms / Lightning / Hail summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Based on historical frequency, the Lac du Flambeau tribe should anticipate an average of 1-2 severe thunderstorm events per year. This equates to a 100% probability in any given year.	5
Trend	Climate change is increasing both the frequency and the strengths of severe storms.	3
Health / Public Safety	Public safety is threatened by structural failure, falling trees and limbs, lightning strikes, and hail. In past events, injuries and fatalities have occurred but have been limited to 2 or fewer fatalities and less than 20 injuries.	1
Home Damage	Home and property damage from downed trees, lightning, and hail is significant in strong and widespread thunderstorms, especially those that include large hailstones.	3

Livelihood	No likely impact.	0
Infrastructure	Heavy winds can severely impact power and communications transmission lines, and block major and secondary roads.	3
Recovery Costs	Past events have resulted in damage to schools, street signs, emergency services, government buildings, utilities, public sector equipment and vehicles, and more. Costs associated with debris clearance and cleanup may be excessive. Costs associated with thunderstorm recovery can easily exceed $500,000 per event.	3
Environment	Past storms have felled hundreds of thousands of trees. Stormwater runoff has the potential to pollute water resources including drinking water.	2
Cultural / Historic	Assigned by workshop participants.	2
Government Services	More than 1 day of disruption is unlikely.	1
Business /Agriculture Impacts	Agricultural losses from wind, hail, and lightning can be severe.	2
Risk Acceptability	Assigned by workshop participants.	3
Mitigation Potential	Standard expected return on investment.	1

4. Epidemic / Pandemic / Vector-Borne Disease

Background: Communicable diseases (also called "infectious" diseases) are illnesses caused by bacteria, viruses, fungi, and prions. The illness may be the result of the infecting organism or a toxin the organism produces. Communicable diseases may be transmitted in several ways, including:

- From an infected person to another non-infected person;
- From an animal to a human; and
- From an inanimate object (doorknobs, table tops, etc.) to a human.

Some communicable diseases can be spread in more than one of these ways. The routes of transmission may include airborne particulates, food, liquids, bodily fluids, contaminated objects, ingestion, or vector-borne spread. Some infectious diseases, such as flu, present seasonal threats to the public and require continual monitoring. A pandemic flu is an epidemic of an influenza virus that spreads on a worldwide scale and infects a large proportion of the world population. Regular seasonal epidemics of flu are more geographically constrained.

A flu pandemic can occur when a new strain of the influenza virus is transmitted to humans from another animal species. Historically, these new human-susceptible strains have arisen most commonly in pigs, chickens, and ducks. The most current and active threat comes from influenza type A strains that originate in birds and become readily transferable into other organisms. These viruses can be transmitted from wild birds to other bird species, causing outbreaks in domestic poultry. These viruses can also mutate into highly virulent strains that can infect humans, with the potential to cause human influenza pandemics. This should especially concern people who live in close proximity to livestock.

Viruses designated as highly pathogenic result in high mortality (up to 100 percent) within 48 hours. Control of outbreaks may require the culling of livestock. Several influenza outbreaks in the past 15 years have resulted in millions of poultry deaths and severe impacts to livelihoods, local economies, and international trade.

An epidemic becomes a pandemic when its influence becomes global. They typically occur when a new pathogen emerges for which people have little or no immunity, and for which there is no vaccine. The disease spreads easily from person to person, causes serious illness or death, and can overwhelm a community in a very short time frame.

Historical Analysis: Influenza Pandemics are naturally occurring events that have struck at various points across the nation's historical record. Each of these events impacted Wisconsin residents. There were three pandemic influenza outbreaks during the 20th century, beginning in 1918, 1957, and 1968 respectively. Since the turn of the 21st century, there has been one pandemic influenza outbreak, which began in 2009 and was brought under control in 2010.

The greatest human loss associated with a pandemic occurred in the 1918 Spanish Flu (H1N1) incident. An estimated 20-40 million people lost their lives worldwide, 550,000 of which were in the United States. The Asian Flu (H2N2) pandemic that struck in 1957 and 1958 had an associated mortality of approximately 70,000 in the United States. The Hong Kong Flu (H3N2), which lasted from 1968 to 1969, killed approximately 34,000 people in the United States. The 2009 Swine Flu pandemic (H1N1), was confirmed to have killed approximately 14,000 people worldwide, of which 3,400 were in the United States, though experts believe these numbers represent only 6-10% of the total number of deaths. In Wisconsin, there were 13,511 confirmed or probable cases of H1N1 from April 2009 to March 2010, with 1,320 hospitalized and 55 deaths. In Vilas County, there were 6 cases of H1N1 with 4 hospitalizations and no deaths reported.

Other events with pandemic potential, including Avian Flu, Severe Acute Respiratory Syndrome (SARS), and Middle Eastern Respiratory Syndrome (MERS), and non-respiratory illnesses like Ebola and West Nile Virus, were either brought under control by a mix of public health and other measures before very high death tolls resulted or are still active but are being successfully controlled.

The Vilas County Health Department tracks communicable disease through a channel of communications at the local, state and regional levels between public health, private physicians, hospitals, and labs. This communication channel allows for prompt investigation of possible outbreaks and unusual situations, and to implement control measures to minimize further transmission of disease to others.

Vulnerability and Risk Assessment: Emerging infectious diseases pose a particular risk to urban and suburban communities due to the close environment in which people interact. Most communicable diseases are dealt with through traditional health department activities. The complexity and magnitude of a Pandemic Influenza outbreak would tax the normal capabilities of the medical service community and the Emergency Management Department would assist in all activities surrounding an event of this severity. The possibility of a communicable disease epidemic or pandemic outbreak is equal across Vilas County and therefore Lac du Flambeau. The ability to predict where and when an event will occur is very difficult. The probability of emerging infectious diseases epidemics is therefore unknown.

Table 9: Vulnerability and risk assessment for Epidemic / Pandemic / Vector Borne Disease summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Infectious diseases are an ever-present concern in Lac du Flambeau as it is throughout the country and the world. Influenza is an annual occurrence and the potential for mutation that results in an exceptionally virulent strain is small but ever-present. Several emerging infectious diseases impact Vilas County at any given time, though the vast majority of these are kept under control through a variety of public health measures. Based on historical frequency, the Lac du Flambeau tribe should anticipate an average of 1 event with epidemic or pandemic potential every 30-35 years. This equates to a 3% probability in any given year.	2
Trend	Higher temperatures and wetter conditions tend to increase mosquito and tick activity, leading to an increased risk of existing and new zoonotic diseases (e.g., West Nile virus (WNV), La Crosse/California encephalitis, Jamestown Canyon virus, St. Louis encephalitis, and Eastern equine encephalitis.) Non-native mosquito species may move into Wisconsin if the climate becomes more suitable for them, bringing with them diseases such as Jamestown Canyon virus, Chikungunya, and Dengue Fever. Ticks are also well-known disease vectors in Wisconsin, carrying pathogens such as Lyme disease, anaplasmosis, Ehrlichiosis, Powassan virus, and Babesiosis. Tick populations are already expanding due in part to climate change. Warmer, wetter weather can cause algal blooms and declining beach health. An increase in flood events may result in more prevalent mold problems in homes and businesses and contamination of wells and surface waters.	3
Health / Public Safety	An epidemic or pandemic caused by an infectious disease has the potential to infect a sizeable number of residents on the Reservation, leading to hospitalization and potentially the death of up to 100% of those infected.	3
Home Damage	No likely impact.	0
Livelihood	Many people will temporarily or permanently lose their source of income due to illness or workplace closure.	3

Infrastructure	No likely impact.	0
Recovery Costs	Recovery costs associated with epidemic or pandemic illness stem from the use of public funds to address transmission prevention (including vector control), decontamination, medical supplies, and other related expenses.	2
Environment	No likely impact.	0
Cultural / Historic	The loss of key community members, notably tribal elders, may have profound and permanent impacts on traditional knowledge and practices.	3
Government Services	Government services may be impacted when government employees become ill, when government facilities are forced to close for decontamination or transmission prevention, or when government personnel are diverted to work on public-health needs.	2
Business / Agriculture	Businesses may be impacted by an epidemic or pandemic event if employees become ill, if customers avoid public spaces, if supply chains are disrupted, or if there are decontamination requirements, among other reasons.	2
Risk Acceptability	Assigned by workshop participants.	3
Mitigation Potential	The real or perceived threat of an emerging infectious disease has the potential to disrupt normal public interactions. The impact of emerging infectious diseases can be mitigated by immunization; reporting, investigation, and surveillance; and response.	2

5. Flood (flash flood, lake, river, stormwater)

Background: A flood is an overabundance of water that engulfs land and other property that is normally dry. There are several different reasons that floods occur, including sustained or heavy rainfall, melting snow, obstruction of a natural waterways (e.g., by beavers, ice, debris, or landslides), among other generative factors.

Major floods affecting wide geographic areas are typically the result of large-scale weather systems capable of generating prolonged rainfall, but events of equally significant magnitude can occur in much less time following intense thunderstorms with exceptionally heavy precipitation rates or dam failures. Floods are capable of undermining buildings and bridges, eroding shorelines and riverbanks, tearing out trees, washing out access routes, and causing loss of life and injuries. Flash floods, which can reach full peak in only a few minutes, are a distinct category of flood characterized by the lack of warning that is possible given their rapid generation.

Flooding on a body of water is normally measured according to an established flood stage, which refers to the level at which inundation of normally-dry areas occurs. This elevation corresponds to an annualized likelihood of reaching such heights. For example, a flood stage that has a 1% chance of being reached or could be expected to occur once across a 100-year period would encompass a land area referred to as the “100-year floodplain” and an event that impacted this area would be called a 100-year flood event. Typically, structures contained within areas that carry a 1% annualized risk of flooding are considered to exist within the floodplain. In many locations, climate change is affecting the recurrence interval for these heavy precipitation events, meaning that the historic 1% annualized risk of flooding may no longer reflect the future risk of those events.

There are several classifications of floods that are differentiated by their cause, location, and duration, among other factors. Flood types that threaten Lac du Flambeau include:

- Flash Flood: A rapid rise in water level on normally-dry land which occurs with little or no warning during or immediately following heavy rainfall. Flash flooding may move at high velocity and contain large amounts of debris which can lead to trees damage, the undermining buildings and bridges, and scouring of new channels. Urban and built-up areas are at greatest risk from flash flooding due to removal of vegetation, covering of ground with impermeable surfaces, and the existence of inadequate drainage systems. Flash flooding is also called stormwater flooding.
- Lake Flooding: Elevated lake water levels that result in expansion onto lakeshore areas.
- Riverine Flooding: Also known as overbank flooding, riverine floods are the most common flood event type. The amount of flooding is a function of the size and topography of the watershed, the regional climate, soil and land use characteristics. In steep valleys, flooding is usually rapid and deep, but of short duration, while flooding in flat areas is typically slow, relatively shallow, and may last for long periods. The cause of flooding in rivers is typically prolonged periods of rainfall from weather systems covering large areas. These systems may saturate the ground and overload the streams and reservoirs in the smaller sub-basins that drain into larger rivers. Annual spring floods are typically due to the melting of snowpack. Riverine flooding can occur on smaller streams and waterways and is referred to as “Urban and Small Stream Flooding”. Such floods are generally more local in their scope, though there may be numerous flooded streams across a wider geographic area impacted by increased precipitation or hydrologic pressures. Streams that pass through urban or built-up areas are more susceptible to stream flooding due to increased surface runoff and constricted channels. Riverine and stream flooding in Lac du Flambeau tends to be heaviest in the spring when melting snow adds to normal runoff and in summer or early fall after intense rainfalls. Flooding occurs in the spring due to snowmelt and frozen soil.

Historical Analysis: Vilas County, within which the majority of the reservation and the Lac du Flambeau town center is located, has an unremarkable historical record with regards to major flooding events. Most of the county’s floodplain surrounds flowage type water bodies for which water levels are actively controlled. Past flood events have caused only minimal property and infrastructure damage and have generally been classified as minor. There is however the potential for increased levels of damage in future events due to the significant number of structures that exist in the floodplain. In addition, demand for shoreland property often results in pressure to develop flood-prone plots.

Flood risk in Lac du Flambeau is greatest in the spring when melting snow adds to normal runoff or in summer or early fall following intense rainfall that lasts for several days.

Buildup from runoff can cause rivers and streams to overflows their banks. Flood waters may take as long as two weeks to recede in such events. Fortunately, the timing and location of this type of flooding is fairly predictable and allows ample time for evacuation of people and protection of property. Understandably, the floodplain and watershed areas are most vulnerable to flooding in Lac du Flambeau.

As of 2018, neither Lac du Flambeau nor Vilas County has ever had a claim submitted under the National Flood Insurance Program. Although flooding has occurred in Vilas County in the past 50 years, including in 1999 during a Federally-declared disaster, and in 2011 as a result of rapid rainfall (flash flooding event), inundation in Lac du Flambeau has been largely limited to roadways and culverts. The most severe flooding event in Lac du Flambeau occurred in August of 2000 as a result of prolonged presence of thunderstorms. The event was characterized as urban and small-stream flooding.[9]

The NOAA National Centers for Environmental Information Storm Events Database lists two flood events for Lac du Flambeau. These include:

- **August 14, 2000**
  Severe thunderstorms developed in the vicinity of a front that was stalled across northeast Wisconsin. Bowing lines of thunderstorms and supercell thunderstorms produced considerable wind damage, some hail, street flooding and a brief tornado touchdown. Strong winds downed numerous trees and power lines. Some homes were damaged when trees fell on them. About 25,000 customers lost electrical power due to the storms. A tornado touched down briefly at Lake Tomahawk (Oneida co.) resulting in tree damage. Heavy rainfall caused street flooding at several locations.

- **June 11, 2017**
  Afternoon thunderstorms downed trees and power lines across parts of northern Wisconsin and produced torrential rainfall totaling 6.5 inches that caused street flooding in the Lac du Flambeau town center as well as in other nearby communities.

[9] North Central Wisconsin Regional Planning Commission. 2013. Vilas County All-Hazards Mitigation Plan. Vilas County Emergency Management.

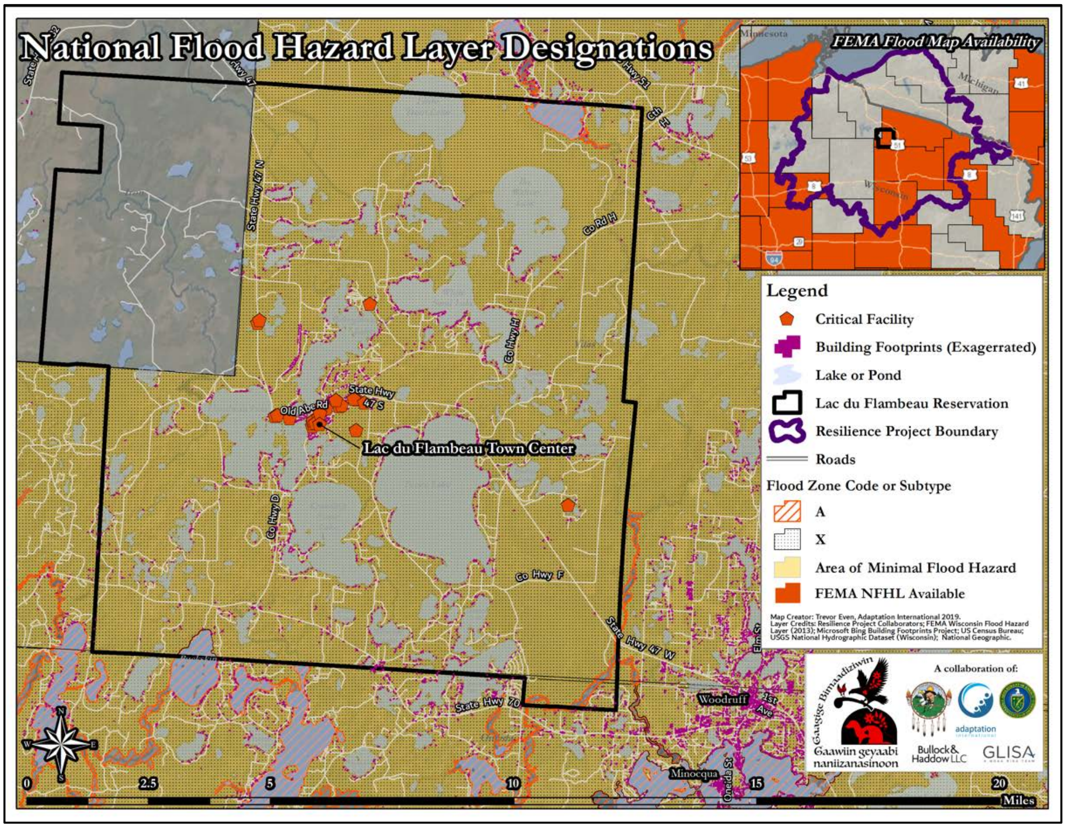

Figure 16: National Flood Hazard designations for the Lac du Flambeau Reservation. Flood Hazard Layers are only available for some of the reservation.

Members of the TEPC are not overly concerned with flooding citing primarily the flat topography of the region and the sandy soils for the lower risk. The June 2017 flash flood event carried so much water that it overwhelmed the downtown sewer system and caused temporary localized flooding. Changing climate conditions are projected to increase the magnitude of extreme precipitation events in the region.

Vulnerability and Risk Assessment: The threat of flooding is typically not considered a community-wide threat. Flooding is most commonly associated with floodplains or lowlands adjacent to water bodies. Lac du Flambeau flood areas are delineated in FEMA National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRMs). FIRMs show the Special Flood Hazard Area (SFHA), defined as the area that is inundated during the base flood, also known as the 1-percent-annual-chance or “100-year” flood. In Wisconsin, the base flood is also referred to as the regional flood. In areas where the Base Flood Elevation (BFE) has been calculated through engineering studies, it serves as the regulatory benchmark for structure elevation or floodproofing. Flood insurance premiums are determined by a structure’s elevation in relation to the BFE. State statutes refer to the BFE as the regional flood elevation; in Wisconsin, the flood protection elevation is two feet above the regional flood elevation.

Floodplain regulation activities in Wisconsin are administered by the Wisconsin Department of Natural Resources (DNR) Floodplain Management Section. The State of Wisconsin has required communities to regulate floodplains since 1968 through Chapter NR 116 of the Wisconsin Administrative Code. The standards established in chapter NR 116 exceed the minimum standards set by the NFIP in order to provide a higher level of protection to Wisconsin residents. Some of the higher standards set by Wisconsin include the prohibition of structures in the floodway, the requirement that elevated structures be at least two feet above the regional flood elevation, and the requirement that structures have dryland access even during flooding.

