Delaware Tribe of Indians Climate Adaptation Plan

Prepared for

The Delaware Tribe of Indians Environmental Program

Prepared by

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October 2024 Draft

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1 Introduction

The Delaware Tribe of Indians (Tribe), with headquarters in Bartlesville, Oklahoma and Caney, Kansas, is one of many tribes today that are descended from peoples who originally spoke two closely related languages, Unami and Munsee. The homelands of the Unami- and Munsee-speaking people were along the Hudson River and Lënapei Sipu (Delaware River), within what are today the states of New Jersey, Pennsylvania, New York, and Delaware. Munsee-speaking people were mainly along the upper Delaware and lower Hudson rivers, while the Unami-speaking people, of whom the Tribe are primarily descendants, were located along the lower Lënapei Sipu (Delaware River). Post colonial contact, the Unami- and Munsee-speaking people were forced from their ancestral homelands, with groups moving to different parts of the United States and Canada. The people who are today known as the Delaware Tribe of Indians followed a forced removal trail that included Ohio, Kansas, and then ultimately northeastern Oklahoma (Delaware Tribe of Indians, 2024).

Today the Tribe has a main campus (or headquarters) situated on 79 acres of land in Bartlesville, Oklahoma. The main campus houses Tribal facilities, including the Delaware Community Center, the Delaware Wellness Center and Tribal Offices, and the Delaware Social Services Building. The campus also has a community pond, an orchard, kìkayàk (elders) housing, and several acres of undeveloped land. The Tribe's Pow Wow grounds are located on a land parcel just north of the main campus, in Copan, Oklahoma. The Tribe has a second headquarters in Caney, Kansas, home to additional Tribal offices, and a 4,000-acre ranch near the town of Sedan, Kansas (Exhibit 1-1).

While the Tribe's official name is "the Delaware Tribe of Indians", the term "Delaware" was assigned by colonialists for the people who lived in the Lënapei Sipu (Delaware River) basin, and Lenape is the Unami self-designation, which roughly translates as "People". The ancestors of the Delaware Tribe of Indians relied on the Lënapei Sipu (Delaware River), its tributaries and the land surrounding it to hunt, fish, gather, and farm. These activities provided the Tribe with mehëmichink (food) and a way to embrace community and culture. Much of the Tribe's spirituality is tied to these ancestral lands. Following the removal of the Tribe to Kansas and Oklahoma, traditional ways had to be adapted to this new environment. As one Lenape kìkay (elder) stated, the Tribe had to adapt from being a woodlands people to

> "***When we left the east coast and were forced out, we had to adapt to new lands, new animals, new places, new plants …***
>
> ***…We were actually a woodland people, but when we got to Kansas and Oklahoma, we had to adapt to being a plains people…and started to hunt buffalo [bison]…***
>
> ***…That's something Tribes have always been able to do, is to adapt to any situation***"
>
> **-Lenape Kìkay (Elder), 2024**

being a plains people, and started to hunt sisilie (bison), which adaptively became culturally important to the Tribe. This ability to adapt to changing environments speaks to the Tribe's core resilience, which is foundational to the Tribe's climate adaptation planning.

Today, the Tribe is striving to build community resilience and sustain traditional ways of life. In particular, mehëmichink (food) sovereignty and addressing mehëmichink (food) insecurity and mehëmichink (food) deserts, while re-invigorating traditional practices and protecting the Tribe's infrastructure are priorities. These priorities are further complicated by climate change. Climate impacts facing the Tribe include higher temperatures and heat waves, drought, and extreme events, such as flooding, and possibly increased exposure to tornadoes (USGCRP, 2023). Given these challenges, the Delaware Tribe of Indians has developed this Climate Adaptation Plan (Plan) to create an adaptive approach to addressing the impacts of climate change.

This Plan details the Tribe's climate resilience planning process (Section 2), describes the vision for the Tribe's people, which is foundational to the planning process (Section 3), and presents the Tribe's climate vulnerability assessment (Section 4). The Plan then describes the specific actions the Tribe can take to adapt to climate change (Section 5), followed by references.

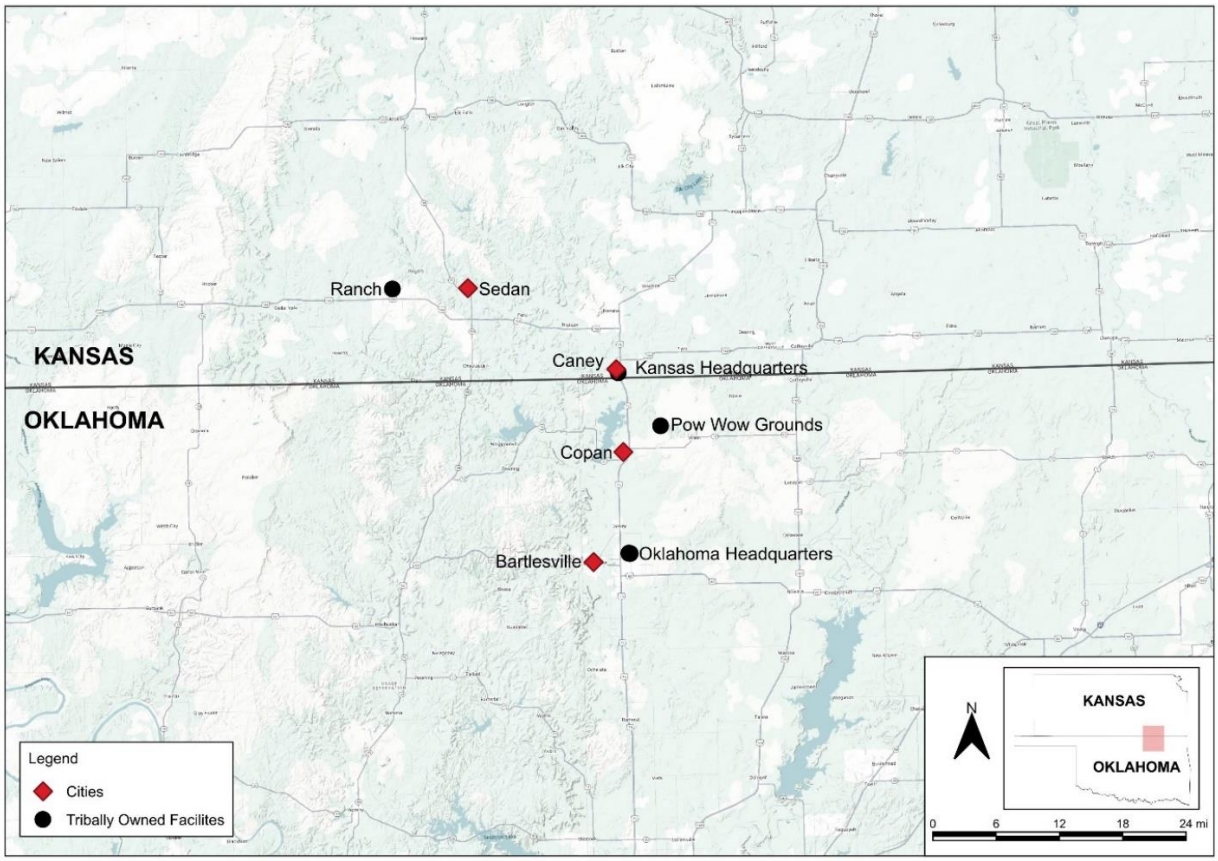


Exhibit 1-1. Map of Delaware Tribe of Indians places, including headquarters in Bartlesville OK and Caney, KS, the Tribe's Pow-Wow grounds in Copan, OK, and the Tribe's ranch, near Sedan, KS.

2 Developing the Climate Adaptation Plan

This Section describes the process the Tribe followed to develop this Plan. To inform the adaptation planning process, the Tribe first gathered information by interviewing kìkayàk (elders), and then conducted some initial geospatial analyses. Building upon these initial activities, the Tribe then followed a stepwise process to develop this Plan (Exhibit 2-1). The Tribe conducted a series of climate webinar workshops with Tribal staff and council members to: 1) develop a community vision for its people (step 1); crosswalk the community vision with climate impacts in a vulnerability assessment (step 2); and identify adaptation actions to address the climate vulnerabilities (step 3). As a next step, the Tribe intends to start implementing adaptation actions identified in the Plan (step 4).

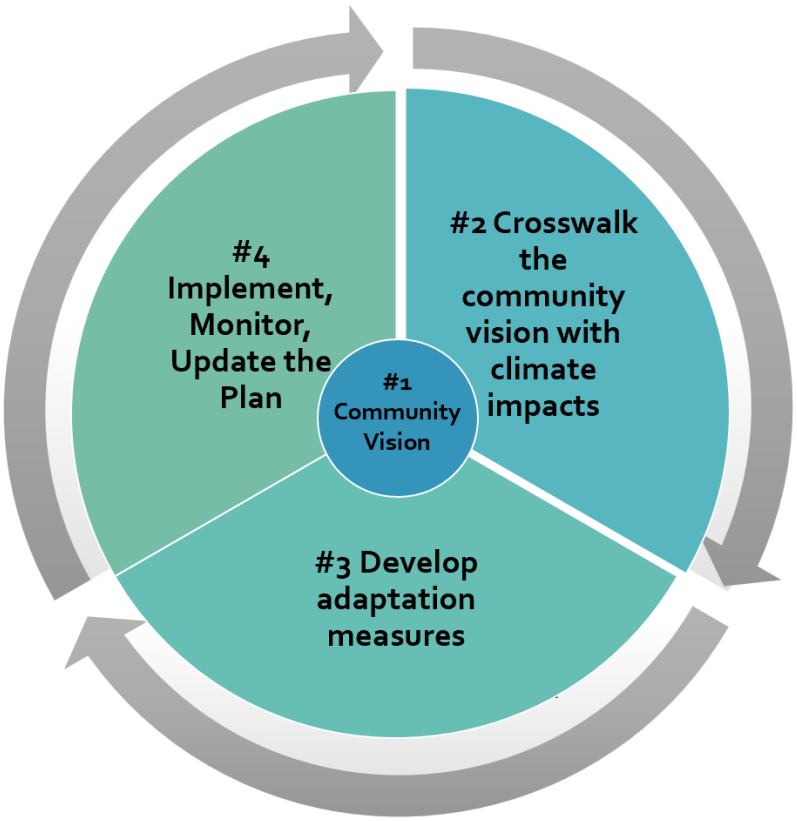


Exhibit 2-1. Climate adaptation planning process.

Refinements may be made to the Plan as implementation proceeds, with planning and implementation viewed as iterative processes. This plan is a living document that will evolve and expand with new knowledge, data, and evidence about the impacts of climate change, through lessons learned as adaptation actions are implemented, and as new climate adaptation strategies are identified.

Below we provide a summary of the initial planning activities conducted by the Tribe, including the kìkay (elder) interviews and the geospatial analysis of climate impacts and climate vulnerabilities (Section 2.1), followed by descriptions of the climate webinar workshops (Section 2.2).

2.1 Initial Climate Adaptation Planning Activities

2.1.1 Kìkay (Elder) Interviews

The Tribe held interviews with Tribal kìkayàk (elders) to record their experiences and perspectives regarding the importance of the environment to the Lenape people, impacts of climate change, and their thoughts on mehëmichink (food) security and emergency preparedness. In total, nine interviews were conducted. The interviews were conducted by Tribal youth, in partnership with the Tribal staff, and each kìkay (elder) was asked the same set of prepared questions. The interviews were held at the annual Pow Wow in May 2024.

Exhibit 2-2 provides a matrix that summarizes the responses for each of the interview questions. The matrix summarizes key themes that emerged from the interviews and provides tallies of the "yes/no" questions. Some of the key themes on the importance of the environment and climate change impacts included:

- **Importance of the environment:** All of the kìkayàk (elders) indicated that the environment is important to the Lenape people. One theme was that the Lenape have a reciprocal relationship with the environment - as one kìkay (elder) commented, "*if we don't take care of it, it won't take care of us.*" Another theme was that part of the Lenape's survival as a people stems from an ability to adapt to changes in the environment, with one kìkay (elder) commenting, "*When we left the east coast and were forced out we had to adapt to new lands, new animals, new places, new plants that were available, we had to learn how to adapt to each of those things.*" Yet another theme that emerged was the importance of the environment for provisioning Lënapei mitsuwakàna (first foods; foods that were eaten pre-colonial contact) and medicine, and in traditional ceremony. One kìkay (elder) noted that while she, "*did not know much growing up,*" she spoke of learning about the environment as a part of, "*learn[ing] about her people,*" highlighting the importance of the environment to the identity of the Lenape.

> "***Our worldview as Lenape people is that the land, the water, the air, the mountains, all creatures, including the humans - we all have a spirit and … we had a knowledge of having a spiritual relationship with all of creation***."
>
> -Lenape Kìkay (Elder), 2024

- **Climate change impacts:** The kìkayàk (elders) discussed many observations of climate impacts, including lower mpi (water) levels (drought) and degraded mpi (water) quality (boil water advisories), observations of hotter temperatures for longer periods, concerns over increased frequency and intensity of extreme events (e.g., flooding, tornadoes), and other impacts. While there may have been different viewpoints on the root cause of these changes, with one kìkay (elder) stating

"*…can't surmise what the weather patterns are going to look like, that's up to our Creator*", all the kìkayàk (elders) noted that changes are occurring.

