Do You Have a Reservoir?

Time

one or two 60-minute sessions

Vocabulary

aquatic, channel, dam, flood, habitat, municipal water storage, reservoir, sediment, watershed

Objectives

Students will:

- research and map the Des Moines River and its dams.
- predict effects of a dam on an area.
- suggest reasons a dam would be built.
- identify consequences of dams to humans and wildlife.

Method

Students will examine the Des Moines River system and determine effects of dams along it.

Materials

copies of an Iowa political or road map (two per student)
copies of student handout *Iowa's Major Reservoirs*
colored markers or pencils
one or more atlases with state maps for the United States
wall map of the United States
reference materials

Background

In 1843, Fort Des Moines was built near the confluence of the Raccoon and Des Moines Rivers. The Dragoons stationed there mostly radiated out to trouble spots on horseback, many times following the Des Moines River north. Hundreds of men would explore and patrol the area now known as Iowa from this fort. The men also used the Des Moines River to receive heavy shipments of supplies by steamboat. Fort Des Moines was closed after three years.

The Des Moines River is the largest interior river in Iowa; flowing 535 miles and draining 9.4 million acres of land. Humans have dealt with **floods** (abnormally high stream/river flow that overtops the banks of a stream/river) since they have lived near its banks. A series of floods took place in 1851, 1859, 1903, 1944, 1947, and 1954. In 1938 and 1944, Flood Control Acts were passed that allowed a study of nine sites along the river for potential flood control structures. In the 1960's, the U.S. Army Corps of Engineers began construction of **dams** (impoundments) at two of these sites, Saylorville and Red Rock. Unlike navigation dams on the Mississippi, these dams were built to control flooding.

Many other streams and rivers were dammed in Iowa. There used to be over 540 water-powered mills in Iowa. Most of these mills required a dam on a river or stream to provide the water power. The first dam in Iowa was built on the Yellow River in northeast Iowa by Jefferson Davis (the later Confederate President) while he was a soldier at Fort Crawford in Prairie du Chein.

People construct dams across rivers for many reasons: to protect land from floods, store water, generate power, redirect river **channels** (deeper part of a moving body of water where the main current

flows), create artificial lakes (reservoirs), and keep water levels high so boats can travel without bottoming out. All dams, no matter why they are built, must be strong enough to contain huge volumes of water without leaking or breaking.

A new body of water is created behind the dam. It may be used for fishing, swimming, waterskiing, and boating. But, thousands of acres of **habitat** (arrangement of food, water, shelter or cover, and space suitable to animals' need) as well as people's homes may be lost when the river valley above the dam floods. Below the dam, the river level drops. The lowered water levels may hinder the migration of **aquatic** (growing, living in, or frequenting water) animals, while the dam itself may become a barrier. The remaining flow may not be enough water to sustain communities downstream.

A placid **reservoir** (natural or manmade body of water) may cover thousands of acres upstream of a dam. Saylorville Lake has a normal water surface area of 5,950 acres. Lake Red Rock covers 19,000 acres. As water entering the reservoir slows down, it drops the **sediment** (fine soil and other particles that settle to the bottom of a liquid) it carries. After many years, accumulating sediment can fill some reservoirs.

Iowa streams and rivers have been dammed at more than 200 locations to provide water for a variety of purposes. Many are used for **municipal water storage** (water stored for public consumption or use) while some are used for flood control and others for recreation. These range in size from 15-acre Mitchell Lake to the large reservoirs. Over 100 lakes have been constructed for recreation throughout Iowa. They are generally small; only one in four is over 100 acres.

For more information on the Dragoons, refer to *Iowa's Water,* page 4.

Procedure

1. Share *background information* on the Dragoons and Fort Des Moines.
2. Have students brainstorm reasons for building a dam.
3. Explain the three main reasons in Iowa: flood control, recreation, and municipal water storage.
4. Locate the Des Moines River watershed on a map of Iowa. Inform students that the Des Moines River is more than 535 miles long and its watershed includes 9.4 million acres of land. Find the Des Moines River watershed (http://ortho.gis.iastate.edu/).
5. Discuss building of dams in Iowa, including *vocabulary words* from above. Ask students to list some potential effects (negative and positive) of dams. Write their responses on a chalkboard.
6. Divide students into pairs. Give each pair a set of colored markers or pencils and a copy of the Iowa map.
7. Students should use one color to trace the Des Moines River from its source to its mouth.
8. Use a second color to highlight the tributaries that flow into the Des Moines River.
9. Consult the map and *Iowa's Major Reservoirs*. Locate dams on the river and use a third color to mark their locations.
10. Have students use a fourth color to outline regions drained by the Des Moines River.
11. Have students label towns and cities in the Des Moines River **watershed** (area of land that drains into a particular body of water): Fort Dodge, Boone, Carroll, Des Moines, Indianola, and Ottumwa.
12. Have students predict which communities depend on the Des Moines River for drinking water.
13. Using maps of the United States compare and contrast the Des Moines River to the Colorado River in western U.S. Are dams located on both rivers? Research why dams are used on the Colorado. How are they different from dams on the Des Moines? Similar?
14. Have students create a drawing of an area before and after a dam is built. National Geographic has an interactive website concerning dams that may give students hints: www.nationalgeographic.com/resources/ngo/education/geoguide/dams/index.html.

