

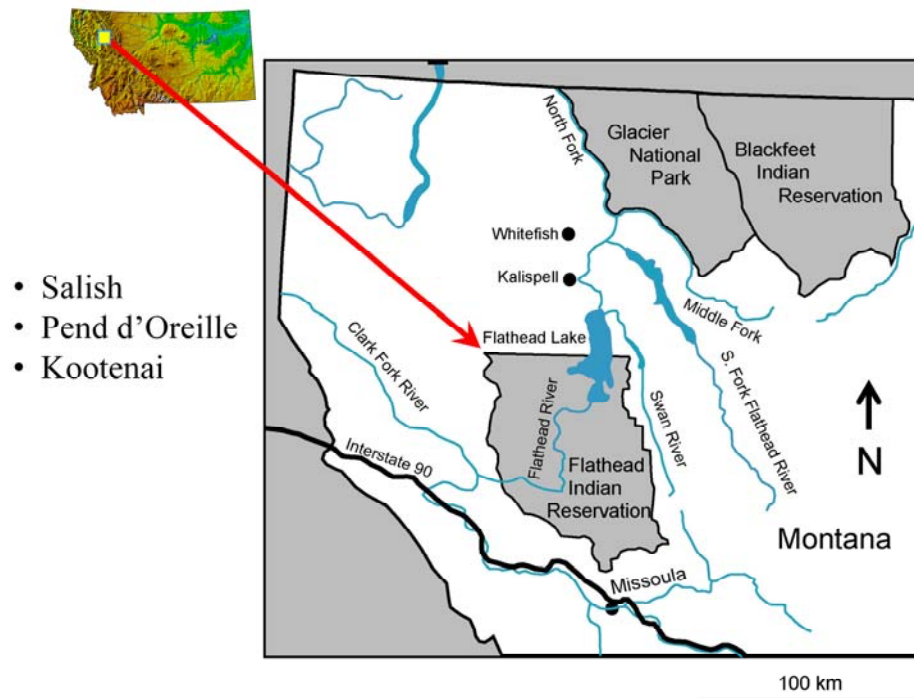


Compatible Indigenous & Geoscientific Knowledge

Flathead Indian Reservation
Northwest Montana

Adam Johnson
AMEC Geomatrix, Inc.
Salish Kootenai College
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This purpose of the project was to help increase interest in the earth sciences in the tribal community by incorporating local Indigenous knowledge.



The Flathead Reservation is home to three tribal groups whose names are commonly written in English as the Salish, the Pend d'Oreille, and the Kootenai.

The Salish and Pend d'Oreille are closely related groups. The Kootenai are unrelated and speak a completely different language.

The reservation is north of Missoula and south of Glacier National Park. It includes a portion of Flathead Lake, an important hydrologic feature that I'll discuss later.

Challenges for Geoscience Education in the Tribal Community

- Learning Objectives – Cultural Content
- Cultural Incongruities
- Tribal Student Enrollment



First, I'd like to discuss several problems relating to geoscience education on a Montana Indian Reservation.

First, the syllabus for each course at SKC contains learning objectives related to cultural content. However, defining "culture" is sometimes a challenge.

Second, many typical geoscience curricula lack place-based content that is culturally relevant and that reinforces Indigenous people's strong ties to the land.

Third, data show that the percentage of tribal students enrolled in earth science programs is small relative to their proportion in the overall population.

Project Origination

- National Science Foundation grant
- Success of geoscience education programs in tribal communities depends in part on close relationships between scientists and community members
- Also important is the inclusion of traditional earth science knowledge in the curriculum.
- The goal was to blend earth science study, traditional tribal knowledge, and relevant oral histories.

In an attempt to address some of these issues locally, a group of SKC faculty secured NSF funding.



