



The Lac Du Flambeau - *Waaswaaganing*
Climate Change Resilience Initiative

September 2020



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DOE Office of Indian Energy - Final Report
Award Number: DE-IE0000067
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DOE Office of Indian Energy - Final Report

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Table of Contents:

Cover Page	1
Executive Summary	4
Report	5
The Lac du Flambeau Tribe and Ojibwe People	5
The Planning Process	6
A. Timeline	6
B. Tribal Climate Resiliency Planning Committee	7
Climate Change on the Reservation	8
A. Geography and Climate	8
B. Climate Change	9
Climate Resilience Initiative-Four Parts	12
A. Energy Reduction Plan	12
B. Climate Vulnerability Assessment	15
C. Adaptation Plan	21
D. Hazard Mitigation Plan	23
Conclusion	27
Lessons Learned	28
Recommendations	28

List of Figures

- Figure 1: Lac du Flambeau Resilience Initiative Logo*
- Figure 2: Photos from one of the TCRP/TEPC workshops*
- Figure 3: Location of the Lac du Flambeau Reservation in North Central Wisconsin*
- Figure 4: Summary of observed changes in temperature and precipitation for the region*
- Figure 5: Summary of projected seasonal climate changes by the 2050s*
- Figure 6: The four components of the Lac du Flambeau Tribe’s Climate Resilience Initiative*
- Figure 7: FY2016/17 electricity usage over all tribal facilities by percentage*
- Figure 8: FY2016/17 propane usage over all tribal facilities by percentage*
- Figure 9: Photos of the Natural Resource utility room, the Dental Clinic, and an HVAC system*
- Figure 10: Relative vulnerability rankings for the four public health related issues*
- Figure 11: Relative vulnerability rankings for the four infrastructure and extreme weather related issues*
- Figure 12: Summary of Climate Change Vulnerability Index (CCVI) scores the 20 species evaluated*

Figure 13: TCRP members working on the climate resilience initiative during one of the project workshops.

List of Tables

Table 1: Members of the Tribal Emergency Planning Committee & Tribal Climate Resilience Planning Committee

Table 2: Summary of observed and projected changes in temperature and precipitation for the region

Table 3: Factors used to evaluate species climate vulnerability in the CCVI analysis

Table 4: Phase I- Implementation actions identified by the TEPC as starting points for action

Executive Summary:

The goals of this project were to create a comprehensive Environmental Resiliency Plan and to increase the capacity of all Lac du Flambeau Tribal Program Managers to incorporate environmental impact thinking into the everyday management of their departments. Environmental Resiliency Planning utilized current Tribal documents, which include the Integrated Resource Management Plan (IRMP), the Lac du Flambeau Tribal Emergency Management Plan (EMP), and the Lac du Flambeau Strategic Energy Plan, as guidance throughout the process. A vulnerability assessment initiated our technical process and allowed us to identify, quantify, and prioritize (or rank) the vulnerabilities in our system. This set the stage for a reduction and resilience plan as well as providing insight for revisions of existing management plans such as the Energy and Integrated Resources Management Plans.

The summary report below provides more detail on this important work to include background information, project planning, timeline, goals/objectives, description of activities performed and conclusions.

Also, the reader can visit the following website in order to comprehensively review the work accomplished:

<http://ldfclimateresilience.org/>

Report:

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 Anishinaabe (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 seven 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 Benton-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. 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 Lac du Flambeau Band of Lake Superior Chippewa Indians 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

Now is the time to take action and work together as a community to plan and prepare for extreme weather events and changing climate conditions; support the health and wellness of our elders, youth, and community; protect and support our natural resources; and diversify and protect our economy. Taking action now will improve the quality of life for the Lac du Flambeau Band of Lake Superior Ojibwe Nation now and far into the future.

The Planning Process

Over the course of almost three years, the Tribe worked with the community to conduct and complete the project. The Climate Resilience Initiative began in the late fall of 2017. Over the years, this project included monthly advisory meetings, four workshops, community surveys, a community open house, and four contracted project partners. The foundation of the Climate Resilience Initiative was built around two key components. First, a broad community survey was conducted to gather input on key areas of concern from both Tribal staff and the community as a whole. Second, the project manager worked with one of the community's spiritual leaders to develop a logo specifically for this project that embodies the concept of resilience for the Tribe (Figure 1).



Figure 1. The project resilience logo designed specifically for the Climate Resilience Initiative to represent what resilience means for the Lac du Flambeau Tribe.

A. Timeline

A brief summary of key dates and timeframes for the project is provided below.

- Fall 2017 – Project kick-off, community survey, and development of project logo
- December 2017 – Workshop 1 - Key Concerns
- Winter – Summer 2019 – Climate Vulnerability Assessment, Energy Reduction Plan
- May 2018 – Workshop 2 – Climate Vulnerability / Hazard Identification
- Spring – Fall 2018 – Hazard Mitigation Plan
- March 2019 – Hazard Mitigation Action and Adaptation Action Workshop
- Fall 2019 – Summer 2020 – Adaptation Plan
- Tribal Council presentations: May 24, 2018; July 31, 2018; March 28, 2019, and August 4, 2020, August 27, 2020

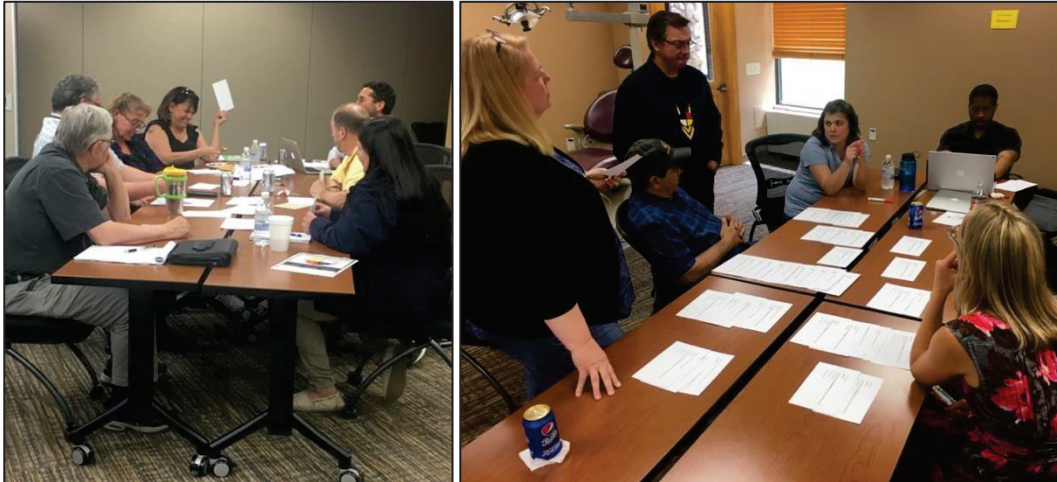


Figure 2: Photos from one of the TCRP/TEPC workshops. Photo Credits: Sascha Petersen

B. Tribal Climate Resilience Planning Committee

The Tribe created a working group to help guide all aspects of the Resilience Initiative. The Tribal Emergency Planning Committee (TEPC) and Tribal Climate Resilience Planning Committee (TCRP) consisted of 43 staff members (Table 1). This group served as core advisors for this project, as well as a separately funded climate change resilience project. The TEPC/TCRP met monthly throughout the project and provided input and guidance during each phase of the development of all aspects of the Resilience Initiative. The group provided input on the Energy Reduction Plan, Hazard Mitigation Plan, Climate Vulnerability Assessment, and Climate Adaptation Plan. All members of the committee were invited to participate in monthly meetings and project workshops. Sub-committees worked to refine hazard mitigation actions for chosen focus areas as well as develop and refine adaptation actions for individual focus areas and species of concern.

