Dams: Removal and Construction in Wisconsin and China

Grade Level: 6th-8th
Subject Areas: Science and Social Studies
Length of Unit: Up to three weeks

Summary

The following unit helps students critically examine the issues surrounding dam construction and removal. Students will investigate the recent history of dam removal on the Baraboo River in Wisconsin, and contrast it with the controversial construction of the Three Gorges Dam on the Yangtze River in China. They will learn to assess the complications inherent in managing water resources, taking into account environmental, housing, tourism, energy, archaeological, and aesthetic needs and priorities. The unit begins with information and activities to help students gain a general understanding of dams. After the introductory activities, students study the Baraboo River Dams in-depth. Students’ understanding of this local environmental issue will help them connect with the Three Gorges Dam controversy. After a thorough exploration of the Three Gorges Dam, students conclude the unit by using their knowledge of dams in Wisconsin and China to create a list of international guidelines for dam construction and removal that encourage environmental, social, and economic sustainability.

Goals

- Increase students’ awareness of environmental issues on both local and global scales
- Foster understanding of students’ citizenship in local and global communities
- Increase students’ awareness of world geography and global connections

Wisconsin’s Model Academic Standards Correlations

Environmental Education

- Knowledge of Environmental Processes and Systems (Energy and Ecosystems): B.8.5, B.8.9, B.8.10
- Knowledge of Environmental Processes and Systems (Natural Resources and Environmental Quality): B.8.12, B.8.15, B.8.16, B.8.17, B.8.23
- Environmental Issue Investigation Skills: C.8.1, C.8.3, C.8.4
I: General Dams

A. Objectives

Students will:

- Present information on one type of dam in a jigsaw activity
- Gain a general understanding of the different types of dams and how they work
- Explain the positive and negative effects of dams
- Construct a model dam based on basic engineering principles of dam construction

B. Activities

1. As a class, brainstorm what the students already know about dams. Encourage students to talk about dams they have seen, from beaver dams to large human-made dams. Students should think about the advantages and disadvantages of dams for people and the environment. Make a list of the ideas generated by the class.

2. On a large piece of butcher paper, create a running list entitled, General Dams, to keep track of new information. Students and the teacher should continually add information to the list. Students should also keep track of new information in notebooks.

3. Divide students into small groups. Hand out information on four types of dams: arch, buttress, embankment, and gravity. The PBS website is helpful for basic information: http://www.pbs.org/wgbh/buildingbig/dam/basics.html. Have each group become “experts” on one type of dam through reading and discussing. Then have the students do a “jigsaw” – create new groups with one member representing each type of dam. The students teach their new group about their dam and take notes while other students present.

4. Lead a discussion on the positive and negative effects of dams. Dams may produce hydroelectric power, reducing reliance on nuclear power and fossil fuels. They may control flooding or irrigate farmlands. Dams may also cause displacement of people, loss of farmland and fisheries, and environmental damage. (For a list of ways that dams harm rivers see http://www.wisconsinrivers.org/harm.html) Next, guide students through PBS’s “The Dam Challenge” found at: http://www.pbs.org/wgbh/buildingbig/dam/challenge/index.html. This interactive activity leads students through the issue of dam repair vs. dam removal.

5. Model Dam Construction: Have teams of students construct model dams to explore dam construction and engineering. Each team should have an empty fish tank and materials that they will choose themselves to build their dam. Challenge each team to build a model dam in their empty fish tank. First, have teams research basic engineering principles of dam construction on the Internet (see http://simscience.org/cracks/index.html). Teams can use material from home or items such as twigs, leaves, food, paper, tape, and glue to construct their dams. Students should use the principles from their research to build their dams. After each team erects its dam, students test them in front of the class by pouring water into one side of the tank until it reaches a predetermined height. The dam that holds the most water back for the longest time is the winner. Have the members of each team work cooperatively to write up an explanation of the engineering principles they used in designing and building their dam. A volunteer from each team should read the explanation to the class when the team's dam is tested (Source: Leaf 2001).
C. Resources