In addition, all of the kìkayàk (elders) spoke of the importance of protecting cultural resources and nkwëchkwënawëna (burial) grounds that may be at risk of flooding. They also provided feedback on mehëmichink (food) security and emergency preparedness. These topics are summarized in Exhibit 2-1 and discussed in further detail from the context of adaptation actions in Section 5.

Exhibit 2-1. Kìkay (elder) interview summary matrix.

Interview Question	Kìkay (Elder) Response
Introductory Question	
Where did you grow up?	• 6 kìkayàk (elders) were from Oklahoma • 1 from Kansas • 1 from Ohio • 1 not reported (not asked)
Importance of the Environment	

How important is the environment to the Lenape people?	All nine kìkayàk (elders) indicated the environment is important. Comments on the importance of the environment are grouped below by key themes:
	• Reciprocal relationship with the environment.
	  ○ One kìkay (elder) noted, "*If we don't take care of it, it won't take care of us.*"
	  ○ Another kìkay (elder) stated, "W*e took care of the water, we took care of the soil, we took care of the animals - even when we hunted them*."
	• Adaptability:
	  ○ One kìkay (elder) described the close relationship with the environment and the importance of the Lenape people's ability to adapt to environmental changes for their survival, "*When we left the east coast and were forced out we had to adapt to new lands, new animals, new places, new plants that were available, we had to learn how to adapt to each of those things….We were actually a woodland people, but when we get to Kansas and Oklahoma, we had to adapt to being a plains tribe people, we stopped being a woodlands culture and started to hunt buffalo (bison)…*"
	• Source of Lënapei mitsuwakàna (first foods):
	  ○ Gardening to supply fresh produce, including the orchard planted on the Tribe's campus
	  ○ Re-introducing (sisilie) bison at the Tribe's ranch
	  ○ One kìkay (elder) noted the importance of, "*planting our food, traditional medicine*"
	  ○ One kìkay (elder) stated, "*Learning what's there to eat, where it's at and when to look for it. Learning, that's the main thing*."

	• Traditional ceremonies: The environment is important to traditional ceremonies (e.g. provisioning traditional mehëmichink (food) and medicines used in ceremonies). • Importance of reintroducing traditional knowledge: One kìkay (elder) shared that she didn't know much growing up, but how important it was to her now to learn about her people. • Impacts on property: An kìkay (elder) voiced concerns about the impacts of the environment (e.g., flooding) on individuals' property.
Climate Impacts	
With shifting weather patterns, what do you think are the biggest environmental challenges the Tribe is facing?	The kìkayàk (elders) noted several observations of changing patterns and associated concerns: • Lower mpi (water) levels (drought concerns) • Hotter temperatures persisting over longer time periods • Less winter • Increased flooding (and concerns about impacts to artifacts back east, impacts on farming) • Mpi (water) quality decline (boil water advisory) • Air quality concerns (mentioned oil fieldso—which elevated temperatures may exacerbate) • Tornadoes • "*A lot of challenges, and getting worse*" • Acknowledgment of changing conditions, even if there may be different interpretations of the cause, "*Can't surmise what the weather patterns are going to look like, that's up to our Creator*."
With many of our historic and cultural resources being affected by coastal erosion and sipu (river) flooding, what do you propose we do with these resources?	All nine kìkayàk (elders) said cultural resources should be relocated (including artifacts and nkwëchkwënawëna [burial] grounds): • One kìkay (elder) indicated there is a cultural responsibility to move resources • Two suggestions for placing artifacts in a museum owned and operated by the Lenape, with an emphasis on passing down knowledge to the youth • Multiple kìkayàk (elders) said resources should be moved to higher ground; some said bring resources back in possession of the Tribe
Should we move these resources, including nkwëchkwënawëna (burial) grounds, to higher grounds?	• All nine kìkayàk (elders) said yes to moving resources to higher grounds
Mehëmichink (food) security	
When you were younger what did you do for mehëmichink (food)?	• Four kìkayàk (elders) indicated their families had vegetable gardens - white corn, blue corn, squash, broccoli, potatoes • Two kìkayàk (elders) mentioned growing up with hunting— ahtu(hw) (deer), chahkolàk (frog), xanikw (squirrel), chëmamës (rabbit)

	• One kìkay (elder) described gathering mehëmichink (food)—ahpawiàk (cattails), tekëneipënàk (Indian potatoes), sipuwasàk (sandhill plums), mhuwinksàk (blackberries) • Three kìkayàk (elders) indicated their families relied upon store-bought goods

Were you passed down any knowledge about traditional medicines?	• Four kìkayàk (elders) responded "yes"
	• Five kìkayàk (elders) responded "no"
	• Kìkayàk (elders) mentioned multiple plants and other materials used as traditional medicines:
	  ○ Burdock (good for blood thinner)
	  ○ Long and short leaf plantain (insect bites)
	  ○ Dandelion (can have as coffee)
	  ○ Nushemakw (willow) bark used for aspirin/for headaches
	  ○ Xalahputisikaon (spiderweb) used as a band-aid to cover cuts and cause them to swell shut
	  ○ Bark teas used for illnesses

Did anyone in your house ever go hungry or was mehëmichink (food) always available?	• No mehëmichink (food) availability concerns were reported by the kìkayàk (elders)
Emergency Preparedness	
When you were younger, what did you do to prepare for a natural disaster like a tornado?	• Three kìkayàk (elders) indicated they had shelters; the rest, "*weathered it out*."
Do you have a plan set in case of a natural disaster?	• Three kìkayàk (elders) indicated that they do not have a plan • Two indicated that they have a plan • Four indicated they have some level of partial planning
Do you have potable water storage on hand?	• Six kìkayàk (elders) said no • Three kìkayàk (elders) said yes
Does your home have a reinforced or protected shelter that you can go to in the event of a destructive storm or tornado?	• Three kìkayàk (elders) said no, they do not have a shelter • Six kìkayàk (elders) said yes, they do have a shelter • One kìkay (elder) mentioned safe room in garages of Tribal kìkay (elder) housing on campus • Two kìkayàk (elders) mentioned concerns about access to shelters for those with physical disabilities

2.1.2 Geospatial Analysis

Given that mehëmichink (food) sovereignty and addressing mehëmichink (food) insecurity and mehëmichink (food) deserts are of central importance to the Tribe, the geospatial analysis focused on mapping parameters that are indicative of current mehëmichink (food) access conditions. The geospatial analysis also focused on flood risk, as increased flooding may also adversely affect the ability of the Tribe to provision mehëmichink (food) to the

community, and may further adversely affect culturally important places, including nkwëchkwënawëna (burial) grounds.

Mehëmichink (food) insecurity: The Tribe is concerned that climate change may cause or exacerbate mehëmichink (food) insecurity. To highlight the issue of mehëmichink (food) insecurity, the Tribe produced a set of maps showing the density of grocery stores and gas stations in the region. Exhibit 2-3 shows that while there is a higher density of mehëmichink (food) stores in the immediate vicinity of Tribal headquarters in Bartlesville, the immediate surrounding areas where Tribal members live have very low densities of mehëmichink (food) stores. In these areas there is greater mehëmichink (food) insecurity, because people need to travel further to get to mehëmichink (food), and there are fewer options generally available. Longer driving distances also places a greater reliance on access to fuel, and thus, density of gas stations also affects mehëmichink (food) insecurity. Exhibit 2-4 shows the density of gas stations that Tribal members rely upon to drive to mehëmichink (food) stores, which shows a similar pattern of low densities, as observed in Exhibit 2-3. The tribe also identified soil quality as a parameter that may affect mehëmichink (food) security. As discussed further below in Section 5, an important element of combatting mehëmichink (food) insecurity is for Tribal members to grow their own mehëmichink (food) and raise their own livestock. Soil quality and soil health are important factors the Tribe will need to consider. For example, it will be important for the Tribe to understand how resilient (or not) local soil types are to potential climate impacts, and actions the Tribe may need to take to sustain soil quality necessary to raise crops and livestock.

Flood risk: Flooding is a concern for the Tribe for multiple reasons, including impacts on infrastructure, property, and agriculture/farming. Flooding is also a concern with respect to potential impacts on nkwëchkwënawëna (burial) grounds. This includes official/public cemeteries and private tëwènama (family) nkwëchkwënawëna (burial) grounds, many of which are located along waterways in locations that are prone to flooding. Exhibit 2-5 shows flood risk overlain with locations of importance to the Tribe in Oklahoma. As discussed in Section 5, the potential flooding of nkwëchkwënawëna (burial) grounds within the Tribe's ancestral homelands and along the removal trail are also a concern for the Tribe.

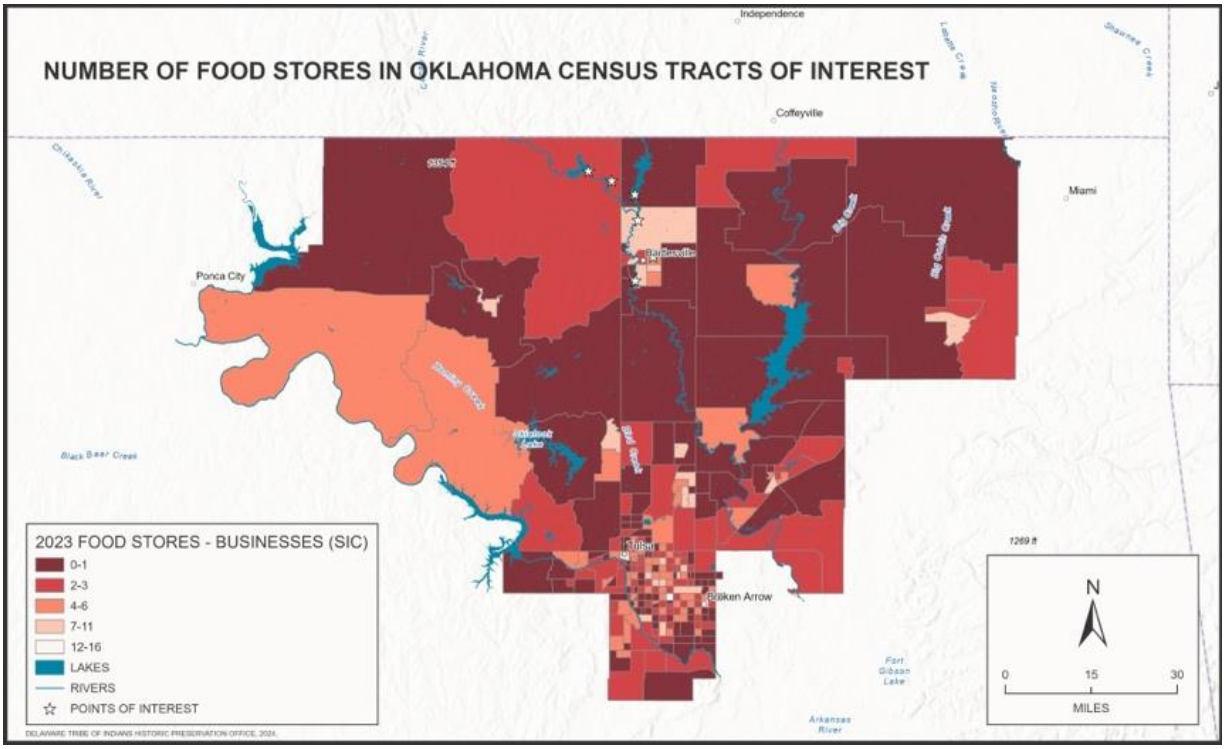


Exhibit 2-3. Density of mehëmichink (food) stores overlain with locations that are important to the Tribe (points of interest).

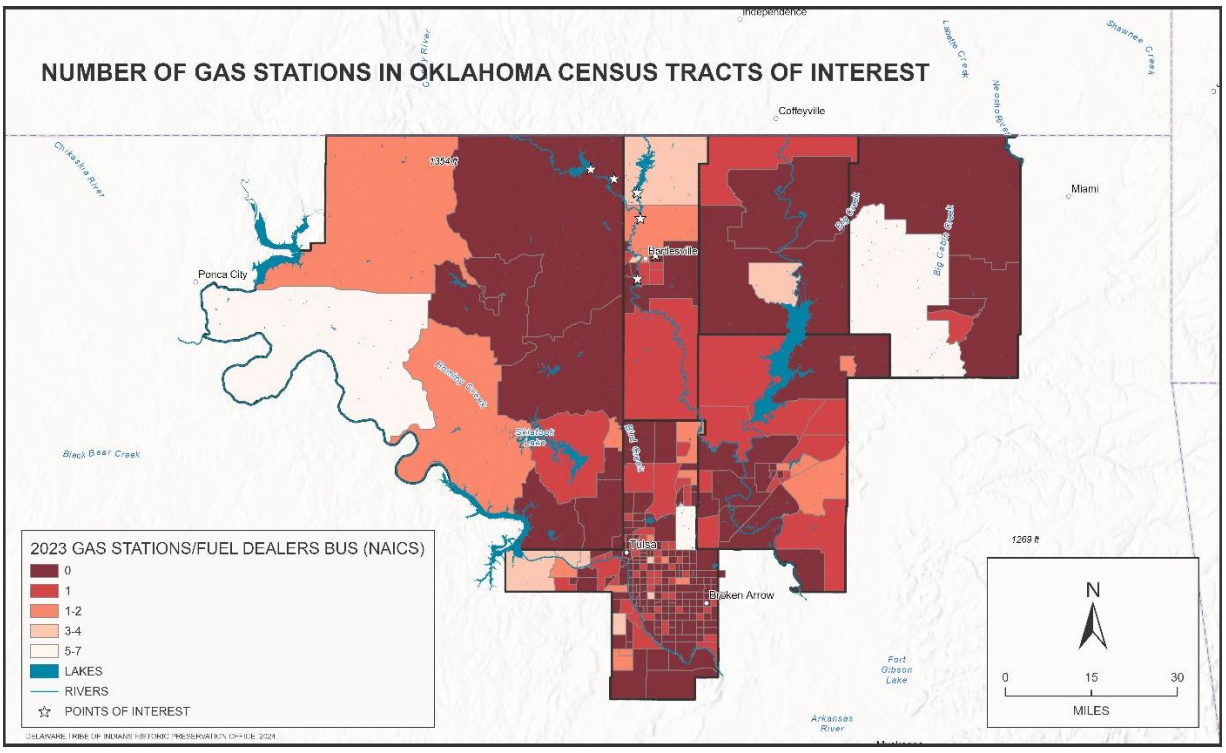


Exhibit 2-4. Density of gas stations overlain with locations that are important to the Tribe (points of interest).