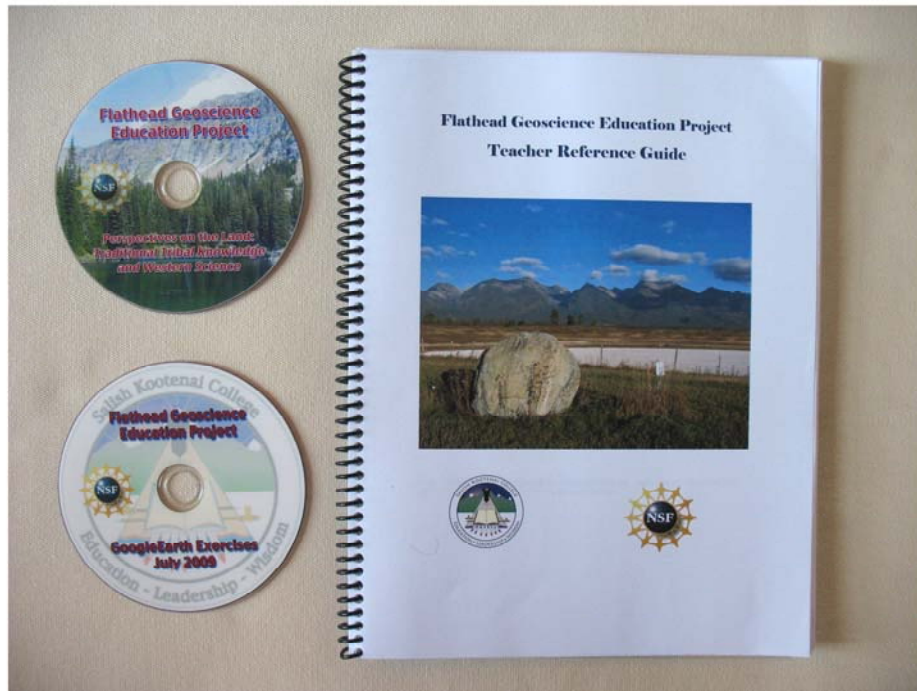
Meetings
Interviews
Field Trips
Research
Writing
Editing
Filming

SKC staff worked with multiple tribal stakeholders to complete a variety of activities over the course of several years.



For the field trips, we travelled to reservation landmarks that were significant to both earth scientists and tribal members.

In this photo, a tribal elder discusses the significance of hot springs and the bedrock outcrop in the foreground.



Final products included a set of curricular resources developed for Flathead Reservation middle school, high school, and college science classes.

We produced several DVD products that include tribal consultant interviews and field trip documentaries.

We also prepared a printed guide for middle school and high school teachers from across the reservation.

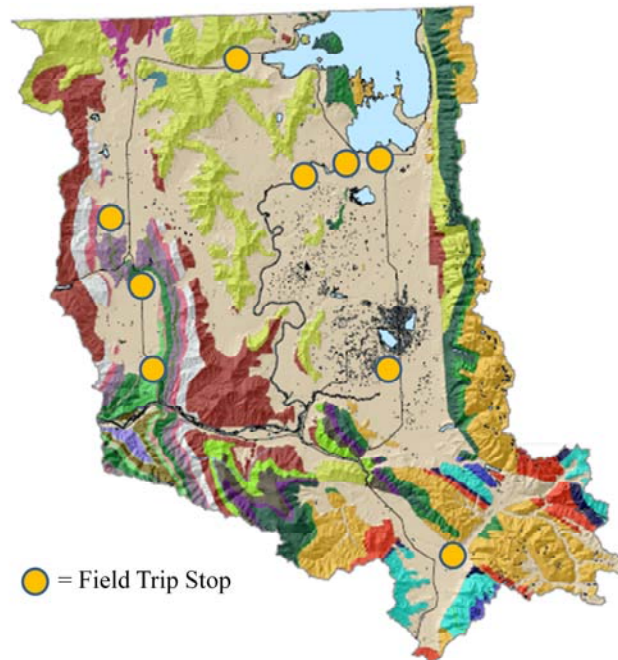


Here is a geologic map of the Reservation.

Bright colors depict Precambrian Belt Supergroup bedrock.

Tan areas are unconsolidated glacial and alluvial deposits.

The Pleistocene glacial history of the reservation is well preserved in the geologic record.