1. Lesson Plans

National Geographic’s Geo-Guide on Dams
Lesson plans on national and international dams

American Field Guide’s unit about dam removal on the Elwha River in Washington State
Designed for grades 10-12, but could be adapted to younger students
http://www.pbs.org/americanfieldguide/teachers/salmon/salmon_sum.html

http://school.discovery.com/lessonplans/programs/threegorges/threegorges.rtf

2. Websites

American Rivers
The latest national dam issues and general environmental aspects of dams
Toolkit page has general information, photos, and video and audio clips
http://www.amrivers.org/drtk.html

Bureau of Reclamation
Information about dams in the Western United States
http://www.usbr.gov/

Cracking Dams
An innovative introduction to civil engineering and the construction of dams
http://simscience.org/cracks/index.html

Hydroelectric Power (maintained by the Missouri Botanical Garden)
An introduction to dams and hydroelectric power
http://mbgnet.mobot.org/fresh/rivers/dams.htm

International Rivers Network Website
Information on international and US dam removal, plus technical challenges and
decommissioning methods of dam removal
http://www.irn.org

United Nations Dam and Development Project
http://www.unep-dams.org/

United States Society on Dams
Information and statistics about dams in the United States
http://www2.privatei.com/~uscold/

World Commission on Dams
http://www.dams.org/
3. **Video**

Film considers environmental, cultural, and economic arguments for and against decommissioning dams. Available at The Video Project:
http://store.videoproject.com/index.html

**II: Baraboo Dams, Baraboo River, Wisconsin**

**A. Background Information**

The Baraboo River has recently become the longest river in North America to be restored by dam removal. The Baraboo River spans about 115 miles from its headwaters in Hillsboro to its confluence with the Wisconsin River south of Portage. In 1837 white settlers began displacing Native American inhabitants (Ho Chunk/Winnebago) in the Baraboo River area. In 1840, the settlers constructed the first dam on the Baraboo River. The settlers chose to construct dams on a 4-5 mile stretch of river known as the Baraboo Rapids because it drops 45 feet and therefore was a good source of energy (especially in this relatively flat region). The dams provided inexpensive mechanical power and created pools for recreation. In the mid-late 1800s, these dams were important for the local economy. They were used to power sawmills, gristmills, textile factories, and later, electrical generators. The Baraboo River Dams changed the Baraboo Rapids from a fast moving stream to a series of sluggish millponds. The name Baraboo is thought to come from the French word “barbeau” for the large sturgeon, or from the Native American word “oochery” meaning many fish. The names suggest that the Baraboo River was once abundant with sturgeon, bass, and other fish. However, since anyone in the city can remember, these kinds of fish had not been seen above the dams. No official records remain, but it is assumed that fish were no longer able to migrate upstream.

Overall, eleven dams were built on the Baraboo River. Over time, these small dams became less important as a source of energy and were replaced by coal-fired power plants and large hydroelectric projects. By the 1990s, only four dams were still on the Baraboo River and these small dams showed signs of deterioration. The decision had to be made whether to repair the dams or remove them. Though the dam removal caused controversy, community members, the Wisconsin Department of Natural Resources, nonprofit organizations, and the city government worked together to remove the dams. The most compelling fact for many people was that it was much cheaper to remove the dams than to repair them. Since the dams have been removed, there has been a dramatic increase in the fish populations.

B. Objectives

Students will:

- Research and discuss arguments for dam removal, repair, and construction in Wisconsin
- Demonstrate how dams affect people differently by writing two letters from two points of view
- Locate and research a dam near their school
- Write their own songs, raps, or poems about the Baraboo River
- Present a viewpoint in a role-playing format

C. Activities

1. On a large piece of butcher paper, create a new running list entitled, *Dams in Wisconsin*, to keep track of Wisconsin-related information. The teacher and students should continually add information to the list. Students should also keep track of new information in notebooks. Place class list near *General Dams* list.

2. On a blank map of Wisconsin, have students draw the Baraboo River and label the political and physical features of the region.

