



EXPLORING THE BIG MUDDY: A VIRTUAL FIELD TRIP DISTANCE LEARNING COMPANION GUIDE

Lesson Title: Forces that Shape the Missouri River

Guiding Question: How has the Missouri River changed over time and how have these changes affected the people and animals who inhabit its land and water?

Topic: Change on the Missouri River

Length: 45 minutes total; 27 minutes, 18 seconds (27:18) for video only

Brief Overview: This lesson plan is designed for distance learning and includes a virtual field trip video (with suggested pauses for questions) and online activity (utilizing historical photographs) to engage students as they explore how the Missouri River has been shaped by the natural environment and human interference.

Columbia Public School Standards:

4th Grade Social Studies

- Describe how Missouri has changed (and stayed the same) over time.
- Use geography to interpret the past and predict future consequences as appropriate to topics or eras discussed and predict future consequences.

4th Grade Science

- Students will be able to analyze & interpret data from maps to describe patterns of Earth's features.
- Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Lesson Objectives:

- Students will understand the complexities of our relationship with the Missouri River.
- Students will know how the Missouri River has changed over time.
- Students will be able to explain how humans have impacted the Missouri River.

Getting Ready:

- **Materials:** Computer, internet access, Google account, Google Drive, ability for students to access and edit Google Slides documents, Zoom account (or your school's equivalent).
- **Make a Copy:** Open the "Explore the Big Muddy: A Virtual Field Trip Class Channelization Activity" Google Slides document and select *File, Make a Copy*

and the *Entire Presentation* option. This will create an editable copy of the document in your Google Drive. The “Exploring the Big Muddy: A Virtual Field Trip Class Guide” document can be presented as is and does not require editing capabilities. However, you are welcome to follow the same procedure to make a copy of this document as well, should they wish to personalize the lesson.

Virtual Field Trip Slideshow Documents:

Document 1	Exploring the Big Muddy: A Virtual Field Trip Class Guide
Document 2	Exploring the Big Muddy: A Virtual Field Trip Class Channelization Activity

- Sharing: Share the “Exploring the Big Muddy: A Virtual Field Trip Class Channelization Activity” with students so that they may edit the Google Slides document. **DO NOT** share “Exploring the Big Muddy: A Virtual Field Trip Class Guide” slideshow presentation until after the activity as the channelization answers are located in this document.
- Preparation:
 - Have pages 3-7 of this companion guide available for reference.
 - Open the copy versions of the “Exploring the Big Muddy: A Virtual Field Trip Class Guide” and the “Exploring the Big Muddy: A Virtual Field Trip Class Channelization Activity” Google Slides documents.
 - Prepare to present “Exploring the Big Muddy: A Virtual Field Trip Class Guide” as the Virtual Field Trip film is embedded in the second slide.
 - Check that video and audio are working properly and that the classroom method of screen sharing is operational for students to view the presentation.

Special Thanks:

This virtual field trip and companion guide would not have been possible without the assistance of many people. We would like to extend an earnest thank you to everyone that helped develop this video and guide including Kristen Schulte, Laura Waldo-Semken, Anna Miller, Jim Karpowicz, Tom Newcomb, Kory Kaufman, Steve Schnarr, and Melanie Knocke. This work is also supported by the Columbia Public Schools Science Department.

BACKGROUND INFORMATION

The Missouri River is 2,341 miles long, the longest river in North America. It flows through parts of 10 states and its watershed covers 1/6 of the United States. As the “center of life” for the Great Plains region, the Missouri River has provided resources for millions of people over thousands of years, allowing them to explore, find food, and trade goods. Today, people still rely on the Missouri River for these services. For example, almost half of all Missourians get their drinking water from the river. And humans aren't the only species that benefit from its waters. Hundreds of species of fish, mammals, birds, and other creatures depend on the Missouri River for their survival.

For centuries, the Missouri River was long, shallow, and meandering, filled with tree snags and islands that made it extremely difficult to navigate. In the last century, humans began an effort to straighten and deepen the river - a process called "channelization" - to make the river easier and safer for boats to pass through. Channelization provides a more stable and unchanging channel in the river and protects cities and towns if the river suddenly tries to change course.

Channelization of the Missouri River started in 1934 when the U.S. Army Corps of Engineers built wooden structures called wing dikes into the river banks. Wing dikes jut out into the river, slowing down the water and causing sediment (dirt, tiny pebbles, and sand) that is normally carried by fast flowing water to settle down behind the dikes. Over time, sediment fills in the area behind the wing dikes, creating new land where the river once flowed. With the help of wing dikes, the path of the Missouri River became narrower, straighter, and deeper. Navigation became easier, allowing more river traffic (barges in particular) to safely use the river. Agriculture also benefited from channelization. As river banks became larger and more stable, they became easier to farm. By 1977, areas where the Missouri River once flowed were being used as farmland.

