WETLAND HEADWATER MONITORING ON THE ROCKY BOY'S INDIAN RESERVATION

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WHERE AND WHY

- The Rocky Boy Indian Reservation of the Chippewa Cree Tribe is in North Central, Montana surrounded by the Bears Paw Mountain Range. The Bear Paw mountains are an isolated mountain range in the semi-arid region of northern Great Plains of Montana.

- The total wetland acreage of the Rocky Boy Reservation is limited at 2,330 acres. Though, the current wetland acreage is responsible for supplying water to all Reservation communities; local rural residences, ranches and their livestock, and the other diverse ecosystems of the Bear Paw Mountains.

- Global warming combined with a periodic drought has stemmed in the immediate need to monitor, protect, and conserve Reservation water supplies and wetlands. Improving wetland condition at headwater locations is crucial to refining wetland functions.

SWEETGRASS PRESERVATION

- Sweetgrass is the most important cultural plant of our Chippewa Cree People. Sweetgrass possesses remarkable cultural value because it is the source that was and is still gathered from generations; Elders to youth, for emotional and spiritual use.

- The sweetgrass acreage in Rocky Boy are unique to the Bearpaw mountain range. Their long leaf blade length (.>100cm), sweet odor and green color it possesses when dried.
- Though today, our local sweetgrass populations are highly imperiled.

ELDER INTAKE

- Our local Chippewa Cree Elders are referred for sweetgrass population monitoring design, objectives, and to establish appropriate protocol during sweetgrass observing. They are also consistently consulted with to locate all known sweetgrass populations. Referred to determine sweetgrass population size and their abundance at historical sites.

ELDER INTAKE, *CONT'D*

- Sweetgrass characteristics and properties are described through interviews, and the traditional method of "picking" is described to have been used to sustainably gather and encourage further sweetgrass growth.
  - A total of 10 historical sites were evaluated in recent study.
  - Leaf blade height is incorporated as a monitoring parameter so that current growth could be compared with blades that were gathered historically (50-60 years ago), and to compare relative growth between sites and years.

SWEETGRASS MONITORING

- Stem density, frequency, and relative canopy cover values are collected at each sweetgrass site. Stem density and leaf blade height measurements were used to compare results among years, as well as with annual temperature and precipitation data.

SWEETGRASS MONITORING, *CONT'D*

- Habitat condition (hydrology, soils, vegetation composition) and factors affecting the condition of wetlands were assessed.
- The habitat condition has declined at 2 of 4 remaining sites that had the largest sweetgrass populations at the beginning of this study
- We attribute habitat decline to a decreasing hydroperiod, increasing temperatures, increasing intervals of severe drought and increasing cover of non-native grasses.

RESULTS

- Sweetgrass monitoring results confirm Chippewa Cree Elder observations and traditional knowledge: sweetgrass abundance and health are indicative of the health of the ecosystem. Leaf blade length is an indicator of climate change. "When people stop paying attention to sweetgrass, it will go away."

REGIONAL CLIMATE & DROUGHT

- During an 11-year monitoring study, the greatest increase in average monthly temperatures (from May-October) on record occurred during 5 of the 11 years. The third, fifth and seventh warmest years on record for Rocky Boy and the state of Montana occurred during the monitoring study. This was accompanied by two of the most severe droughts in recent history (2017; 2021) that occurred during the third and fifth warmest years on record (Table 4).

Year	Drought Severity rank (127 yr period)	Warmest Year on Record rank	Avg Temperature	July average temperature departure (F) (statewide-MT)	July average temperature departure (F) (North-Central MT-Rocky Boy Reservation)
2021	4	3	74.2	6.9	6.5
1936	1	1	72.6	8.0	9.9
2017	3	5	72.9	5.9	5.2
2007	-	2	75.7	7.6	8.0
2006	-	4	73.2	5.5	5.5
1960	-	6	72.5	4.1	4.8
2012	-	7	72.3	5.0	4.6
2020	-	15	71.2	0.1	3.5

REGIONAL CLIMATE & DROUGHT, *CONT'D*

- During the 2017 drought, mean statewide temperature departure (6.0°F) was the highest since the Great Drought of 1936 (NOAA 2017,2021). It was the third driest year on record for Rocky Reservation and north-central Montana.
- From 2011-2017, north-central Montana and the Rocky Boy Reservation experienced increased mean temperatures (+4.9°F) that were higher than statewide averages (+4.5°F) and when compared with historical averages (1900-1981) (NOAA 2017). The northern Great Plains region is especially prone to periodic drought cycles which are magnified by steady increases in annual average temperatures during recent years.

REGIONAL CLIMATE & DROUGHT, *CONT'D*

- Furthermore, Rocky Boy and the State of Montana experienced another severe drought again in 2022. Our declining sweetgrass populations has been subjected to 2 consecutive droughts accompanied by record high summer temperatures during 2021 and 2022.