Table 1: Members of the Tribal Emergency Planning Committee (TEPC) and Tribal Climate Resilience Planning Committee (TCRP) 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 and TEPC 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 Infrastructure
Able	Lauren	Historic Preservation		X		
Allen	Dee	Tribal Council, Environmental Response			X	X
Chapman	Eric	Tribal Council, Emergency Management Coordinator, and Natural Resources	X	X	X	X
Chapman	Lyle	Tribal Fish Hatcher				
Coy	Emerson	Planning				
De Vries	Jason	Water Regulatory				X
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	Water Resources		X		
Johnson	Greg	Ojibwe Language Program		X		
LaBarge	Jerome	Land Management		X		
LaBarge	Jerry	Cultural Activities Coordinator		X		
Mayo	Zoya	Land Management				X
Meizer	John	Housing Authority Maintenance				X
Moore	Jesse	Forestry				
Moran	Kelley	Peter Christensen Dental Clinic				
Moran	Patricia	Natural Resources				
Peterson	Byron	Great Lakes Restoration Initiative				
Peterson	Jessie	Land Management				
Peterson	Sandy	Water and Sewer				
Poupart	David	Community Health			X	
Rising Sun	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
Valliere	Leanne	Community Health			X	
Valliere	Scott	Water and Sewer				X
Viriden	Andre	Great Lakes Restoration Initiative		X		
Wawronowicz	Larry	Natural Resources Director		X		
Wilke	Mark	Casino Safety Manager	X			
Wolfe	Sue	Public School	X			
Wolfe	Wayne	Wildlife		X		
Young	Melinda	Tribal Historic Preservation Office				
Zimmerman	Mike	Fire Department				X

Climate Change on the Reservation

Waaswaaganing Gaagige Bimaadiziwin Gaawin Gegaabi Naniizanasinon

A. Geography and Climate

The Lac du Flambeau Tribal Reservation (black square, Figure 3) and watersheds within 50 miles of the reservation boundary (purple polygon, Figure 3) comprise the geographic focus of the Resilience Initiative. The Reservation (black square, Figure 3) includes 86,630 acres

(144 square miles) of land area located in North Central Wisconsin and primarily situated within Vilas County.

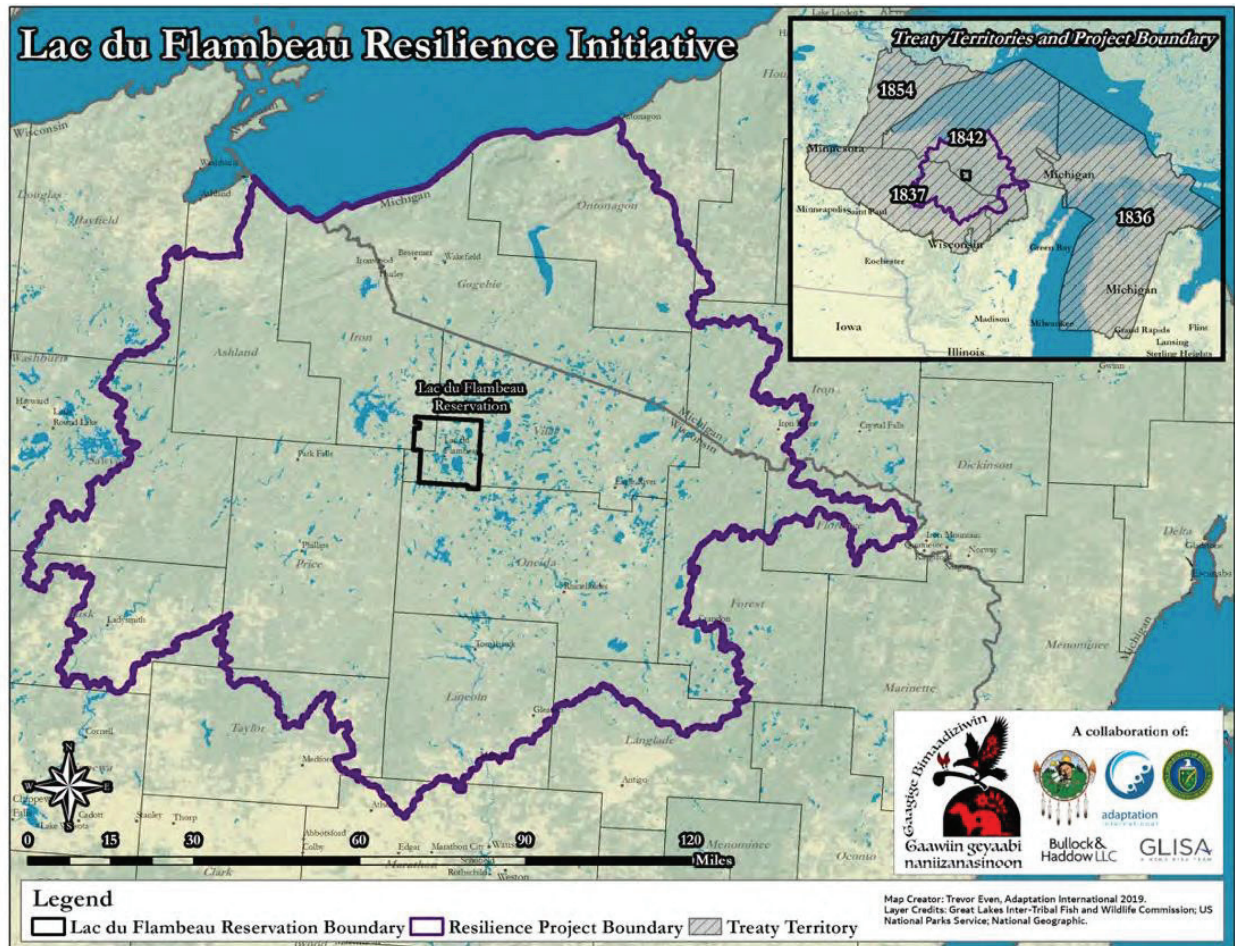


Figure 3: Location of the Lac du Flambeau Reservation in North Central Wisconsin. Reservation shown as the black square. Resilience Initiative planning area designation shown in purple. Relevant treaty areas shown in map inset.

B. Climate Change

The climate of the region has already changed from what it was in the recent past. Average annual temperatures have increased 3.1°F since 1951. Temperature observations show that temperature has increased during all seasons. Projections under the “business-as-usual” climate change scenario (RCP 8.5), downscaled and averaged specifically for the area that includes watersheds within 40 miles of the reservation boundaries, show increasing annual temperatures and across all seasons. Average annual temperatures, as well as spring, summer, and fall temperatures, may increase by more than 10 degrees Fahrenheit by the end of the century. Annual precipitation has decreased in the summer months but increased in the other three seasons. Climate 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 through the end of the century. Projected increases in

average annual temperature and precipitation are shown below (Table 2). Summaries of the projected seasonal changes are shown in Figures 4 and 5.