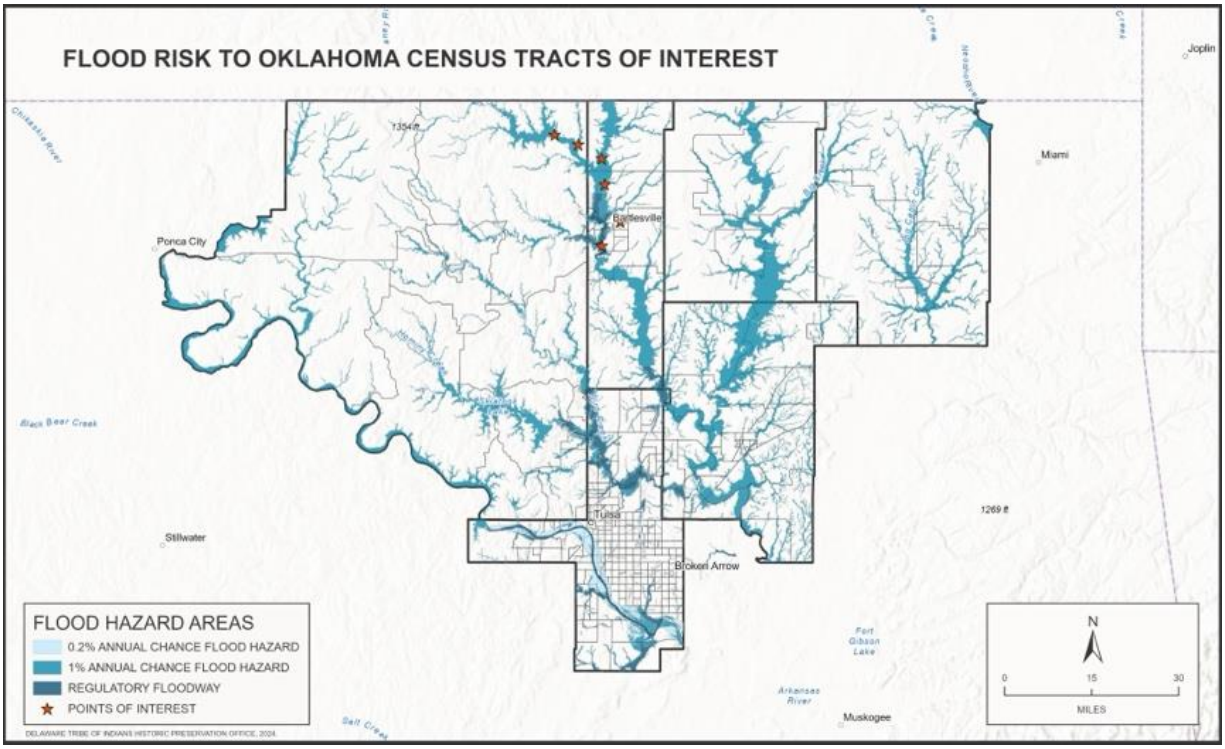


Exhibit 2-5. Flood risk areas overlain with locations that are important to the Tribe (points of interest).

2.2 Climate Webinar Workshops

After completing the kìkay (elder) interviews and initial identification of climate concerns, the Tribe engaged in the climate planning process described above (see Exhibit 2-1) to prepare this Plan. A series of four webinar workshops were held as a part of the adaptation planning process on August 27, September 3, September 5, and October 8, 2024. Meeting attendance at each workshop ranged from three to six individuals. Participants included Tribal employees from the Environmental Program and Historic Preservation Department, as well as current and past Tribal Council members, and were facilitated by Natural Nexus LLC. During the webinars, the participants developed Tribe's community vision (step 1), elucidated the consequences of climate impacts for different aspects of the Tribe's community vision for input into a vulnerability assessment (step 2), and identified and discussed adaptation actions (step 3).

The workshops provided crucial input that informed the development of the Tribe's community vision. The participants shared multiple perspectives on the severity of the consequences to the Tribe if aspects of the community vision were adversely affected by climate change and identified potential adaptation actions.

2.2.1 Workshop #1

The first workshop focused on introducing the climate planning process, discussing existing climate impacts, and introducing how a community vision can be developed. The remaining portion of the workshop then focused on building the Tribe's community vision through conversation amongst participants. The discussion was guided with a series of questions or prompts, such as, "*What are things that you would like to preserve within the community*?" and, "*What are things you'd like to add like to add or remove from your community*?" This conversation helped to identify several key aspects of the Tribe's way of life that the Tribe would like to focus on for climate adaptation planning— mehëmichink (food) sovereignty, infrastructure, traditional places and practices, and community. The Tribe's community vision is described in greater detail below in Section 3. During the workshop, participants also identified potential adaptation actions for these aspects of community life, which are also discussed further below (Section 5).

2.2.2 Workshop #2

The second workshop focused on identifying how consequential certain climate vulnerabilities would be to the Tribe. The participants were asked a series of questions that addressed the key aspects of the Tribe's community vision (food sovereignty, infrastructure, traditional places and practices, and community). Each question presented a climate vulnerability and asked the participants to score how consequential the vulnerability would be to the Tribe. The results were used in the vulnerability assessment (described in further detail in Section 4). Participants also raised additional adaptation action ideas during the discussion, which are noted and are summarized in Section 5.

2.2.3 Workshop #3

The third workshop focused on reviewing the community vision that had been developing throughout the workshop process. The participants discussed possible additions and adjustments to the community vision. Participants also clarified some of the consequence scores that were recorded at the second meeting, to ensure that the Tribe's perspective was adequately represented in the vulnerability assessment.

2.2.4 Workshop #4

During the fourth workshop, the participants focused on adaptation actions. Throughout the first three workshops, participants touched on many potential adaptation actions while discussing climate impacts and vulnerabilities. During the fourth workshop, the participants reviewed the climate adaptation actions that had been identified to date and their relevance to key aspects of the Tribe's community vision. The participants reviewed adaptation actions that could build resilience into mehëmichink (food) sovereignty, followed by those that could help protect infrastructure and traditional places and practices. They agreed that building resilience into these three components of the Tribe's community vision in turn contributed to building resilience into community.

3 Developing the Delaware Tribe of Indians' Community Vision

As described in Section 2.2, a key focus of the first and second climate workshops was developing the Tribe's community vision for its people, which then served as the foundation for next steps in the climate adaptation planning process. Workshop participants were asked a series of questions to help with articulating the community vision. Specifically, they were asked to envision an ideal future they would like to leave for their children and grandchildren and describe key elements of that community vision. They were then asked what they love about the community today (what is good/what should be preserved), and what is missing from the community today. Exhibit 3-1 illustrates some of the themes and key phrases that emerged during the discussion. A summary of responses to the prompts is provided below.

Exhibit 3-1. Themes from the vision building exercise.

What do you envision for future generations?

- Everything Tribal members need for sustenance can be found within the Tribe's campus and ranch— Fruits, vegetables, chickens/eggs, honey, cattle/sisilie (bison) – all grown/raised on the Tribe's lands
- Traditional subsistence is the norm
- Younger generations are taught traditional ways starting at a very young age
- Mehëmichink (food) sovereignty is central
- The community returns to living a camp life
    - The community is together
    - Being good relatives/Reciprocity

    - Traditional teaching for younger generation—aunties and uncles are the traditional teachers for children in the tëwènama (family)
    - Strong kìkay (elder) presence—feeling of being cared for by our kìkayàk (elders)
- Children feel secure and connect with each other and community
- Bringing back subsistence = bringing back traditional cultural practices

What do you love about this community?

- Songs, dances, and ways of being—A desire for these to be a stronger presence in community life
- Holding onto our sovereignty
- Community is a very strong theme throughout – high priority to build/expand upon sovereignty for the community, Lënapei mitsuwakàna (first foods) for the community, building strong relationships within the community, supporting the community

What is missing?

- Strong community relations – need to bring this back
- Prevalence of songs and dances—Community involvement lacking
- Mehëmichink (food) security

3.1 Delaware Tribe of Indian's Community Vision

Exhibit 3-2 shows the key aspects of Tribal life that are essential components of the community's identity and well-being and that are priorities to include in the Tribes' climate planning efforts. The key aspects of the Tribe's community vision include:

- **Mehëmichink (food) sovereignty:** Mehëmichink (food) sovereignty (the right of the Tribes to make their own decisions on mehëmichink (food) production, distribution, and consumption in a way that aligns with their cultural, ecological, social, and economic values) includes access to healthy mehëmichink (food) and the ability to grow and raise traditional mehëmichink (food). Elements include farming/community gardens, raising chickens, and beehives on the Tribe's main campus, and raising wèhshùmwis (cattle) on the ranch, with re-introduction of sisilie (bison) in the future. It also includes preparing Lënapei mitsuwakàna (first foods) and sharing meals as a community.
- **Infrastructure:** This includes:
    - Tribal-owned facilities (e.g., buildings at the Tribe's headquarters, the Pow Wow grounds, the ranch)
    - Transportation infrastructure (roads and bridges) that the Tribe does not own or manage, but uses to access Tribal facilities and in their daily lives
    - Tribal energy infrastructure and thus Tribal economic and energy security

  - Tribal business sector activities (the Tribe's cattle ranching business)
  - The property (homes) of individual Tribal members
  - The ability to respond to emergencies and protect people and Tribal facilities and infrastructure
- **Tradition**: Tradition is comprised of two subcategories: traditional places and traditional activities.
  - Traditional activities include engaging in song and dance, ceremonial practices, xès (hide) tanning, regalia-making, use of pimëwakàn (sweat lodge), and specific traditional practices that occur in response to seasonal triggers, as well as the ability to pass down knowledge of traditional activities to younger generations.
  - Traditional places include all places important to the Tribe, where Tribal activities take place. This includes the Tribe's main campus, the Tribe's ranch, and the Pow Wow grounds. It also includes the Tribe's ancestral homelands, the removal trail, and nkwëchkwënawëna (burial) grounds located within the ancestral homelands, along the removal trail, and in public and private locations in Oklahoma and Kansas.
- **Community:** Community is about relationships and connections, traditional roles and responsibilities, a strong kìkay (elder) presence, being good relatives, and strong communication between Tribal government and Tribal members. When community relations are strong, there is a feeling of being cared for, and a sense of returning to "camp life". When the tribe is able to practice its mehëmichink (food) sovereignty, has reliable infrastructure, and traditional places/practices are strong, the Tribe's community is strong. Thus, community is at the center of the community vision.