- Warmest Years on Record + Avg. July Temp during Monitoring Study (1900-2021) (NOAA, 2017; 2021)

Year During Monitoring study	Warmest year on record ranked	Drought Year	Average July temperature departure (F) (North-Central MT-Rocky Boy Reservation)
2021	**3**	**2021**	**6.5**
2020			-1.7
2019			-1.3
2018			0.0
2017	**5**	**2017**	**5.9**
2016			-0.4
2015			-0.1
2014			2.3
2013			1.3
2012	**7**		**4.6**
2011			0.2

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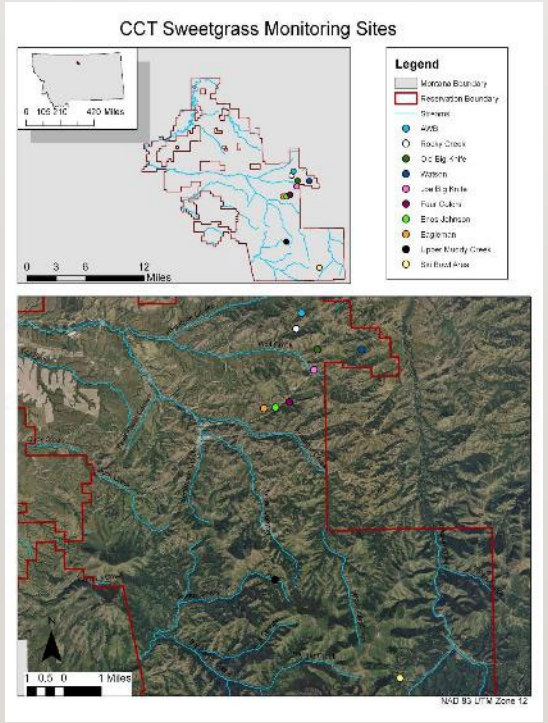
SWEETGRASS LIFE HISTORY AND CHARACTERISTICS

- Local Sweetgrass populations are exceedingly scarce. Factors affecting the local population viability include biogeographic isolation, life history characteristics, habitat specificity, availability and condition, vulnerability of wetland habitat to disturbance, climate change and declining population trends.

An assessment summary evaluating local extirpation risk is summarized in Table 1.

Sweetgrass Monitoring Sites on the Rocky Boy Indian Reservation

Bigknife

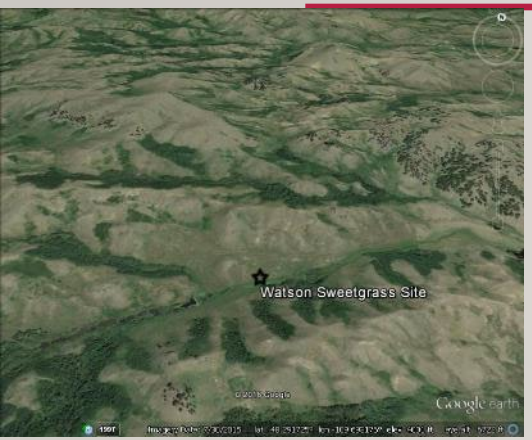


Eagleman

AWB

Upper muddy creek

Sweetgrass Monitoring Sites on the Rocky Boy Indian Reservation

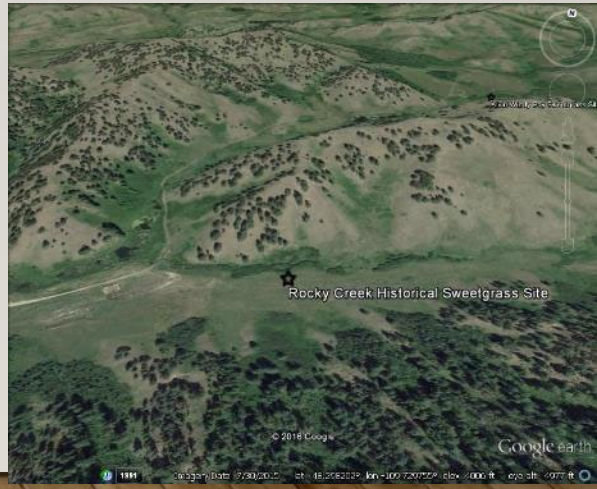


Watson

Fourcolors

Ski bowl historical

Rocky creek



SWEETGRASS MONITORING DATA SUMMARY

Blue Line: Seasonal wetlands (OBK,AWB,WAT) with seasonal drawdown by August, and with Sweetgrass populations located on outer perimeter of wetland.
Interpretation: Sweetgrass populations found in seasonal wetlands (blue line) and along the outer perimeter of wetland show a sharp decline (trend line in black) in total no. of plots over the 11-year monitoring period; decreasing by 90 percent.