Table 2 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%

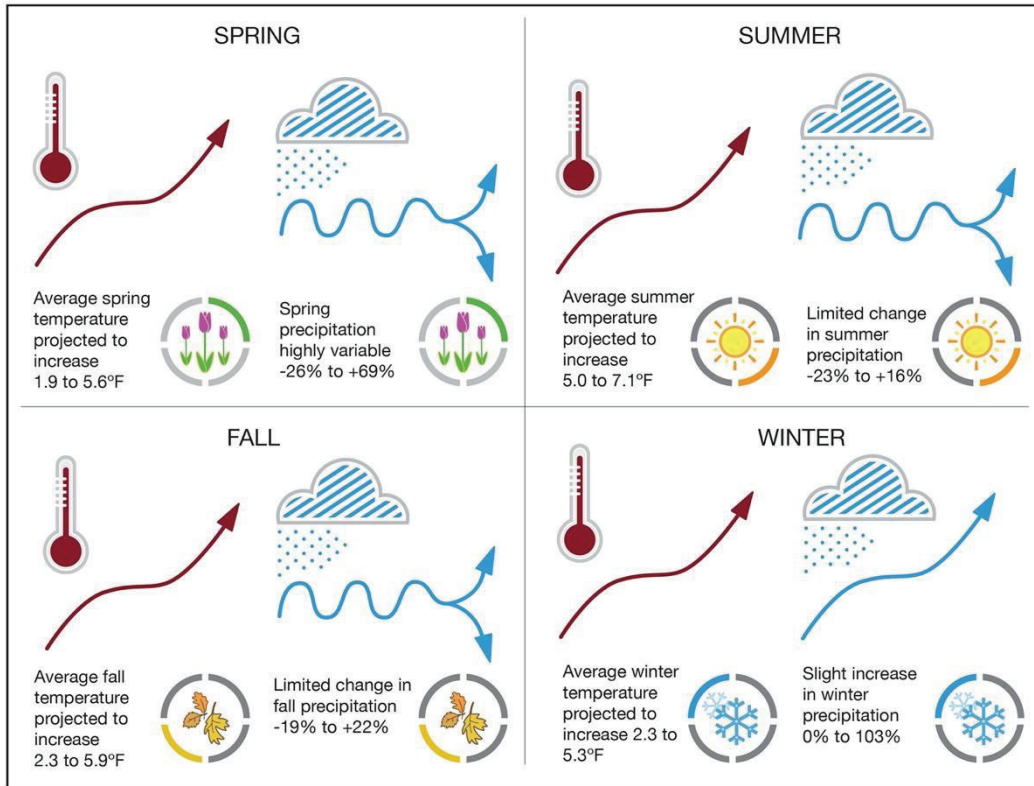
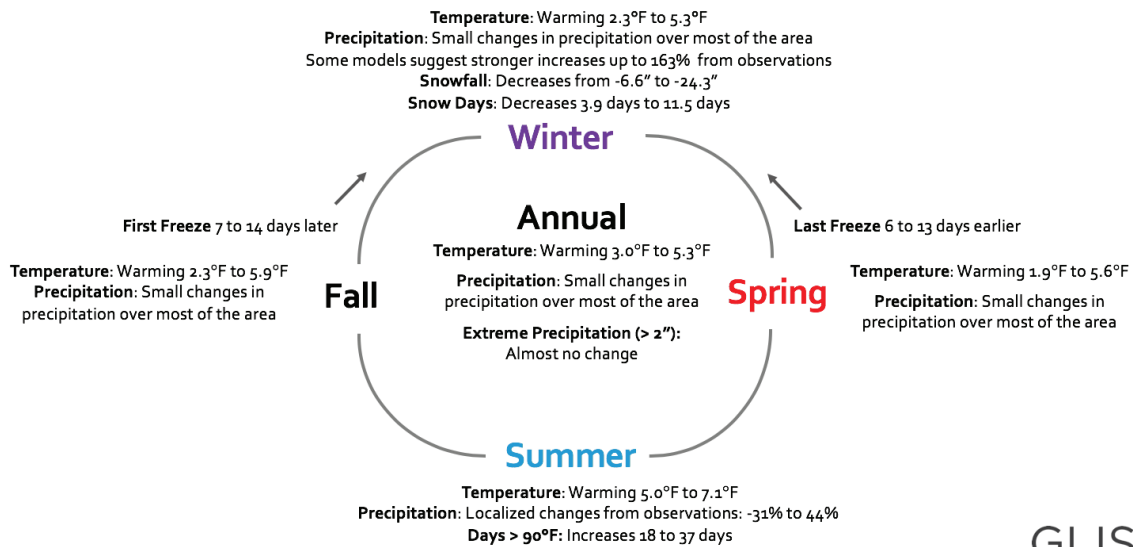


Figure 4: Summary of observed changes in temperature and precipitation for the region for the resilience project boundary under the "business-as-usual" climate scenario (RCP 8.5) broken down by season. Local downscaling of climate projections and analysis conducted by Great Lakes In Integrated Sciences and Assessment Center at the University of Michigan for the Resilience Initiative Project Boundary.

Mid-21st Century Projections for Lac du Flambeau



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Figure 5: Summary of projected seasonal climate changes by the 2050s 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 In Integrated Sciences and Assessment Center at the University of Michigan for the Resilience Initiative Project Boundary.

Climate Resilience Initiative – in Four Parts

One of the main goals of the resilience initiative is to protect *minobimadiziiwin* (culture and way of life) and the economy of the *Waaswaaganing* (Lac du Flambeau) community for the next seven generations. To do so, the Lac du Flambeau Climate Change Resilience Initiative is composed of four key plans and efforts that, taken together, create the foundation for the Tribe’s ongoing work on climate change resilience to protect the Tribe now and for generations to come. The four plans are: 1) Energy Reduction Plan; 2) Climate Vulnerability Assessment; 3) Adaptation Plan; and 4) Climate Smart Hazard Mitigation Plan.