Past flooding events in Wisconsin have typically affected:

- Infrastructure – flooded public facilities;
- Roadways – washouts, inundated roadways, debris clean-up;
- Residential structures – flooded basements, damaged septic systems;
- Businesses – loss of commerce; and
- Agriculture - inundated cropland.

Table 10: Vulnerability and risk assessment for Flooding summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	While major flooding events are relatively rare in Lac du Flambeau, minor flood events with more local impacts should be expected to occur every 15-20 years. This equates to approximately 5-7% probability in any given year.	3
Trend	Climate change is increasing the number of precipitation days and the quantity of rainfall in individual events. Flood risk is therefore likely to increase as a result of climate change.	3
Health / Public Safety	Flood events in Lac du Flambeau may impact property beyond the roadway and culvert impacts seen in past events. While potentially damaging to property, such impacts are however unlikely to pose a significant threat to public health and life safety. No likely impact.	0
Home/Property Damage	Flood risk in Lac du Flambeau presents a moderate risk (11-35 homes) for home and property damage.	2
Livelihood	Impacts on livelihood related to flooded businesses and/or homes presents a low-level risk in Lac du Flambeau.	1
Infrastructure	Transportation infrastructure is most acutely impacted by flood events. However, flood events have the potential to impact groundwater quality.	1
Recovery Costs	Recovery costs related to repair of public facilities and infrastructure, debris clearance, and mitigation may be significant in the aftermath of a flood event.	3

Environment	Three exists significant risk for environmental damage in flood events resulting from inundation, erosion, contamination, or a combination of the three.	3
Cultural / Historic	Flood waters impacting historic or cultural facilities can result in significant and permanent impacts.	3
Government Services	Government services, notably public school services, may be impacted for a short time in the event of a flood event.	1
Business / Agriculture	Flood events can result in road closures, inundation and destruction of crops, loss of grazing areas, and livestock fatalities.	2
Risk Acceptability	Assigned by workshop participants.	2
Mitigation Potential	High expected return on investment.	2

6. Severe Winter Storms / Ice Storms

Background: Severe winter storms are extratropical, cold-weather cyclonic weather hazards associated with excessive precipitation of snow, sleet, and ice. Severe winter storms can impede or fully disrupt travel, are accompanied by dangerously cold temperatures, and can cause many secondary hazards including avalanches, snow drifts, and floods. The longer-term effects of successive snow accumulation can be disastrous: snow melts and runs off once temperatures begin to rise, leading to mudslides and widespread flooding. Blizzards are a type of severe snowstorm accompanied by very low temperatures (below 20°F) and high winds (35 mph or greater).

Ice storms can lead to the development of a thick glaze of ice on trees, cars, roads, and other surfaces, making conditions extremely hazardous to motorists and pedestrians, and can lead to property damage from collapsed roofs, fallen trees and limbs, damaged power and communications poles and lines, and other physical and environmental impacts. During a severe winter storm, power and telecommunications may be disrupted for days. When severe winter storms are accompanied or followed by heavy rainfall, snowmelt can result which causes sudden and severe flooding.

The following are National Weather Service (NWS) approved descriptions of winter storm elements:

- Heavy snowfall: accumulation of six or more inches of snow in a 12-hour period or eight or more inches in a 24-hour period.
- Blizzard: sustained wind or frequent wind gusts of at least 35 mph accompanied by considerable falling and/or blowing snow and visibility below ¼ mile.
- Ice storm: freezing rain produces significant or damaging accumulations of ice, usually ¼" or thicker.
- Freezing drizzle/freezing rain: drizzle or rain that falls as a liquid but freezes into glaze upon contact with the ground or objects with a temperature of 32°F or below.

- Sleet: pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially-melted snowflakes. Heavy sleet is defined as sleet accumulation exceeding ½ inch.
- Wind chill: measure of accelerated heat loss from exposed skin due to increased wind speeds.
- Lake Effect Snow: Snow showers that are created when cold, dry air passes over a large warmer lake, such as one of the Great Lakes, and picks up moisture and heat resulting in heavy but localized snowfall. This type of snow storm has the potential to be a significant hazard or be life threatening.

Historical Analysis: While heavy snow and ice storms have been a part of nearly every winter in Lac du Flambeau, true blizzards are rare throughout Wisconsin. Blizzards are more likely to occur in the northwestern part of the state than in the south-central parts, although heavy snowfalls is most common in the southeast. Blizzard-like conditions do often exist during heavy snowstorms when gusty winds cause the severe blowing and drifting of snow. The NOAA National Centers for Environmental Information reports 68 winter storm events in Vilas County between January 1, 2001 and May 1, 2018. All of these storms contained some form of snow, sleet, freezing rain, or ice conditions. The record 24-hour snowfall is 24 inches, while the record monthly snowfall accumulation is 83 inches. An April 13-15, 2018 blizzard dropped 19.5 inches of snow on Lac du Flambeau and up to 30 inches in other communities in the region. Impacts from the heavy snow and high winds (up to 50 mph) included road closures, business closures, and roof collapse.

Vulnerability and Risk Assessment: Geographic exposure is relatively uniform across the Lac du Flambeau Reservation and is therefore consistent with county-wide assessments. Winter storms present a significant threat to the health and safety of affected citizens and can result in significant damage to property and community and business disruption. Heavy snow or accumulated ice can cause the structural collapse of buildings, disrupt infrastructure networks, increase the prevalence of motor vehicle accidents, and can isolate residents from much needed assistance and services.

Table 11: Vulnerability and risk assessment for Severe Winter Storms / Ice Storms summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Based on historical frequency, the Lac du Flambeau tribe should anticipate an average of 3.7 significant winter weather events per year. This equates to a 100% probability in any given year.	5
Trend	Wisconsin is experiencing rising annual average temperatures as a result of climate change. While statewide increases have averaged 2.5°F since 1950, Vilas has seen an increase of approximately 1-1.5°F. As both temperature and precipitation increase during the winter months, freezing rain will be more likely. Additional wintertime precipitation in any form will contribute to saturation and increase the risk and/or severity of spring flooding. The combination of factors indicates a rising trend in impacts related to severe winter storms.	3

Health / Public Safety	Few (if any) deaths and/or injuries have been directly attributable to severe winter storms in Vilas County. Future risk is associated with automobile accidents, slips and falls, reduced access to emergency medical care, falling tree limbs, and exposure to the cold.	1
Home Damage	Home damage is associated with falling trees and branches, wind damage, water damage from ice dams, water damage from frozen water pipes and LP lines, frozen septic systems, and exceeded roof snow loads.	1
Livelihood	No likely impact.	0
Infrastructure	The potential for prolonged disruption of infrastructure due to damaged power and communications transmission lines exists.	3
Recovery Costs	Costs associated with clearing and treating roads and managing debris can exceed $500,000 in severe events.	3
Environment	Damages tend to be isolated and require minor remediation actions.	1
Cultural / Historic	Potential damage caused by snow, ice, and/or wind to cultural and historic sites and/or facilities, or the loss of plants and animals critical to tribal life, presents a low and/or short-term threat.	1
Government Services	Availability of key government services, including schools and emergency services, may be impacted by severe winter storms. Nonessential services may be impacted for several days.	2
Business / Agriculture	Business impacts, primarily business interruption, may result from broken supply chains, a loss of e-commerce, unavailability of utility services, physical access problems, and a loss of tourism resources. Storms that occur early or late in the season can impact crops. All winter storms can have an impact on the timber industry.	3
Risk Acceptability	Assigned by workshop participants.	2
Mitigation Potential	High expected return on investments	2

7. Forest and Wildland Fires

Background: Chapter 26.01 of the Wisconsin State Statutes defines forest fires as *"uncontrolled, wild, or running fires occurring on forest, marsh, field, cutover, or other lands involving farm, city, or village property and improvements incidental to the uncontrolled, wild, or running fires occurring on forest, marsh, field, cutover, or other lands."* They often begin unnoticed, can spread quickly, and are usually signaled by dense smoke that can fill the air for miles around. Wildfires in Wisconsin are primarily human-caused by burning yard debris, fireworks, arson, or campfires, for example. They can also be caused by natural events like lightning.

Wildfire classifications in Wisconsin include:

- Interface or intermix fires (also known as wildland-urban interface or WUI fires): Occur in areas where both vegetation and structures provide fuel.
- Firestorms: Occur during extreme weather (e.g., high temperatures, low humidity, and high winds) with such intensity that fire suppression opportunities are limited. These events typically burn until the weather or fuel conditions change to reduce the fire spreading behavior.
- Prescribed fires: Occur with the intentional application of fire to wildland natural fuels, under specific environmental conditions, to accomplish planned land management objectives. They are a part of a fuel management strategy and one of the most complicated and complex operations to implement.

Wildfires are often a secondary impact of other hazards. Some hazards cause wildfires, some intensify them, and others are themselves intensified by wildfires. In Wisconsin, the following hazards may interact with wildfires, altering the conditions in the fire:

- Severe thunderstorm wind events: Higher wind speeds increase the rate at which wildfires spread. The rate of spread varies directly with wind velocity. Additionally, high winds and downbursts can cause blowdowns, leaving downed trees and branches as fuel for wildfires.
- Lightning: A cloud-to-ground lightning strike may cause a wildfire.
- Flooding: Wildfires clear vegetation from the landscape, decreasing the soil's ability to absorb moisture and removing obstructions that could slow floodwaters. This increases the likelihood of flooding in fire-ravaged areas.
- Landslides and mudslides: Because wildfires remove vegetation and damage soils, flash runoff erosion is more likely and can contribute to landslides and/or mudslides. Though this is of limited concern given the topography of the Lac du Flambeau Reservation.

The following figures summarize both the number of wildfires in and around the reservation between 1980 and 2013 and the causes of those fires.

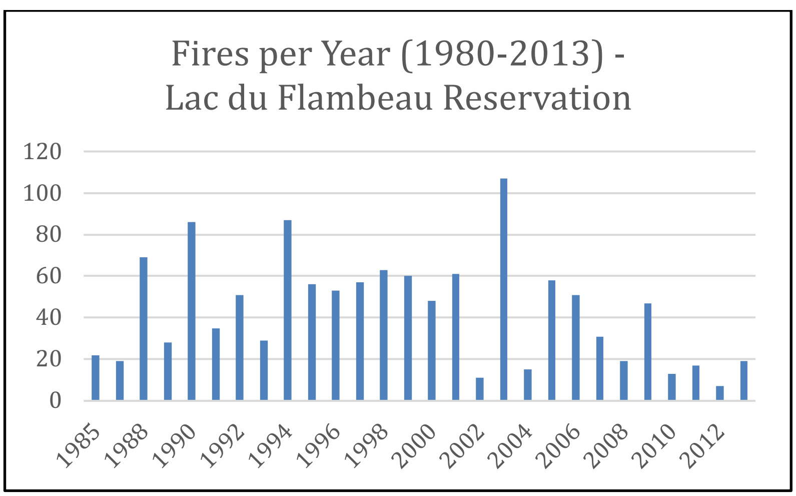

Figure 17: Number of Wildfires per year on the Lac du Flambeau Reservation from 1980-2013. Source GEOMAC Wildfire database.

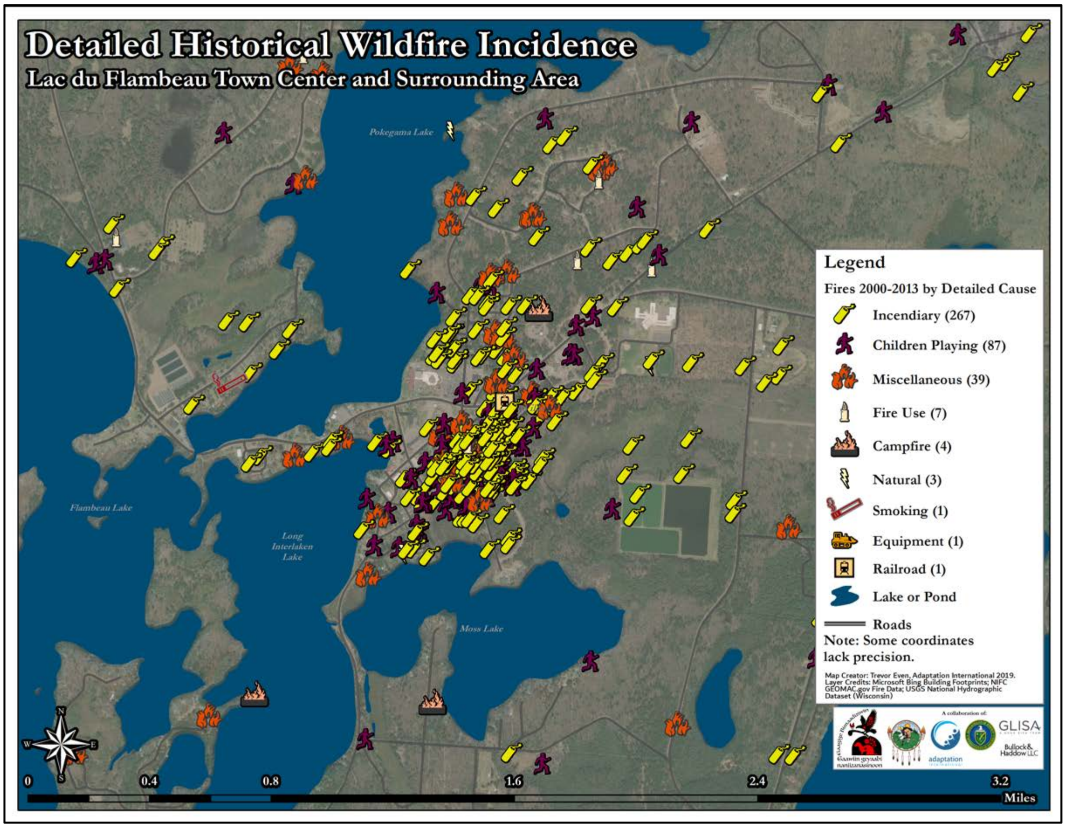

Figure 18: Detailed wildfire events by cause for the Lac du Flambeau Reservation from 1980-2013. GEOMAC Wildfire Database. Humans (particularly fireworks or children playing) were the primary identified causes of wildfire for the fires within the Reservation.

The majority of the reservation is classified as Wildland Urban Intermix. While the area of the Lac du Flambeau Town is classified as Interface, much of the rest of the reservation is forested with low density housing. The reality (Shown in Figure 19) is that a wildfire in the region has the potential to affect all segments of the community.

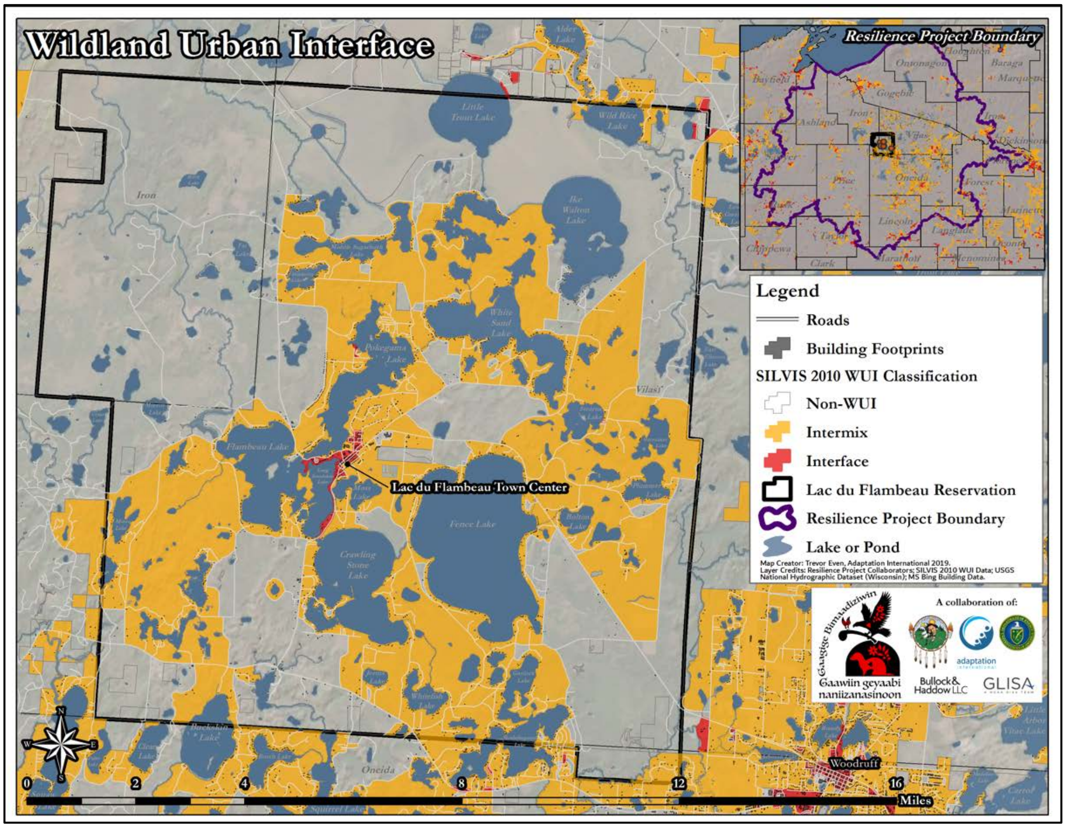

Figure 19: Wildland Urban Interface designations for the Lac du Flambeau Reservations. Areas shown in Red are Interface areas (primarily the Lac du Flambeau Town Center) where areas shown in yellow are "Intermix" areas with homes and buildings throughout the forest. The gray shaded areas are primarily forest with some homes and buildings (black dots) scattered throughout.

Several Wisconsin communities participate in the Firewise Communities Program, which is a multi-agency effort that brings together state government offices, tribes, organizations, fire departments, and communities to reduce the loss of life, property, and resources to wildland fire by building and maintaining communities in a way that is compatible with natural surroundings. This goal is accomplished by actively involving homeowners, community leaders, planners, developers, and others in the effort to decrease the fire risk before a fire starts. The Firewise Communities approach emphasizes community responsibility for planning and designing a safe community, effective emergency response, and individual responsibility for safer home design, construction, landscaping, and maintenance. There are three main Firewise concerns in fire-prone areas:

1. <u>Buildings:</u> Emphasis is on flammability of residential buildings/areas and outbuildings.
2. <u>Surrounding vegetation:</u> Does the current vegetation help spread fire or promote fire suppression?
3. <u>Access:</u> Can emergency vehicles and workers service the area if/when a fire is burning?

There are currently 11 Wisconsin communities in the Firewise program, mainly in the central part of the state.