3. Comparing pictures: Have the students look at historical photographs of Baraboo, and then compare these with photos taken before and after dam removal. Ask students what they notice. (See Baraboo Dam Resources for photographs.)

4. Have students read *Wisconsin Dam Removals Bring Support, Fun, Fish*, an article about Baraboo River dams in the Missoulian ([http://www.missoulian.com/specials/milltown/removals.html](http://www.missoulian.com/specials/milltown/removals.html)). Once students have read the article, have them choose one of the dams mentioned (on the Baraboo River or Koshkonong Creek), and pretend it has not been removed yet. Have them write a letter to the editor from two points of view – one for dam removal, one for dam repair.

5. Show videos that illustrate different perspectives on the dam debate. Students should note who the “players” are and what perspectives they bring to the debate. Two possible videos to use for this activity are: *Taking a Second Look: Communities and Dam Removal* and *Water and Dams in Today’s World*. *Taking a Second Look*, produced by River Alliance which features case studies of communities that have removed dams in Wisconsin, Maine, and California. *Water and Dams in Today’s World*, produced by the US Society on Dams, focuses on the benefits that people realize from dams. (See resource list below for information on how to obtain these).

6. Have the students use the Wisconsin Department of Natural Resources site to learn more about dams near their homes or school. The site has an interactive map that shows all of the dams in Wisconsin. Students can click on dams to find the name, owner, and size of the dam. They could also find more information about the Baraboo Dams. [http://maps.dnr.state.wi.us/dams/viewer.htm](http://maps.dnr.state.wi.us/dams/viewer.htm)

8. Have the students listen to the song, *Caretaker of the River*, a song about damming the Wolf River by Wisconsin musician David Habeck. Provide examples of socially conscious rap and poetry. Then, have the students write their own songs, raps, or poems about the Baraboo River and perform them for the class.

9. Visit River Alliance or have a speaker visit the class.

10. If you are close enough, plan a field trip to the Baraboo River or another nearby river.

11. Based on the information gathered in the previous activity, have students participate in a class simulation about whether a dam in their community should be repaired or removed. Or, have the students debate whether a new dam should be built in their community. Divide the students into small groups each representing the key players in the debate: local residents, fishermen, environmentalists, etc. Have the students research their position and develop their arguments. Then have the students present and discuss “in character” in a town hall meeting style debate. After the simulation have students step out of character and discuss which arguments they find most compelling.

D. Resources

1. Articles/Guides


2. Websites

   - River Alliance of Wisconsin Extensive information, recent photographs, river clean-up information, and a video [www.wisconsinrivers.org](http://www.wisconsinrivers.org)
Wisconsin Department of Natural Resources
Interactive map shows all dams in Wisconsin. Includes the name, owner, and size of each dam. 
http://maps.dnr.state.wi.us/dams/viewer.htm

3. Photographs

Recent:
River Alliance www.wisconsinrivers.org

Historical:
*Baraboo River Historical Photos: Phase 1* by Citizens for Waterfront Revitalization (available at Public Libraries in Baraboo and Reedsburg),

Reedsburg Public Library http://www.scls.lib.wi.us/reedsburg/local_his.html#photo

Baraboo Now Website http://www.baraboonow.com/photogalleries/historicgallery.asp

4. Video/Audio

*Taking a Second Look: Communities and Dam Removal.* This video is produced by River Alliance and you can order it from their website for $5.

*Water and Dams in Today’s World.* This video is produced by the United States Society on Dams. Teachers can order it from their website for free.

*The River Rocks!* 40 minutes of music stories about Wisconsin’s environment http://www.wisconsinwaterhistory.org/riverocks/cut5.htm

III: Three Gorges Dam, Yangtze River, China

A. Background Information

The Three Gorges Dam is located on the Yangtze River, known as the Ch’ang Chiang (“Long River”) in China. The Yangtze is the third longest river in the world, flowing 3,900 miles from its source on the Tibetan Plateau to its mouth on the East China Sea. The Yangtze River Basin is one of the longest-inhabited regions in China where people have farmed for thousands of years. Today, 400 million Chinese live in the basin.