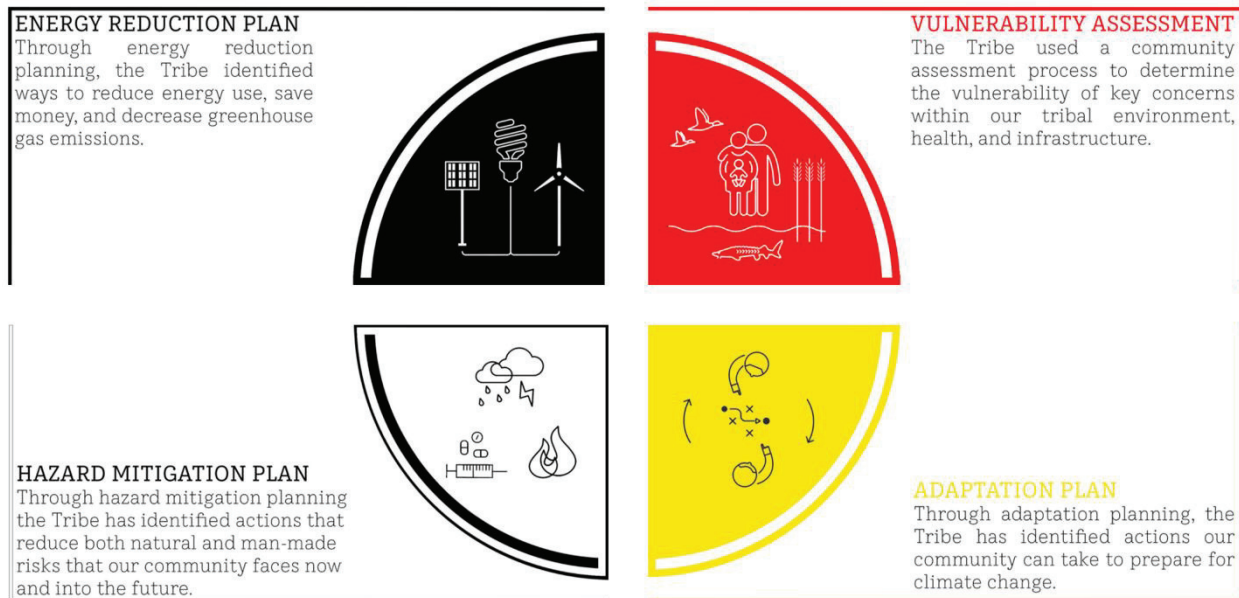


Figure 6: The four components of the Lac du Flambeau Tribe’s Climate Resilience Initiative. The four plans are: 1) Energy Reduction Plan; 2) Climate Vulnerability Assessment; 3) Adaptation Plan; and 4) Climate Smart Hazard Mitigation Plan.

A brief summary of each of the plans and the results of the planning processes is provided below. More details for each effort and the associated technical documents can be found on the Lac du Flambeau Climate Resilience project website at www.ldfclimateresilience.org.

A. Energy Reduction Plan

Since 2009, the Tribe has been committed to better understanding and reducing its energy use. “The Lac du Flambeau Tribe will commit to utilize local energy resources that reduce the environmental and financial costs of energy use to ultimately gain Tribal energy independence.”

The purpose of conducting the Energy Reduction Plan was to collect electricity (Figure 7) and propane (Figure 8) energy use data from all available tribal facilities, create a comprehensive facilities based energy inventory, look at changes in energy use over time, and develop recommendations on ways that the Tribe can reduce energy use, save money, and limit greenhouse gas emissions. The project team calculated facility energy use for the FY14/15 and FY16/17 operational years. Several of the tribal facilities had equipment upgrades over the past few years, and this analysis helped to quantify some of the savings from those equipment and facility upgrades as well as identify opportunities for future energy savings and emissions reductions.

FY 2017 Electricity Use

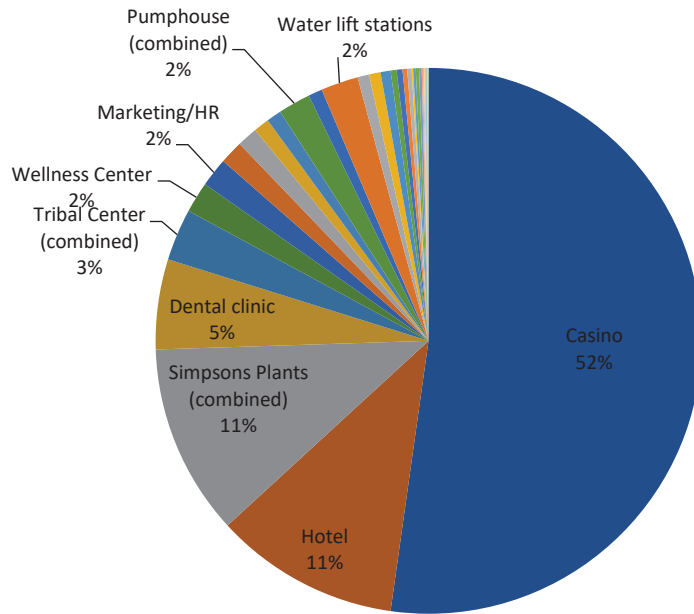


Figure 7: FY2016/17 electricity usage over all tribal facilities by percentage. The casino is the largest electricity user at 52% of the entire tribal usage, followed by the hotel at 11%. Majority of the other facilities were less than 1% of the overall usage.

Propane FY2017

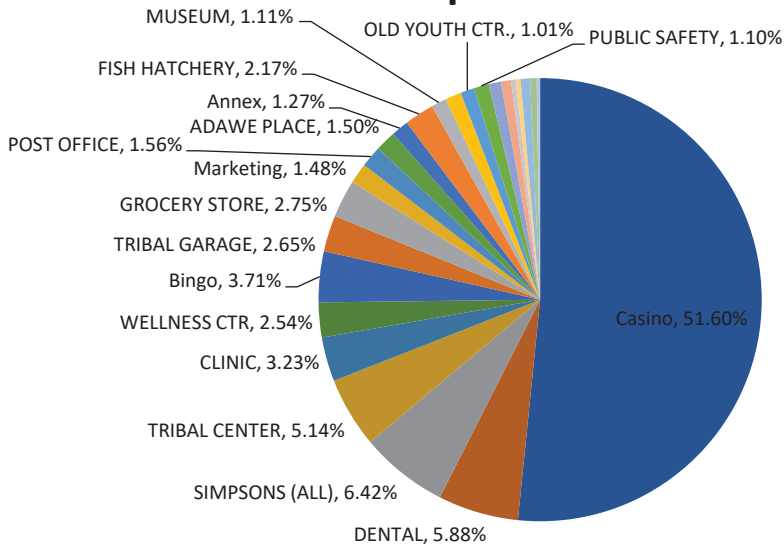


Figure 8: FY2016/17 propane usage over all tribal facilities by percentage. The casino remains the largest propane user at 52% of the entire tribal usage, followed by the Simpsons plant at 6%. Majority of the other facilities were between 1-2% of the overall usage

Key Energy Reduction Plan Findings

The full set of findings and additional analysis can be found on the Tribe's resilience initiative website – www.ldfclimateresilience.org.

- Energy efficiency investments the Tribe has made in buildings have reduced propane and electricity use. The highest reductions are for the Tribe's Casino and the Hotel.
- Significant savings have been achieved through better building space management by avoiding heating and lighting underutilized buildings.
- Investing in a data tracking system, such as [Wegowise](#), will allow the Tribe to more easily track changes in energy use over time.
- Developing strong policy standards for new buildings and retrofits will ensure investments are cost effective. Adopting the highest efficient building codes; requiring new buildings to be "renewable energy capable"; and purchasing only EnergyStar rated appliances and equipment will help the tribe achieve its resilience and energy independence goals.
- Implementing the recommendations from the strategic energy plan remains a priority.



Figure 9: Photos of the Natural Resource utility room (left), the Dental Clinic (center), and an HVAC system (right) taken in December 2017 (top) and November 2018 (bottom). Photo credits: Sascha Petersen and Ellu Nasser.