Historical Analysis: Between 2000 and 2009, there was an annual average of 70.9 wildfires in Vilas County, burning an average of 32 acres total. The Vilas County wildfire burns approximately one-half acre. Fires remain small primarily as a result of rapid response firefighting capabilities, however, there exists the risk for a large fire such as a 2010 fire in Conover that burned over 30 acres and a 2012 fire that in Land O' Lakes that burned over 80 acres. Fires elsewhere in Michigan have burned much more than this, including the 2012 Duck Lake fire that burned over 21,000 acres and destroyed 136 structures.

April is the leading month for wildfire in Vilas County, with 40% of all fires between 2000 and 2009 occurring then. Wildfires can happen in any month, but the lowest historic risk has been during December, January, and February.

The Town of Lac du Flambeau experienced 484 wildfires between 2000 and 2009, which is the largest number for a single jurisdiction in the county. These fires resulted in 132 acres burned, which is also the highest in the county.

Vulnerability and Risk Assessment: Within Vilas County, 496,000 acres or 76% of all land, is classified as forestland. On the Lac du Flambeau Reservation, more than 34,000 of a total 86,573 acres (~40%) is classified as forestland. The potential for property damage from fire increases each year as more recreational and retirement homes are developed on wooded land. Rural buildings may be more vulnerable because of lack of access. Access to buildings off main roads is sometimes long, narrow driveways with minimal vertical clearance making it hard for emergency vehicles to combat fires. These buildings also may not have much of a defensible space because of little area between the structures themselves and highly flammable vegetation.

The trend toward introducing more human development into fire prone areas has brought about the term wildland urban interface or WUI. The WUI identifies areas where structures and human development meet or intermingle with undeveloped wildlands. It is within these areas where wildfire poses the greatest risk to human lives and property. Campgrounds are also a concern because of campfires. Vilas County has federal, state, county and numerous privately-owned campgrounds throughout the County. There are 121 individual campsites in Lac du Flambeau.

The WDNR has completed a statewide evaluation of fire risk, referred to as the CAR or Communities At Risk assessment. This assessment uses extensive DNR geo-databases to analyze and map hazardous woodland fuel types and the degree of the intermixing of development with wildlands. The maps identify the level of risk for each community on a scale of very high, high, moderate, or low, and also have a community of concern designation. Lac du Flambeau has a high-risk level.

Table 12: Vulnerability and risk assessment for Forest and Wildland Fires summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Based on historical frequency, the Lac du Flambeau tribe should anticipate an average of 50 events per year. This equates to a 100% probability in any given year.	5
Trend	Wildfire risk is expected to hold relatively constant despite increased climate variability and increases in development within the wildland-urban interface.	2
Health / Public Safety	Wildfires in Lac du Flambeau do not typically result in injuries or fatalities. However, the potential exists for a large and/or fast-moving fire to result in injury or death, as experienced elsewhere in the United States in recent years.	1
Home/Property Damage	In the event of a major fire, many homes may be damaged or destroyed.	3
Livelihood	A major fire may require closure of all places of employment in the vicinity of the fire.	2
Infrastructure	Forest and wildland fires often impact networked critical infrastructure, including power and communications transmission lines and power transfer stations.	2
Recovery Costs	Costs associated with forest fires can exceed $500,000.	3
Environment	Forest and wildland fires often have a start yet moderate impact on the natural environment. Impacts can grow exponentially, however, when fires are followed by torrential rains and mudslides result.	1
Cultural / Historic	Potential damage caused by forest and/or wildland fire to cultural and historic sites and/or facilities, or the loss of plants and animals critical to tribal life, presents a moderate threat.	2
Government Services	Government services are not likely to be severely impacted by a major fire.	1
Business / Agriculture	Fires can impact crops and livestock, and cause business interruption either indirectly as a result of transportation, power, and communications infrastructure impacts, or directly as a result of evacuation or physical damage,	2
Risk Acceptability	Assigned by workshop participants.	1
Mitigation Potential	High expected return on investments.	2

8. Hazardous Materials Release / Contamination / Run-off

Background: A hazardous materials incident can be described as the uncontrolled release of hazardous materials capable of posing a risk to life, health, safety, property, or the environment. A hazardous materials incident is most often a result of accidents at fixed facilities or during Transportation.

Under the Emergency Planning Citizen Right to Know Act (EPCRA), a hazardous material is defined as any chemical that is a physical hazard or health hazard [defined at 29 CFR 1910.1200] for which the Occupational Health and Safety Administration (OSHA) requires a facility to maintain a Material Safety Data Sheet (MSDA). Under EPCRA there is no specific list of hazardous materials. An extremely hazardous substance (EHS) is defined as one of the 356 substances on the United States Environmental Protection Agency (EPA) list of extremely hazardous substances, identified at 40 CFR Part 355. EPCRA of 1986 also known as SARA Title III, brings industry, government and the general public together to address emergency planning for accidental chemical releases. The emergency planning aspect requires communities to prepare for hazardous chemical releases through emergency planning. This provides essential information for emergency responders. The community right-to-know aspect increases public awareness of chemical hazards in their community and allows the public and local government to obtain information about these chemical hazards.

Hazardous materials are any solid, liquid, or gas that can pose a threat to human health and/or the environment due to being radioactive, flammable, explosive, toxic, corrosive, a biohazard, an oxidizer, an asphyxiant, or capable of causing severe allergic reactions. The release of hazardous materials can lead to property damage, short- and long-term health effects, serious injuries, and even death. Emergency response to incidents involving the release of hazardous materials may require fire, law enforcement, search and rescue, and hazardous materials units. The vast majority of reported hazardous materials incidents result from the loading, unloading, and transportation of hazardous materials.

Lac du Flambeau participates in the Vilas County Local Emergency Planning Committee (LEPC), which is a county-level requirement and has been established in accordance with federal legislation. It is responsible for implementation of EPCRA at the county level, inclusive of the development of a County Hazardous Materials Response Plan. This plan establishes policies and procedures for responding to hazardous material incidents. The LEPC is required to review, test, and update the Plan every two years. Methods for notification and reporting an incident are outlined in the plan, which is tested through tabletop, functional and full-scale exercises and actual response situations.

To provide a high level of hazardous materials response capabilities to local communities, Wisconsin Emergency Management contracts with eight Regional or "Level A" Hazardous Materials Response Teams. The Regional team for Vilas County is located at Wausau. The Regional Response Team may be activated for an incident involving a hazardous materials spill, leak, explosion, injury or the potential of immediate threat to life, the environment, or property.

The Regional or "Level A" Team respond to the most serious of spills and releases requiring the highest level of skin and respiratory protective gear. This includes all chemical, biological, or radiological emergencies.

County or “Level B” Teams respond to chemical incidents which require a lower level of protective gear but still exceed the capabilities of standard fire departments. Currently, there are 36 counties that have a “Level B” team. Those teams may provide assistance to surrounding counties and are approved by the local Emergency Planning Committees. Vilas County contracts with Oneida County's “Level B” Hazardous Response Team which is made up of fire personnel from the Rhinelander Fire Department and area volunteer fire departments. In addition to the “Level B” hazardous Response team, members from the Rhinelander Fire Department are also a “Level A” Chemical Assessment Team (CAT) for the Wausau Regional or “Level A” Team. These HazMat Teams have the capabilities to respond to incidents that require a high degree of personal protection and respiratory protection.

Note that one key concern, a hazardous spill on the Lac du Flambeau Reservation, is the response time from either the County “Level B” (estimated response time four hours) or Regional “Level A” team (estimated response time six hours). This extended period of time may allow the dispersal of hazardous chemicals into the environment especially if they are airborne or released into a water body.

Historical Analysis: Most hazardous materials incidents are so small that they fall below the threshold for reporting and are therefore not tracked. Within Vilas county, there have been an average of 3 to 4 incidents per year reported. Within Lac du Flambeau, there has been 1 major hazardous materials spill requiring response from a Level B Hazardous Materials Response Team. This event occurred on August 12, 2005 and involved a spill of 40 gallons of hazardous materials as a result of a transportation accident.

Between 1978 and 2017, there were a total of 60 hazardous materials incidents in Lac du Flambeau. Twenty-three of these were the result of leaking storage tanks, 15 were related to materials spills, and 22 were events for which no action was required.[10]

Table 13: Summary of recorded Hazardous Material spills, releases, or leaks in the Lac du Flambeau Region 1978-2017.

Event Name	Location	Start Date	End Date	Event Type
HWY 70	STH 70	1978-10-04	1999-09-28	SPILL
3055 HWY H	3055 CTH H	1986-09-02	1987-11-06	SPILL
CHIPPEWA LODGE	3525 CHIPPEWA LODGE TR	1989-07-19	1989-08-25	SPILL

[10] Wisconsin Department of Natural Resources, Bureau for Remediation and Redevelopment Tracking System (BRRTS), 2018.

FLAMBEAU MOBIL STATION	701 PEACE PIPE LN	1990-06-06	2003-04-25	LUST
LAC DU FLAMBEAU TN HALL	109 OLD ABE RD	1990-12-14	1997-12-17	LUST
SCHILLEMAN RESIDENCE	14809 ARTISON LN	1991-05-08	1995-04-21	LUST
GRIZZLY BILLS	1420 STH 70 W	1992-04-30	1995-06-15	LUST
TOWER MOTEL	14277 STH 70 W	1992-08-24	2001-12-05	LUST
SNARSKI/BISSELL (RITCHIE OIL)	1653 SEVEN OAKS LN	1992-09-05	1998-06-25	ERP
1653 SEVEN OAKS LN	1653 SEVEN OAKS LN	1992-09-05	1998-06-25	SPILL
KUREK (FMR JANOTTA PROP.)	3089 KIBONIKI RD	1993-03-26	1994-04-29	LUST
PATTERSON TOM	11795 STH 70 W	1993-05-21	1994-11-17	ERP
VALS AUTO & BOAT REPAIR	2851 STH 47 S	1993-09-13	1994-08-29	LUST
KEENAN IRENE	1795 CTH D	1993-11-09	1994-08-29	ERP
BOBIDOSH (FMR SINCLAIR OIL)	STH 47 & CTH H NW CNR	1993-11-18	1995-09-28	LUST
LAC DU FLAMBEAU TN HALL	109 OLD ABE RD	1994-06-01	1995-10-20	LUST
ST ANTHONYS CHURCH	650 OLD ABE RD	1994-08-11	1995-01-30	LUST
14257 HWY 70 W	14257 STH 70 W	1994-09-16	1994-09-15	SPILL
TIMBERLAND TOWER	14257 STH 70 W	1994-09-19	1997-01-02	LUST
FENCE LAKE LODGE	12919 FRYING PAN CAMP	1995-06-02	1996-02-23	LUST
DILLMANS SAND LAKE LODGE	3305 SAND LK LODGE RD	1995-09-19	2002-09-06	LUST
K & M MINI-MART	2855 STH 47	1996-05-30	2005-09-07	LUST
FRANCOIS KEN PROPERTY	1870 W STH 47	1996-06-27	0000-00-00	LUST
LDF TRIBAL CAMPGROUND	2501 STH 47	1996-08-07	2000-07-20	LUST
PATTERSON LUMBER CO (FMR)	11795 STH 70 W	1997-02-01	2003-07-29	LUST
TOWER STANDARD SERVICE	14267 STH 70 W	1997-05-07	0000-00-00	LUST
NIIJII CENTER	838 WHITEFEATHER ST	1997-12-09	2000-04-07	LUST
FLAMBEAU BUS (FORMER)	736 OLD ABE RD	1998-02-26	2001-09-05	LUST
YUKON COUNTRY STORE	2641 STH 47	1998-03-11	2003-06-30	LUST
WATSONS HOLIDAY BEACH RESORT	3315 SAND LAKE LODGE	1999-05-17	1999-12-22	LUST

LAMPO PROPERTY	1359 W SQUAW LAKE RD	2005-07-18	2010-07-19	LUST
SCHROM EXCAVATING ACCDNT	CTH D & SILVER BEACH RD	2005-08-12	2005-08-12	SPILL
WILLIAM WYSS PROPERTY	1525 CTH F	2006-09-03	2006-09-08	SPILL
RAY CORULLO SPILL	STH 70 (1/2M W OF CTH D)	2008-12-23	2009-06-08	SPILL
WI PUBLIC SERVICE CORP SPILL	1233 AKIWENSI DR	2010-08-02	2010-10-08	SPILL
WI PUBLIC SERVICE (WPS) SPILL	12190 WAR PATH LN	2010-10-29	2010-12-20	SPILL
HILGY LP GAS SPILL	1755 E FENCE LAKE RD	2012-10-24	2012-10-24	SPILL
WISCONSIN PUBLIC SERVICE	2732 MAANG AVE	2016-07-30	2016-08-19	SPILL

Vulnerability and Risk Assessment: Hazardous materials risk in Lac du Flambeau exists as a result of multiple sources, including:

- Storage of hazardous materials at commercial and private facilities (e.g., gas station, private workshop), including Leaking Underground Storage Tank (LUST) incidents;
- Transport of hazardous materials on roads and highways;
- Use of hazardous materials in mining, agriculture, commercial, and other operations;
- Flood-driven runoff of chemicals into surface and groundwater; and
- Transport of hazardous materials (petroleum) via pipeline (in Vilas County - there are no pipelines on the Lac du Flambeau reservation)

Table 14: Vulnerability and risk assessment for Hazardous Materials Release / Contamination / Run-off summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Between 1978 and 2017, there were 38 hazardous materials incidents requiring action to clean up or otherwise remediate the incident. This gives a frequency of slightly less than one event per year.	4
Trend	Hazard event frequency is unlikely to change significantly as a result of climate change or development patterns.	2
Health / Public Safety	The vast majority of hazardous materials events have had no impact on human health or life safety. Future events do have the potential to impact life safety, especially in the event of a transportation accident.	1
Home/Property Damage	Excepting hazardous materials spills that originate from and cause damage to the same private property, there is a negligible long-term threat to homes and/or private property as a result of hazardous materials spills in Lac du Flambeau. No likely impact.	0
Livelihood	No likely impact.	0
Infrastructure	Beyond temporary road closures within small geographic limits, three are unlikely to impact infrastructure.	0

Recovery Costs	Remediation costs from hazardous materials spills, notably those that affect groundwater, may be significantly more than the threshold for this measure.	3
Environment	Contamination of soil and groundwater may have profound effects on local flora and fauna and on the use of such resources by the community.	3
Cultural / Historic	Tribal practices and traditions may be significantly and permanently impacted by contamination of land and waterways.	3
Government Services	No likely impact.	0
Business / Agriculture	No likely impact.	0
Risk Acceptability	Assigned by workshop participants.	3
Mitigation Potential	High expected return on investment.	2

9. Tornado / High Wind

Background: A tornado is a violently rotating column of air (vortex) extending from the base of a convective cloud (usually cumulonimbus) to the ground. Tornadoes in Wisconsin are most commonly associated with the presence of intense squall lines and supercell thunderstorms.

Tornadoes can be classified as supercell or non-supercell. Supercell tornadoes are derived from supercell thunderstorms of which a key component is a rotating updraft. These tornadoes can be devastating. Non-supercell tornadoes are formed by a spinning column of air near the ground and tend to be short-lived and weaker than supercell tornadoes. Non-supercell tornadoes include gustnadoes, land spouts, and water spouts.

Although most U.S. tornadoes last less than ten minutes, they can persist for more than an hour. The tornadoes' paths can range in length from a few hundred feet to several miles, and their widths may range from tens of yards to one or two miles. Tornado intensity is measured using the Enhanced Fujita Tornado Scale (EF-Scale, see Figure 20), which is based on wind speeds data.

EF Rating	Wind Speeds	Expected Damage
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.

Figure 20: Enhanced Fujita (EF) Ratings, windspeeds, and expected damages.

Straight-line winds, which are also associated with thunderstorms, cause damages that are similar to those caused by tornadoes and are therefore often confused with them. Straight-line winds are considered "severe" if moving at or over 58 miles per hour. Different categories of straight-line winds include:

- <u>Downdrafts:</u> Small-scale columns of air that rapidly sink toward the ground (a "downburst" is a result of a strong downdraft).
- <u>Downbursts:</u> Strong downdrafts with horizontal dimensions larger than 2.5 miles resulting in an outward burst of damaging winds where it meets the ground. Downburst damage can be as severe as that which results from a strong tornado.
- <u>Microbursts:</u> Small concentrated downbursts, generally less than four kilometers across, lasting only five to ten minutes, and with maximum wind speeds of 168 mph. Microbursts can be wet or dry, with wet microbursts accompanied by heavy surface precipitation, and dry microbursts occurring with little or no precipitation reaching the ground.
- <u>Gust fronts:</u> The leading edge of rain-cooled air that meets the warm air of a thunderstorm. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm.
- <u>Derechos:</u> Widespread thunderstorm wind events caused when new thunderstorms form along the leading edge of the outer boundary of the storm-cooled air. These phenomena typically occur in the summer when thunderstorms form over the wide plains. Derechos,

which often produce severe rainfall, can produce strong winds that persist for a long time and cover a very large geographic area.

- Bow echoes: These winds get their name from the bow-shaped appearance they make on radar displays. Damaging straight-line winds often occur near the crest, or center, of a bow echo, which can extend over 300 kilometers in length, last for several hours, and produce extensive swaths of wind damage on the ground.[11]

Historical Analysis: Vilas County has experienced 14 tornadoes since 1964. Of these, one tornado impacted Lac du Flambeau. The following description of these 14 events was produced by the National Weather Service:

- **May 4, 1964** The F/EF-1 tornado was first reported 10 miles southwest of St. Germain around 6 pm CST. The tornado travelled just over 7 miles before dissipating in St. Germain at 6:10 pm CST. The tornado had a maximum width of 125 yards. The local storm report indicated the tornado touched down twice and crossed over the Big St. Germain drawing water to a height of 200 feet. There was considerable damage to resorts and woods in the path of the tornado.
- **June 26, 1969** According to the local storm report, the F/EF-1 tornado skipped northeast through the forests of Price, southeast Iron and western Vilas Counties. The tornado struck Vilas County from 2 miles west of Manitowish Waters around 4:30 pm CST and moved to three miles southwest of Presque Isle. Most of the damage occurred around Manitowish Waters.
- **June 26, 1969** The F/EF-2 tornado formed near Lac Du Flambeau around 5 pm CST and skipped northeast for nearly 29 miles. The tornado dissipated along the Michigan border 9 miles northwest of Land O' Lakes. Maximum width of the tornado was 35 yards. Resort areas from Fence Lake northeastward across Big Crooked and High Lakes suffered damage.
- **July 7, 1970** The F/EF-1 tornado developed across Iron County in northwest Wisconsin. The tornado travelled east southeastward for nearly 38 miles across Vilas County around 7 pm CST. The tornado travelled from Winchester to Boulder Junction to Conover. Extensive damage to woods and lake property were noted in the path of the tornado.
- **July 12, 1973** The F/EF-1 tornado was struck touchdown just south of Boulder Junction around 3 am CST. The tornado was 100 yards wide and travelled 19.5 miles before dissipating near Sayner. Scattered damage to the woods was reported along the path of the tornado.
- **June 13, 1981** The F/EF-1 tornado touched down at County Highway N about a half mile north Sayner. The tornado moved east for three miles through the dense forest and cross the intersection of Highway N and Highway G then dissipated. The tornado damaged electric lines, telephone poles and trees. The tornado was fifty yards wide.
- **July 3, 1983** The Eagle River Municipal Airport was hit by the F/EF-1 tornado at 4:39 am CST. The tornado was 20 yards wide and travelled a half mile before dissipating. Two single engine planes were destroyed, and thirteen others were damaged. Five eighths inch ropes holding the planes down were shredded. One plane cart wheeled four hundred feet.