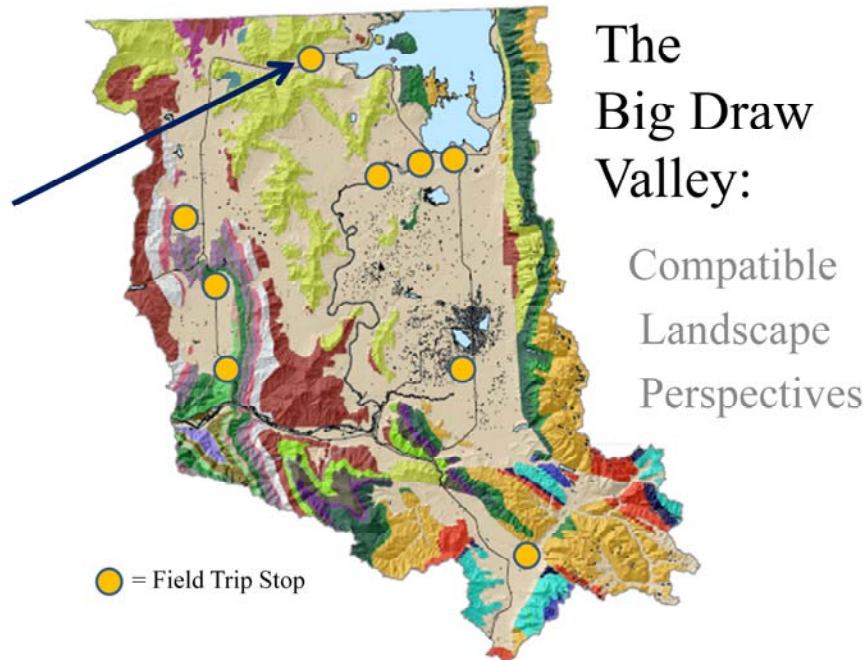


Here is the same map, with orange circles showing the sites that we focused on and visited for this project.

These locations were chosen based on meetings and discussions between the various collaborators.

Participants identified field sites critical to understanding local geoscience concepts, traditional knowledge, and oral histories.

The rest of my presentation focuses on one of these localities.



Here is the approximate location of the Big Draw, a long and narrow valley on the northern portion of the reservation.

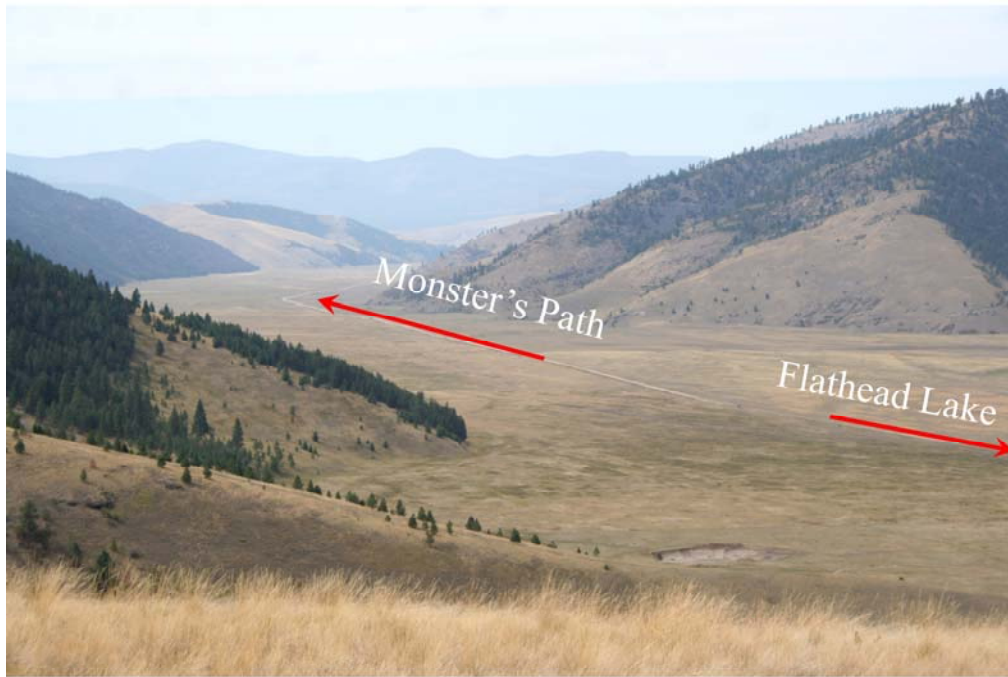
The valley preserves impressive glacial erosional and depositional features.