B. Climate Vulnerability Assessment

Through a nine-month community engagement process, the tribe identified 20 **Natural Resources** species, four **Community and Public Health**, and four **Infrastructure** issues of concern. Using a combination of a western science based tool, the Climate Change Vulnerability Index (CCVI) developed by NatureServe, and a community assessment process, the tribe determined the relative vulnerability of these concerns.

Public Health

Four public health issue areas are included in the Climate Resilience Initiative:

1. ***Extreme Heat (including Heat Waves) Impacts on Elders and Youth;***
2. ***Increases in Vector-Borne Diseases;***
3. ***Mental Health Impacts from the Loss of Natural Resources (due to Climate Change); and***
4. ***Increases in Allergies, especially for Elders and Youth.***

For the Public Health related issues, the assessment process relied primarily on a workshop and input from the TCRP/TEPC to review relevant local climate projections, consider western science summaries, and incorporate local knowledge to assess the sensitivity and adaptive capacity of each key concern. The results of that process are summarized below (Figure 10) and details on each individual issue can be found on the Tribe’s Climate Resilience Initiative website: www.ldfclimateresilience.org.

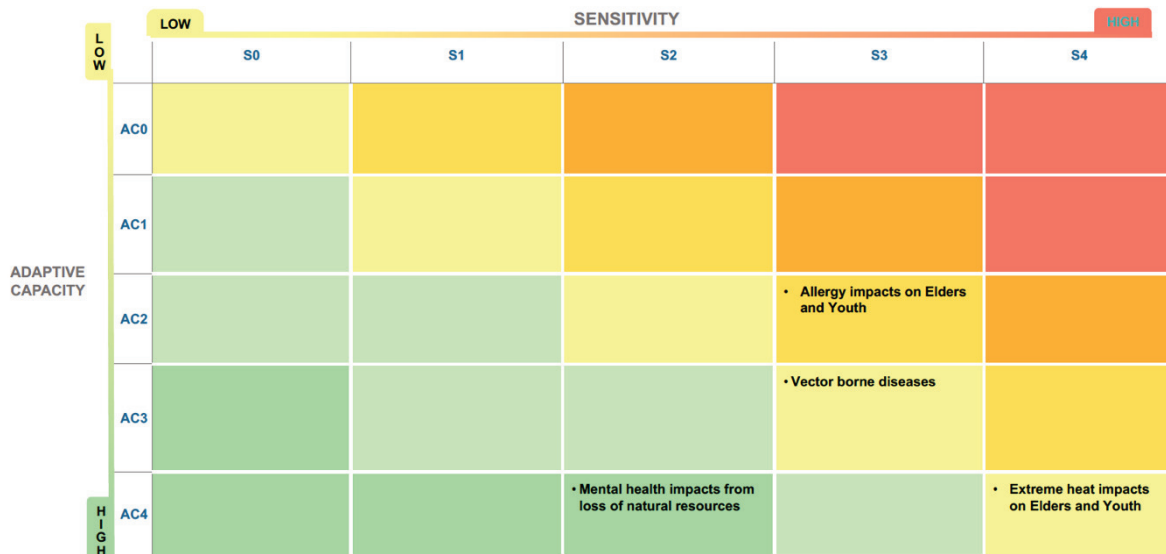


Figure 10: Relative vulnerability rankings for the four public health related issues selected by the tribe for evaluation in this project. Vulnerability is determined by a combination of climate exposure, sensitivity, and adaptive capacity as determined by the best available science and by local knowledge. Relative vulnerability rankings shown by the colors – Mental Health (low vulnerability, green), Vector borne diseases and Extreme heat impacts on Elders and youth (medium-low vulnerability – yellow), and Allergy impacts on Elders and Youth (medium vulnerability – light orange).

Infrastructure

Four infrastructure issue areas are included in the Climate Resilience Initiative:

1. **Wildfire Affecting Homes and Buildings;**
2. **Severe Thunderstorm Impacts Affecting Run-Off;**
3. **Flooding Affecting Homes and Buildings; and**
4. **Flooding Affecting the Water Treatment Plant.**

For the Infrastructure related issues, the assessment process relied primarily on a workshop and input from the TRCP/TEPC to review relevant local climate projections, consider western science summaries, and incorporate local knowledge to assess the sensitivity and adaptive capacity of each key concern. The results of that process are summarized below (Figure 11) and details on each individual issue can be found on the Tribe’s Climate Resilience Initiative website: www.ldfclimateresilience.org.

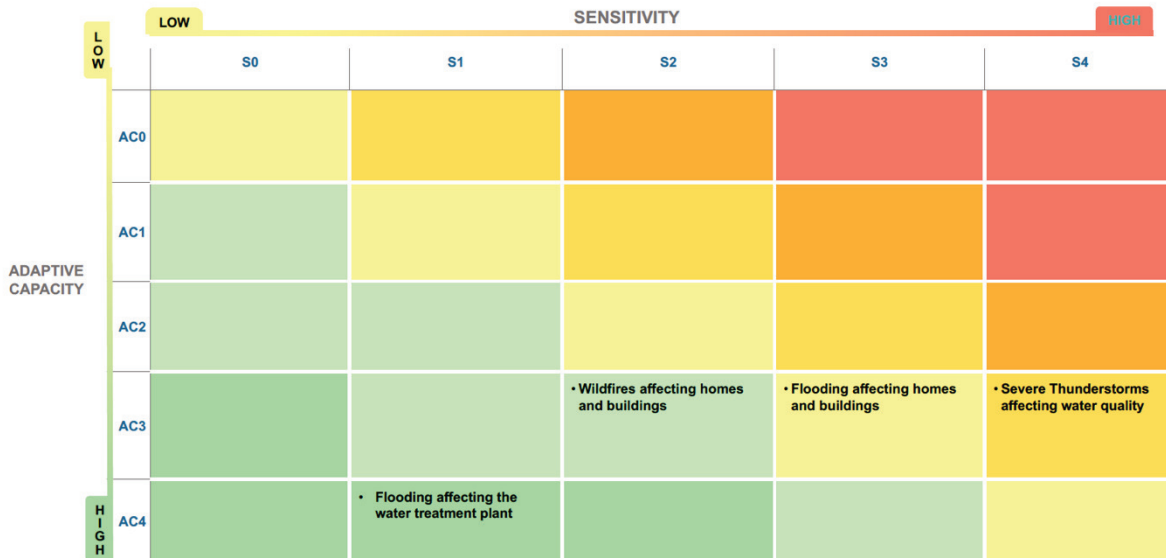


Figure 11: Relative vulnerability rankings for the four infrastructure and extreme weather related issues selected by the tribe for evaluation in this project. Vulnerability is determined by a combination of climate exposure, sensitivity, and adaptive capacity as determined by the best available science and by local knowledge. Relative vulnerability rankings shown by the colors – Flooding affecting the water treatment plant and Wildfires affecting homes and buildings (low vulnerability, green), Flooding affecting homes and buildings (medium-low vulnerability – yellow), and Severe thunderstorms affecting water quality (medium vulnerability – light orange).

Natural and Cultural Resources

Natural resources found in and around the reservation play a vital 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.