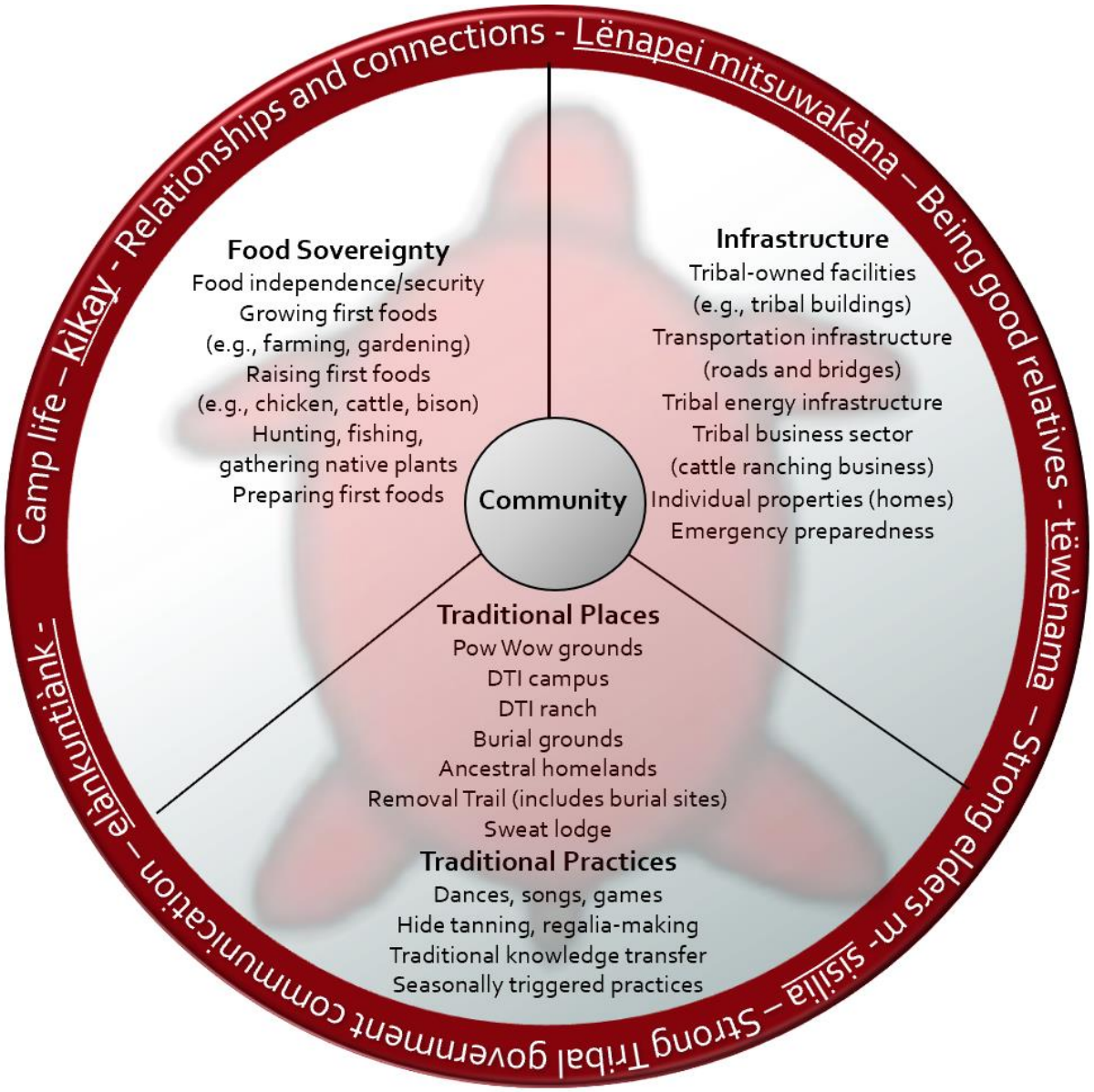


Exhibit 3-2. Delaware Tribe of Indians community vision.

4 Vulnerability Assessment

Vulnerability refers to the degree to which people or the things they value are susceptible to being adversely impacted by climate change. A climate vulnerability assessment allows decision-makers to analyze and weigh climate impacts to help identify and prioritize adaptation actions. Vulnerability assessments combine:

1) the *likelihood* that a climate impact will occur, and

2) the *consequence* of each vulnerability to the Tribe.

To conduct the vulnerability assessment, climate impacts were identified and ranked in terms of their likelihood to occur, based on best available science. The consequences of these impacts on aspects of the Tribe's community vision was then determined with Tribal input during the Webinar Workshops described above (Section 3).

This vulnerability assessment is focused on climate impacts on the Tribal places and resources in Oklahoma and Kansas. The Tribe may also develop a formal analysis for places containing nkwëchkwënawëna (burial) grounds and other culturally important sites within the Tribe's ancestral homelands and along the removal trail, in the future. These locations are under different climate regimes (e.g., eastern coastal areas), and thus will require a separate vulnerability assessment. While the vulnerability of these ancestral places is not formally assessed in this document, due to their great significance the Tribe has already begun identifying priority adaptation actions for them (Section 6).

Climate impacts are discussed in Section 4.1 An analysis of the likelihood that climate impacts will occur, the consequences to the Tribe if they do, and the resulting climate risk, determined by combining likelihood and consequence scores is presented in Section 4.2.

4.1 Climate Impacts

There are several climate impacts that may affect the Tribe in the States of Oklahoma and Kansas. These include impacts related to increased temperature, precipitation, extreme events (extreme precipitation, flooding, tornadoes), mpi (water) quality, drought, and other impacts (wildfire, air quality). This section presents information on observed and projected trends for these impacts.

4.1.1 Temperature

Below we summarize impacts associated with temperature, including increasing annual temperatures, extreme temperatures, and changes in seasonality.

Increase in average annual temperature

Average annual temperatures in Oklahoma have risen 0.6°F since the beginning of the 20th century (NOAA, 2022a) and have risen about 1.5°F in Kansas over the same time period (NOAA, 2022b). Since 2010, temperatures in Oklahoma have been higher than they were during the previous 40 years and have approached levels of the 1930s Dust Bowl era. This recent warming is mainly reflective of winter and spring temperatures. Summer average temperatures were above the long-term 20th century average in the 2010s, which included the all-time hottest summer in 2011, but have otherwise been below the long-term average (NOAA, 2022a). Summer temperatures in Kansas have been slightly warmer, with temperatures near or above average since 2000, and record high temperatures in the summer of 2012 (NOAA, 2022b).

While annual average warming in Oklahoma and Kansas has not been as drastic as in other regions in the country, projections show an overall increase in average temperatures, and for all emissions scenarios. Under all modeled scenarios, temperatures are projected to exceed record levels by the middle of this century in Oklahoma (NOAA, 2022a). In Kansas, a larger range in temperature increases is projected, and under lower emissions scenarios, projections are only slightly warmer than historical records (NOAA, 2022b).

What are "Shared Socioeconomic Pathways" (SSPs)?

SSPs are the newest greenhouse gas (GHG) emission scenarios developed for the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report.

In order to develop the SSPs, five future societal pathways were first produced, based on different assumptions about how demographics and economics may change over the next century. Then, assumptions about climate mitigation policies that could be consistently applied to those socioeconomic futures were developed (referred to as shared policy assumptions, or "SPAs"). Integrated assessment models then took these pathways and produced alternative plausible trajectories of greenhouse gas emissions and land-use change. Earth system models (e.g., CMIP6) use those emissions and land-use changes as inputs to produce climate outcomes for these different emissions scenarios:

- SSP1-2.6 = "Low" or "low emissions scenario"
- SSP2-4.5 = "Intermediate" or "middle emissions scenario"
- SSP3-7.0 = "High" or "upper-middle emissions scenario"
- SSP5-8.5 = "Very high" or "upper emissions scenario"

Sources: Fifth National Climate Assessment, Ch 3 (USGCRP, 2023); USGS National Climate Change Viewer (USGS, 2021).

Exhibit 4-1 shows the historical and projected annual and seasonal average temperatures in Washington County, Oklahoma, from 1950 to 2100 for three different SSPs (USGS, 2021). The blue line and shaded area represent the average annual projected temperatures and range for the SSP2-4.5 scenario (middle emissions scenario). The orange line represents the SSP3-7.0 scenario (upper-middle emissions scenario), and the red line represents the SSP5-8.5 scenario (upper

emissions scenario). Under all three scenarios there is a projected increase in average annual temperature, with the summer projected to experience the biggest increases in average temperature:

- SSP2-4.5 Scenario (blue line): The average annual temperature is projected to be around 63°F by 2050, an increase of 5°F from the historical average.
- SSP3-7.0 Scenario (orange line): The average annual temperature is projected to be approximately 63°F by 2050, with a greater rate of increase as time progresses.
- SSP5-8.5 Scenario (red line): The average annual temperature is projected to be approximately 65°F by 2050, an increase of 7°F from the historical average.

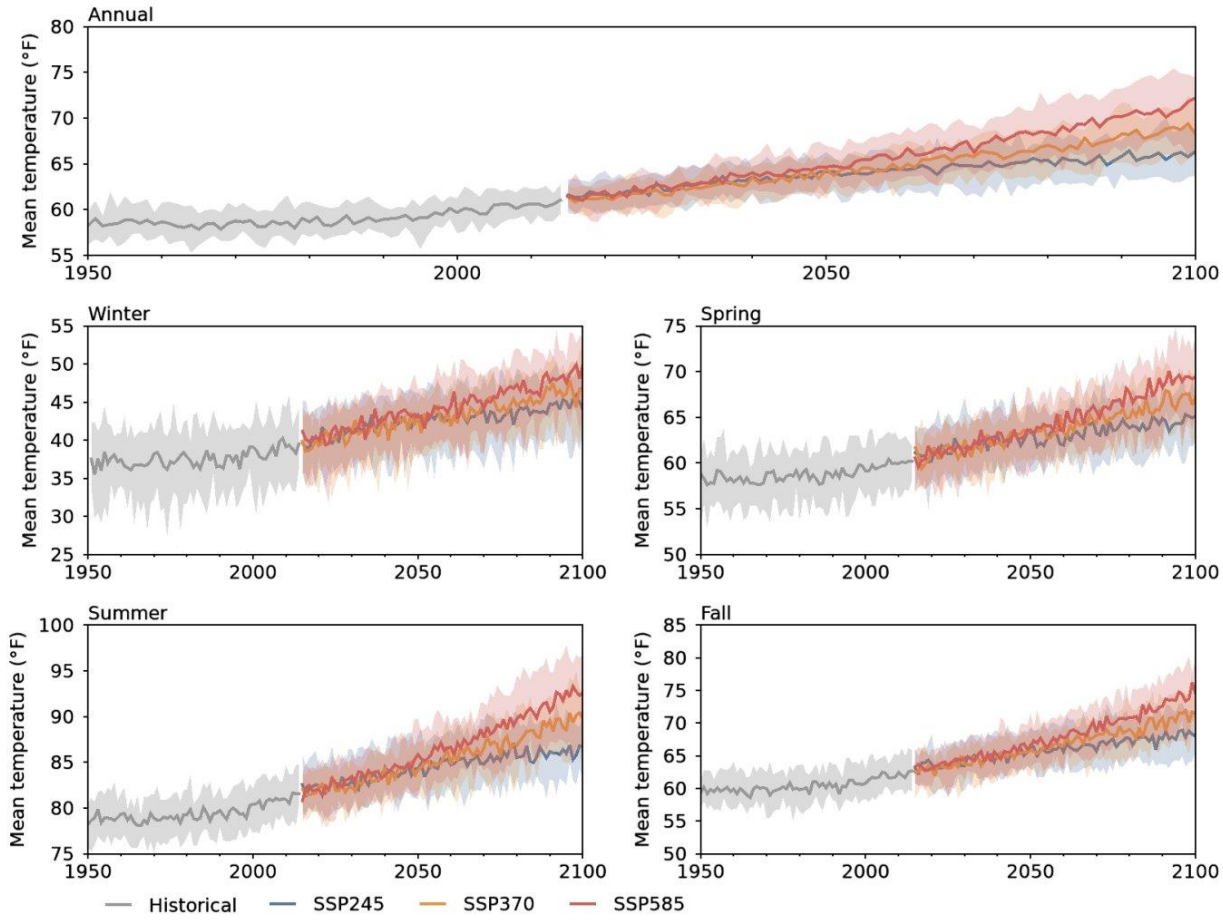


Exhibit 4-1 Historical (gray line) and projected annual and seasonal mean temperatures in Washington County, Oklahoma. Source: USGS, 2021.

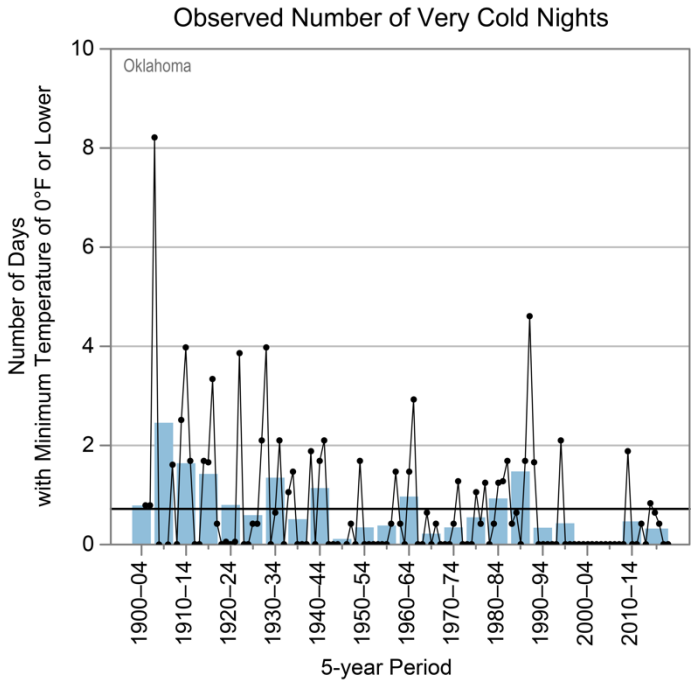


Exhibit 4-2 Observed number of very cold nights in Oklahoma from 1900-2015. Source: NOAA, 2022a.

Warming has also been observed in terms of a decrease in the number of very cold nights (defined as nights with a minimum temperature of 0°F or lower). Exhibit 4-2 shows data for the state of Oklahoma, indicating fewer cold nights between 1990 and 2015 than compared to historical values. However, there is also variability in temperature trends. For example, Oklahoma experienced a cold wave in February 2021 where temperatures remained below freezing for 10 consecutive days (not shown in Exhibit 4-2). This cold wave resulted in heavy snowfall, ice, and power outages (NOAA, 2022a). There have similarly been fewer extremely cold nights in Kansas, over similar time periods. In addition, there has been an increase in the duration of the freeze-free season in Kansas by about nine days in the 2000s, compared to the 20th century average, and this is noticeable especially in eastern Kansas (NOAA, 2022b).