It is also the focus of at least three different Indigenous stories.

I'm going to present brief and simplified versions of each story.

Oral Tradition - Kootenai

- A hawk was angry at his wife's amorous relationship with a monster that lived in Flathead Lake.
- The hawk battled the monster, and shot it with an arrow.
- The monster then swallowed all the water in the lake. The monster tried to escape from the hawk, but because he was so full and heavy, he dragged his body along the ground, gouging out the Big Draw.
- Later, hawk pulled the arrow out of the monster, and all the water drained through the valley back to the lake.



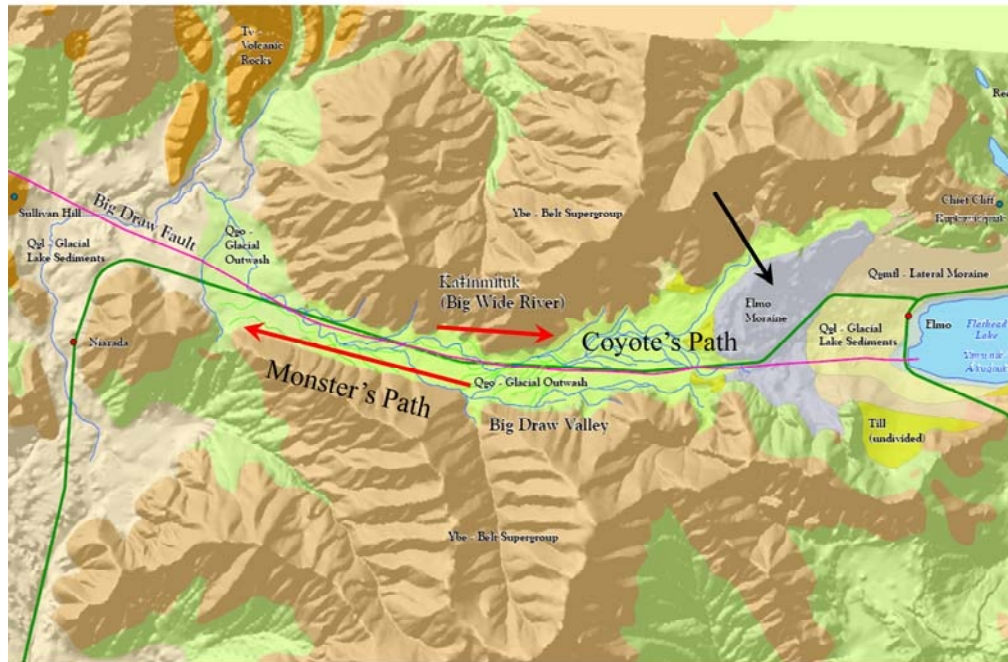
Here is an oblique view of the Big Draw Valley looking to the west.

Flathead Lake lies to the east. In the Kootenai story, the monster dragged itself to the west, away from the lake.

When the arrow was pulled out of the monster's body, the water drained back toward the lake.