Four natural resource species groups (20 individual species) are included in the Climate Resilience Initiative:

1. ***Trees & Plants;***
2. ***Fish & Amphibians;***
3. ***Birds & Bees; and***
4. ***Mammals.***

The Tribal Climate Resilience Planning Committee engaged in a lengthy discussion and consensus-building process to select the 20 plant and animal species for initial analysis in the Climate Resilience Initiative. These discussions included consideration of the cultural significance and importance of a particular species, whether it was a Clan species, or if it was an indicator species; limiting the list to 20 was a difficult task. The Tribe assessed the vulnerability of each of the 20 species to climate change using a tool called the [Climate Change Vulnerability Index \(CCVI\)](#) developed by Nature Serve. The NatureServe CCVI Release 3.0 is a tool that estimates a species' relative vulnerability to climate change within a given assessment area. The CCVI uses projected changes in air temperature and moisture availability, species range data, and species-specific life history characteristics to calculate a species' direct and indirect climate exposure, sensitivity, and adaptive capacity¹, ultimately generating a numerical sum quantifying a species' relative vulnerability. The CCVI tool also highlights species-specific sensitivities that contribute to vulnerability, offering detailed information to help guide future climate adaptation efforts.

Direct climate exposure was measured by calculating the percent of each species' range that is exposed to different levels of projected change in temperature and moisture. Indirect exposure to climate change, as well as species-specific sensitivities and adaptive capacity, were evaluated using a suite of 23 variables (Table 1).

¹ The CCVI tool defines these terms as follows. *CCVI Exposure*: Projected climate change (shifts in temperature and moisture) across the range of the species within the assessment area. *CCVI Sensitivity*: The extent to which a species will respond to shifts in climate. *CCVI Adaptive capacity*: The ability of the species to withstand environmental changes.

Table 3: Factors used to evaluate species climate vulnerability in the CCVI analysis.

Factor	Description
Indirect Climate Exposure Factors	
Sea Level Rise	Effects of sea level rise on species habitat (not relevant for USRT species)
Natural Barriers	Geographic features of the landscape that may restrict a species from naturally dispersing to new areas
Anthropogenic Barriers	Features of anthropogenically altered landscapes (urban or agricultural areas, roads, dams, culverts) that may hinder dispersal for terrestrial and aquatic species
Climate Change Mitigation	Effects of land use changes resulting from human responses to climate change (seawall development, wind farm, biofuel production)
Species Sensitivity and Adaptive Capacity Factors	
Dispersal / Movement	Ability of species to disperse or migrate across the landscape to new locations as conditions change over time
Historical Thermal Niche	Exposure to temperature variation over the past 50 years
Physiological Thermal Niche	Dependence on cool or cold habitats within the assessment area
Historical Hydrological Niche	Exposure to precipitation variation over the past 50 years
Physiological Hydrological Niche	Dependence on a specific precipitation or hydrologic regime
Disturbance	Dependence on a specific disturbance regime likely to be impacted by climate change
Dependence on Ice / Snow	Dependence on ice, ice-edge, or snow-cover habitats
Restriction to Uncommon Geologic Features	Dependence on specific substrates, soils, or physical features such as caves, cliffs, or sand dunes
Habitat Creation	Dependence on another species to generate habitat
Dietary Versatility	Breadth of food types consumed; dietary specialists vs. generalists (animals only)
Pollinator Versatility	Number of pollinator species (plants only)
Propagule Dispersal	Dependence on other species for propagule dispersal
Sensitivity to Pathogens or Natural Enemies	Pathogens and natural enemies (e.g., predators, parasitoids, herbivores, and parasite vectors) that can increase or become more pathogenic due to climate change
Sensitivity to competition from native or non-native species	Species may suffer when competitors are favored by changing climates
Interspecific Interactions	Other interspecific interactions not including diet, pollination, and habitat creation
Genetic Variation	Measured genetic variation (high, medium, low)
Genetic Bottlenecks	Occurrence of bottlenecks in recent evolutionary history
Reproductive System	A plant's reproductive system may serve as a proxy for a species' genetic variation or capacity to adapt to novel climatic conditions (plants only)
Phenological Response	Phenological response to changing seasonal temperature and precipitation dynamics

Each factor was evaluated independently for each species and given a classification defined by NatureServe. The five categories are: 1) *Greatly Increases Vulnerability (GI Red)*, 2) *Increases Vulnerability (Inc. - yellow)*, 3) *Somewhat Increases Vulnerability (SI-yellow)*, 4) *Neutral*, and 5) *Unknown*.

The four vulnerability ranking categories seen in this assessment are described below.

- **Extremely Vulnerable:** Species abundance and/or range extent within the project area is extremely likely to substantially decrease or disappear.
- **Highly Vulnerable:** Species abundance and/or range extent within the project area is likely to decrease significantly.
- **Moderately Vulnerable:** Species abundance and/or range extent within the project area is likely to decrease.
- **Less Vulnerable:** Available evidence does not suggest that species abundance and/or range extent within the project area will change substantially, actual range boundaries may change.