Extreme Temperature

No discernable trends in the number of extremely hot days (defined by days with a maximum temperature of 100°F or higher; Exhibit 4-3) and extremely warm nights (defined by nights with a minimum temperature of 80°F) are discernable for Oklahoma over the past century, except for the 2010–2014 period. The 2010–2014 period included both the hottest summer (2011) and the hottest overall year (2012) on record for Oklahoma. While there is a lack of trend in the observed data, unprecedented warming is projected for Oklahoma in the upcoming decades (see above). With these increases in temperature, future heat waves are projected to be more intense, while cold waves are projected to become less intense (NOAA, 2022a). In Kansas, similar conditions are expected (NOAA, 2022b).

Increases in extreme heat, or heatwaves, lead to several other climate related risks such as, decreased air quality and increases in heat-related deaths. In Oklahoma and Kansas, most heat related deaths occur between July and September, during heatwaves, and will likely increase with increasing frequency of extremely hot days. Heatwaves pose a particular risk to vulnerable communities, including the elderly lacking air conditioning or other means to combat extreme temperatures. Higher temperatures are also expected to increase the range and activity of disease carrying insects such as ticks and mosquitos (NOAA, 2022a; NOAA 2022b).

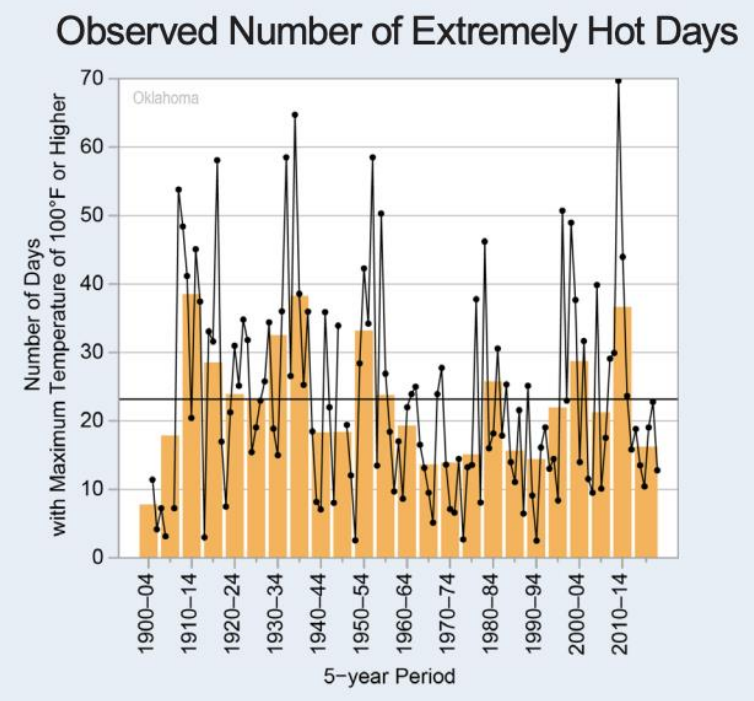


Exhibit 4-3 Observed number of extremely hot days (days over 100° F) in Oklahoma. The data is categorized into 5-year sections except for 2014 to 2020 (last section). The black line represents the long-term average number of extremely hot days Source: NOAA, 2022a.

Change in seasonality

Seasonal characteristics such as timing, duration, and variability of seasons are shifting in response to changing temperature, combined with precipitation patterns. Changes in average annual seasonal temperatures and increases in the number of extremely hot days and decreases in cold nights can all contribute to shifts in seasonality. These shifts may affect the timing and length of certain events, for example, higher winter temperatures can cause earlier spring snow melting. Fewer freeze-free days may alter growing seasons and the types of crops that can be grown. Many diseases that are spread seasonally are expected to shift in distribution. For example, Valley Fever (*coccidioidomycosis*), a lung infection caused by breathing in spores, which is most common in the Southwest region of

the United States, is expected to spread to northern states as drought and temperatures continue to increase (USGCRP, 2023).

4.1.2 Precipitation

Precipitation is highly variable from year to year in Oklahoma, with the total annual precipitation over the period of record (since 1895) ranging from a low of 20.3 inches in 1910 to a high of 53.7 inches in 2015 (NOAA, 2022a). Kansas similarly has variable precipitation (low of 15.3 inches in 1956; high of 40.6 inches in 1951; NOAA, 2022b).

Projected data do not show conclusive trends (either up or down) regarding annual average precipitation over the next century (Exhibit 4-4). If the average precipitation stays the same while temperature increases, the frequency and duration of drought conditions could increase (drought is discussed in Section 4.1.5). Further, while precipitation is not projected to increase, the pattern of how precipitation falls is expected to change, with a projected increase in the occurrence of extreme precipitation events (see section 4.1.3).

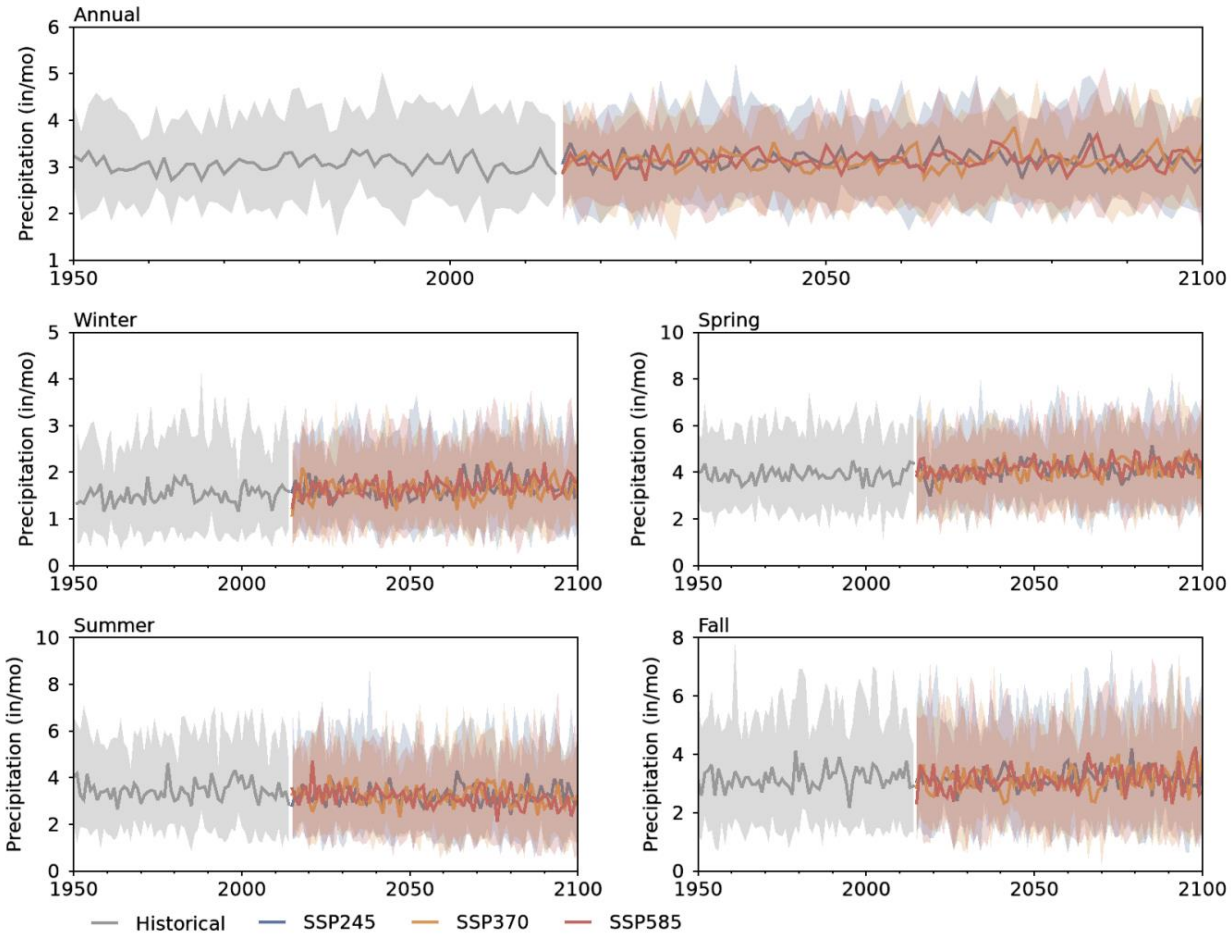


Exhibit 4-4 Historical (gray) and projected (colored) annual and seasonal mean precipitation in Washington County, Oklahoma. Source: USGS, 2021.

4.1.3 Extreme Events

Extreme precipitation events and flooding

Since 1950, there has been a significant increase in the annual number of extreme precipitation events in Oklahoma, where extreme precipitation events are categorized as 2 inches or more in one day. According to the Fifth National Climate Assessment, eastern Oklahoma has experienced a 46% increase in extreme precipitation events (USGCRP, 2023; Exhibit 4-5). The year with the most days of recorded extreme precipitation in Oklahoma was 2015 (NOAA, 2022a). An increase in the annual number of extreme precipitation events has also been observed in Kansas, over similar time periods (NOAA, 2022b). With continued warming, precipitation extremes are projected to increase in the southern plains. With 2°C (3.6°F) of global warming, total precipitation on the heaviest 1% of days and the five-year maximum daily precipitation are projected to increase across all of Oklahoma, and the annual maximum daily precipitation is projected to increase over much of Oklahoma. These metrics are also projected to increase in southern Kansas (USGCRP, 2023; Exhibit 4-6). With increased extreme precipitation events comes the risk of increased flooding, with the Fifth National Climate Assessment reporting that, for example, observed extreme precipitation events have contributed to increases in sipu (river) flooding (USGCRP, 2023).

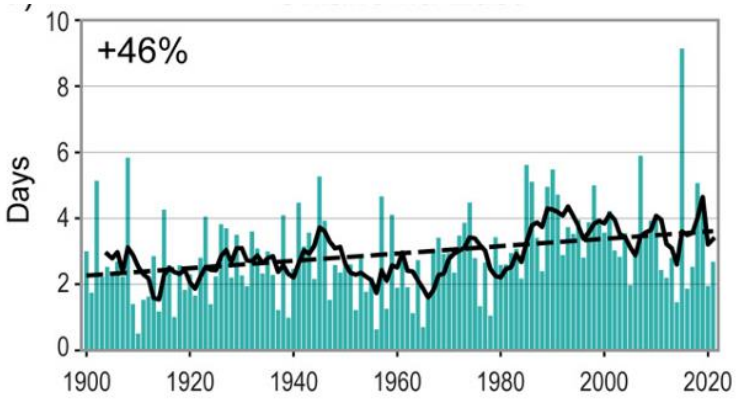


Exhibit 4-5 Number of days with more than 2 inches of precipitation from 1990–2021 in Eastern Oklahoma. The black dashed line shows the long-term average, and the solid black line shows the 5-year average. Source: USGCRP, 2023.

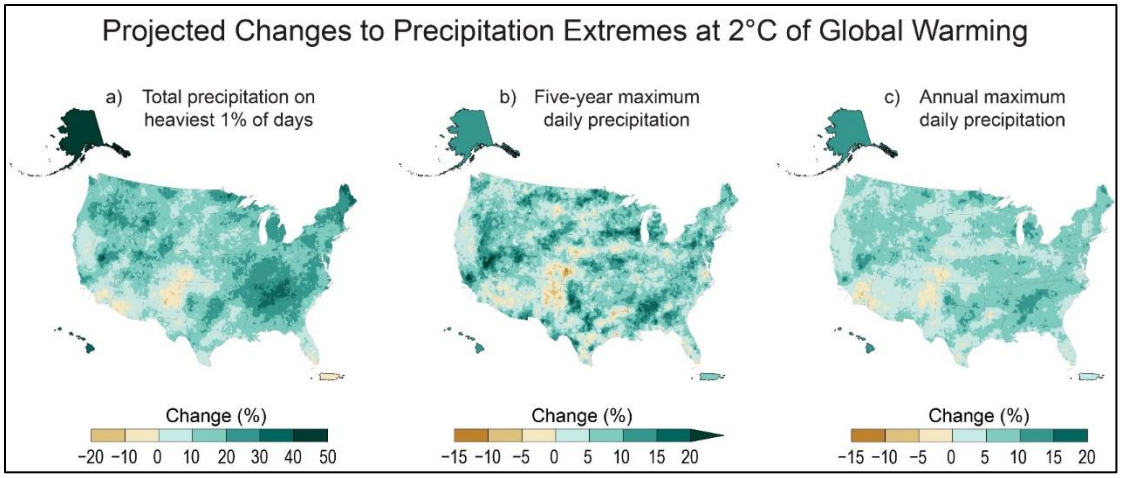


Exhibit 4-6. Projected changes in precipitation extremes at 2°C (3.6°F) of global warming. Source: USGCRP, 2023.

Tornadoes

It is challenging to draw definitive conclusions on the influence of climate change on short-lived climate events such as tornadoes, due to the lack of observations and data regarding the conditions that lead to the formation of tornadoes. While the average number of tornadoes has remained relatively constant, there is some evidence that they are becoming more frequent and powerful. There is also evidence that more tornado outbreaks are occurring more in the fall, while peak tornado season has historically been in the summer (Moore 2018). Additionally, "Tornado Alley," (Exhibit 4-7) is shifting eastward (USGCRP, 2023), towards Washington County.