However, with such major changes to the river, there are significant environmental consequences, such as an increase of erosion, a loss of wetland habitats, reduced woody debris being washed into the river, channel incision, and a decrease in species diversity. For example, when channelization removes the natural bends from a river, the water flow has more time to build up speed. The faster water then pulls more of the surrounding soil with it, causing an increase in erosion.

Additionally, because the river now flows so fast and straight, there is very little of the slow, shallow habitat and sandbars that used to be found in the unchannelized and meandering river of old. This loss of habitat has been detrimental to animals (such as the Pallid Sturgeon) who rely on slow-moving water or sandbars for certain stages of their life cycle.

SUGGESTED PROCEDURE

VIRTUAL FIELD TRIP - PART I: 17 minutes (video + ~ 4 minutes of discussion)

Open the “**Exploring the Big Muddy: A Virtual Field Trip Class Guide**” and the shared “**Exploring the Big Muddy: A Virtual Field Trip Class Channelization Activity**” document. Check the audio of the embedded Virtual Field Trip film on the second slide of the Class Guide. Be sure that it will be audible for students when screen share is enabled. For reference, time codes (for example 04:30 = 4 minutes, 30 seconds) are used to identify specific segments of the video. The time code can be found in the lower left corner of the YouTube Video Player, to the right of the play/pause button. Present virtually through Zoom or your school’s equivalent video conferencing program. Share your screen and prepare to present the Class Guide.

Share Screen, Begin Presentation and Start Video on Slide 2.

00:00 - Introduction

Students are introduced to Laura Semken, their guide on this virtual field trip. Laura welcomes them to the Missouri River, explains how to prepare for their upcoming boat ride (proper clothing, footwear, and life jackets), and introduces them to their boat captain.

04:30 - Big Manitou Bluffs

At Big Manitou Bluffs, Laura describes how melting glaciers formed bluffs over the course of years and years. She also introduces students to sedimentary limestone, the type of rock often found in the central Missouri area. This limestone contains bits of fossilized animals called *crinoids* from millions of years ago, when the land was a shallow sea. These animals appear to be shaped like underwater flowers. Most of the crinoids that one can easily find are circular fossils from the stalk or column of the creature. The crinoid actually became Missouri state's fossil after a group of Lee's Summit school students worked to promote it as a state symbol.

07:31 - Torbett Spring

During this segment, Laura introduces Steve Schnarr who explains some of the history of Lewis and Clark Cave and Torbett Spring.

11:05 - After an explanation of rock paintings, just after Steve says "It's a fun way to look back in time," - **PAUSE VIDEO FOR DISCUSSION.**

Discuss with students: Think about how water changed the shape of the land. Laura and Steve have discussed several ways in which water can change the shape of land and rock. Ask the following questions:

a. What are some ways that you think water could affect the land?

Suggested Answers: Erosion, the formation of the bluffs and caves found in Missouri, the stalagmites and stalactites or even how major waterways can shift during flooding.

b. What would happen if it rained a lot for a long period of time?

Suggested Answers: Underground caves could fill up, Torbett Spring would be flowing fast, the level of the Missouri River could increase. After a very long time, new caves and springs could form. The consistent, higher volumes of water would cause quicker change to the land.

a. What about if it didn't rain at all?

Suggested Answers: Ground water supplies like caves and springs could dry up along with shallow creeks and streams. The Missouri River's water level would go down. The land would experience a drought.

11:05 - **RESUME VIDEO** - California Island

During this segment, Laura discusses the history and dangers of travel on the Missouri

River and how the US government decided to change the river to make it easier for boats traffic.

13:10 - After Laura says "The US Government decided to change the river to make it easier for boats to travel on it," - **PAUSE VIDEO FOR ACTIVITY AND STOP SCREENSHARE.**

Transition to Activity

Discuss with students: How would you change a river to make it safer for boats? For the next 10 minutes, you will be working in groups to make observations like scientists to better understand how humans have changed the Missouri River over time.

CHANNELIZATION OF THE MISSOURI RIVER ACTIVITY: 10 minutes

- Divide students into groups and assign each group to an activity slide.
 - Make sure students have access to the “Exploring the Big Muddy: A Virtual Field Trip Class Channelization Activity” document and can edit.
1. Explain that each group will need to:
 - a. Read the “Task Card” on Slide 2 of the “Exploring the Big Muddy: A Virtual Field Trip Class Channelization Activity” document.
 - b. Carefully follow instructions.
 - c. Work together as a team to complete the activity on their group slide.
 2. Explain that you are going to give them a hint for the activity.
 - a. The objects in the photos that look like fences are called wing dikes. These are used to help with channelization of rivers. This may help you put the pictures in order.
 3. Place the groups into Zoom breakout rooms (or the equivalent) to allow them the ability to work together.
 4. While students work in groups, check on the breakout rooms and listen to their discussions. Allow eight minutes for the activity.
 5. After ten minutes, close the breakout rooms and tell students to leave their pictures in order on their slides. Tell them that Laura will explain the actual order of the photos in the video.