Quantitatively (CCVI) Assessed Species FINAL																												
English Name	Scientific Name	Group	Sea level	Natural barriers	Anthropogenic barriers	Climate change mitigation	Dispersal/Movement	Historical thermal niche	Physiol. thermal niche	Historical hydro. niche	Physiol. hydro. niche	Dependence on disturbance	Dependence on ice/snow	Physical habitat features	Other species for habitat	Dietary specificity	Pollinator specificity	Other species for dispersal	Pathogens/enemies	Competition	Other species interaction	Genetic variation	Genetic bottleneck	Reproductive system	Phenological response	Documented response	2050, RCP 8.5	2090, RCP 8.5
Common Loon	<i>Gavia immer</i>	Bird	N	N	N	N	N	N	Inc	N	Inc	N	N	N	N	N/A	N	SI	U	N	U	U	U	U	U	U	LV	MV
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Bird	N	N	N	N	N	N	Inc	N	SI	N	N	N	N/A	N	U	N	N	N	N	N/A	N/A	U	U	U	LV	LV
Great Blue Heron	<i>Ardea herodias</i>	Bird	N	N	N	N	N	N	Inc	SI	N	N	N	N	N/A	N	U	N	N	N	N/A	N/A	N	U	U	LV	LV	
Snowshoe Hare	<i>Lepus americanus</i>	Mammal	N	SI	Inc	N	N	SI	Inc	N	SI	GI	N	N	N/A	N	SI	SI	SI	N	N/A	N/A	Inc	U	U	HV	EV	
Waabizheshi	<i>Martes americana</i>	Mammal	N	SI	Inc	N	N	GI	Inc	N	Inc	GI	N	N	N/A	N	U	SI	N	U	U	U	U	U	U	HV	EV	
Little Brown Bat	<i>Myotis lucifugus</i>	Mammal	N	N	SI	N	SI	N	Inc	SI	SI	N	N	N	N/A	N	SI	N/A	N	N	N	N/A	N/A	U	U	MV	HV	
Common Muskrat	<i>Ondatra zibethicus</i>	Mammal	N	SI	SI	N	SI	N	Inc	SI	N	N	N	N	N/A	N	U	U	N	U	U	U	U	U	U	LV	MV	
Black Bear	<i>Ursus americanus</i>	Mammal	N	N	N	N	N	N	Inc	N	N	N	N	N	N/A	N	SI	N	N	N	N/A	N/A	U	U	U	LV	LV	
White Tailed Deer	<i>Odocoileus virginianus</i>	Mammal	N	N	N	N	N	N	Inc	N	N	N	N	N	N/A	N	U	N	N	N	N/A	N/A	N	U	U	LV	LV	
Spring Peepers Frog	<i>Pseudacris crucifer</i>	Amphibian	N	SI	Inc	N	SI	N	Inc	Inc	SI	N	N	N	N/A	N	SI	SI	N	N	N/A	N/A	U	U	U	MV	EV	
Cisco	<i>Coregonus artedii</i>	Fish	N	Inc	Inc	N	Inc	N	GI	Inc	Inc	U	SI	N	N	SI	N/A	N	U	U	N	U	U	U	Inc	U	HV	EV
Lake Sturgeon	<i>Acipenser fulvescens</i>	Fish	N	SI	Inc	N	N	N	GI	Inc	SI	U	N	N	N	N/A	N	SI	U	N	U	U	U	U	U	U	MV	EV
Ogaa (Walleye)	<i>Sander vitreus</i>	Fish	N	N	Inc	N	N	N	SI	Inc	Inc	SI	N	N	N/A	N	U	SI	N	U	U	U	U	U	U	U	MV	HV
Honey Bee	<i>Bombus affinis</i>	Invert-Insect	N	N	N	N	N	N	SI	Inc	N	SI	N	N	N	SI	N/A	N	Inc	SI	SI	N	N/A	N/A	N	U	MV	EV
Manoomin (Wild Rice)	<i>Zizania palustris</i>	Plant	N	Inc	Inc	N	Inc	N	SI	Inc	Inc	Inc	SI	N	SI	N/A	SI	SI	SI	Inc	N	N	N/A	N/A	U	U	EV	EV
Northern White Cedar	<i>Thuja occidentalis</i>	Plant	N	N	N	N	SI	N	Inc	Inc	Inc	Inc	N	N	N/A	N	N	N	Inc	N	N	N/A	N/A	SI	U	U	MV	EV
White Birch	<i>Betula papyrifera</i>	Plant	N	N	N	N	N	N	Inc	Inc	N	Inc	N	N	N/A	N	U	Inc	N	N	N/A	N/A	U	U	U	U	MV	EV
Highbush Cranberry	<i>Viburnum trilobum</i>	Plant	N	N	N	N	N	N	Inc	Inc	SI	U	N	N	N/A	N	SI	U	N	N	N/A	N/A	SI	U	U	U	LV	HV
Sugar Maple	<i>Acer Saccharum</i>	Plant	N	N	N	N	N	N	SI	Inc	Inc	SI	N	N	N/A	N	N	N	N	N	N	N/A	N/A	SI	U	U	LV	MV
Wild Strawberry	<i>Fragaria virginiana</i>	Plant	N	N	N	N	N	N	Inc	N	N	N	N	N	N/A	SI	N	N	U	N	N	N/A	N/A	N	U	U	LV	LV

Figure 12: Summary of Climate Change Vulnerability Index (CCVI) scores the 20 species evaluated over the course of this project. Species are grouped by type (Birds, Mammals, Amphibians, Fish, Insects, and Plants) and evaluated based on 23 individual species specific factors that affect vulnerability. Vulnerability rankings are shown in the final two columns based on the higher climate change scenario (RCP 8.5) for the 2050s (second to last column), and 2090s (last column). Vulnerability rankings fall into four categories: Low Vulnerability (LV- green), Medium Vulnerability (MV - yellow), High Vulnerability (HV - orange), and Extreme Vulnerability (EV- red).

This initial list of 20 species are a starting point for further work by the Tribe to assess and reduce the vulnerability for all species in the region. As additional funding is secured, more species can be added to this list and assessed. The goal is for this project to lay the foundation for the ongoing work of building climate resilience throughout the community and with the natural resources that are integral to our culture, livelihoods, and lifeways.



Figure 13: TCRP members working on the climate resilience initiative during one of the project workshops.

C. Adaptation Plan

As a critical step towards building resilience, the tribe has identified hundreds of actions to respond to the natural and man-made impacts on **Natural Resources, Community and Public Health**, and **Infrastructure**. These actions were co-developed and prioritized through a community engagement and review process whereby key Tribal experts provided input into the design and selection of the actions.

A short summary of the high priority or initial actions identified to respond to climate change, address the key concerns related to public health, infrastructure, and natural resources is provided below (Figure 14). These 14 action areas were selected by the TCRP/TEPC as places to begin implementing actions that will enhance the resilience of the community. Example actions for each of the key concerns and individual species can be found on the Tribe's Climate Resilience Initiative website: www.ldfclimateresilience.org.

Actions for Phase I Implementation	Responsible Party	Priority	Focus Area		
			Public Health	Natural Resources	Infrastructure
Enhance financial support for Drug Endangered Children (DEC) and the adult response team as well as coordination with other tribal programs.	Drug Endangered Children Team	High			
Review and apply for funding relating to responding to substance abuse issues including intervention, prevention, and treatment.	Planning Department	High			
Enhance partnerships with local agencies to provide public education and outreach on all substances, including where addicts can find assistance for treatment and recovery.	State of Emergency	High			
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 education on ways to avoid vector borne diseases (especially for elders/youth).	Community Health, Clinic, Vilas County Public Health, Natural Resources	High			
Monitor and expand list of vulnerable populations within the Reservation, with a focus on those with lower capacity and few resources to adapt to extreme heat conditions (e.g., those with chronic diseases, elders).	Community Health, Elders Program, Clinic, Emergency Management	High			
Expand food sovereignty efforts through the development of more community gardens, cultivating traditional plants, and land management projects that provide opportunities to connect people (especially youth) to the land. Expand efforts to teach people how to gather and process traditional foods, promote culture, and what constitutes a healthy diet.	Natural Resources (Gitigaan Coalition), Planning Department	High			
Expand programs to empower youth, including youth forums, language revitalization, and community organizing trainings to support further reintegration back into culture.	Natural Resources (Gitigaan Coalition), Planning Department, Youth Center, Tribal Historic Preservation Office, Language Program	High			
Document tribal stories through storytelling, book writing, and other forums to get the truth of traumas out and heal the wounds of past generations.	Clinic, Language Program, Tribal Historic Preservation Office, Family Circles, Youth Center, Elder Program	High			
Protect and mitigate existing impacts to the forests particularly adjacent to wetlands and riparian areas. 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 of climate change to cultural and historical resources.	Water Resource Program, Natural Resources, Land Use Allocation Team	High			
Invest in 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, Land Use Allocation Team, Planning Department, Roads Department	High			
Conduct outreach activities to increase awareness of tornado risk including: - Educating citizens through Public Service Announcements; - Conducting tornado drills in schools and public buildings; - Distributing tornado shelter location information; - Supporting severe weather awareness week; - Promoting the use of NOAA weather radios; and - Teaching school children about the dangers of tornadoes and how to take safety precautions.	Emergency Management, Communication Office	High			
Continue to identify special needs populations (e.g. homebound, those who use durable medical equipment, elders with mobility issues) at particular risk from lack of shelter, isolation, and cold temperatures 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			

Figure 14: Initial 14 actions identified by the Tribal Climate Resilience Planning and Tribal Emergency Preparedness Committees as high priorities for implementation. Implementation of these actions will improve the health, safety, security, and resilience of the community.

