The Course of a River

Time

one or two 45-minute sessions

Vocabulary

aquatic, channel, channelization, erosion, flood, floodplain, habitat, meander, pool, riffle, sediment, water quality, watershed

Objectives

Students will:

- discover how rivers are formed.
- collaborate to create their own river.
- apply forces of nature to alter a river.
- apply human techniques to alter a river.

Method

Students discuss the Boyer River's history using historical and present day maps and aerial photos. Students explore the natural processes and human alterations of a river through an activity using a stream table.

Materials

Harrison, Crawford, Sac, and Buena Vista counties' historic vegetation maps from www.glo.gis.iastate.edu/maps/maps.html

current land cover maps from http://ortho.gis.iastate.edu/

Boyer River watershed boundary map obtained by calling the Geological Survey Bureau at 319/335-1575 and asking for its watershed map

stream table for class demonstration. This may be borrowed by contacting the DNR Aquatic Education Program (641/747-2200) for a list of sites with stream tables for loan, or visit www.iowadnr.gov/education/strtabloc.html. Directions for building a stream table are listed at www.iowadnr.gov/education/files/strtbldir.pdf. Drawings of a stream table are available at www.iowadnr.gov/education/files/strtbldrw.pdf.

Background

In 1820, Stephen Kearny and company traveled along the Boyer River in present day western Iowa. The river was a slow, meandering stream, breaking up the vast tall grass prairie. The Boyer provided **habitat** (arrangement of food, water, shelter or cover, and space suitable to animals' needs) for **aquatic** (growing, living in, or frequenting water) animals in its pools and riffles. The crew celebrated the Fourth of July along this river by drinking whiskey, toasting their forefathers with a mint julep, and eating pork and biscuits.

The majority of the Boyer River and its **watershed** (land that drains into a particular body of water) were "settled" by Euro-Americans within 12 years of Kearny's journey. Pioneers and their descendents began tilling the prairie sod to create farmsteads and build houses, churches, schools, and businesses in. Sometime after settlement, humans began channelizing the river.

In its natural state, streams and rivers **meander** (turn or wind), changing their course over time. **Pools** (areas of a stream or river which is deeper than adjacent areas, water flow may be slowed, and the bottom usually is made of very small particles) and **riffles** (area of a stream or river with faster current; usually more shallow than a run or pool; the water surface is broken up due to flowing over rocks) located between meanders support a diversity of aquatic life. **Channelization** (straightening) accompanied with replacing the surrounding natural vegetation with row crops, eliminates much of the habitat so much of the aquatic life disappears from the area. This modification results in faster moving water, which increases **erosion** (removal or wearing away of soil or rock by water, wind, or other forces or processes) and deepens **channels** (deeper part of a moving body of water where the main current flows). This chain reaction initiated by stream channelization destroys the natural integrity of stream channels and often results in major damage to bridges. **Floods** (abnormally high stream/river flow that overtops the banks of a stream/river) also are more severe.

Most of Iowa's interior rivers and streams have channelized stretches – some 3,000 miles of Iowa rivers have been lost to channelization. The Boyer River is one of the more heavily channelized rivers in the state.

The Boyer River empties into the Missouri River. According to the Missouri River Natural Resources Committee and the U.S. Geological Survey-Biological Resources Division, 735 miles of the Missouri River have been channelized or stabilized, shortening the river by 72 miles and eliminating 127 miles of river shoreline habitat. 168,000 acres of former river disappeared as **sediment** (fine soil and other particles that settle to the bottom of a liquid) accumulated behind the wing dikes, forming new land. Over 35,000 acres of river channel were lost along Iowa alone. Development for agriculture and urban areas replaced nearly 354,000 acres of floodplain habitats. Levees, built to protect against flooding, encouraged development of the **floodplain** (land near a stream/river which flood water spills onto). They also isolated aquatic habitats off the main channel and wetlands from the river.

For more information on Stephen Kearny's exploration refer to *Iowa's Water*, page 4.

Procedure

1. Share with students the *background information* of Stephen Kearny's journey. Discuss historical conditions of the Boyer River. Look at the Boyer River's watershed map from the Geological Survey Bureau. Note where the boundaries are.
2. Show students historical vegetation maps of Harrison, Crawford, Sac, and Buena Vista counties. Find the Boyer River on each map and look at the vegetation surrounding it. Note that the river on the map is where it was in 1999. Look for wetlands and forested areas away from the river. Does the river look like it is accurately marked?
3. Look at current land use patterns in the Boyer River's watershed by looking at the land cover maps on the website listed earlier. Compare and contrast the historical vegetation and present land cover maps of Harrison, Crawford, Sac, and Buena Vista counties. Again, find the Boyer River on each map. Ask students how the river has changed. Initiate a discussion on changes of the Boyer and the effects of channelization on the natural processes of a river. Include vocabulary from above.
4. Inform students they will be creating their own rivers. If using a borrowed stream table, follow the directions below.
5. Using a scoop or cupped hands, create a meandered (S-shaped) channel. Watch water flow through the stream's channel. Note the erosion of banks and creation of sandbars. If left to flow for a short period of time, the stream may create multiple channels. Discuss where aquatic wildlife lives in streams. Locate pools and riffles. Take a small, floating object, and time how long it takes it to reach the end of the stream from any given point. Record the results. Increase the flow of water to allow the stream to flow outside of its banks. Note what happens.

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6. Have students make a channelized (straight) stream. Watch water flow through the stream's channel. Ask students where aquatic wildlife would live. If left to flow for a short period of time, the channelized stream will begin to meander. Straighten the channel and take the floating object from before. Again, time how long it takes to reach the end of the stream from the designated point. Increase the flow of water again to allow the stream to flow outside its banks. Note differences between the channelized and meandering streams' floods.
7. Allow time for students to explore the stream table. Observe and comment on natural processes they discover.

Evaluation

1. What was the Boyer River like when Stephen Kearny and company traveled along its shores? What is the Boyer River like today?
2. Does a river tend to flow in a straight line, or curve like an "S"?
3. Where does aquatic wildlife live in a meandering stream? Where does aquatic wildlife live in a channelized stream? What happens to the diversity within a stream when it is channelized? (Diversity decreases due to the absence/reduction in habitat.)
4. What happens to the velocity of water when a stream/river is channelized?
5. What happens when a meandering stream floods? What happens when a channelized stream floods? Does this affect the floodplain differently?
6. Why do people channelize streams/rivers? What are benefits to channelization? What are drawbacks?
7. How does channelization affect **water quality** (condition of water)?

Extensions

Take a field trip to a meandering and channelized stream. Look for aquatic wildlife (insects, fish, crustaceans, etc) at both streams. Record and compare results.

Look at different rivers in Iowa. What similarities do they have with the Boyer River? What differences?

Research other explorations in western Iowa.

Research what life was like in your county when the Boyer River was being explored in 1820.

Teacher Aids

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"Biodiversity of Iowa: Aquatic Habitats." 2001. Des Moines: Iowa Department of Natural Resources' Aquatic Education Program.

"Living Landscape." Conservation Technology Information Center.