[11] Coppola, Damon P. 2015. Introduction to International Disaster Management, 3rd Edition. Elsevier. Burlington. https://amzn.to/2w3haWF.

- **April 27, 1984** The F/EF-3 tornado developed near Fawn Lake in Oneida County around 2:37 pm CST. The tornado travelled to near Star Lake in Vilas County before dissipating around 3:07 pm CST. The tornado leveled several thousand acres of forest, destroyed or damaged 80 homes and cabins, ripped up docks and tossed boats in the air or wrapped them around trees. A Fawn Lake man was killed after getting his family to safety. The hardest hit areas were Fawn Lake, Two Lakes, Hasbrook and Gilmore Lakes in Oneida County. In Vilas County, the hardest hit areas were St. Germain Lake, Lost Lake and Star Lake. The tornado travelled 29 miles and reached a maximum width of 880 yards.
- **July 24, 1986** The F/EF-1 tornado briefly touched down around 2:15 pm CST on South Shore Drive near Little St. Germain Lake near St. Germain. The tornado was 50 yards wide and travelled a quarter of a mile. Five buildings, some garages, some boats and docks were damaged. A dozen trees were snapped off at the base.
- **July 29, 1988** The brief tornado touched down in the Eagle River around 8:30 pm CST. The tornado was 50 yards wide and only travelled a tenth of a mile. The F/EF-1 tornado damaged the Northland Pines High School in Eagle River. Winds accompanying the storm downed signs and trees in the Eagle River area.
- **August 1, 1988** The F/EF-1 tornado touched one mile west of St. Germain around 6:52 pm CST. The tornado was 50 yards wide and travelled one mile. The tornado caused falling trees to damage cars and buildings one mile west of St. Germain. Another tornado (F/EF-0) was reported at 7:22 pm CST two miles southeast of Eagle River.
- **August 1, 1988** A brief tornado (F/EF-0) occurred 2 miles southeast of Eagle River around 7:22 pm CST. The tornado was 25 yards wide and travelled three tenths of a mile. The tornado damaged some trees.
- **April 26, 1994** The F/EF-1 tornado touched down a mile and a half north of Conover around 2:55 pm CST. The tornado was 150 yards wide and travelled four and a half miles before dissipating 3 miles southeast of Land O' Lakes around 3:05 pm CST. The tornado damaged a house just north of Conover and leveled hundreds of trees along its four and a half mile path into the Nicolet National Forest.
- **July 14, 1995** The tornado touched down a mile and a half southwest of Phelps around 4:40 pm CST. The F/EF-1 tornado was 250 yards wide and travelled east for three and a half miles before dissipating just southeast of Phelps at 4:47 pm CST. Trees fell on cars, homes and businesses.

There were no tornadoes reported in Vilas County between 1995 and 2017. However, several strong wind, funnel cloud, dust devil, and high wind events that have occurred:

- **July 27, 2010 -** A cold front combined with a warm and humid air mass to trigger thunderstorms that moved across northeast Wisconsin. The storms produced hail to golf ball size, wind gusts to 95 mph, funnel clouds and heavy rainfall that led to flash flooding. Downed trees and power lines were common, and thousands of homes lost power.
- **May 22, 2011 -** Severe thunderstorms produced high winds, large hail, and a tornado across central and northeast Wisconsin. Unstable air combined with a surface boundary and an upper air disturbance to produce thunderstorms. Storms became severe during the afternoon and early evening, causing numerous incidents of large hail and isolated straight-line wind damage. A long-track tornado moved from western Wisconsin into the central part of the state, snapping or uprooting many hundreds of trees and damaging several buildings and farm equipment. A funnel cloud was spotted in Lac du Flambeau.

Vulnerability and Risk Assessment: Wisconsin lies along the northern edge of the nation's maximum frequency belt for tornados, known as "Tornado Alley". Vilas County and Lac du Flambeau Tribal Lands are mostly rural. More densely settled areas are more vulnerable than lesser-populated areas because people and property may be concentrated in the storm or tornado's path. Those living in mobile homes or working and attending school in prefabricated structures are at greatest risk because these structures are more easily destroyed. The National Weather Service claims that between 1985 and 1998, 40 percent of all deaths in the United States from tornadoes occurred in mobile homes, compared to 29 percent in permanent homes, and 11 percent in vehicles.

According to the U.S. Census Bureau, only about 1.8% of the occupied housing units (1712) in Lac du Flambeau are mobile homes. In addition to mobile homes, there are many other areas that are vulnerable to tornadoes such as campgrounds. Campgrounds are vulnerable because typically there is little or no effective shelter available to those using the site. Youth camps operating in the area present a similar vulnerability. There are approximately 121 campsites in Lac du Flambeau, which together accommodate up to 424 persons.[12]

Vilas County experiences a tornado or strong wind event every 4.4 years. The impact of events is not uniform across the entire geographic area, and therefore likelihood risk in Lac du Flambeau constitutes 15% of the county, and therefore should assume an impact likelihood of 1 event per 25 years. Tornadoes that have occurred in Vilas County have caused between $0 and $25 million in property damage. The expected loss in any single event has been estimated as $1.9 million.[13]

Table 15: Vulnerability and risk assessment for Tornado / High Wind summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Based on historical frequency, the Lac du Flambeau tribe should anticipate an average of 1 event every 25 years. This equates to a .04% probability in any given year.	2
Trend	Research on the impact of climate change on tornado and high wind frequency and severity remains inconclusive.	2
Health / Public Safety	Tornadoes represent a significant life safety risk for anyone in a structure without a tornado-safe shelter (e.g., a safe room). However, a tornado will likely impact a limited physical area that falls within the tornado's track, and not the reservation as a whole.	2
Home Damage	Homes directly impacted by a tornado are typically destroyed. Those in the immediate vicinity are damaged by flying debris.	2

[12] Vilas County. 2013. Vilas County All Hazards Mitigation Plan.
[13] Vilas County. 2013. Vilas County All Hazards Mitigation Plan.

Livelihood	If a tornado strikes the reservation's central business district, there will be moderate to high livelihood impacts.	2
Infrastructure	Past tornadoes and strong wind events have damaged power and communications transmission lines and have blocked primary and secondary roadways.	2
Recovery Costs	Costs associated with tornadoes and strong winds can exceed $500,000 in any single event.	3
Environment	Tornadoes can have a moderate impact on forests when many trees are felled.	2
Cultural / Historic	Potential damage caused by high winds or a tornado to cultural and historic sites and/or facilities, or the loss of plants and animals critical to tribal life, presents a moderate threat.	2
Government Services	Tornado events are fleeting, lasting a very short time, and government services are likely to be resumed within one day if impacted.	1
Business / Agriculture	Tornadoes can have a significant impact on area businesses if major roadways or business districts are closed for recovery. Loss of utilities or transportation access will also impact businesses. Tornado winds can devastate crops.	3
Risk Acceptability	Assigned by workshop participants.	2
Mitigation Potential	Mitigation involves enhanced tracking, warning, and notification system; public education; and increased use of tornado-safe building technology.	2

10. Extreme Heat

Background: Major diversions in average seasonal temperatures can cause injuries, fatalities, and major economic impacts when they are prolonged or coincide with other natural or technological events. Extreme heat, called a heat wave, occurs when temperatures of ten or more degrees above the average high temperature persist across a geographic region for several days or weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, can occur when a "dome" of high atmospheric pressure traps hazy, damp air close to the ground. Excessively dry conditions that coincide with extreme heat can provoke wind and dust storms. When little rain occurs in conjunction with extreme heat, droughts are likely to occur.

Extended periods of warm, humid weather can create significant risks for people, particularly the elderly who may lack air conditioning or proper insulation or ventilation in their homes. Animals are also at risk during extended periods of heat and humidity. The National Weather Service issues a Heat Advisory when the Heat Index ranges from 105°F to 114°F daytime and remains at or above 80°F at night, during a 24-hour period. The heat index combines the effects of heat and humidity to better reflect the risk of warm weather to people and animals. When heat and humidity combine to reduce the amount of evaporation of sweat from the body, outdoor activity becomes dangerous even for those in good shape. The index measures the apparent temperature in the shade. People exposed to the sun would experience an even higher apparent temperature. A heat index of 105°F is considered dangerous and prolonged exposure can result in heat stroke, exhaustion and cramps. People should be reminded to use extreme caution when the heat index is between 95°F and 105°F. A heat index of 95°F occurs when the temperature is 90°F degrees and the relative humidity is 50 percent.

When extreme heat conditions are forecast, the National Weather Service (NWS) warns people and agencies to take precautions:

- Excessive Heat Outlook: Issued when conditions for an excessive heat event may occur in the next three to seven days; provides information for those who need to plan for heat (emergency management, public health officials, utility companies, etc.).
- Excessive Heat Watch: Issued when conditions for an excessive heat event will occur in the next 12 to 48 hours.
- Excessive Heat Advisory: Issued when the daytime heat index is expected to exceed 100°F in the next 36 hours; or if the heat index is expected to exceed 95°F for four consecutive days.
- Excessive Heat Warning: Issued when the heat index is expected to exceed 105°F during the day and 75°F throughout the night in the next 36 hours; or if the heat index is expected to exceed 100°F for four consecutive days.

Temperature (°F)

Relative Humidity (%)

	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Figure 21: Heat Warnings for frontline or vulnerable populations based on temperature and humidity levels. Source: NOAA, NWS. 2018 Heat Index. https://www.weather.gov/safety/heat-index

Historical Analysis: The return interval for extreme heat events in Lac du Flambeau is the same as has been calculated across all of Vilas County, one major incident ever 13 years (based on historical data). That said, the State of Wisconsin experienced an average of 10 heat wave days per year during the 2000s, and this number is expected to increase to 35 per year by 2030, and 60 per year by 2050.[14] With summer temperatures projected to rise between 5.0°F and 7.1°F by 2050, hot summer days are also likely to increase. Within the Resilience Initiative project boundary summary days over 90°F are projected to increase between 18 and 37 days a year.

Vulnerability and Risk Assessment: According to Wisconsin Emergency Management, excessive heat has become the deadliest hazard in Wisconsin in recent times. Extreme heat incidents occur across large geographic areas, often several states at once. These events therefore affect all living things within the impacted area, including livestock, wild animals, pets, and crops. Elders and youth are at highest risk of heat related injuries, which can lead to death. Electrical infrastructure is often affected by heat waves, whether from damaged transmission lines, exceeded demand, or other effects.

Within Vilas County, Lac du Flambeau faces higher than average vulnerability to heat-related events.

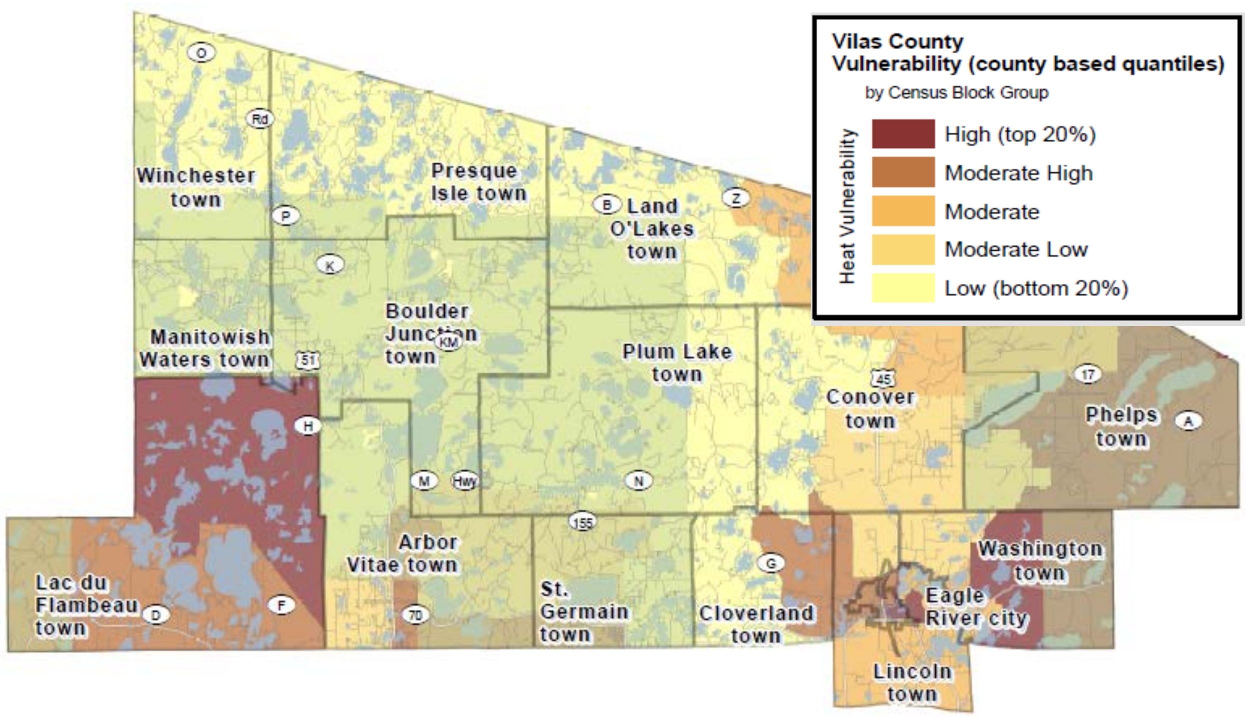

Figure 22: Heat related vulnerability by census block group. Vilas County and the Lac du Flambeau Reservation are in the two highest categories of relative vulnerability for the region. Source: Department of Health Services, Bureau of Environmental and Occupational Health 8/2015 https://www.dhs.wisconsin.gov/publications/p01084-vilas.pdf.

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[14] Climate Central. 2018. States at Risk: Wisconsin. http://statesatrisk.org/wisconsin/extreme-heat.

Table 16: Vulnerability and risk assessment for Extreme Heat summarizing assessment and scores for each measure.

Measure	**Assessment**	**Value**
Probability	Approximately 10 heat wave days occur in in Wisconsin each year, giving an almost 100% likelihood of occurrence in any given year.	5
Trend	The number of heat wave days is increasing on account of climate change.	3
Health / Public Safety	Extreme heat events cause more fatalities than any other hazard in Wisconsin. Without relief from the extreme weather, vulnerable people can suffer from heat exhaustion, heat stroke, or death.	1
Home/Property Damage	No likely impact.	0
Livelihood	No likely impact.	0
Infrastructure	Prolonged extreme heat events can lead to power outages.	1
Recovery Costs	No likely impact.	0
Environment	Extreme heat events can have a significant impact on plants, crops, water resources, and animals.	2
Cultural / Historic	Plants, animals, and natural resources utilized in tribal practices and traditions may be impacted during prolonged periods of extreme heat.	1
Government Services	Government services, namely access to public school, may be impacted during prolonged periods of extreme heat.	2
Business / Agriculture	Excepting during periods of concurrent drought, extreme heat will have little to No likely impact. on business and agriculture.	0
Risk Acceptability	Assigned by workshop participants.	2
Mitigation Potential	High expected return on investments.	2

11. Extreme Cold

Background: Extreme cold temperatures, which may be fleeting or may persist for days or weeks, can have severe negative consequences. Cold temperatures are considered 'extreme' when a significant drop below the average low temperature for the area is observed, and these conditions are likely to cause adverse effects to unprepared people, animals, and property.

Wind Chill Chart

Temperature (°F)

Wind (mph) Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 23: Wild Chill and relative temperatures. Source: National Weather Service

The risk from extreme cold stems from the possibility that it triggers health emergencies in susceptible populations, such as those who are without shelter or stranded, or who live in a home that is poorly insulated or without heat. Wind chill, which is a measure of apparent temperature relative to actual temperature based on observed wind speed, can exacerbate the effects of extreme cold (see Figure 23). Hypothermia is a dangerous condition that is observed much more frequently during periods of extreme cold.

Extreme cold can cause damage to structures from frozen pipes, including fuel lines, and may lead to bursting or breakage. Fires are common during periods of extreme cold because more people use fireplaces to heat their homes. This effect is increased when power outages accompany the extreme cold. Carbon monoxide poisoning is another related hazard of indoor wood-fire heat.

With extended periods of extreme cold, secondary environmental hazards may arise, such as ice jams or shoves on major waterways. Flooding behind the jammed ice can be disastrous, especially in conjunction with the extremely cold temperatures that threaten anyone without shelter. Equipment and infrastructure required for heating, transportation, power generation and transmission, and other services may not be functional in extremely cold conditions. Roadways can become more dangerous at very low temperatures (below -20) because salt is no longer able to melt the ice. While wild animals are typically able to cope with the cold weather, pets are highly susceptible to frostbite and hypothermia.

Historical Analysis: Vilas County, and Lac du Flambeau specifically, experience some of the coldest average temperatures in Wisconsin (see Figure 24).[15] A historical and media search finds that notable periods of extreme cold occurred in 1912, 1936, 1951, 1982, 1994, 1996, 1999, 2006, 2007, 2014 and 2018.[16,17] In January of 2014, wind chill temperatures reached 55 below zero, knocking out power to many residents, forcing the closure of schools, government and community services (e.g., the Rhinelander Food Pantry, Meals on Wheels, and the Kids in Need community service project), and requiring the Lac du Flambeau government and others in Vilas County to open warming shelters. This event coincided with a propane shortage, which increased health and safety risk due to the fact that so many homes rely on propane for heating needs. Many residents were forced to seek shelter in community shelters or with friends and neighbors. More broadly across the state, impacts included frozen water intakes at major energy utilities.