VIRTUAL FIELD TRIP - PART 2: 18 minutes (video + ~ 4 minutes of discussion)

Return to the Class Guide Presentation and Share Screen.

13:10 – **RESUME THE VIDEO** - Indian Cave Bend

A series of photos of Indian Cave Bend over the course of several decades show the result of channelization of the Missouri River.

15:56 - After Laura says "Over time, humans changed the river from being wide and shallow to narrow and deep. The bends or meanders were damned and this separated the river from its natural flood plain," - **PAUSE VIDEO FOR DISCUSSION.**

Discuss with students: Think about the similarities and differences between your order of your photographs and the information presented in the video. Ask the students the following questions:

a. What did you observe about the video's order?

b. Is it similar or different from yours?

Explain in detail the true order of the photo set by going through the rest of the Class Guide presentation slide by slide (**Slides 4 through 11**). The descriptions of the pictures featured on these slides are below:

- **Slide 5** – Before the Missouri River was channelized, it was very wide and shallow. There were also numerous islands (*point to islands in the middle of the photo*) in the river, making it very dangerous for steamboat travel. It was also difficult for farmers to water their crops and control flooding.
- **Slide 6** – That is why engineers created levees and wing dikes to direct the river's flow into a deep and narrow channel. These changes improved transportation, irrigation, and helped control flooding on the Missouri River.
- **Slide 7** – You can see the wing dikes doing their job.
- **Slide 8** – You can see that the channel is now completely to the left of the wing dikes.
- **Slide 9** – You can see vegetation growing in (*point to shaded area by wing dike*).
- **Slide 10** – You can see that vegetation has completely taken over – a whole forest grew in, even over the top of the wing dikes.
- **Slide 11** – This last photo shows the forest cut down so the surrounding land can be used for agriculture. Farming up to the edge of the Missouri River was an early agricultural practice. Now farmers leave buffers of vegetation between the farm land and the river.

Discuss with students: We have learned how humans changed the shape of the Missouri River. Before the wing dikes that narrowed the river were built, the Missouri River was surrounded by shallow, wide wetlands which filled with water whenever there was a flood. Think about the shape of the river now.

a. What type of land is next to the river?

Suggested Answers: Farmland, cities, conservation areas. Let the students lead the conversation. For students who are familiar with the river, ask them what type of land they noticed in their own experiences.

b. What might happen when there is flooding in the Missouri River?

Suggested Answer: Flooding impacts farmland, residential areas and wildlife. Consider things like damages and the cost to rebuild.

15:56 - **RESUME VIDEO** - Missouri River Habitat & Tadpole Chute

During this segment, students will learn a little more about flooding along the Missouri River. Following that, Steve shares the importance of Tadpole Chute to native species who have lost much of their habitat over time. He explains the need to incorporate areas designed for wildlife along the river in order to prevent the extinction of native species who were greatly affected by channelization.

22:26 - After Steve says "All the fisherman love coming up in here because they know that's where the fish hang out. So, I hope you get to visit and enjoy it," - **PAUSE VIDEO FOR DISCUSSION.**

Discuss with students: Steve showed us one example of recent attempts to help fish like the Pallid Sturgeon.

a. What are some ideas that you have to help endangered wildlife like the Pallid Sturgeon fish and Piping Plover bird?

Suggested Answers: These ideas might be similar to the River chutes described in the video or ideas like fish stairs/elevators that help fish like salmon migrate past manmade obstructions like dams.

22:26 - **RESUME VIDEO** - Bald Eagles and Review

During this segment, students will learn about bald eagles and how they were brought back from the verge of extinction. Laura will then summarize the field trip and say goodbye to Captain Kory, Steve, and the students.

27:18 - **STOP VIDEO** - Video concludes. The End!

REFERENCES

Missouri River Relief. (2018, June). [Channelization](https://mospace.umsystem.edu/xmlui/bitstream/handle/10355/65866/Channelization-8-24pdf?sequence=1&isAllowed=y). Retrieved June 20, 2019, from the following website:<https://mospace.umsystem.edu/xmlui/bitstream/handle/10355/65866/Channelization-8-24pdf?sequence=1&isAllowed=y>