From 1950 to 2023, Washington County has experienced 36 tornadoes (Mesonet 2023). Most recently, in May 2024, Bartlesville experienced a EF4[1] tornado, with wind speeds high enough to easily destroy homes. The tornado began in Barnsdall, Oklahoma, and migrated southwest to Bartlesville. The tornado caused significant damage to homes, structures, and trees. While the tornado did not directly hit the Tribe's Pow Wow grounds, the accompanying high winds caused considerable damage, including uprooting trees, and large fallen tree limbs caused damage to the stands and individual Tribal members' camps located at the Pow Wow grounds. While there are limited data projecting trends for tornado frequency and intensity, tornadoes are a concern for the Tribe.

[1] Category of the Enhanced Fujita (EF) Scale which estimates wind speeds based on damage. A common way of categorizing tornadoes in North America. The EF scale ranges from EF1 to EF5. EF4 refers to tornadoes estimated to have wind speeds of 166-200 mph.

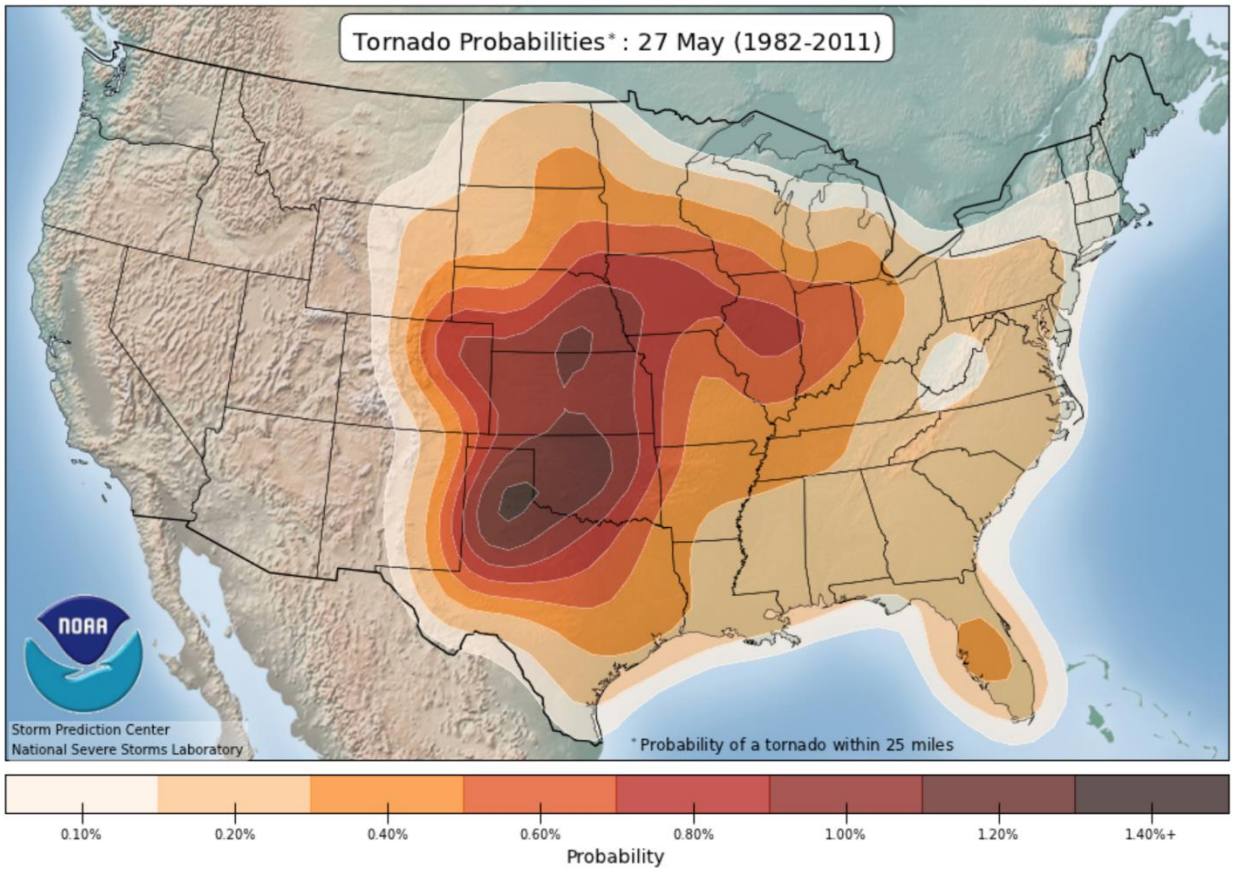


Exhibit 4-7. Tornado Alley. Source: NOAA, 2023.

4.1.4 Mpi (Water) Quality

Mpi (water) quality degradation can be exacerbated by several factors relating to climate change. The observed and projected changes in precipitation and flooding in Oklahoma and Kansas are expected to result in decreased mpi (water) quality through increased erosion and sediment loading. Cycles of wildfires and flood events can also further contribute to increased sediment loads in sipuwa (streams) and other surface mpi (water). Flooding can transport chemicals such as fertilizers, nutrients, and other chemicals from agricultural fields and livestock operations into surface mpi (water). Increasing temperatures can also impact mpi (water) quality by accelerating the growth of bacteria and algae that proliferate in warmer mpi (water; USGCRP, 2023).

4.1.5 Drought

Since the creation of the United States Drought Monitor Map in 2000, Oklahoma has been drought-free for only 21% of the time and has had at least 50% or more drought coverage for approximately 28% of the time. In 2011, a severe drought occurred when the state experienced its third driest January–October on record, receiving only 19.4 inches of precipitation—more than 10 inches below the long-term average. Extremely dry and hot

conditions continued in 2012. By the end of September 2012, more than 95% of the state was experiencing extreme drought conditions. Projections of increased temperatures (see Section 4.1.1) and a lack of an increase in annual average precipitation (see Section 4.1.2) means that higher temperatures will increase evaporation rates and decrease soil moisture, leading to increased intensity of future droughts. Kansas is expected to experience similar conditions (NOAA, 2022a,b). In addition to adversely affecting agriculture and terrestrial ecosystems, drought may threaten mpi (water) reserves, resulting in lower sipu (stream) flow and groundwater levels.

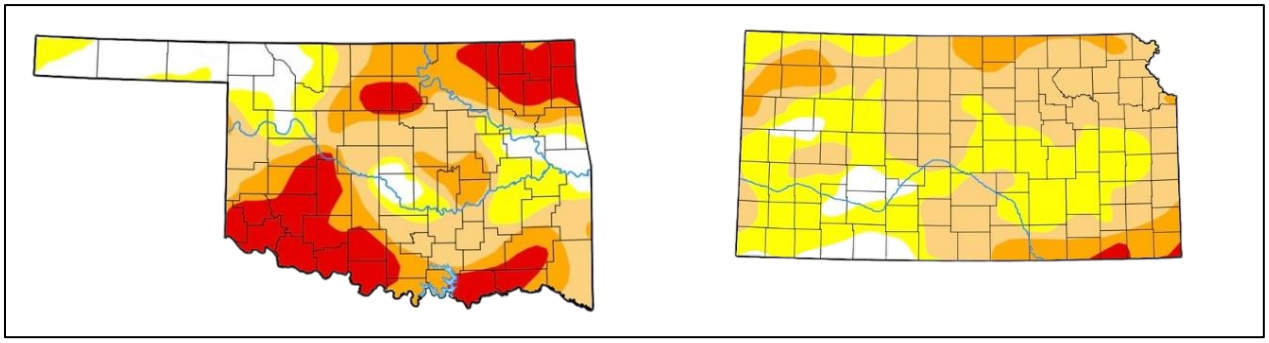


Exhibit 4-8 Drought severity across Oklahoma and Kansas. Washington county is experiencing extreme drought as of October 8, 2024. Source: Fuchs, 2024.

4.1.6 Other Climate Impacts

Additional climate impacts that may be of concern in Oklahoma and Kansas include wildfires and air quality. Increased temperature combined with no changes in precipitation may result in drought as described above, and therefore an increased risk of wildfires. For example, during the 2011 period of drought described above in Section 4.1.5, wildfires burned more than 132,000 acres in Oklahoma (NOAA, 2022a).

Air quality may be degraded as a result of climate change. Increased temperatures result in increased levels of ozone in the atmosphere; drier/drought conditions may increase airborne dust; and larger and more frequent wildfires can degrade air quality through more smoke. Ozone, dust, and smoke particulate matter can all cause adverse health effects to people when inhaled (USGCRP, 2023).

4.2 Vulnerability Assessment Results

4.2.1 Climate Impact Ranking

We assigned scores to the likelihood that each of the climate impacts described above will occur on a five-point scale, where high likelihood equals 5 and low likelihood equals 1. Exhibit 4-9 provides a summary of the ranking system, and description of each score. Exhibit 4-10 provides the likelihood scores assigned to each climate impact. The scores are based on the best available science from published literature and government agency reports, including the Fifth National Climate Assessment (USGCRP, 2023), the National Oceanic and Atmospheric Administration's state climate summaries (NOAA 2022a,b), the United States Geological Survey National Climate Change Viewer (USGS, 2021), and other sources.

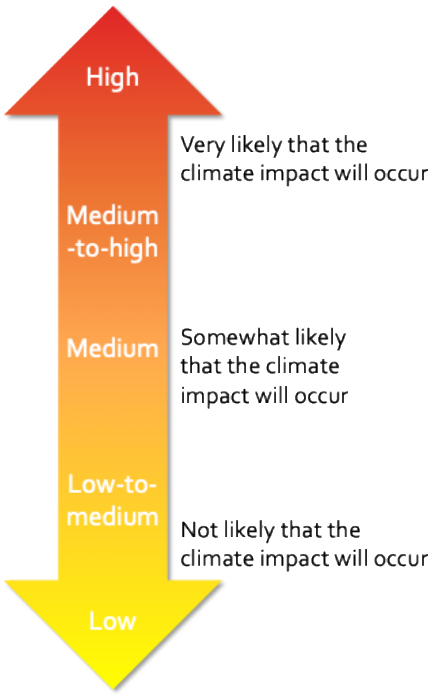


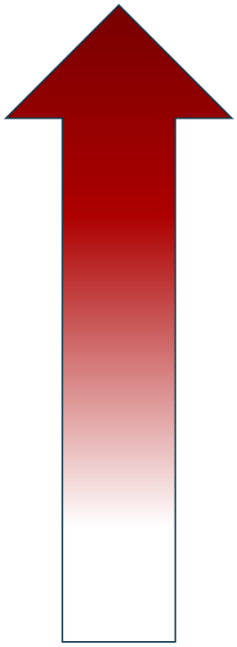
Exhibit 4-9. Climate impact scores.

Exhibit 4-10. Likelihood score rankings for each climate impact.

Climate Variable	Climate Impact	Likelihood Score
Temperature	Increase in average annual temperature	**High**
	Change in seasonality	**High**
Extreme temperature	Increase in the frequency of extreme heat	**High**
Extreme storm events	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	**Medium**
Mpi (water) quality	Decrease in mpi (water) quality	**Medium**
Drought	Increased intensity and frequency of drought events	**Medium**
	Decrease in surface/groundwater resources	**Medium-to-low**
Wildfires	Increase in wildfire frequency	**Low**
Air quality	Decrease in air quality	**Low**

4.2.2 Consequence Scoring

Consequence scoring indicates how severe an impact is on the aspects of the community vision, should a potential vulnerability occur. Consequences were scored on a scale of 1-5, with 5 being high. Exhibit 4-11 shows the scale. For example, a high consequence score means that if the potential climate vulnerability occurs, aspects of the community vision would be impacted significantly. The consequence scores were developed as a group exercise during Workshop #2 and Workshop #3. During the workshops, the participants were asked to score the consequences of potential vulnerabilities, with the vulnerabilities derived from the community vision. For example, one of the potential vulnerabilities under (mehëmichink (food) sovereignty was "The ability for the Tribe to achieve mehëmichink (food) sovereignty and independence may be affected by changing climate conditions (e.g., disease decreases deer population; ability to grow, harvest and dry òpsko (corn husks) is diminished due to drought conditions)." The group gave this vulnerability a 5, a high consequence score.



High – if the potential vulnerability occurs there will be a very significant consequence

High-to-medium – if the potential vulnerability occurs there will be a significant consequence

Medium – if the potential vulnerability occurs there will be a moderate consequence

Medium-to-low – if the potential vulnerability occurs, there will be little-to-no consequence

Low – if the potential vulnerability occurs there will be no consequence

Exhibit 4-11. Consequence scoring scale.

4.2.3 Climate Risk

To determine the overall climate risk for each potential climate vulnerability, the likelihood and consequence score are then combined (taking an average) to obtain an "Overall Climate Risk." For this exercise, we focused on climate impacts with a ranking of 2 (medium-to-low) and above, and climate vulnerabilities with a consequence score of medium and above (which encompassed all of the climate vulnerabilities).

Exhibits 4-12 to 4-15 list the climate vulnerabilities for mehëmichink (food) sovereignty, infrastructure, traditional places, and community relations. As shown in the tables, the scores for mehëmichink (food) sovereignty range from high-to-medium to high overall climate risk, infrastructure range from medium to high overall climate risk; the scores for traditional places and practices range from medium to high overall climate risk, and for the scores for community are all high climate risk.