Oral Tradition – Pend d'Oreille

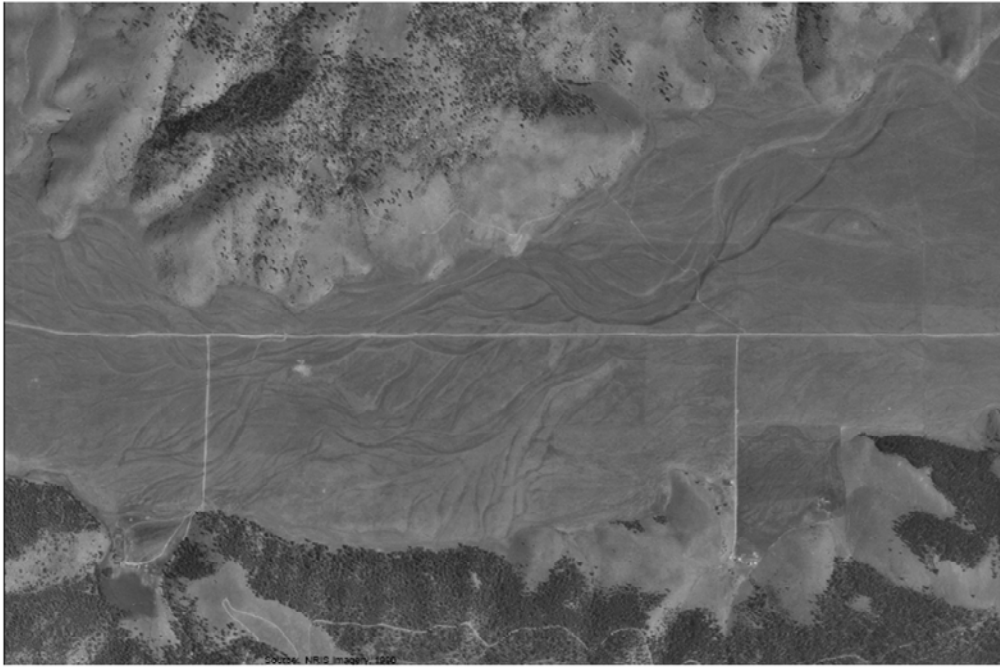
- Coyote was digging a channel for a river eastward from the Big Draw toward F.H. Lake.
- Purpose was to bring salmon to the P.O. tribe.
- However, just before he connected the channel with the lake, he was distracted by a woman and never finished his work.
- Instead, he left a large pile of material at the eastern end of the river channel (Elmo Moraine)



Here is a geologic map of the Big Draw valley.
 Brown formations are Precambrian bedrock.
 Green represents glacial and alluvial deposits.
 Note: Monster's path, Coyote's path, and the Elmo Moraine.
 Kootenai term for Big Draw translates as Big Wide River.

Oral Tradition – Salish/Pend d'Oreille/Kootenai

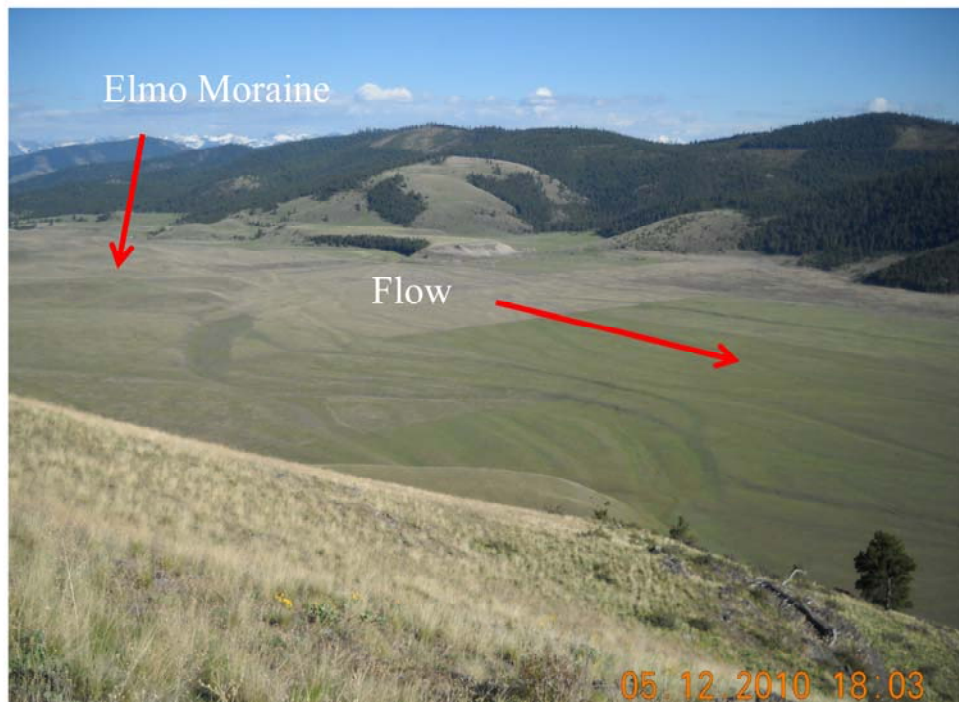
- A giant beaver lived in Flathead Lake prior to the arrival of Indians in the valley.
- At that time, the outlet of the lake was the Big Draw Valley. The giant beaver built a dam across the river outlet [Elmo Moraine], causing the lake level to rise.
- As the beaver got older and bigger, he built the dam higher, but soon the water began to run out at the south end of the lake [current outlet at Polson]. So the beaver built up a high dam at that point [Polson Moraine].