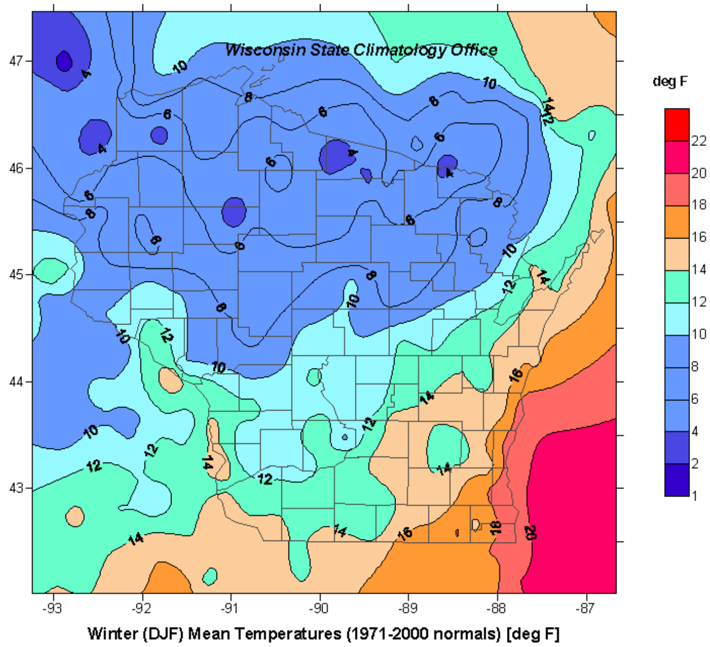

Figure 24: Average winter (December, January, February) temperatures for the State of Wisconsin. Temperatures in Vilas County and the Reservation are in the single digits well below freezing.

Vulnerability and Risk Assessment: Geographic exposure is relatively uniform across the Lac du Flambeau Reservation. Among residents, the elders and very young children, those with functional and cognitive needs, and those in low income households are at greatest risk.

Table 17: Vulnerability and risk assessment for Extreme Cold summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	Based on historical frequency, the Lac du Flambeau tribe should anticipate periods of extreme cold every 8-12 years, equating to a 10% probability in any given year. More recently, probabilities have increased given there have been 6 events in 25 years which equates to 1.1 events per 4-year period.	4

[15] Wisconsin State Climatology Office. 2018.http://bit.ly/2KrEjoY.
[16] Lakeland Times. 2014. "The Weather Outside Has Been Frightful". January 6. http://bit.ly/2JFnEwQ.
[17] NOAA National Centers for Environmental Information Storm Events Database. http://bit.ly/2jjgfYW.

Trend	Climate change results in greater temperature variability. However, climate predictions show winter temperatures increasing 2.3°F to 5.3°F degrees across the Resilience Initiative project boundary by 2050. In that same timeframe, the number of days with below zero lows will decrease by 13 to 27 days per year.	1
Health / Public Safety	Extreme cold events can cause frostbite. Those without access to reliable home heating are more susceptible. Most people will be able to find relief in community warming centers or with friends and neighbors. Socially isolated senior citizens, those with functional needs, and poor households are most at risk. During very cold or prolonged events, many households will be impacted by the public health impacts of extreme cold weather. .	2
Home/Property Damage	Home and property damage are common during periods of extreme cold as a result of frozen water pipes and septic systems.	2
Livelihood	Businesses and other places of employment may need to close as result of extreme cold.	1
Infrastructure	Extreme cold can lead to power failure when water intake points at power generation facilities become frozen. Excessive demand on both power and propane can result in outages or shortages.	3
Recovery Costs	Costs are primarily associated with the need to use alternate road treatment, and with the repair of damages caused by frozen pipes.	1
Environment	No likely impact.	0
Cultural / Historic	No likely impact.	0
Government Services	Government services have closed for multiple days during past extended periods of cold weather.	2
Business / Agriculture	Some businesses will be forced to close due to the danger of employee exposure, the loss of utility access, damage to water pipes or sewage, and other reasons.	1
Risk Acceptability	Assigned by workshop participants.	1
Mitigation Potential	High expected return on investments.	2

12. School Violence / Armed Attack / Workplace Violence

Background: Attacks involving edged weapons, firearms, explosives, or other weapons can inflict a high number of casualties in a very short timeframe, overwhelming immediate response capacity and leading to profound secondary effects that disrupt the community and adversely affect lives. The risk from armed attacks exists in schools, in places of business, in places of worship, in government facilities, and in public places, among others.

Recent high-profile armed attacks and incidents of workplace violence include the 2009 Fort Hood shooting (13 killed, 44 injured), the 2015 San Bernardino shooting (16 killed, 23 injured), the 2016 Orlando Pulse Nightclub shooting (50 killed, 53 injured), and the 2017 Las Vegas shooting (59 killed, 851 injured). School shootings are notable in their physical and psychological impact given the young age and vulnerability of victims. However, despite the high-profile nature of these events, they remain relatively rare when data is nationalized.

Historical Analysis: While shootings (including those resulting in fatalities) have occurred in Lac du Flambeau, there have been no mass shootings or other significant instances of armed attack in Lac du Flambeau. The frequency of these events is unlikely to be altered with changing climate conditions.

Vulnerability and Risk Assessment: Armed attacks are possible in all communities in the United States, and all communities are likewise vulnerable to them. Given the prevalence of private gun ownership in the United States, elimination of this risk is unrealistic. Prevalence of preparedness training and communications in schools and places of employment, including "Run, Hide, Fight" and standard lockdown drills help to reduce the likely impacts of such events.

Table 18: Vulnerability and risk assessment for School Violence / Armed Attack / Workplace Violence summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	The likelihood of an armed attack in Lac du Flambeau is low (one event every 20-100 years)	2
Trend	There are no anticipated changes in hazard probability on account of climate change, population dynamics, or other factors.	2
Health / Public Safety	Armed attacks have the potential to result in a high number of injuries and/or fatalities.	3
Home/Property Damage	No likely impact.	0
Livelihood	No likely impact.	0
Infrastructure	No likely impact.	0
Recovery Costs	Recovery costs from an armed attack are likely to be low and pertain to repair of public facilities and costs associated with injury and fatality response.	1
Environment	No likely impact.	0
Cultural / Historic	Cultural and historical risk from armed attacks is associated with the loss of key members of the community.	1

Government Services	Government services, namely access to public school, may be impacted for several days in the event of an armed attack.	2
Business / Agriculture	No likely impact.	0
Risk Acceptability	Assigned by workshop participants	2
Mitigation Potential	High expected return on investment.	2

13. Dam Failure

Background: There is only one official water control structure on the Lac du Flambeau reservation. There are two regulated Dams in the region with the potential to release water downriver and directly affect the reservation. While dam failure can be related to extreme precipitation events and the forces associated with extremely high-water levels, this primarily a technological or man-made hazard where the failure of the dam structure has the potential to affect communities and natural resources downstream of the dam.

Historic Analysis: Dam failures have not happened in Vilas County or the Reservation in the past. Though, there are some aging dams that are concerns for tribal members.

Vulnerability Assessment: The tribe is particularly concerned about the potential for a dam failure to affect downstream natural and cultural resources such as *Manoomin* (Wild Rice). The unexpected release of water downstream, particularly in the floating leaf stage of wild rice development has the potential to uproot the seedlings and lead to the failure of the wild rice harvest in the affected streams and lakes.

Table 19: Vulnerability and risk assessment for Dam Failure summarizing assessment and scores for each measure.

Measure	Assessment	Value
Probability	The likelihood of a dam failure affecting the reservation is rare (less than 1 event every 100 years).	1
Trend	There are no anticipated changes in hazard probability on account of climate change, population dynamics, or other factors.	2
Health / Public Safety	A significant dam failure has the potential to injure people where the water surge flows.	2
Home/Property Damage	Dam failure could result in property damage for more than 35 homes.	3
Livelihood	No long-term impacts to livelihoods are expected	0
Infrastructure	The cost of repairing the dam alone will have a significant impact on the community.	3

Recovery Costs	Recovery costs from a failure are likely to be high	3
Environment	The potential damage to wild rice harvest areas alone is enough to make these impacts potentially severe.	3
Cultural / Historic	Cultural and historical risk from a dam failure could be severe given the connection to wild rice.	3
Government Services	Government services are unlikely to be affected for more than a day.	1
Business / Agriculture	Business and in particular wild rice harvest could be affected.	3
Risk Acceptability	Assigned by workshop participants	1
Mitigation Potential	Standard return on investment.	1

Part IV: Mitigation Strategies (Element C)

Development Process

The development and prioritization of mitigation actions followed the process describes in Section X.X. These actions were drawn from existing tribal activities, actions that are being taken by other communities facing similar hazards, and the tribal staff member's recommendations. The TERC worked together both in sub-committees and in a full group during a workshop to refine and prioritize the actions.

Criteria for Evaluating Actions

For each of the key hazards, the project team and the TEPC identified key goals to guide the development of specific actions. Those actions were then refined and prioritized using the following criteria. The TEPC assigned rankings to each of the following categories:

- Feasibility: a combined ranking of the politically and technically feasibility on an action;
- Cost: an initial assessment of the overall cost of the action broken into three categories: low cost (< $10,000), medium cost (< $10,000 and < $100,000), and high costs (> $100,000);
- Timing: the ideal timing for implementation (immediate, short-term (1-3 years), medium term (4-5 years), and long-term (> 5 years); and
- Synergies with existing programs: Overlap with existing programs that could be used for implementation.

These factors were considered and combined by the TEPC to identify an implementation priority for each action (low, medium, high). As part of this process, the TEPC also identified the department or organization who would be the lead on the implementation and if any specific partners would be required for the implementation to be successful.

Priority Actions

A set of 15 key actions were identified by the TEPC as priorities for initial implementation. These included actions from most of the key tribal departments represented by members of the TEPC and represent initial starting points for the implementation of hazard mitigation actions.

Table 20: Phase I- Implementation actions identified by the TEPC as starting points for action.

Actions for Phase 1 Implementation	Responsible Party(ies)	Priority
Enhance support for Drug Endangered Children (DEC) and adult response team that will coordinate with other tribal programs.	LdF DEC Team	high
Review and apply for any funding relating to substance abuse issues including intervention, prevention and treatment.	Planning Dept.	high
Enhance partnerships with other local agencies to provide public education and outreach on all substances and where addicts can find assistance for treatment and recovery.	State of Emergency	high
Continue/Enhance Training of school personnel with a focus on the School Safety Team. Use team to respond to threat situations and mental health issues.	Schools	high
Expand community educational campaign about ways to avoid vector borne diseases (especially for Elders/youth). Develop messages that are easily understood by the target audience.	Community Health, Clinic, Vilas County PH, Natural Resources	high
Monitor and expand list of vulnerable populations within LDF reservation with low capacity and few resources to adapt to extreme heat conditions (e.g., chronic diseases, elders).	Community Health, Elders Program, Clinic, Emergency Mgmt	high
Expand food sovereignty efforts through more community gardens, cultivating traditional plants, and through land management projects to provide opportunities to connect people (especially youth) back to the land. Expand efforts to teach people how to gather and process traditional foods, to promote culture, healthy diet.	Natural Resources (Gitigaan Coalition), Planning	high
Expand existing programs to increase youth empowerment, including youth forums, language revitalization, community organizing trainings to support further reintegration back into culture.	Natural Resources (Gitigaan Coalition), Planning, Youth Center, THPO, Language Program	high
Work to document tribal stories through storytelling, book writing, and other forms to get the truth of traumas out and heal the wounds of past generations.	Clinic, Language Program, THPO, Family Circles, Youth Center, Elder Program	high
Protect and mitigate existing impacts to the forests along the wetlands and riparian areas, and within the wetlands system. Monitor vegetation changes in watersheds through ground cover surveys, aerial photography or by relying on the research from local conservation groups and universities. Integrate assessment of potential impacts to cultural and historical resources.	Water Resource Program, Natural Resources, LUA team	high
Invest in and utilize green infrastructure to help control runoff, capture stormwater, and reduce water demand. Some common green infrastructure practices include bioretention areas (rain gardens), low impact development methods, green roofs, swales (depressions to capture water) and the use of vegetation or pervious materials instead of impervious surfaces.	Water Resource Program, Natural Resources, LUA team, Planning, Roads Dept.	high
Conduct outreach activities to increase awareness of tornado risk, to include (but not be limited to): i. Educating citizens through Public Service Announcements ii. Conducting tornado drills in schools and public buildings. iii. Teaching school children about the dangers of tornadoes and how to take safety precautions. iv. Distributing tornado shelter location information. v. Supporting severe weather awareness week. vi. Promoting use of NOAA weather radios.	Emergency Management, Communication Office	high
Continue to identify special needs populations (homebound, durable medical, handicap...) at particular risk from lack of shelter, isolation, and cold temperatures, especially as may occur during extended power outages.	Elder Services	high
Continue to work with Oneida County to maintain Level B Hazardous Materials Response Team support	Emergency Management	high
Provide local household Hazardous Materials Disposal options either continuously or on a bi-annual or quarterly basis.	Natural Resources	high

All Hazard Mitigation Actions

1. All Hazards

Goal: The goal of these hazard mitigations actions is to prepare and protect all residents and visitors from all hazards.

Table 21: Actions to mitigate the risk of all natural and manmade hazards affecting the community.

Community Safety & Security Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
ALL HAZARDS						
Promote NOAA Radios ($30 per radio - 4,000 radios) for use during weather-related safety and security events.	high	Immediate	low (< $10K)	Emergency Management	Community health, elders, PCHC, School, Elder Care	High
Maintain active, effective educational and information/communication on community, safety and security issues.	high	Immediate	low (< $10K)	Communications	All programs - Indian child welfare, community health, school	High
Purchase or develop a mobile incident command center to coordinate response activities across all departments ($100,000-$150,000).	medium	Short-term (1-3 years)	high (> $100K)	Law enforcement, Emergency Management	Vilas County Emergency Response	medium

2. Plant and Animal Epidemic / Invasive Species / Species Loss

The potential loss of plant and animal species that are important to the Tribe's history, culture, and lifeways, is a critical concern and hazard facing the community. The development of the pre-disaster hazard mitigation plan is being completed in conjunction with the tribe's climate adaptation plan that focuses on these natural resources and an initial set of 20 key plant and animal species. Detailed actions for each of these species are incorporated by reference into this plan.

Goal: The goal of these hazard mitigations actions is to reduce the risk and extent of loss of critical natural resources (plant and animal species) and the spread of invasive species on individuals, families, and the community as a whole. Implementation of these actions will help ensure the health and wellness of the community, as well as decrease the incidence of other man-made hazards.

Table 22: Actions to mitigate the risk of Plant & Animal Epidemics / Invasive Species / Species Loss

Community Safety & Security Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
Plant and Animal Epidemic / Invasive Species / Species Loss						
Implement all of the high-priority actions developed as part of the Climate Change Adaptaiton planning process	medium	Short-term (1-3 years)	high (> $100K)	Natural Resources, Forest Management, Fisheries, Others.	Planning	high

Community Health Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
MENTAL HEALTH IMPACTS FROM LOSS OF NATURAL RESOURCES						
Expand food sovereignty efforts through more community gardens, cultivating traditional plants, and through land management projects to provide opportunities to connect people (especially youth) back to the land. Expand efforts to teach people how to gather and process traditional foods, to promote culture, healthy diet.	high	Immediate	high (> $100K)	Natural Resources (Gitigaan Coalition), Planning	Gitigaan Coalition, GLIFWC	high
Expand existing programs to increase youth empowerment, including youth forums, language revitalization, community organizing trainings to support further reintegration back into culture.	high	Immediate	high (> $100K)	Natural Resources (Gitigaan Coalition), Planning, Youth Center, THPO, Language Program	Gitigaan Coalition, GLIFWC	high
Expand opportunities to have ceremonies to increase multi-generational exchange and healing.	high	Immediate	medium ($10K to $100K)	Clinic, Language Program, THPO, Family Circles, Youth Center, Elder Program	Clinic, Language Program, THPO, Family Circles, Youth Center, Elder Program	high
Work to document tribal stories through storytelling, book writing, and other forms to get the truth of traumas out and heal the wounds of past generations.	high	Immediate	medium ($10K to $100K)	Clinic, Language Program, THPO, Family Circles, Youth Center, Elder Program	Library programs	high
Secure additional funds to expand mental health services.	high	Short-term (1-3 years)	high (> $100K)	SOE, Clinic, Family Resource Center, Planning		high
Expand opportunities to engage the community in nature preservation projects and efforts.	high	Immediate	medium ($10K to $100K)	Natural Resources Dept		medium

3. Illegal Drug Crisis

Goal: The goal of these hazard mitigations actions is to reduce the risk and extent of impacts of illegal drug usage on individuals, families, and the community as a whole. Reducing the burden on emergency responders, public health, and public safety staff will create more capacity for these providers to assist in responses to other hazards.

Table 23: Actions to mitigate the risk of the Illegal Drug Crisis

Community Safety & Security Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
ILLEGAL DRUG CRISIS						
Continue to update the Tribal Action Plan (TAP) on a continuous basis.	high	Immediate	low (< $10K)	Prevention program, HCAT -healthier community action team, State of Emergency, School, MINO, DHS Program managers	Tri-county gov't level- Three tribes	high
Enhance existing counseling efforts.	high	Immediate	medium ($10K to $100K)	FRC -Director, PCHC Administration, Community Health Supervisor, State of Emergency	Family Resource Center Community Health GookomisEndaad, Seven	high
Enhance police education on prevention of use - illicit/misused drugs and paraphernalia.	high	Immediate	medium ($10K to $100K)	Police Dept	Prevention Programs, local coalitions	high
Enhance police enforcement on drug interdiction on illicit/misused drugs and paraphernalia.	high	Immediate	high (> $100K)	Law enforcement (conservation and police)	Tribal Courts - Wellness Courts,	high
Enhance support for Drug Endangered Children (DEC) and adult response team that will coordinate with other tribal programs.	high	Immediate	high (> $100K)	LdF DEC Team	Vilas county DEC Team	high
Enhance mental health screening process during regular check-ups at the health clinic.	high	Immediate	low (< $10K)	PCHC, FRC, Community Health, PCDC	School, Vilas County public health. local councilers	high
Build a Safe House for children in families dealing with an emergent drug situation.	medium	Short-term (1-3 years)	high (> $100K)	Family Services		high
Build a Mentor House for children in families dealing with an long-term drug situation.	medium	Short-term (1-3 years)	high (> $100K)	H-CAT		medium
Create a permanent emergency shelter/safe house for other people(s) facing a drug crisis.	medium	Short-term (1-3 years)	high (> $100K)	SOE	Emergency Shelter Supervisor	low
Review and apply for any funding relating to substance abuse issues including intervention, prevention and treatment.	high	Immediate	medium ($10K to $100K)	Planning Dept.	All other agencies/Dept	high
Increase and sustain targeted distribution of Naloxone to people who use drugs, family members of those who use drugs, and first responders.	high	Medium-term (4-5 years)	medium ($10K to $100K)	Prevention Program - PCHC	Planning Dept, Community health (long term home)	medium
Partner with local medical professionals and organizations in Neighboring towns to provide Medication-Assisted Treatment (MAT) (e.g.,	medium	Immediate	medium ($10K to $100K)	PCHC, GE,	Seven Generation, FRC	high
Continued support of Syringe Service Program.	high	Immediate	medium ($10K to $100K)	Community Health	Lots of programs - police, schools. youth center	medium
Enhance partnerships with other local agencies to provide public education and outreach on all substances and where addicts can find assistance for treatment and recovery.	high	Immediate	low (< $10K)	SOE	Local Coalitions -FRC, state access to treatment	high
Increase ability for the Tribe to provide treatment/recovery facilities for all age groups.	high	Short-term (1-3 years)	high (> $100K)	Planning, PCHC, SOE, FRC, GE		high
Increase youth knowledge of substance abuse risk and benefits through school programs and community events.	high	Immediate	low (< $10K)	SOE	Local Coalitions -FRC, state access to	high

4. Severe Thunderstorms / Lightning / Hail

Goal: The goal of these hazard mitigations actions is to minimize the threat to human life and property caused by associated thunder and lightning.