Red Line: Sweetgrass found in semi-permanent to permanent wetlands (West Fork, 4 Colors and 4 Colors fen) show a steady decline over time (second trend line in black) in total no. of plots containing sweetgrass; decreasing by 19 percent over a 7 year period (2015-2021).

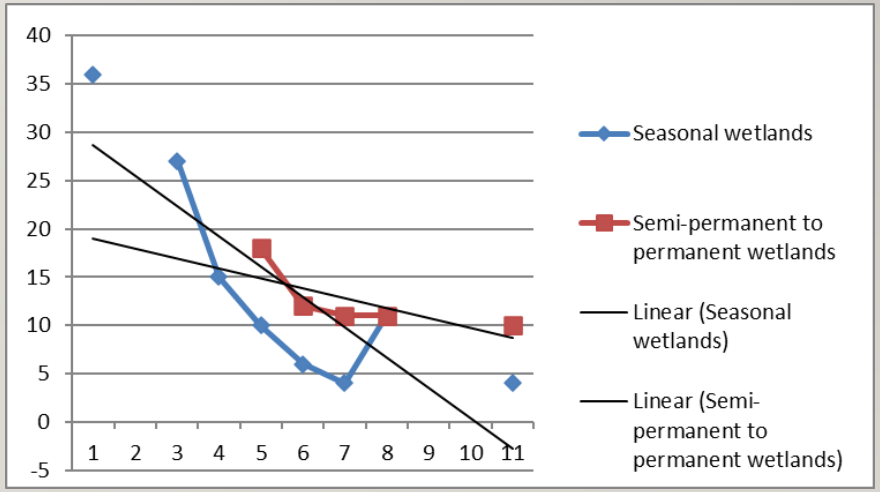


Figure 1:
Combined No. of 1 m sq plots containing sweetgrass at 6 sites over 11 years

Stem Density and Average Leaf Blade Length

Sweetgrass stem density has continued to decline consistently. Density was significantly greater from 2011 - 2014 when compared to 2015 – 2021. Sweetgrass leaf blade length was greatest from 2014 through 2016. After a sudden decline during the drought of 2017, mean leaf blade length increased in 2018, but declined again during the drought of 2021.

Drought during the growing season resulted in reduced average leaf blade length. This was most apparent in populations found in seasonal wetlands where growth is more directly influenced by summer precipitation and where populations are found on the outer perimeter of the wetland.

Leaf Blade Length - Pearson Correlation Coefficients and associated p values

	Overall	**OBK**	**WAT**
Total Precipitation	0.45611 0.2568	0.0804 0.86397	0.43817 0.27758
Maximum Daily Temperature	-0.59765 0.11778	-0.11284 0.80967	**-0.72413** **0.04228**
Minimum Daily Temperature	0.17005 0.68728	-0.13862 0.76697	0.09474 0.82348

Interpretation –
There was a strong, positive linear correlation between sweetgrass stem density and growing season precipitation and a strong, negative correlation between density and growing season daily maximum temperature both overall and for the OBK population (historically and at the beginning of the study, the largest sweetgrass population at Rocky Boy). For the WAT population, a strong, negative linear correlation was found between leaf blade length and growing season daily maximum temperature.

Overall, there is a strong positive correlation between sweetgrass stem density and total precipitation during the growing season and a strong negative correlation between daily maximum temperature and for the population found at Old Big Knife. There is a strong negative correlation between leaf blade length and maximum daily temperature during the growing season at the Watson site. The relationship between total annual precipitation, maximum temperature and minimum temperature and sweetgrass stem density and leaf blade length is not apparent.

HEADWATER WETLAND MONITORING

The CCT Wetland Program Headwater Monitoring Goals and Objectives include:

1) Select sites for re-assessment
2) Conduct wetland assessments at headwater wetlands
3) Apply Cultural Assessment methods as CCT RAM to include upland buffer composition and condition into overall Traditional Knowledge Habitat Scores;
4) Collect water quality samples at headwater wetlands for analysis;
5) Use wetland assessment results to develop restoration and management guidelines
6) Assess headwater wetlands for remnant sweetgrass populations or as potential assisted migration sites.
7) Develop SOPs for hydric soil monitoring; sample sites during Year 2 of this study