Geologists explain the well-preserved landscape of the Big Draw in terms of glacial erosion during the retreat of the Cordilleran Ice Sheet. Large volumes of glacial melt water flowed from the Flathead Lake basin westward through the Big Draw.

This aerial photograph clearly shows a series of braided glacial outwash channels that formed downstream of the Elmo Terminal Moraine when melt waters overtopped the moraine (compare with Beaver story).

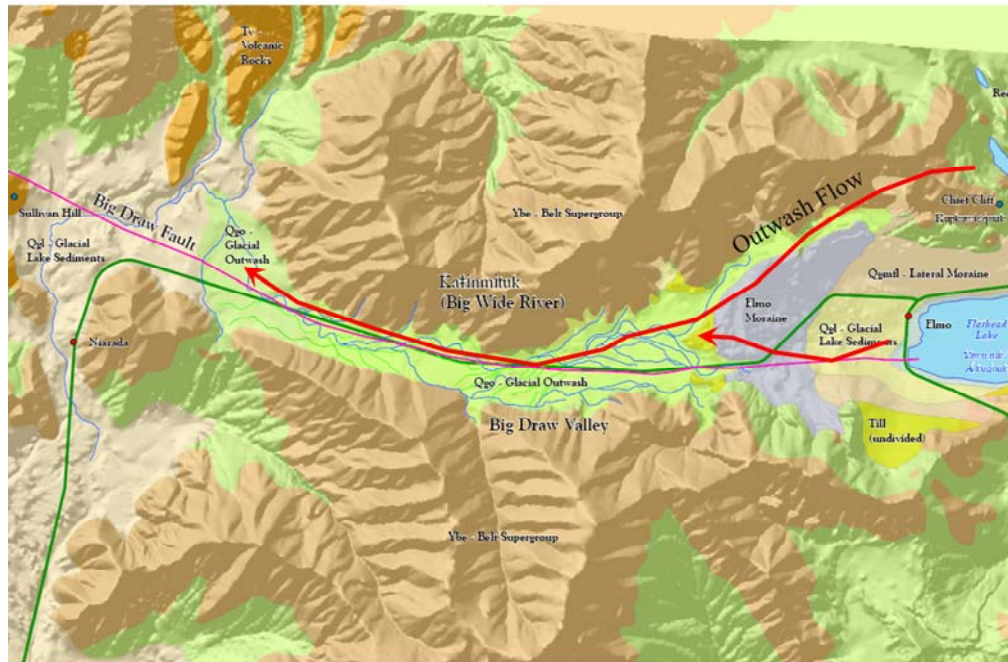
These features have not contained significant water for 10,000 years.



Here is another oblique image looking to the southeast.

You can see

- 1) the Elmo Moraine
- 2) well-preserved glacial outwash channels
- 3) evergreens mark the point of the Elmo spill point



Here is the geologic map showing the flow paths of the outwash channels.

Remember, the monster's body was dragged to the west, while Coyote was digging the river channel toward the east.

The tribal stories and the geologic hypotheses are compatible perspectives that benefit from mutual reinforcement.

The details of each story do not necessarily match, but the overall themes have common elements.

According to these histories, a large volume of flowing water played a major role in creating the local landscape.

The tribal narratives are consistent with the notion of first-hand observation of glacial activity in the Pleistocene.



In summary, the goal of this project was to blend earth science study with traditional tribal knowledge and oral histories.

Tribal landscape knowledge is abundant, and it can be integrated into existing science curricula.

The products can be used at SKC and in K-12 classrooms across the reservation.

If teachers can show that indigenous knowledge is relevant and important information, more students may be influenced to pursue careers in the geosciences.



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