Exhibit 4-12. Mehëmichink (food) sovereignty vulnerabilities and climate risk levels.

Vulnerability	Climate Impact	Likelihood Score		Consequence Score	Overall Climate Risk	Climate Risk Category
Food Sovereignty		Individual	Overall			
The ability for the Tribe to achieve food sovereignty and independence may be affected by changing climate conditions (e.g., disease decreases deer population, ability to grow, harvest and drying corn husks).	Increase in average annual temperature	5	3.7	5	4.4	Medium-to-high
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				
	Increase intensity and frequency of drought events	3				
	Decrease in surface/groundwater resources	2				
Crops (e.g., corn, squash, beans), may be affected by changing climate conditions (e.g., severe drought prevents plant growth)..	Increase in average annual temperature	5	3.7	5	4.4	Medium-to-high
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				
	Increased intensity and frequency of drought events	3				
	Decrease in surface/groundwater resources	2				
The ability of the Tribe to reintroduce buffalo at the ranch may be adversely affected by climate change.	Increase in average annual temperature	5	3.7	5	4.4	Medium-to-high
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				
	Increased intensity and frequency of drought events	3				
	Decrease in surface/groundwater resources	2				
The ability of the Tribe to raise chickens may be adversely affected by climate change.	Increase in average annual temperature	5	4.3	5	4.7	High
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
The ability of the Tribe to hunt deer and other wildlife as a method of provisioning healthy food may be limited or lost due to climate change.	Increase in average annual temperature	5	4.2	5	4.6	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Increased intensity and frequency of drought events	3				
The ability of the Tribe to fish as a method of provisioning healthy food may be limited or lost due to climate change.	Increase in average annual temperature	5	4.2	5	4.6	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Increased intensity and frequency of drought events	3				
The ability of the Tribe to gather wild plants as a method of provisioning healthy food may be limited or lost due to climate change.	Increase in average annual temperature	5	4.2	5	4.6	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Increased intensity and frequency of drought events	3				
The preparation of first foods may be adversely affected by climate change (e.g., extreme temperatures limit the ability to use the campus cookhouse.)	Increase in the frequency of extreme heat	5	4	5	4.5	High
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				

Exhibit 4-13. Infrastructure vulnerabilities and climate risk levels.

Vulnerability	Climate Impact	Likelihood Score		Consequence Score	Overall Climate Risk	Climate Risk Category
Infrastructure		Individual	Overall			
Changing climate conditons and extreme climate events (e.g., tornadoes, heat waves) may limit the Tribe's ability to respond to emergencies and protect Tribal members.	Increase in the frequency of extreme heat	3	3.0	5	4.0	Medium-to-high
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
Changing climate conditons and extreme climate events (e.g., tornadoes) may damage or strain existing transportation infrastructure (e.g., roads and bridges).	Increase in average annual temperature	5	3.7	5	4.3	Medium-to-high
	Increase in the frequency of extreme heat	3				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
Changing climate conditons and extreme climate events (e.g., tornadoes) may damage or strain tribal owned facilities (e.g., buildings on the main campus, ranch, in Copan and Powwow grounds).	Increase in average annual temperature	5	3.7	5	4.3	Medium-to-high
	Increase in the frequency of extreme heat	3				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
Changing climate conditons and extreme climate events (e.g., tornadoes) may affect the Tribal business sector activities (e.g., drought and high temperatures can affect the cattle ranch).	Increase in average annual temperature	5	3.7	3	3.4	Medium
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				
	Increased intensity and frequency of drought events	3				
	Decrease in surface/groundwater resources	2				
Climate change and extreme climate events can strain financial resources needed to make Tribal members homes reslient.	Increase in the frequency of extreme heat	3	3.0	5	4.0	Medium-to-high
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
Climate change may affect the Tribe's water supply (e.g., boil water advisories, water use restrictions).	Increase in average annual temperature	5	3.5	5	4.3	Medium-to-high
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				
	Increased intensity and frequency of drought events	3				
	Decrease in surface/groundwater resources	2				
quality, which may be particularly problematic for elders or Tribal members with health	Increase in average annual temperature	5	5.0	5	5.0	High
	Increase in the frequency of extreme heat	5				
Climate change and extreme climate events may affect the Tribe's energy infrastructure.	Increase in average annual temperature	5	4.3	5	4.7	High
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
Ability of the Tribe to raise cattle on the ranch may be affected by climate change (e.g., severe drought).	Increase in average annual temperature	5	3.7	3	3.4	Medium
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				
	Increased intensity and frequency of drought events	3				
	Decrease in surface/groundwater resources	2				

Exhibit 4-14. Traditional places and practices vulnerabilities and climate risk levels.

Vulnerability	Climate Impact	Likelihood Score		Consequence Score	Overall Climate Risk	Climate Risk Category
Traditional Places and Practices		Individual	Overall			
Access to powwow grounds may be limited or lost due to extreme climate events.	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3	3.0	4	3.5	Medium-to-high
The annual powwow may need to change time (e.g. move a ceremony to another date due to extreme heat or poor air quality) due to changing climate conditions.	Increase in average annual temperature	5	4.3	4	4.2	Medium-to-high
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
Access to the campus (indoor and outdoor facilities) may be limited or lost due to extreme climate events (e.g., flooding, tornadoes).	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3	3.0	5	4.0	Medium-to-high
Access to the ranch and impacts to the ranch pastures may result from a changing climate (e.g. severe flooding, severe drought).	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3	3.0	3	3.0	Medium
Access to burial grounds may be limited or lost due to extreme climate events (e.g., flooding causes road wash-out).	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3	3.0	5	4.0	Medium-to-high
Burial grounds are lost due to extreme climate events (e.g., flooding).	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3	3.0	5	4.0	Medium-to-high
The ability for the Tribe to engage in traditional practices (e.g., song and dance during community gatherings) may be adversely affected by climate change.	Increase in average annual temperature	5	4.2	5	4.6	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Increased intensity and frequency of drought events	3				
	Decrease in air quality					
Climate change may affect seasonality and seasonal triggers (e.g., the first strawberry, winter storytelling).	Increase in average annual temperature	5	5.0	5	5.0	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
The ability for the Tribe to engage in hide tanning and regalia making may be adversely affected by climate change.	Increase in average annual temperature	5	3.7	4	3.9	Medium-to-high
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				
	Increased intensity and frequency of drought events	3				
	Decrease in surface/groundwater resources	2				
The ability to use the Tribe's sweat lodge may be affected by climate change.	Increase in average annual temperature	5	4.2	5	4.6	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Decrease in water quality	3				

Exhibit 4-15. Community vulnerabilities and climate risk levels.

Vulnerability	Climate Impact	Likelihood Score		Consequence Score	Overall Climate Risk	Climate Risk Category
Community Relations		Individual	Overall			
The ability of the Tribe to strengthen traditional roles and responsabilities (e.g., the role of elders in the community) may be limited by climate change.	Increase in average annual temperature	5	4.2	5	4.6	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
	Increased intensity and frequency of drought events	3				
The ability of the Tribe to build and strengthen "camp life," (e.g., children playing and learning outdoors) may be limited due by climate change.	Increase in average annual temperature	5	4.5	5	4.8	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
The ability for Tribal members to build and strengthen community relations (e.g., roles of elders, teaching youth, strengthen traditonal roles and responsabilities,etc.), may be adversely affected by climate change.	Increase in average annual temperature	5	4.5	5	4.8	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
The ability to be good relatives and maintain reciprocity with the environment may be adversley affected by climate change.	Increase in average annual temperature	5	4.5	5	4.8	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				
The ability of aunties and uncles to share knowledge and teach youth may be adversely affected by climate change.	Increase in average annual temperature	5	4.5	5	4.8	High
	Change in seasonality	5				
	Increase in the frequency of extreme heat	5				
	Increase in extreme events (e.g., thunderstorms, tornadoes) and flooding	3				

5 Climate Adaptation Actions

This section summarizes potential adaptation actions the Tribe has identified to address climate vulnerabilities. The adaptation actions are organized according to the key aspects of community life in the community vision (food sovereignty, community relations, traditional places and practices, and infrastructure).

5.1 Mehëmichink (Food) Sovereignty

Climate adaptation actions focused on mehëmichink (food) sovereignty, including reducing mehëmichink (food) insecurity and addressing mehëmichink (food) deserts, are a centerpiece to the Tribe's climate adaptation planning, as mehëmichink (food) sovereignty can build the community's resilience to climate change (see text box). By the same token, these adaptation actions, such as growing the tribe's own crops and raising chickens, cattle, sisilie (bison), may themselves be vulnerable to climate change impacts.

Food sovereignty builds the community's resilience to climate change:

- **Lënapei mitsuwakàna (first foods) are healthy foods. Healthier individuals are more able to withstand the physiological impats of climate stressors, such as extreme heat, and are better able to care for their relations.**
- **Lënapei mitsuwakàna (first foods) builds self-reliance. Community members are no longer dependent upon distant food stores that may not be accessible during extreme events.**
- **Mehëmichink (food) sovereignty builds community relations. Working together to grow crops, raise livestock, gather, hunt and namès (fish) strengthens community bonds and traditional roles (e.g., aunties and uncles teaching youth how to plant, harvest, hunt, namès (fish), gather). These strong community relations are drawn upon when responding and adapting to climate impacts.**

A healthier, stronger community is a more resilient community.

In the vulnerability assessment (Section 4), mehëmichink (food) sovereignty overall climate risks ranked from medium-high to high. Specifically, the overall climate risks to the Tribe's ability to grow crops (e.g., corn, squash, beans), and raise livestock and to re-introduce sisilie (bison) at the Tribe's ranch were medium-high (second highest score). The overall climate risk to the Tribe's ability to hunt wildlife, namès (fish), and gather wild plants all were high (highest ranking). As a result, the overall climate risk of the Tribe to achieve mehëmichink (food) sovereignty was medium-high. Below we describe potential adaptation actions the Tribe has identified to build resilience into mehëmichink (food) sovereignty.

Growing Crops and Accessing Fresh Lënapei Mitsuwakàna (First Foods)

Potential adaptation actions that the Tribe has identified to address climate vulnerabilities to accessing fresh mehëmichink (food) and growing crops include:

- Grow crops (corn, beans, squash, fruit, berries, etc.) on the main campus to provide a local, nutritious source of Lënapei mitsuwakàna (first foods), to build self-reliance, mehëmichink (food) sovereignty, and minimize dependence upon outside sources of mehëmichink (food; grocery stores) that may be unavailable/inaccessible during extreme climate events.
- Provide space for larger-scale agriculture as well as community gardens space for individual/ tëwènama (family) plots.
- Select and plant temperature- and drought-resilient species.
- Plant a variety of crops to build resilience into yields (i.e., if one type of crop fails due to climate stressors, other crops are still available for the community to harvest).
- Build greenhouses on the Tribe's main campus—this may allow the Tribe to continue to grow certain cultivated crops and native plants in a more controlled environment that may not otherwise survive.
- Set up bee hives to help with pollination (and as a source of honey).
- Convert sod/mowed lawn space on campus to native vegetation hakihakàn (garden) space, with a focus on plants that are edible/used for medicine.
- Supply/stock the Tribe's mehëmichink (food) pantry with Tribally grown crops.
- Conduct community outreach to raise awareness of the opportunity to participate in planting/harvesting and availability of fresh Lënapei mitsuwakàna (first foods).
- Change the time of day that outdoor farming/gardening activities take place to avoid the heat of the day and adjust days to avoid bad air quality days.
- Develop a youth farming program to teach youth all steps in the traditional growing and harvesting cycle and the cultural importance of certain crops to the Tribe; Include Lënapei lixsëwakàn (Lenape language) learning as a component.
- Create a climate-resilient Lënapei mitsuwakàna (first foods) coordinator position to oversee developing and implementing a Tribal-wide Lënapei mitsuwakàna (first foods) agricultural plan for the Tribe, oversee the creation of community gardens, and the creation of the youth farming program.

Re-introduction of the Sisilie (Bison)

The Tribe has also identified re-introducing sisilie **(**bison) as a climate adaptation action. For thousands of years, sisilie and the North American grasslands have been linked in a reciprocal relationship in which sisilie (bison) movement, grazing, and migration maintained the function and stability of the plains. Thus, re-introducing the sisilie (bison) is a nature-

based adaptation action that can enhance and build resiliency into grassland habitats, as well as contributing to mehëmichink (food) sovereignty and building resiliency into communities through healthy Lënapei mitsuwakàna (first foods), as well as strengthening community bonds and relations.