Table 24: Actions to mitigate the risk of Severe Thunderstorms / Lightning / Hail

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
SEVERE THUNDERSTORMS AFFECTING WATER QUALITY						
Develop models to understand potential water quality changes.	medium	Short-term (1-3 years)	high (> $100K)	Natural Resources, Planning, Outside Federal Agencies		medium
Work with Federal partners to preserve or restore wetlands ecosystems in buffer zones along rivers and lakes for flood control and water quality management. Re-assess buffer zone setbacks.	high	Immediate	medium ($10K to $100K)	Water Resources Program, Natural Resources, Land Use, Planning, Conservation Code Committee		medium
Expand work with utility companies to reduce sediment and nutrient inputs into source water bodies, regulate runoff (construction site) and streamflow, buffer against flooding (e.g. wetlands).	high	Immediate	low (< $10K)	LUA Team	Ongoing projects are occurring.	medium
Work with Federal partners to take action through existing authorities to ensure enforcement of water quality standards.	high	Immediate	medium ($10K to $100K)	Water Resource Program, Tribal Council/Gov't, Natural Resources		high
Protect and mitigate existing impacts to the forests along the wetlands and riparian areas, and within the wetlands system. Monitor vegetation changes in watersheds through ground cover surveys, aerial photography or by relying on the research from local conservation groups and universities. Integrate assessment of potential impacts to cultural and historical resources.	high	Immediate	low (< $10K)	Water Resource Program, Natural Resources, LUA team		high
Integrate climate change projections into consideration for new and existing stormwater and sewer infrastructure improvements.	high	Immediate	high (> $100K)	Water Resource Program, Natural Resources, LUA team, Planning		high
Invest in and utilize green infrastructure to help control runoff, capture stormwater, and reduce water demand. Some common green infrastructure practices include bioretention areas (rain gardens), low impact development methods, green roofs, swales (depressions to capture water) and the use of vegetation or pervious materials instead of impervious surfaces.	high	Immediate	high (> $100K)	Water Resource Program, Natural Resources, LUA team, Planning, Roads Dept.		high
Conduct education and outreach about green infrastructure to help control runoff, capture stormwater, and reduce water demand. Some common green infrastructure practices include bioretention areas (rain gardens), low impact development methods, green roofs, swales (depressions to capture water) and the use of vegetation or pervious materials instead of impervious surfaces.	high	Immediate	low (< $10K)	Water Resource Program, Natural Resources, LUA team, Planning, Roads Dept., Communications Dept		high
Improve enforcement of existing codes or create new codes related to septic systems and private wells.	medium	Short-term (1-3 years)	high (> $100K)	Water Resource Program, Natural Resources, LUA team, Planning		medium

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
THUNDER LIGHTNING & HAIL						
Educate public of dangers - Partner with the schools to complete lightning awareness program (brochure, warnings at parks, school curriculum enhancements).	high	Immediate	low (< $10K)	Emergency Management, Communications	Schools	high
Research and Retrofit structural shelters at public parks and athletic fields with grounding, where needed.	high	Short-term (1-3 years)	high (> $100K)	Faciities	Planning, parks and recreation	medium
Require tie-downs with anchors and soil type-specific ground anchors for manufactured homes.	medium	Short-term (1-3 years)	medium ($10K to $100K)	Property owners -	Building Codes	medium
Encourage the use of laminated or impact resistant glass for tribal buildings, businesses, and homes.	medium	Short-term (1-3 years)	medium ($10K to $100K)	Property owners -	Building Codes	low
Require chimneys extending six feet or more above a roof to have continuous reinforced steel bracing.	medium	Short-term (1-3 years)	medium ($10K to $100K)	Property owners -	Building Codes	low

5. Epidemic / Pandemic / Vector-Borne Disease

Goal: The goal of these hazard mitigations actions is to protect the health and safety of community residents especially in the face of communicable and vector borne diseases.

Table 25: Actions to mitigate the risk of Epidemic / Pandemic / Vector-Borne Disease

Community Health Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
GENERAL CLIMATE/HEALTH						
Integrate climate change health issues into all comprehensive plans such as emergency management, public health preparedness, town/county/regional planning, forest service, education, transportation and air and water quality.	high	Immediate	low (< $10K)	TCRP/TEPC	CLIMATE RESILIENCE INITIATIVE	high
Partner and engage with public agencies, researchers, grassroots civic groups and private business to identify common issues related to climate change in the area including the TRCP group.	medium	Short-term (1-3 years)	low (< $10K)	TCRP/TEPC	CLIMATE RESILIENCE INITIATIVE	medium
Provide opportunities for education related to climate change and health as new information becomes available and new hires occur. Seek funding for additional training and support related to climate health issues.	high	Short-term (1-3 years)	low (< $10K)	COMMUNITY HEALTH, ADMINISTRATION, HUMAN RESOURCES	CLIMATE RESILIENCE INITIATIVE	high
Create a local Climate and Health web page within your tribe's web site. Focus could include topics related to climate adaptation, mitigation strategies, as well as up to date information on how our air, water and weather are changing in our county.	high	Immediate	low (< $10K)	TCRP/TEPC; ADAPT INT'L	CLIMATE RESILIENCE INITIATIVE	high
Continue and improve social media presence for emergency response during and/all climate-health related incidents. By utilizing Facebook and other various social media information can be provided to the community on where to obtain health services during disasters.	low	Short-term (1-3 years)	low (< $10K)	EMERGENCY MGMT	HAZARD MITIGATION PLAN	medium

Community Health Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
EPIDEMIC / PANDEMIC / VECTOR-BORNE DISEASES						
Create social-distancing SOPs for government offices, and the casino.	high	Short-term (1-3 years)	low (< $10K)	Emergency Mgmt, Tribal Council/Gov't/President	Climate Resilience INitiattive	high
Expand waterless hand washing stations in public places.	medium	Short-term (1-3 years)	low (< $10K)	Community Health, Building Facilities Mgr, Planning		high
Continue process for creation of responses plan as new vector borne diseases emerge.	high	Immediate	low (< $10K)	Community Health, Emergency Mgmt, Vilas County PH	Ongoing programs exist -	high
Expand community educational campaign about ways to avoid vector borne diseases (especially for Elders/youth).	high	Immediate	low (< $10K)	Community Health, Clinic, Vilas County PH, Natural Resources	Ongoing programs exist -	high
Expand monitoring and tracking of vector borne diseases in the WEDSS system. Enhance community education to increase reporting. Monitor broader vector borne disease trends.	high	Immediate	low (< $10K)	Community Health, Clinic, Vilas County PH	Ongoing programs exist -	medium
Work with Town and Tribal authorities to require new developments in at-risk areas to include features that reduce habitat and mitigate health risk of vector populations.	medium	Medium-term (4-5 years)	high (> $100K)	LUA, NR, Planning		medium
Expand the coordination between local natural resource agencies and Vector Control programs to ensure that emergency vector control occurs in extreme cases of disease outbreaks, and that vector populations are managed in a way that protects human health, regulatory compliance, and ensures ecological integrity and vitality.	medium	Medium-term (4-5 years)	medium ($10K to $100K)	Solid Waste, Environmental PH, NR		medium

6. Flood (flash flood, lake, river, stormwater)

Goal: The goal of these hazard mitigations actions is to protect the safety and property of all residents from extreme water levels.

Table 26: Actions to mitigate the risk of Flooding

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
FLOODING AFFECTING HOMES & BUILDINGS						
Adopt a post-disaster recovery ordinance that prevents high-risk repair and reconstruction activities, primarily based on flood-map designations and assessed risk.	high	Short-term (1-3 years)	medium ($10K to $100K)	LUA Team		medium
Develop flood management systems that better utilize natural floodplain processes.	low	Long-term (>5 years)	low (< $10K)	Emergency Mgmt		low
Enhance existing ordinances which manage riparian buffers along rivers, streams, lakes, and other water bodies.	high	Short-term (1-3 years)	low (< $10K)	Natural Resources		medium
Expand programs working to protect sensitive land from development using land acquisition through purchase.	low	Long-term (>5 years)	high (> $100K)	Land Management		high
Maintain and enhance the tribal stormwater management plan. Include an evaluation of the tribe's vulnerability to drainage pipe (Stormwater Conveyance) flooding and identify appropriate solutions to minimize those risks (e.g., pass ordinances that ban dumping or blocking of natural and man-made drainage systems). Establish a surface flooding reporting and tracking system to allow for mapping of the tribe's changing flood risk (stormwater management).	high	Short-term (1-3 years)	medium ($10K to $100K)	Planning/Natural Resources, Tribal Roads		high
Ensure that the Conservation Code committee continue to meet periodically to discuss issues and recommend projects.	high	Immediate	low (< $10K)	Conservation Code		high
Continue to record high water events and review emergency plans to adjust plan accordingly.	high	Immediate	low (< $10K)	Roads, Natural Resources, Emergency Mgmt		high
Expand efforts to conduct routine cleaning of debris from storm drainage systems and bridge bracing and purchase equipment.	high	Immediate	medium ($10K to $100K)	Natural Resources, Roads		high
Continue to create and disseminate information to the public for flood related emergencies (reference Disaster Debris Management).	high	Immediate	medium ($10K to $100K)	Emergency Mgmt, Planning, Tribal Roads, Healthy Homes Committee		medium
Install and elevate backup power sources to maintain some level of power during events that could cause grid power failure at critical community facilities (e.g., Generators for Fuel pumps).	high	Short-term (1-3 years)	high (> $100K)	Community Facilities, Planning, Roads, Water & Sewer		high

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
FLOODING AFFECTING THE WATER TREATMENT PLANT						
Ensure water treatment facilities and equipment are floodproofed. Elevate waste water equipment, make pumps submersible, and protect electrical equipment. Construct external flood barriers, install sandbags temporarily, and provide backup power generation to pumping stations. Integrate shifting weather patterns into facility design and management processes. Identify thresholds for damage (e.g., the elevation of facilities, combined with precipitation totals could define the flood stage that could overtop barriers) and develop strategies focused on mitigating and building resilience for those thresholds.	high	Immediate	high (> $100K)	Water & Sewer, Emergency mgmt, Planning, NR		high
Develop an MOU to provide for bottled water/water trucks in cases of contamination.	high	Immediate	medium ($10K to $100K)	Emergency mgmt		high
Invest in supplies which can assis in cases of long-term power outages, to include portable generators, portable lift station, and a third back up wellhead.	high	Immediate	high (> $100K)	Emergency mgmt, Water & Sewer		high

7. Severe Winter Storms / Ice Storms

Goal: The goal of these hazard mitigations actions is to protect the health and safety of tribal residents from the adverse effects of heavy snow, blizzards, or other severe winter conditions.

Table 27: Actions to mitigate the risk of Severe Winter Storms / Ice Storms

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
WINTER STORMS						
Review and continue the priority system for opening roads and highways.	high	Immediate	high (> $100K)	Tribal Roads,	Town of Lac du Flambeau, Connection with other department for shared equipment use	high
Identify buildings appropriate for shelters (warming centers) and coordinate with American Red Cross.	high	Immediate	medium ($10K to $100K)	Emergency Management	Casino, Natural Resources, Public Library	high
Expand public education efforts on dangers of winter storms.	high	Immediate	low (< $10K)	Emergency Management		medium
Ensure construction codes require minimum roof load capacity that exceeds the maximum expected snow accumulation (across multiple storms) and encourage snow removal.	high	Immediate	low (< $10K)	Tribal Council	Planning	medium
Require updated codes/systems to shadow LEED requirements for any public facility renovation or construction project.	low	Long-term (>5 years)	medium ($10K to $100K)	Facilities		medium
Identify redundant power needs and install integrated generators as required, particularly for critical facilities, special needs populations.	medium	Short-term (1-3 years)	high (> $100K)	Facilities, Casino	WPS - priority list, school,	medium
Continue to identify special needs populations (homebound, durable medical, handicap...) at particular risk from lack of shelter, isolation, and cold temperatures, especially as may occur during extended power outages.	high	Immediate	low (< $10K)	Elder Services	Public Health Vilas County, Community Health.	high

8. Forest / Wildland Fire

Goal: The goal of these hazard mitigations actions is to protect the safety and property of residents from forest and wildfires.

Table 28: Actions to mitigate the risk of Wildfire / Structure Fire

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
WILDFIRES AFFECTING HOMES & BUILDINGS						
Enhance community education on how to reduce fire risk on individual properties, promote fire safety, and appropriate responses during wildfire events.	high	Immediate	low (< $10K)	Fire Department	Natural Resources, forestry,	medium
Encourage the use of non-combustible construction materials for new construction.	low	Long-term (>5 years)	low (< $10K)	Chippewa Housing Authority,	Planning, land management, HUD -	low
Increase the protection of external propane tanks for both residential and commercial properties (citing, physical protections, education).	medium	Short-term (1-3 years)	medium ($10K to $100K)	Chippewa Housing Authority,	Planning, land management, HUD -	high
Encouage community members to follow the standars of a fire buffer program (vegetation) such as use of the FireWise Community standards.	medium	Long-term (>5 years)	low (< $10K)	Land Management,Chippewa Housing Authority,	Private land owners, Town of Lac du Flambeau	low
Expand efforts to develop defensible zones around infrastructure network components (e.g., power, water, gas, other) including fire equipment access.	high	Short-term (1-3 years)	medium ($10K to $100K)	Water and sewer	Wisconsin Electric	medium
Promote fire safety and safe evacuation routes for both residential and commercial areas.	medium	Medium-term (4-5 years)	low (< $10K)	Fire department, emergency management, tribal roads	Town of Lac du Flambeau, vilas county	low
Explore becoming a "Firewise USA" community (https://www.nfpa.org/Public-Education/By-topic/Wildfire/Firewise-USA).	high	Immediate	low (< $10K)	Fire and Forestry		low
Expand controlled burns and study the enhancement of firebreaks near critical facilities and neighborhoods.	high	Immediate	high (> $100K)	Wildlife, forestry	Roads, wildlife management	high
Monitor trends in forest condition and climate to proactively identify areas high susceptibility to wildfire.	high	Immediate	medium ($10K to $100K)	Forestry Department	Fuels management plan	high
Coordinate with County and State Division of Forestry for public education related to fire management plans for effective control of wildfires in protection zones near communities and focus on removal of hazard fuels, prescribed fire, and emergency evacuation plans.	high	Immediate	low (< $10K)	Forestry Department		medium
Ensure adequate shelters are in place as part of wildfire emergency response plans to provide a health and safe temporary (Red Cross) shelter for those displaced by fires.	high	Immediate	low (< $10K)	Emergency Management	Hotel - Red Cross for displaced people	medium
Identify high fire risk areas and encourage the safe burial of existing power lines to avoid interruptions due to wildfire events.	high	Short-term (1-3 years)	medium ($10K to $100K)	Land use programs	WPS - Existing program to burry lines for winter storms	high
Prepare to provide public buildings as "clean-air" spaces for emergency air quality situations such as wildfire smoke.	low	Long-term (>5 years)	high (> $100K)	Casino,	schools?	low
Encourage training and support for wildfire management response for local fire crews.	high	Immediate	low (< $10K)	fire department,	certified wildland firefighters	medium

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
STRUCTURAL FIRE						
Review building codes and zoning ordinances and update to require or provide incentives such as FireSmart building standards for new builds and renovations and the installation of sprinkler systems in commercial buildings.	medium	Short-term (1-3 years)	low (< $10K)	fire department	emergency management, facilities, chippewa housing authority	medium
Enhance training for fire department personnel on the latest response techniques.	high	Immediate	medium ($10K to $100K)	fire department		medium
Encourage the development of CERT team membership within the community.	medium	Immediate	low (< $10K)	Emergency Management		medium

9. Hazardous Materials Release / Contamination / Run-off

Goal: The goal of these hazard mitigations actions is to protect people and the natural environment from adverse effects of hazardous materials incident.

This category includes the release of potentially hazardous chemicals due to either a natural event, such as flooding, or an intention man-made release. Additional actions related to reducing the risk of a terrorist attach using gun violence are included in the school and workplace violence hazard actions.

Table 29: Actions to mitigate the risk of natural or man-made Hazardous Materials release.

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
HAZARDOUS MATERIALS INCIDENTS CONTAMINANTS						
Level B Training for Response Team members for Lac du Flambeau.	low	Long-term (>5 years)	high (> $100K)	Fire Department	Town Fire Department	low
Continue to work with Oneida County to maintain Level B Hazardous Materials Response Team support	high	Immediate	low (< $10K)	Emergency Management	Oneida County	high
Monitor truck shipments of hazardous materials both to and from tribal lands and passing through Tribal lands.	high	Immediate	medium ($10K to $100K)	Emergency Management	Environmental Response, Natural Resources	low
Provide local household Hazardous Materials Disposal options either continuously or on a bi-annual or quarterly basis.	high	Short-term (1-3 years)	high (> $100K)	Natrual Resources	Oneida County, Advanced disposal transfer center	high
Consider how to create and then disseminate information to the public for new extreme-weather related emergencies (e.g., what to do with toxic materials that may be in a flooded basement, what to do with the water in a basement that becomes contaminated, etc.).	high	Short-term (1-3 years)	low (< $10K)	Natrual REsources	Planning, Communications	low

Community Safety & Security Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
TERRORISM						
Expand education and awareness for the community of the potential threats and encourage the "See Something, Say Something" Campaign.	high	Immediate	low (< $10K)	Emergency Management, law enforcement	County Sheriff, Communications	medium
Maintain Standard Operating Procedures (SOPs) and communications across departments, with local, state and Federal agencies.	high	Immediate	low (< $10K)	Emergency Management, law enforcement	County Sheriff, State Agencies	medium
Continue to seek grant funding through FEMA/DHS Grants and Tribal Homeland Security Grants for terrorist and HAZMAT equipment to enable its emergency response personnel to prepare and respond to acts of terrorism and hazardous materials incidents.	medium	Short-term (1-3 years)	medium ($10K to $100K)	Planning - Environmental Response, Emergency Management, law enforcement		medium

10. Tornado / High Wind

Goal: The goal of these hazard mitigations actions is to protect health and safety of community residents and tourists and minimize loss of life and property.