D. Hazard Mitigation Plan

For the Lac du Flambeau Tribe, water is a central and critical component of day-to-day life. About half of the reservation's geographic area consists of water or wetland habitat, 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 as the climate changes.

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 set them up to continue to identify and implement mitigation actions in the future.

The 18-month plan development process culminated in an update to the 2006 plan that the Lac du Flambeau Tribe completed in collaboration with Vilas 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).² An adopted FEMA-approved hazard mitigation plan is a condition to receiving certain types of non-emergency disaster assistance.

A short summary of the hazard assessment and hazard mitigation action development process is provided below. A more complete description can be found on the Tribe's Climate Resilience Initiative website: www.ldfclimateresilience.org. The website also provides a link to the completed and FEMA-approved Hazard Mitigation Plan with all the details of the planning process, assessment, and actions for each hazard area.

Hazard Profiles and Assessment

The hazard identification process recognized 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 thirteen highest-ranking hazards in this plan are profiled below and listed in order of relative risk (Figure 15).

² FEMA. Tribal Mitigation Plan Review Guide. 2018. FP 206-112-01 OMB Collection Number: 1660-0062

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 15: 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.

Development of Hazard Mitigation Actions

The development and prioritization of mitigation actions followed the process described in the previous sections. These actions were drawn from existing tribal activities, actions that are being taken by other communities facing similar hazards, and the tribal staff members' recommendations. The TEPC 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. For each proposed action, the TEPC worked together in small and large groups during a workshop to assign qualitative rankings for each of the following categories:

- **Feasibility:** a combined ranking of the political and technical feasibility of an action (low, medium, high);
- **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 cost (> \$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 not individually weighted but used to inform the discussion and allow the TEPC to work together and use a consensus-based approach to assign 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 successful implementation.

Priority Actions

Through discussion, each member of the TEPC selected an action that her/his department could commit to completing and implementing in the near future. The listed 15 key actions in Table 3 are a subset of the more expansive list of actions designed to reduce the risk of each hazard addressed in the plan and represent the Tribe's priorities for initial implementation. They represent initial starting points for the implementation of hazard mitigation actions across a majority of the Tribe's departments. The expectation is that this initial list will be refined and updated overtime as the actions are taken and new actions reviewed and added to the priority list.

Table 4: Phase I- Implementation actions identified by the TEPC as starting points for action. Table includes action summary, responsible party, priority, and potential funding sources.

Community Safety & Security Actions	Responsible Party(ies)	Priority	Potential Funding Source
Enhance support for Drug Endangered Children (DEC) and adult response team that will coordinate with other tribal programs.	LdF DEC Team	High	Federal Emergency Management Department (FEMA) Wisconsin Department of Children and Families Indian Health Service Substance Abuse and Mental Health Services Administration (SAMSHA) Coordinated Tribal Assistance Services (CTAS)
Review and apply for any funding relating to substance abuse issues including intervention, prevention, and treatment.	Planning Dept.	High	FEMA SAMSHA Indian Health Services U.S. Department of Health and Human Services
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	FEMA SAMSHA Wisconsin Department of Health Services Medical College of Wisconsin
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	FEMA Bureau of Indian Education Wisconsin School Safety Grant U.S. Department of Justice
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 education about vector borne disease prevention could include specific suggestions such as personal protection (e.g., use effective tick repellents and apply according to the label instructions), seeking medical attention with the onset of symptoms following an insect bite, avoid being outside during dawn/dusk (high mosquito time), etc.	Community Health, Clinic, Vilas County PH, Natural Resources	High	FEMA U.S. Environmental Protection Agency Indian Health Service - Community Health Wisconsin Department of Health Services Wisconsin Dept of Agriculture and Consumer Protection Centers for Disease Prevention and Control (CDC)
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	FEMA Indian Health Service Wisconsin Department of Health Services U.S. Environmental Protection Agency Medical College of Wisconsin
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	FEMA Indian Health Service Bureau of Indian Affairs U.S. Department of Agriculture (USDA)
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	FEMA Bureau of Indian Affairs Wisconsin Department of Public Instruction Administration for Native Americans
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	FEMA Indian Health Service Bureau of Indian Affairs - Historic Preservation SAMSHA Wisconsin Department of Public Instruction
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	FEMA Bureau of Indian Affairs U.S. Environmental Protection Agency USDA - Natural Resources Conservation Service
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	FEMA Bureau of Indian Affairs U.S. Department of Transportation U.S. Department of Energy
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	FEMA Bureau of Indian Affairs Wisconsin School Safety Grant
Continue to identify special needs populations (e.g. homebound, durable medical) at particular risk from lack of shelter, isolation, and cold temperatures, especially as may occur during extended power outages.	Elder Services	High	FEMA Wisconsin Department of Health Services Wisconsin Aging and Disabilities Resource Center
Continue to work with Oneida County to maintain Level B Hazardous Materials Response Team support.	Emergency Management	High	FEMA U.S. Environmental Protection Agency U.S. Department of Transportation
Provide local household Hazardous Materials Disposal options either continuously or on a bi-annual or quarterly basis.	Natural Resources	High	FEMA Indian Health Service Wisconsin Department of Health Services

Conclusion

The Lac du Flambeau Tribe is helping to lead the way in preparing for climate change in the Great Lakes region. By taking a holistic view of the climate change problem and by involving the community in all aspects of the project from the very beginning, the Tribe is working to ensure that the results of the project are effective and usable.

Although the Climate Resilience Initiative is complete, it is not the end of the process. It is a step along the journey towards building climate resilience. The goal is to have this as a living framework that can be updated and modified over time. As the actions are implemented, or as information changes, new actions will be added to the priority list or integrated into planning and management documents. Some departments are already starting to do this as they are using the adaptation actions developed through this program to inform their annual applications to the general fund or develop strategic implementation plans. By continuing to invest in the resilience initiative and support the work done by the TCRP/TEPC, the Tribe will be able to keep up with changing climate conditions and ensure that their priority actions are useful and usable by both departmental staff and the community as a whole.

By completing this project, the Lac du Flambeau Tribe has taken the next big step in the resilience journey and created a solid foundation not only to better understand climate change related risks and impacts, but also to take action to address those risks, adapt to changing conditions, and build resilience for generations to come. By acting now, the tribe will help ensure that the community will continue to survive and thrive in *Waaswaaganing* for the next seven generations.



Figure 16: The land and water of the region. Photo credit: Sascha Petersen

Lessons Learned:

1. Community engagement was the key and absolutely necessary for the success of this project.
2. Tribal Program engagement is also key to the success of the project and is helpful when incorporating environmental impact thinking into the everyday management of their departments, especially for non-natural resource/environmental programs.
3. Combining the planning for Climate Resiliency and Emergency Management was a very good idea because of the common treads and connections associated with how climate change will impact natural resources, infrastructure and community health/welfare at the same time.

Recommendations:

1. Not sure I have a recommendation but it is very important to continue to emphasize the need for climate resiliency planning coupled with alternative and conservation energy planning.