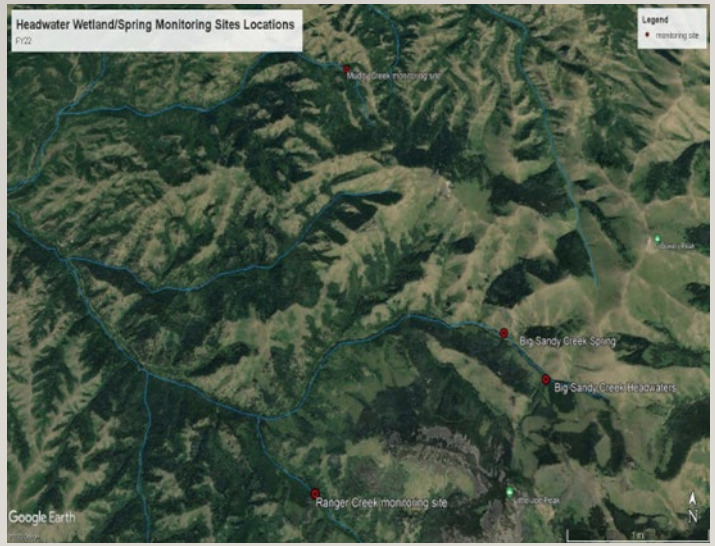
Due to alarming local sweetgrass population trends and climate trends, headwater wetlands were investigated in 2020-2022 to evaluate suitable assisted migration sites for our highly imperiled sweetgrass. **Sites are on average 1250 feet higher than riparian sites containing sweetgrass populations and >500 feet higher than the highest elevation sweetgrass population that is included in our monitoring study.**

Assisted Migration can be defined as moving plants, seeds or plant parts to another location. **Historically, assisted migration was regularly conducted by indigenous peoples that transported and consciously scattered seeds or planted plants at new locations. Today, assisted migration refers to relocating plants to more suitable sites to mitigate for climate change and local extirpation risk.** In most cases, assisted migration sites are cooler, wetter, found at higher elevations or in relatively undisturbed habitat. **Assisted migration projects involve species that inherently cannot migrate to new sites at a rate to outpace environmental change and impacts to its habitat.**

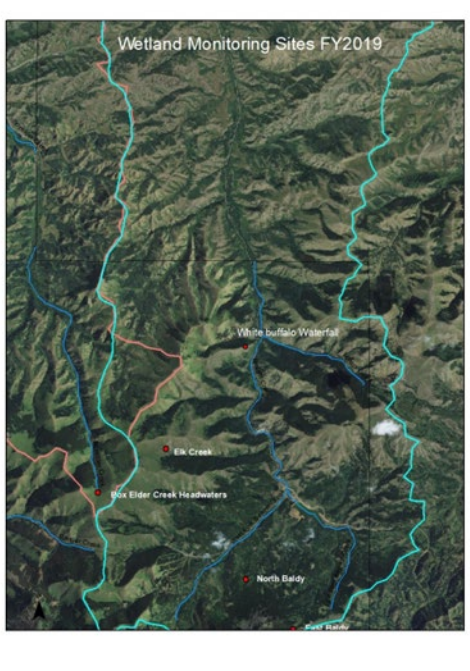
HEADWATER SITES

- Headwater Wetlands were assessed in 3 watersheds: Beaver Creek, Box Elder and Big Sandy Creek. A total of 15 sites were monitored and 5 more sites will be monitored this year.

Big sandy



Beaver creek



Box elder

CCT RAM

The Chippewa Cree Tribe developed a rapid and uncomplicated system to assess the functional capacity of wetlands on Reservation. Although the Montana Department of Transportation (MDT) method has been used on the Reservation, there are concerns that this method may not be an adequately rated functional capacity of wetlands for ecological and hydrological criteria that are most relevant to the prairie environment and most importantly, traditional culture of the Chippewa Cree Tribe.

- CCT Rapid Assessment Method and the MTNHP wetland assessment methods were used to evaluate headwater wetland condition at each site. Headwater wetland water quality samples were also collected and analyzed at each site. Sites were scored on overall habitat condition and were evaluated for restoration needs and as potential sweetgrass assisted migration sites.

CONCLUSION

Headwater sites that can be used as sweetgrass assisted migration sites had very High EIA scores and were found at the highest elevations in all 3 watersheds, on easterly or north-eastern aspects, with intact native vegetation and no exotic vegetation cover and at points of ground water discharge.

-We developed narrative restoration benchmarks and restoration plans for headwater sites requiring restoration work. Overall, headwater wetlands scored higher in EIA assessments when compared with lower elevation sites.

-We identified additional metrics that can be used in future wetland and upland buffer wetland assessments to assess uniqueness, rarity and diversity of wetland and upland habitats and their cultural significance to the Chippewa-Cree Tribe.

-These metrics will identify sites containing cultural species or species that are uncommon, rare, locally imperiled, endemic, restricted to certain habitat types or with restricted range distributions as well as any exceptional, diverse, undocumented or unusual plant community types.

- Important Point: there are examples at Rocky Boy for most of the metrics listed under each attribute (Cultural, Rare/Endemic, Plant Communities, Composition and Diversity)

-These metrics can be used on federal and state lands off-reservation to flag sites and species of cultural conservation value and importance. Most cultural species do not have any state or federal regulatory protection off-reservation but may be rare or uncommon in a jurisdictional area, state or region.