Table 30: Actions to mitigate the risk of Tornadoes / High Winds

Extreme Weather Events and Infrastructure	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
TORNADOS/HIGH WINDS						
Maintain and improve warning system for all natural hazards. Extend Mass Warning System - location of tower(s), distribution of radios, promotion of weather spotter programs.	medium	Short-term (1-3 years)	high (> $100K)	Emergency Management	Planning	medium
Identify and define existing storm shelters. Map locations and share that with the community members.	high	Short-term (1-3 years)	low (< $10K)	Facilities Manager	Planning, land management, Emergency Management	low
Create signs identifying shelters both on and within buildings.	high	Immediate	low (< $10K)	Facilities Manager, Emergency Management		high
Encourage construction of safe rooms in new schools, daycares, and nursing homes.	medium	Short-term (1-3 years)	low (< $10K)	Emergency Management, Land Management	Facilities Management	medium
Encourage the construction and use of safe rooms in homes and shelter areas of manufactured home parks, fairgrounds, shopping malls, or other vulnerable public structures.	medium	Short-term (1-3 years)	low (< $10K)	Emergency Management, Land Management	Facilities Management	medium
Conduct outreach activities to increase awareness of tornado risk, to include (but not be limited to): i. Educating citizens through Public Service Announcements ii. Conducting tornado drills in schools and public buildings. iii. Teaching school children about the dangers of tornadoes and how to take safety precautions. iv. Distributing tornado shelter location information. v. Supporting severe weather awareness week. vi. Promoting use of NOAA weather radios.	high	Immediate	low (< $10K)	Emergency Management, Communication Office		high

11. Extreme Heat

Goal: The goal of these hazard mitigations actions is to protect the health and safety of community residents, particularly elders, youth, and those with special medical needs.

Table 31: Actions to mitigate the risk of Extreme Heat.

Community Health Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
EXTREME HEAT IMPACTS ON ELDERS & CHILDREN						
Monitor and expand list of vulnerable populations within LDF reservation with low capacity and few resources to adapt to extreme heat conditions (e.g., chronic diseases, elders).	high	Immediate	low (< $10K)	Community Health, Elders Program, Clinic, Emergency Mgmt	Emergency Mgmt's Heat Response Plan	high
Create a policy reservation-wide to ensure that all new buildings have A/C (especially using a "green building" standard sourcing energy from solar, geothermal and other sources).	high	Immediate	low (< $10K)	Planning, Tribal Facilities, CHA, Land Mgmt	Climate Resilience Initiative	high
Integrate policies into existing plans that protect, maintain, and enhance tree canopy in urban settings to reduce heat (e.g., Forest Mgmt Plan, IRMP).	medium	Short-term (1-3 years)	low (< $10K)	Forestry, Natural Resources		medium
Seek funding for cooling efficiency measures, such as screening and shading devices.	medium	Medium-term (4-5 years)	low (< $10K)	Planning, CHA		medium

12. Extreme Cold

Goal: The goal of these hazard mitigations actions is to protect the health and safety of community residents, particularly elders, youth, and those with special medical needs.

Table 32: Actions to mitigate the risk of Extreme Cold

Community Health Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
EXTREME COLD IMPACTS ON ELDERS & CHILDREN						
Monitor and expand list of vulnerable populations within LDF reservation with low capacity and few resources to adapt to extreme heat conditions (e.g., chronic diseases, elders).	high	Immediate	low (< $10K)	Community Health, Elders Program, Clinic, Emergency Mgmt	Emergency Mgmt's Heat Response Plan	high
Identify buildings appropriate for shelters (warming centers) and coordinate with American Red Cross.	high	Immediate	medium ($10K to $100K)	Emergency Management	Casino, Natural Resources, Public Library	high
Expand public education efforts on dangers of extreme colde events.	high	Immediate	low (< $10K)	Emergency Management		medium
Identify redundant power needs and install integrated generators as required, particularly for critical facilities, special needs populations.	medium	Short-term (1-3 years)	high (> $100K)	Facilities, Casino	WPS - priority list, school,	medium
Continue to identify special needs populations (homebound, durable medical, handicap...) at particular risk from lack of shelter, isolation, and cold temperatures, especially as may occur during extended power outages.	high	Immediate	low (< $10K)	Elder Services	Public Health Vilas County, Community Health.	high

13. School Violence / Armed Attack / Workplace Violence

Goal: The goal of these hazard mitigations actions is to enhance protection and continue information sharing and coordination between local agencies and departments as well as federal and state, county, municipal emergency service and law enforcement agencies.

Table 33: Actions to mitigate the risk of School Violence / Armed Attacks / Workplace Violence

Community Safety & Security Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
SCHOOL & WORKPLACE VIOLENCE						
Enhance training for school personnel with a focus on the School Safety Team. Use team to respond to threat situations and mental health issues.	high	Immediate	medium ($10K to $100K)	School,	Emergency management, law enforcement, head start	high
Enhance regular active shooter drills with lockdowns (School and Workplace).	high	Immediate	low (< $10K)	Schools, PCHC	Casino	low
Review and enhance existing security measures at school buildings in tribal areas (Headstart, youth center) including visitor screening and registration, physical barriers, and alert and notification systems for teachers, students, staff, and parents.	medium	Short-term (1-3 years)	high (> $100K)	Jason - Facilities maintance, emergency management,	emergency management, law enforcement. neighboring school districts	medium
Review and update existing security measures in Tribal workplace areas including visitor screening and registration, physical barriers, and alert and notification systems for employees (dental clinic, tribal center, museum, health center, casino).	low	Short-term (1-3 years)	high (> $100K)	Jason - Facilities maintance, emergency management,	emergency management, law enforcement. All dept	medium
Maintain current deployment of school security officers/Liasion officers and increase security levels at schools.	high	Immediate	medium ($10K to $100K)	Police Department	Schools	low

14. Dam Failure

Goal: The goal of these hazard mitigations actions is to protect the safety and property of Lac du Flambeau community and all residents.

Table 34: Actions to mitigate the risk of Dam Failure

Community Safety & Security Actions	Feasibility (technical & political)	Timing	Cost	Responsible Party(ies)	Synergy with Other Policies & Programs	Priority
DAM FAILURE						
Conduct assessment of potential dam failure impacts on Tribal lands.	medium	Short-term (1-3 years)	medium ($10K to $100K)	Natural resources -risk management	planning	low
Encourage the Town/Municipalities to assess, inspect and maintain policies to help ensure continued structural integrity of dams. (Bear River, Rest Lake).	medium	Short-term (1-3 years)	low (< $10K)	Natural resources -risk management	planning	medium
Conduct inspections of the conditions publicly and privately maintained dams within tribal lands.	medium	Short-term (1-3 years)	low (< $10K)	Natural resources -risk management		medium
Identify Tribal structural and nonstructural measures designed to repair and enhance dam/levy systems.	low	Medium-term (4-5	low (< $10K)	Natural resources -risk management	Planning	low
Conduct a public education campaign concerning the potential impacts of a dam failure on tribal lands, businesses, critical infrastructure, and homes.	low	Medium-term (4-5 years)	low (< $10K)	Natural resources -risk management	planning	low
Consider removing homes, businesses and public infrastructure from areas in the immediate vicinity of identified dams.	low	Medium-term (4-5 years)	low (< $10K)	Natural resources -risk management	planning	low

Part V: Plan Updates (Element D)

Future Updates

In order for this multi-hazard mitigation plan to continue to be relevant and useful for the Tribe, it will need to be updated to reflect changes in on the ground risks in the community, enhanced understanding of changing climate conditions, and the emergence of new issues of concern. This update process will be part of a standardized system to review activities and projects and monitor and track implementation. The effort will include:

- An official review and update process for the complete hazard mitigation plan every five years that will generate a new hazard mitigation planning document that will be adopted by Tribal Council;
- The Tribal Emergency Planning Committee will continue to meet quarterly (or monthly) as needed to exchange information and provide updates on the implementation of the actions identified in this plan;
- The Tribal Emergency Planning Committee will annually review any new climate projections for the region or additional infrastructure development; and
- The Tribe's annual budgeting process will be informed by the hazard and resilience needs of the tribe. Each department responsible for actions identified in this plan will report to Tribal Council annually on the progress of implementing those actions, upcoming priorities for action, opportunities for external funding, and funding needs.

Status of Actions Identified in the 2006 Plan

A lot has changed since the completion and approval of the 2006 hazard mitigation plan. The emergence of the illegal drug crisis, an enhanced understanding of the realities and nuances of climate change, and the capacity of the tribe to conduct its own hazard mitigation planning effort. The tribe has made significant progress on developing and sharing educational materials on a variety of hazards (exemplified by "tornado week" in early April or annual presentations and activities at the community forum). The tribe has also made progress developing a mass warning system (community siren), enhancing protection for critical facilities such as water towers, and implementing new security measures at the schools.

Plan Integration

For each action, the TEPC identified not only responsible departments, but also synergies with existing department plan or tribal operations and management plans. This identification will also facilitate the integration of these actions into the on-going operations and management plans when resources and the timing make this integration possible.

Part VI: Assurances and Plan Adoption (Element E)

Appendix A: Analysis of Climate Data

Climatological Observations Summaries

The observational datasets provided by the Great Lakes Integrated Sciences and Assessments (GLISA) contain information from the late 1800s to the present. These observational data provide high-quality observations that represent the overall climate of the Great Lakes region. The observational datasets used for the Lac du Flambeau Tribe of Lake Superior Chippewa Indians (Lac Du Flambeau) Climate Change Resilience Plan were the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Climate Divisions and the Global Historical Climatology Network Daily (GHCN-D) Station observations.

NCEI Climate Divisions Dataset The NCEI Climate Divisions dataset is a long-term temporal dataset for the contiguous United States. The Climate Divisions were used to identify seasonal and annual trends in geographically relatable areas. For each Climate Division, monthly station temperature and precipitation values were computed from the NCEI GHCN-Daily observational dataset. Each division was small enough to be subjected to similar climate forces while incorporating enough observations to provide a statistically sound summary of trends at the multi-county scale. The period of record for the Climate Divisions dataset spanned from 1895 to present, and this is important for understanding climate trends at a broader scale than local observations.

Selection of Geographic Area of Interest

At the February 2018 meeting hosted by Adaptation International (AI) and the Lac du Flambeau Climate Resilience Planning (TCRP) Committee, GLISA was invited to present an overview of its work with Tribal Nations across the Great Lakes region. In addition, GLISA provided a summary of the climate information that would be used in support of this project (i.e., historical observations and future projections). At the conclusion of the meeting, the TCRP decided upon an area of interest (AOI) for which GLISA would customize summarized climate information. This AOI is composed of several watersheds within a forty-mile radius of the Lac du Flambeau Reservation. This AOI is significant due to hunting and other activities important to the Tribe (see Figure 1).

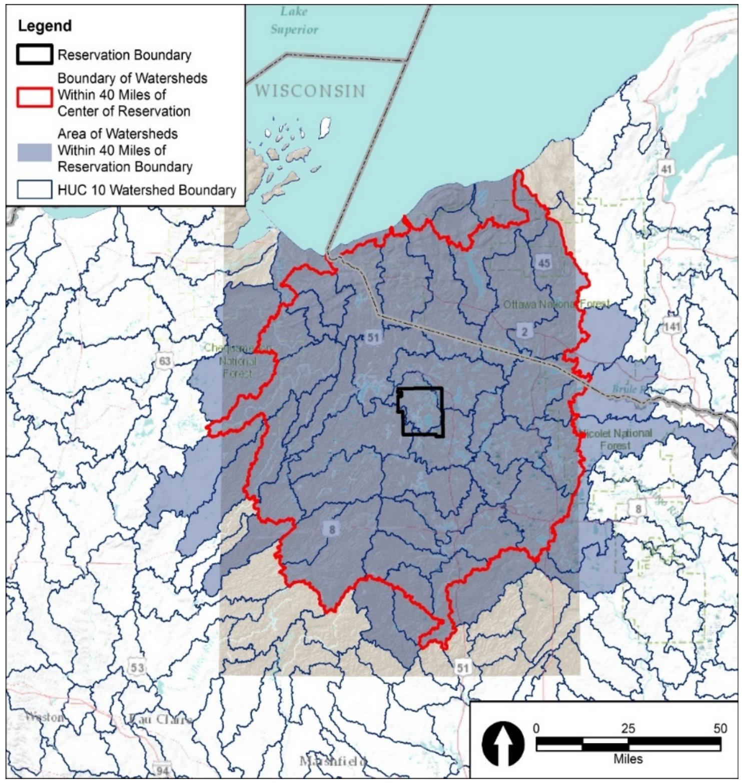

Figure 25: Lac du Flambeau TCRP's Area of Interest (AOI) which spanned over several watersheds within a forty-mile radius of the reserved lands. The red border is the outline of the forty-mile boundary, and the blue area highlighted the AOI for this analsis. (Source: Adaptation International)

As part of the ongoing efforts to support climate adaptation activities within the Great Lakes region, GLISA has developed summaries of the observed historical climate for NCEI Climate Divisions. The Climate Division for North Central Wisconsin (WI CD2) was used in support of the analysis of the Lac du Flambeau Tribal Climate Resilience Planning (TCRP)

Committee's AOI. Compared to the other climate divisions surrounding the area (i.e., Northwestern Wisconsin (CD1), Northeastern Wisconsin (CD3), and Western Upper Michigan (CD1)), WI CD2 has the most coverage in the AOI as shown in Figure 2. This was optimal for understanding how the observed climate trends have been changing within the area surrounding the Lac du Flambeau Reservation.

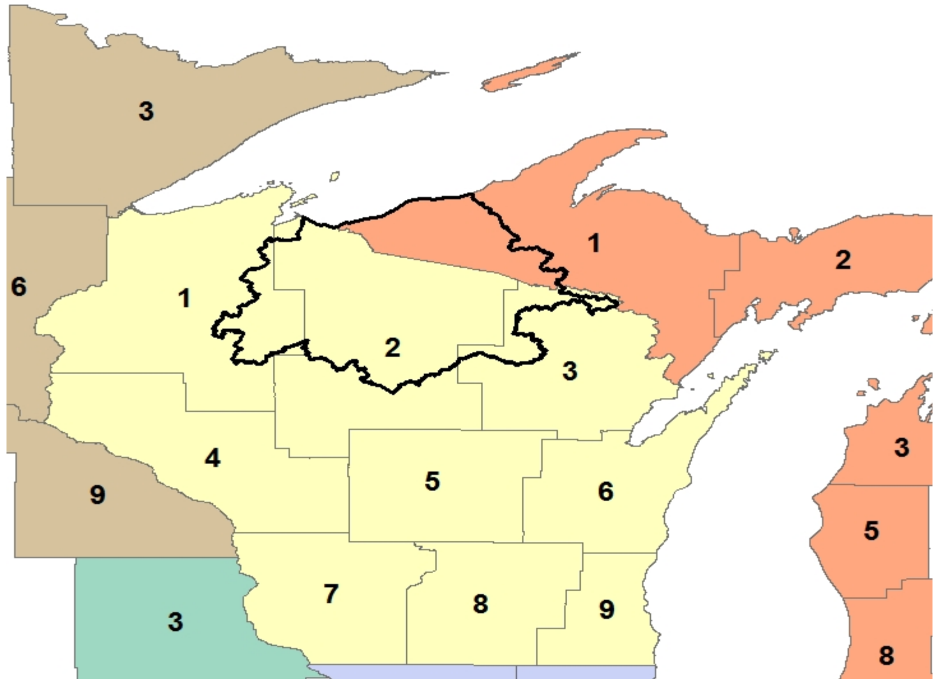

Figure 26: The AOI overlaid on the NCEI Climate Divisions. Majority of the AOI is within WI CD2 (North Central Wisconsin), and this Climate Division was used in the analysis for the historical climatological trends. (Source: GLISA)

Global Historical Climatology Network Daily (GHCN-D) Station Datasets

GHCN-D is the NCEI integrated database of climate summaries from land observation stations across the globe, which have been subject to standardized quality assurance controls. The GHCN-D is comprised of daily climate records from numerous land surface stations, and these stations are used to describe the typical climate of a particular place. The GLISA quality-controlled GHCN-D stations contained over 60 years of the high-quality land surface observations for the stations surrounding the Great Lakes region.
For the GHCN-D stations included in the analysis, the data was further processed by a series of scripts which were used to review the quality flags (i.e., signifying inaccurate data) of the observations. If a flag was found for a single observation, it was not used within the calculation of the climate trends for the given station. This ensured anomalies found from any single daily observation did not adversely influence the characterization of the station's climate trend. The scripts provided outputs in the form of Comma Separated Values (.csv) files which were compatible with many spreadsheet applications. Web files were formatted and uploaded to the server hosting the GLISA website, allowing GLISA to easily update the information on the Great Lakes Station Climatologies webpage currently available for a given station. This process was used for the processing and updating of the climate data on the Great Lakes Climate Divisions webpage from the NCEI Climate Divisions as well.

The GHCN-D stations located in Rest Lake, WI and Minocqua, WI were used in the analysis of the Lac du Flambeau Tribal Climate Resilience Planning (TCRP) Committee's AOI. These stations are located at opposite ends of the reserved lands of Lac du Flambeau. The climatological observing station at Rest Lake is located to the north of Lac du Flambeau, while the climatological observing station at Minocqua is located to the south of Lac du Flambeau (Figure 3). The use of these stations provided a more localized understanding of the local climate observed within the Lac du Flambeau Reservation.