Sisilie (Bison) and Climate Resilience -

Due to their role in the plains' ecosystem, sisilie (bison) can build climate resilience:

- **Grazing: Grazing promotes species diversity, seed dispersal, and restructures vegetation patches; greater species diversity promotes resilience; they are also a more sustainable grazer, compared to cattle.**
- **Movement: Sisilie are large animals and create significant physical disturbances. These disturbances take the form of grazing, stomping and wallowing, which help to create diverse habitats within the plains. For example, wallowing creates vernal pools for amphibians.**
  Migration: Migration changes mëkëkèk (prairie) structure and allows for the spread, introduction and diversification of native species throughout their migratory path at a landscape scale.
- **Response to drought: Sisilie (bison) can adapt to drought by shifting their diets and decreasing their body mass.**
- **Response to heat: Sisilie (bison) are more adaptable to drought and episodes of extreme heat because they need less shade and less water than cattle, and because they need less water they disturb waterbodies less than cattle, resulting in less sipu (stream)/pond sedimentation and water quality degradation.**

Potential adaptation actions to address vulnerabilities with raising sisilie (bison) include:

- Set up a paid internship/exchange program to apprentice with sister tribes who have sisilie (bison) herds/programs to learn how to raise sisilie (bison) as good relatives, and how to build resiliency into sisilie (bison) herds and their habitat.
- Develop a sustainable plan for raising sisilie (bison) on the Tribe's ranch, including the number of sisilie (bison) the ranch acreage can sustainably hold, ensuring their nutrient requirements are met, potentially re-introducing native mëkëkèk (prairie) plants, etc. This plan would be based on a combination of indigenous ways of knowing and western science, and it could be led by the intern(s), once they have completed their training.

- Develop a cultural learning camp to teach youth about the importance of the sisilie (bison) and supporting ecosystem, and to teach resiliency strategies to sustain the Tribe's future herd. The camp could be housed in existing bunkhouses and learning spaces in buildings on the ranch.

Hunting, fishing, plant gathering

Actions to adapt to changes in access to and availability of wild game, namès (fish), and gathered plants may be more limited, as the Tribe does not own or manage most of the lands that are utilized for hunting, fishing, and plant gathering. However, despite this limitation, there are some adaptation actions the Tribe could implement. Adaptation actions to address changes in access to and availability of wild game, namès (fish), and gathered plants include:

- Adjust the time of day/change the days that outdoor hunting/fishing/gathering activities take place, to avoid the heat of the day, heatwaves, and bad air quality days.
- Adapt to shifts in namès (fish) species. As mpi (water) temperatures increase, colder temperature species may become less prevalent/disappear, replaced by namès (fish) species that tolerate warmer, lower mpi (water) quality conditions. The Tribe could adapt by learning to namès (fish) and prepare meals using these newer species.
- Stock the pond on campus with temperature-appropriate namès (fish) species (the stocked namès (fish) assemblage could be changed over time to adjust with warming temperatures).
- Develop agreements/exchanges with other Tribes with wild game that may be less vulnerable to climate change impacts (e.g. Tribes further north).
- "Re-wild" a section of one of the pastures on the ranch to allow native plants to grow. This could be an area for Tribal members to gather and teach youth about the uses of plants for mehëmichink (food) and medicine. It could also potentially support some wildlife for hunting.
- Sustain native plants in greenhouses. It may be possible to cultivate and grow certain wild plants in a more controlled greenhouse environment, as noted above.
- Develop and implement youth hunting, fishing, and gathering educational programs, so that traditional knowledge is maintained for future generations.
- Shift the balance of mehëmichink (food) reliance to crops and livestock the Tribe can grow on their lands.

5.2 Infrastructure

Infrastructure aspects of the community vision that are vulnerable to climate change that the Tribe identified include:

- Tribal-owned facilities (e.g., buildings on the main campus, office in Copan, Pow Wow grounds, the ranch).
- Transportation infrastructure (roads and bridges) that the Tribe does not own or manage but uses to access Tribal facilities and in their daily lives.
- Tribal energy infrastructure and thus Tribal economic and energy security.
- Tribal business sector activities, such as agriculture/cattle ranching businesses.
- The property (homes) of individual Tribal members.
- The ability to respond to emergencies and protect people and tribal facilities and infrastructure.

All these received an overall climate risk of at least medium-high, with Tribal energy infrastructure ranked high. An over-arching adaptation action that could address all of these vulnerabilities is the development of an emergency preparedness plan (EPP). The EPP would outline steps the Tribe can take ahead of time to prepare for disasters, as well as actions to take in the event of a disaster. Below we describe additional adaptation actions for each of the vulnerabilities listed above, many of which could be incorporated into an overall EPP.

Tribal-Owned Facilities

Adaptation actions for tribal-owned facilities include:

- Building/upgrading storm shelters (kaoxënikaon [tornado shelters]) on the main campus, at the Pow Wow grounds, at the Copan office, and at the ranch.
- Creating alternative evacuation routes from facilities to safe gathering places.
- Establishing communication procedures and lines of authority in the event of a disaster.
- Installing alternative power supplies. his could include solar and solar-powered batteries.
- Installing shade structures in outdoor spaces to provide cooler areas for Tribal members to gather and engage in outdoor activities.
- Conducting community outreach on cooling stations that are open to Tribal members on campus during heat waves.

Transportation Infrastructure

The Tribe does not own or manage local roads and bridges, and this limits the type of adaptation actions the Tribe can take. Nevertheless, there are adaptation actions the Tribe can consider. Transportation resiliency actions include:

- As noted above, creating alternative evacuation routes from Tribal facilities to safe gathering places.
- Coordinating with state and local governments on local road conditions, for example, sharing observations of obstructed culverts, etc.
- Creating lines of communication with state and local government officials that can be used to coordinate in the event of a disaster.

Tribal Energy Infrastructure

Adaptation actions to address climate vulnerabilities with Tribal energy infrastructure include:

- As noted above, installing solar panels, and solar-powered batteries at Tribal facilities.
- Converting to energy efficient equipment.
- Converting Tribal vehicles to electric or hybrid vehicles and installing charging stations at Tribal facilities.
- Expanding recycling and composting programs to minimize waste and reduce CO_2 emissions.

Tribal Business Sector

Adaptation actions to build resiliency into the Tribal business sector (which at this time is mainly cattle ranching) include many of the measures already described above. Additional adaptation actions the Tribe could consider for the cattle ranching business include:

- Evaluating the seeding and planting of drought tolerant native plant species.
- Maintaining control over invasives that may have less nutritional value for the herd and consume excessive mpi (water).
- Continuing to adapt and optimize the size of the herd relative to available grazing and mpi (water) sources.

Tribal Members' Properties

Adaptation actions to address climate vulnerabilities associated with individual Tribal members homes include:

- Surveying Tribal members to determine number of households with/without storm/kaoxënikaon (tornado shelters), and number of households with EPPs.
- Developing a program to install shelters in individual homes, this would include securing funding for the program.
- Developing a communication and outreach campaign for Tribal members on "how to" develop their own EPP.

The importance of access to shelters was a theme that emerged from the kìkay (elder) interviews, including ensuring that shelters are accessible to individuals with reduced mobility (see Section 2.1).

5.3 Traditional Places and Practices

Traditional Places: Traditional places identified by the Tribe include key places where Tribal activities take place; the Pow Wow grounds, the Tribe's ranch, and headquarters (the main campus). Nkwëchkwënawëna (burial) grounds located in the Tribe's ancestral homelands, along the removal trail and at public cemeteries and private nkwëchkwënawëna (burial) locations in Oklahoma and Kansas were also identified as traditional places for which adaptation actions should be developed. The overall climate risk of these traditional places was medium to medium-high.

- **Pow Wow grounds, main campus and the ranch:** Many adaptation actions are already identified for the Pow Wow grounds, the ranch, and the main campus, under Section 5.2 above. In addition to these actions, the Tribe identified another potential adaptation action for the Pow Wow grounds of changing the time of year the Pow Wow is held, to avoid peak storm/tornado seasons.

- **Nkwëchkwënawëna (burial) grounds, ancestral homelands, and the removal trail:** The importance of addressing climate impacts to nkwëchkwënawëna (burial) grounds is highlighted by feedback provided during the kìkay (elder) interviews. All of the interviewed kìkayàk (elders) (see Section 2.1) indicated that nkwëchkwënawëna (burial) grounds and other cultural resource sites within the Tribe's ancestral homelands and along the removal trail should be protected from climate impacts, such as flooding. Some indicated that nkwëchkwënawëna (burial) grounds and cultural artifacts should be moved to higher grounds, while others suggested that cultural artifacts should be retrieved and placed in a Lenape-owned and managed museum—a place where cultural knowledge could be sustained and shared with next generations. Given the importance of these sites, the Tribe's proposed adaptation action is to create a formal committee to further investigate Tribal members' preferences on how to address flooding concerns at nkwëchkwënawëna (burial) grounds and other ancestral sites with cultural resources. The recommendations of the committee could then be implemented as a next step adaptation action.

Traditional Practices: Traditional practices identified by the Tribe include song and dance, games, ceremony, pimëwakàn (sweat lodge), regalia-making and xès (hide)-tanning, seasonally triggered activities, and knowledge transfer. The overall climate risk of these practices was medium to medium-high in the vulnerability assessment. Some adaptation

actions that have already been described above may also address these climate vulnerabilities. For example, actions aimed at building resiliency at the Pow Wow grounds will also help to sustain traditional song, dance, and games that take place at the Pow Wow grounds. These previously identified adaptation actions include:

- Preparing the EPP with evacuation routes and lines of communication in an emergency
- Installing storm (tornado) shelters
- Building shade shelters
- Changing the time of year that Pow Wow takes place
- Installing solar panels at the Pow Wow grounds

These adaptation actions that sustain the ability to gather in person, such as the EPP, building shade shelters at Tribal outdoor spaces (e.g., on campus), and building storm shelters will build resiliency into practicing ceremonies that are important to conduct with tëwènama (family) and community members.

The Tribe has a pimëwakàn (sweat lodge) located on the main campus. More recently it has not been used. Revitalizing the could help to build community resilience, and adaptation actions that focus on access/usability of the main campus described above would also serve as adaptation actions for the pimëwakàn (sweat lodge).

Adaptation actions to build resiliency into traditional regalia-making and xès (hide)-tanning, seasonally triggered activities, and traditional knowledge transfer to youth may include:

- Developing a youth program on regalia-making and xès (hide)-tanning so that the traditional knowledge is passed down from knowledge holders to the next generation to sustain and build resilience into the practices and keep the knowledge within the Tribe.
- As noted above in Section 5.1, the Tribe could also consider setting up agreements or exchanges with other Tribes or organizations to secure materials (e.g., game hides) for xès (hide) tanning and regalia-making.

5.4 Community

According to the Tribe's community vision, community is about relationships and connections, traditional roles and responsibilities, a strong kìkay (elder) presence, being good relatives, and strong communication between Tribal government and Tribal members. When community relations are strong, there is a feeling of being cared for, and a sense of returning to "camp life." The overall climate risk of different aspects of this aspect of the community vision all scored high, consistent with how important community relations are to the Tribe. When resiliency is built into the other three components of the Tribe's vision (food

sovereignty, infrastructure, and traditional places and practices), resiliency is built into community. For example, when community members come together to grow and harvest Lënapei mitsuwakàna (first foods) and raise livestock on Tribal lands, traditional roles and relationships are strengthened, thus strengthening and building resiliency into the community. Thus, a multi-pronged approach to adaptation actions in which resiliency is built into all three wedges of the community vision ultimately supports and sustains community resiliency.

5.5 Summary of Adaptation Priorities

All of the adaptation actions described above in sections 5.1–5.4 can be considered high priorities for the Tribe, because they address key aspects of the community's way of life highlighted in the Tribe's community vision (see Section 3) that are vulnerable to climate change impacts (see Section 4).

Within this list of adaptation actions, the Tribe may wish to further prioritize actions that can address multiple vulnerabilities at once. For example, the Tribe may wish to focus on the development of an EPP early on in the adaptation implementation process, because such a plan would address multiple infrastructure vulnerabilities. These include risk of damage to Tribal-owned facilities, transportation routes, energy infrastructure, and Tribal businesses. It could also address risks to the wellbeing of individual Tribal members (e.g. need for shelters at individual homes, need for individual EPPs), and climate risks when engaged in traditional activities (e.g., song, dance, games at the Pow Wow grounds).

The Tribe may also wish to prioritize other categories of adaptation actions because they build climate resiliency, while simultaneously addressing other stressors that have long disproportionately affected the community, threatening Tribal sovereignty and traditional ways of life. For example, the adaptation actions surrounding mehëmichink (food) sovereignty not only build climate resiliency, but they also build community health and well-being. A diet comprised of Lënapei mitsuwakàna (first foods) improves the physical health of community members; access to Lënapei mitsuwakàna (first foods) reduces mehëmichink (food) insecurity and mehëmichink (food) deserts; and when coming together to grow crops, raise livestock, hunt, namès (fish), and gather, traditional relationships and bonds within the community are all strengthened, strengthening overall community health and resiliency.

Another practical consideration when prioritizing adaptation actions is the availability of funding. Adaptation actions may become prioritized in the future because they align with an available grant or other funding source, while others do not at that particular time.

Finally, as noted in the description of the planning process (Section 2), this Plan is intended to be a living document, with planning and adaptation viewed as iterative. Thus, as

implementation of adaptation actions proceeds, shifts in the Tribe's priorities may occur as lessons are learned, and new adaptation actions may also emerge. For example, this Plan proposes to create a formal committee to further investigate community member preferences in addressing risk of flooding of nkwëchkwënawëna (burial) grounds. The committee's findings and outcomes may lead to new adaptation actions not currently conceived, that could be subsequently added to the Tribe's list of adaptation actions and subsequently implemented.

To close in the words of one kìkay (elder):

"***That's something tribes have always been able to do, is to adapt to any situation, if you're going to survive you have to learn that very well***."

-Lenape kìkay (elder), 2024.

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