Evaluation

1. How has the Des Moines River changed since the Dragoons traveled its shores? How has this affected water quality?
2. Why were dams built on the Des Moines River? What do you think would happen if there were no dams on the Des Moines River?
3. What is a difference between Saylorville dam and Lock and Dam 10 on the Mississippi River?
4. Could a steamboat float up the Des Moines River to Des Moines today? Why or why not?
5. What happens to water as it reaches a reservoir? What happens to the sediment in the water?
6. How does the Des Moines River compare with the Colorado River? See above.
7. What are some benefits of dams?
8. What are some negative impacts of dams?
9. Have pairs of students display their maps of the dams, watersheds, and cities along the Des Moines River.

Extensions

Find a stream or river near your school. Follow it along its course. Have students pick a location where they can imagine a dam. How wide would it be and how high? Have students imagine the reservoir created by the dam. Use a topographical map to determine the extent of the reservoir created. To get a sense of its size, decide how deep the water should be in the reservoir, and then climb up one of the banks until you are that far above the present surface of the stream or river. Have students walk upstream, staying as much as possible at the same level. The surface of a reservoir is nearly flat, so if you stay at the same elevation while you walk, you'll actually trace the shoreline of your imaginary reservoir. Explore your imaginary reservoir, asking students: What effects would the dam have on the land upstream? What happens to the people and animals upstream? What happens to the water while the dam is being built? What would happen if there was a leak in the dam? What happens to the river or stream below the dam?

Borrow a stream table to demonstrate what a stream looks like before and after a dam is built. Contact 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.

Teacher Aids

Posters

"Aquatic Life." Ill. Brian Wignall. 1989. Des Moines: Iowa Department of Natural Resources' Aquatic Education Program.

"Benthic Macroinvertebrates." Ill. SB Lauterbach. Des Moines: Iowa Department of Natural Resources' Aquatic Education Program.

"Life in a Stream." Ill. Brian Wignall. 1989. Des Moines: Iowa Department of Natural Resources' Aquatic Education Program.

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

"Canaries of the Deep, The Plight of the Fresh Water Mussel." 2003. Geode Resource Conservation and Development Incorporated.

"Living Landscape." Conservation Technology Information Center.

Fact Sheet: Iowa's Major Reservoirs

Impoundment	Location	Costs	Benefits
Lake Red Rock	60 miles downstream from Des Moines on the Des Moines River	$88,000,000 in federal funds to construct 19,000 acres of land permanently flooded 70,000 acres flooded at "full pool" level	Provides recreation in the form of fishing, camping, and water skiing Prevents flooding in the cities of Ottumwa, Eldon, Eddyville, Keosaqua, and Farmington Prevents flooding of 36,000 acres of farmland Prevented estimated $449 million from 1969-1999
Lake Rathbun	7 miles N of Centerville on the Chariton River	$28,894,210 in federal funds to construct 11,000 acres flooded permanently 21,000 acres flooded at "full pool"	Water from reservoir allows operation of Rathbun Hatchery Provides flood control to 148,000 acres in the Chariton River Basin Provides recreation in the form of boating, fishing, swimming, hiking, and camping
Coralville Lake	Upstream from Iowa City on the Des Moines River	$1,465,000 for construction of a bridge over the reservoir 4,900 acres permanently flooded Lands and roads in "flood pool" are flooded for longer periods of time than were expected forcing government acquisition of them	Est. $23,853,400 saved in flood control between 1958-1986 (No acreage figures) Provides recreation in the form of boating, camping, hiking, fishing, picnicking, and swimming
Saylorville Lake	11 miles upstream from the city of Des Moines on the Des Moines River	5,950 acres permanently flooded 16,700 acres flooded at "full pool" Necessitated construction of three additional dams to protect Polk City during times of high water levels Estimated cost of $130,100,000 Possible damage to Ledges State Park	Provides recreation in the form of fishing, swimming,. and boating Provides water to the city of Des Moines and Southern Iowa Utilities (which pays $512,600 annually for 25 years for the water) Provides flood protection to the City of Des Moines

Information derived from "Water Resources Development in Iowa 1987": U.S. Army Corps of Engineers, North-central Division; www.mvr.usace.army.mil/redrock/flooddamage.htm.
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