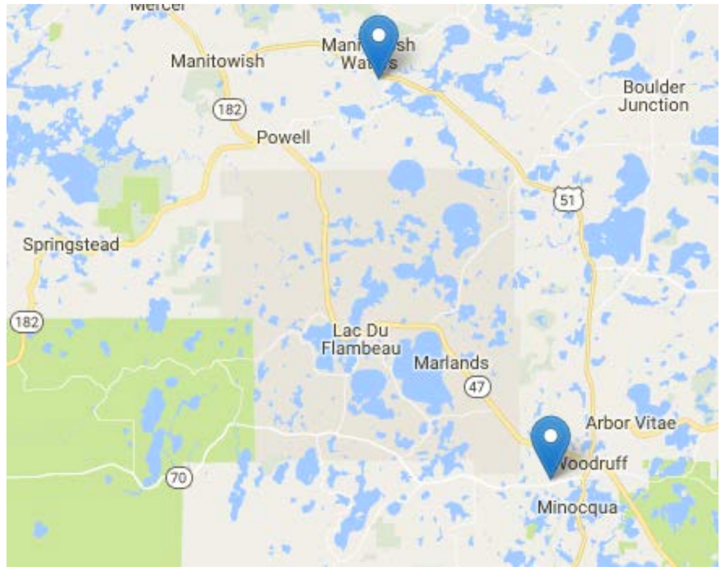

Figure 27: The GHCN-D Station Observations around the Lac du Flambeau Reservation. The station in Rest Lake, WI is located to the north, and the station in Minocqua, WI is located to the south. (Source: GLISA)

Historical Observation Sources

Global Historical Climatology Network Daily (GHCN-D) Station Observations:
https://www.ncdc.noaa.gov/ghcn-daily-description
http://glisa.umich.edu/climate-stations
National Centers for Environmental Information Climate Divisions:
https://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-divisions.php ;
http://glisa.umich.edu/resources/great-lakes-climate-divisions

Climate Projections Summaries

Future Climate Data for the Great Lakes Region

Climate models are used to generate future climate data that are often used in climate adaptation planning. Global climate models (GCMs) simulate important physical processes and interactions involving the land, atmosphere, ocean, and ice over the entire Earth. Dozens of GCMs exist as different modeling groups work to improve model simulations. Computing limitations restrict GCMs to relatively coarse spatial resolution—meaning the models divide the Earth’s surface into relatively large areas (called grid boxes) for performing simulations and averaging. Unfortunately, this limitation makes GCMs an insufficient source of information for processes that occur at relatively small spatial scales (such as those that would occur within an individual grid box), like extreme precipitation or wind, because these events are not physically simulated in the models but estimated. In particular, most GCMs do not include a representation of the Great Lakes or they are too simplistic in their representation to accurately simulate lake-land-atmosphere interactions (i.e., lake-effect precipitation), which are important in the Great Lakes region. This, along with the exclusion of other smaller scale climate processes, make GCMs best suited for large-scale (global) climate studies.

When one is interested in studying plausible future climates at smaller areas of interest, like the Great Lakes region, the details of the landscape become important (i.e., topography). These features are typically better represented in Regional Climate Models (RCMs) that include simulations of smaller scale climate processes at finer spatial resolutions (Figure 4). Such enhancements make RCMs much more computationally expensive compared to GCMs, so they are primarily designed for and limited to specific regions. An RCM relies on the input from a GCM at its geographical boundary to provide the initial or starting conditions for the simulation. The RCM then performs a more detailed simulation of the climate prediction over a specific region. This approach of generating a fine-scale climate simulation informed by larger-scale GCM simulations is called “dynamic downscaling.”

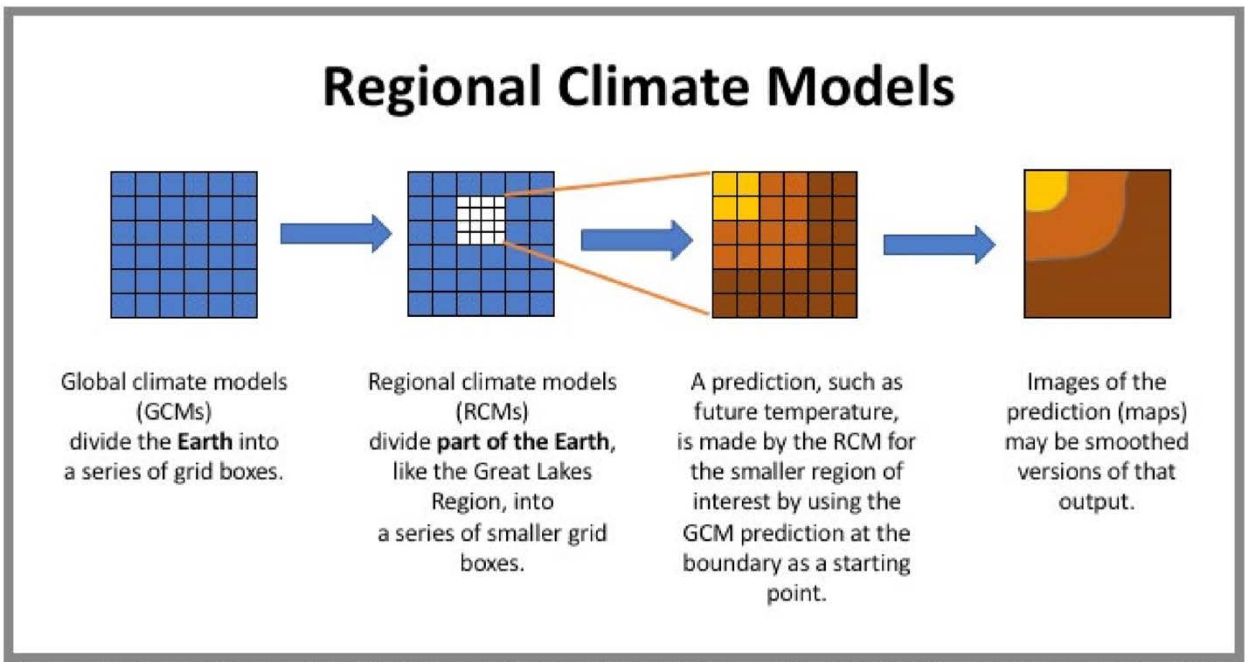

Figure 28: Depiction of how global climate models divide the surface of the Earth into relatively large grid cells and regional climate models perform simulations over smaller portions of the Earth at finer spatial resolutions. (Source: GLISA)

Global Climate Model Quality

As previously stated, most GCMs do not include the Great Lakes physically, or adequately represent their influence on important atmospheric processes, so their quality is rather poor for the region. Hence, there is a need for RCM simulations. However, the quality of the final RCM

Table 1: GCM biases in near-surface air temperature (°C) and precipitation (mm/day) over land within the Great Lakes Basin reported as root-mean-square-differences from observations. Better performing models are bolded. (Source: Notaro et al. 2014)

MIROC5	2.85	**0.28**
IPSL-CM5-MR	1.49	0.67
MRI-CGCM3	**1.10**	0.61
ACCESS1-0	1.28	0.59
GFDL-ESM2M	1.71	**0.36**

projection depends in part on the quality of information coming from the GCM that is used as input at the boundary of the RCM. Notaro et al. (2014) evaluated 33 GCMs prior to selecting a subset of six that were used as part of the Nelson Institute Center for Climatic Change Research's dynamically-downscaled simulations in the Great Lakes. The models ran under the Representative Concentration Pathway 8.5 (RCP 8.5), which projected the highest greenhouse gas emissions model analysis. These models were downscaled to a 25-kilometer spatial resolution according to the RCP8.5 scenario using the International Centre for Theoretical Physics (ICTP) Regional Climate Model Version Four (RegCM4) coupled to a one-dimensional lake model to represent the Great Lakes. The RegCM4 was originally developed at the National Center for Atmospheric Research and is currently maintained by the International Center for Theoretical Physics (2010). Root mean-square-differences, a measure of accuracy, were used to show how well each GCM simulated historical observations of temperatures and precipitation over the Great Lakes Region (Table 1). Root-mean-square-difference values closer to zero indicate smaller model error (bias), which was determined by comparing the historical simulation in the model to observations. Values shown in **bold** text in Table 1 indicate the model was in the top 33% for best performance for the select variable.

Regional Climate Model System 4 (RegCM4)

What elevates this dynamical-downscaling effort above many others was the inclusion of an interactive 1-D lake model that more realistically simulated lake temperatures and lake ice—two variables necessary for capturing critical lake dynamic feedbacks to the atmosphere. The inclusion of the Great Lakes and lake processes in RegCM4 has resulted in some of the best available model simulations for the Great Lakes region to-date. Detailed descriptions of RegCM4's ability to simulate specific climate variables can be found in Table 2. These evaluations pertain only to the performance of RegCM4, driven by observational reanalysis data (i.e., spatially gridded compilations of instrument observations), and do not include the inherited GCM biases.

Table 35: Summary of RegCM4 historical performance based on evaluation information found in Notaro et al. 2013b and 2014.

Air Temperature	The RCM accurately captures the seasonal cycle and long-term trends for air temperatures across the region.
Precipitation	The RCM best captures the pattern and magnitude of winter precipitation but overestimates precipitation during the other seasons.
Lake Temperature	In general, the RCM reproduces the seasonal cycle of lake temperatures (although inter-annual variability is underestimated), but summertime temperatures are too warm and lake stratification occurs too early in the model. The model captures the historical time series and spatial pattern of rapid summer lake temperature warming due to shift towards earlier stratification.
Lake-Effect Precipitation	The RCM accurately captures the seasonality, inter-annual variability, and long-term trends in lake-effect snowfall. The RCM underestimates seasonal snowfall downwind of Lakes Superior, Michigan, Huron, and Erie by −21%, −13%, −7%, and −6%, respectively. Downwind of Lake Ontario the RCM produces 27% too much snowfall. Figure 1. The RCM captures the timing of the lake-effect rain season, lake-effect snow season, and lake-effect stable season across the Great Lakes.
Snow	The RCM captures the general snowfall pattern across the region including proper placement of lake-effect snowfall peaks. However, the RCM produces too much snowfall at 85% of the locations where comparisons with observations were made.
Lake Ice	The RCM produces a fair representation of the spatial distribution, long-term trends and seasonal evolution/inter-annual variability of Great Lakes' ice cover, although the absence of horizontal mixing and ice movement in the lake model causes an excessive and overly persistent ice cover. The RCM simulates too much annual ice cover ranging from +11% on Lake Huron to +20% on Lake Superior. Ice forms too early in the season at the shoreline in the RCM and not enough ice forms at the deepest points in the lakes. The RCM produces a realistic spatial pattern of ice thickness, with the thickest ice over shallow coastal waters.

The quality of the GCM impacts the quality of the RCM's future projections, because GCM biases were carried into the RCM simulation. For example, a GCM with a warm bias may prevent the RCM from simulating ice on the Great Lakes during winter, which has implications for the RCM's simulation of lake-effect precipitation, lake evaporation, and other lake-effects. The final set of six GCMs were selected based on those that had sufficiently high spatial resolution, good overall performance, and represented a range of future warming and precipitation change.

Dynamically-downscaled Climate Projections for the Great Lakes Region

Table 36: Institutions producing GCM simulations used to provide boundary conditions to RegCM4 (Source: Notaro et al. 2014)

Driving GCM
Centre National de Recherches Meteorologiques Coupled Global Climate Model Version Five (CNRM-CM5)
Model for Interdisciplinary Research on Climate Version Five (MIROC5)
Institut Pierre Simon Laplace Coupled Model Version Five-Medium Resolution (IPSL-CM5-MR)
Meteorological Research Institute Coupled Global Climate Model Version Three (MRI-CGCM3)
Centre for Australian Weather and Climate Research, Australia GCM (ACCESS1-0)
National Oceanic and Atmospheric Administration Geophysical Fluid Dynamics Laboratory model (GFDL-ESM2M)

This project utilized a set of dynamically-downscaled climate projections that were designed for the Great Lakes region. Projections of future change (mid- and late-21st century) have been made publicly available for a variety of climate variables. The mid-century period spanned over the years of 2040-2059, and the late-century period spanned over the years of 2080-2099. The data was made available for download (netcdf files) or viewable as mapped products at the link below.

Link to Data: http://nelson.wisc.edu/ccr/resources/ dynamical-downscaling/index.php

Characterization of Dynamically-downscaled Climate Model Simulation Results for the Lac du Flambeau AOI

As agreed upon by the TCRP, AI, and GLISA, the characterization of dynamically-downscaled climate model simulation results was presented through the use of both maps and spreadsheet applications. This methodology has proven successful in characterizing climate observations and projected climate trends as part of previous collaborations between GLISA, AI, and other Indigenous Tribes in the region. This process involved collecting historical observations for the locations within the Lac du Flambeau AOI from the NCEI and future climate projections from the dynamically-downscaled output of the RCM simulations described in the previous section.

The output from the six dynamically-downscaled models were processed using a Python programming language script. The variables acquired for this analysis consisted of temperature and precipitation outputs given by the Nelson Institute, and several other variables, such as days over 90°F, first fall freeze, last spring freeze, and many others, were detailed in Table 5. These variables were chosen based on the priorities specified by the TCRP to be used in the Climate Change Resilience Plan.

Table 37: List of the variables chosen by TCRP, AI, and GLISA for the climate analysis of the AOI. All data was provided by the Nelson Institute dynamically-downscaled Regional Climate Models.

Variable	Units
Temperature	°F
Precipitation	Inches
Days with 2+" of Precipitation	Days/Decade
First Fall Freeze	Days
Last Spring Freeze	Days
Days Over 90°F	Days
Days Over 100°F	Days
Snowfall Change	Inches
Snowfall Days	Days
Snowfall Greater than 6"	Days

The Python programming scripts used the output data from the Nelson Institute to analyze the changes in these variables based on the time periods of 2040-2059 (i.e., mid-century) and 2080-2099 (i.e., end of century or late-century) compared to the observed climatological conditions. Due to their resolution, the dynamically-downscaled models provide information at scales as fine as 25-kilometers, and the outputs provided by the Nelson Institute consisted of NetCDF spatial data files consisting of past change in trends for the observations during the period of 1980-1999[18]. Given that the model simulations provide a projection of the spatial variation in projected trends across the Great Lakes, the Python code was used to process the data within the boundary of the AOI. This involved applying certain Python functions to carve or "clip" the data within the boundary. The "clipping" of the data gathered the data cells which were contained within the AOI, and the results were spatially averaged over the area to provide a single number representing the change for the entire AOI.

The Python code created by GLISA provided two forms of data that can be used for further analysis of the climate around Lac du Flambeau. The maps provided a visualization of the results from the processing for all six models, individually, and for the ensemble mean. The ensemble mean was produced by taking the average of the results from all six models. The maps generated as part of this project provided results which spanned the Great Lakes region (bounded by the area of 40°N to 50°N and 75°W to 95°W) as well as the AOI coverage of Lac du Flambeau[19]. The numerical outputs from the models that were processed using the Python code were placed into a Comma Separate Values (.csv) spreadsheet. This latter spreadsheet provided the spatial average of all the variables for each of the six models during the mid-century and end of century time periods for the Lac du Flambeau AOI[20]. The range of a variables was determined through identifying the minimum and maximum number of all six models, and these ranges were provided for the mid-century and end of century time periods.

[18] Source: https://nelson.wisc.edu/ccr/resources/dynamical-downscaling/index.php
[19] Link:https://drive.google.com/open?id=1iVkDaJlaL8dk97vIE-UV5VwdbjWMFOCd
[20] Link: https://drive.google.com/open?id=1-VJnYgYPT4-ogu2fqZcotBWfv7-dSg02

Calculation of the Hamon Moisture Metric (HMM)

The calculation of the Hamon Moisture Metric (HMM) is a method of integrating temperature, precipitation, and sunlight hours to produce the results needed for the Climate Change Vulnerability Index (CCVI) created by NatureServe[21]. The CCVI has aided in identifying which species are most vulnerable to the drastic effects of climate change impacts. The HMM is based on the Hamon potential evapotranspiration equation which quantifies the ratio between water availability and the evaporative demand (Hamon, 1961 and Lu et. al., 2005). The determination of the ratio required the use of temperature, precipitation, and number of daylight hours for a given location as specified by the formulas given in Copeland et al., 2010. The data from the Nelson Institute was used to calculate this ratio based on the formula which is the ratio of actual evapotranspiration (AET) and potential evapotranspiration (PET).

$$Hamon\ Moisture\ Metric\ (HMM)\ =\ PET/AET$$

The calculation of HMM required gathering historical gridded climatological observations and model projections, which were used with ecological data provided by AI, for the CCVI analysis. The Dynamically-downscaled data from the Nelson Institute has gridded historical data available, and this gridded data was paired with the projections to ensure consistency in the comparing the models' historical model outputs and models' projections. The following formula was used to compute the PET used in the CCVI analysis:

$$PETHamon\ =\ 13.97dD2\ Wt,$$

where d is the number of days per month; D is the hours of sunlight for the given month; and W_t is the saturated water vapor density, which is dependent on the average temperature of the month T, defined by the following formula:

$$Wt\ =\ (4.95e0.062T)/100$$

The PET was dependent on the average monthly temperature, and temperatures below 32°F make the PET zero. This would make winter months more likely to have zero PET due to the average below-freezing temperatures. The AET depended on several conditions of whether the monthly average total precipitation is greater or lesser than the PET. The AET would equal the precipitation amount if the amount was greater than the PET; however, the AET and PET would be the same once the precipitation amount was less than the PET for the month.

An additional code was created by GLISA to calculate the ensemble mean of the historical and future gridded model outputs for this calculation. The historical data was averaged over the time period of 1980-1999 for consistency with the 20-year averaging of the mid-century and end of century time periods. Once the ensemble mean was calculated for the

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[21] link: http://www.natureserve.org/conservation-tools/climate-change-vulnerability-index

different parameters of the HMM (i.e., W_t, PET, and AET), the resulting calculation was outputted into gridded NetCDF files. The gridded outputs provided the HMM for the entire Great Lakes region, and AI has continued the processing of the CCVI with the resulting gridded data for further analysis.

CCVI Analysis Differences

The CCVI analysis involved integrating gridded model data from climate change models with ecological data to find which species are most vulnerable to climate change impacts. Due to their efficiency of depicting the dynamics of the Great Lakes with the atmosphere, GLISA used data from the Nelson Institute and provided an ensemble mean containing an average of all six models. This ensemble mean provided some consensus of direction as to how the models were behaving based on model runs for mid-century and end of century.

In contrast, the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) used the same data provided by the Nelson Institute to create their own method of calculating the CCVI. GLIFWC's method involved using two representative models giving the most and least amount of change in the future based on all six models. This method was distinctly different from GLISA's since two models were chosen to represent the behavior of the data; however, GLISA's method did take into consideration the different behaviors of the models based on the ensemble mean. GLISA's method can be thought of as a middle ground for how the results of the CCVI should be interpreted compared to GLIFWC's methodology. Other factors and further investigations will be needed to understand the advantages and disadvantages of each method.

Appendix B: Public Engagement

Items to be inserted –

- Initial Survey – Online and paper
- Initial Survey Responses
- Review Survey
- Review Survey Responses