The Yangtze River is home to 322 species of fish and 169 species of amphibians. Among these are the Chinese alligator, the most threatened crocodile species in the world, the Yangtze River dolphin, the most threatened cetacean in the world, and the finless porpoise, the only freshwater-adapted porpoise in the world.

Preliminary construction on the Three Gorges Dam began in 1993 and the dam is scheduled for completion in 2009. At 6,100 ft. high and 1.3 miles wide, the Three Gorges Dam will be the largest and most powerful hydroelectric project in the world. The dam will benefit some two million Chinese by
controlling flooding on the lower Yangtze River, generating hydroelectric power, and reducing pollution caused by the burning of coal. The dam will also cause problems, such as displacing people, destroying important archaeological sites, and devastating fragile habitats.


B. Objectives

Students will:

- Research and discuss arguments for and against construction of the Three Gorges Dam
- Research one aspect of the geography of the Yangtze River Basin and do a brief presentation
- Demonstrate how dams affect people differently by writing letters from two points of view
- Create graphic organizers that illustrate the effects of the Three Gorges Dam
- Present a viewpoint in a role-playing format

C. Activities

1. As a class, brainstorm what the students already know about China. Make a list of the ideas generated by the class.

2. On a large piece of butcher paper, create a new running list entitled, Dams in China, to keep track of China-related information. Students and the teacher should continually add information to the list. Students should also keep track of new information in notebooks. Place list near General Dams and Dams in Wisconsin lists.

3. On a blank map of China, have students draw the Yangtze River and label the dam site and the political and physical features of the region. Maps of the Three Gorges Dam regions can be found on the Probe International Website. Students could also use an atlas or social studies textbook to find these features.

4. Divide students into groups, have each group research a topic about the Yangtze River: geography, people, economy, agriculture, fisheries, navigation, and history. Then, have each group do a short presentation with a visual aid while the other students take notes.

5. Create a slide show of the region and dam. Have students note what they notice about each picture. The Probe International (PI) Website has some excellent photos of the region. PI’s website shows the region around the dam and before and after shots of the areas flooded behind the dam. It also shows photos of people’s homes that have refused to leave the area. Many of these people’s homes have already been destroyed, so they have constructed temporary shelters.

6. Show the PBS Video, Great Wall Across the Yangtze. Have students note who the “players” are and what perspectives they bring to the debate.

7. Using the information collected in their notebooks, have the students create graphic organizers to illustrate the following: the nearby vs. faraway effects of the dam, the immediate vs. future effects of the dam, and the linkages between environment, society, and economy. For example, nearby effects may include the loss of homelands, farms, & fisheries or an increase in recreation/tourism on the new reservoir. A faraway effect may include production of electricity.
Flood mitigation may be both a nearby and faraway effect. Students could illustrate the information in a simple chart, a word web, or a drawing. Have the students do additional research if necessary. When the students have completed their graphic organizers, lead a discussion on who bears the cost of the dam, who reaps the benefits, and why.

8. Each week have a group of students present the latest developments in the Three Gorges Dam controversy to the class. The Three Gorges Probe website is an excellent resource for this. [http://www.threegorgesprobe.org/](http://www.threegorgesprobe.org/). Also, students should look for bias in these news stories.

9. Have students participate in a class simulation about what should be done about the Three Gorges Dam. Divide the students into small groups each representing the key players in the debate: government officials, project engineers, environmentalists, archaeologists, farmers, and city dwellers. Have the students research their position and develop their arguments. Then have the students present and discuss “in character” in an international summit style debate. The PBS website can help students develop their arguments: [http://www.pbs.org/itvs/greatwall/controversy.html](http://www.pbs.org/itvs/greatwall/controversy.html). After the simulation have students step out of character and discuss which arguments they find most compelling.

D. Resources

1. Articles

   CNN Articles

2. Lesson Plans


3. Websites

   International Crane Foundation Website
   Effects of Three Gorges Dam on Siberian Crane habitat

   International Rivers Network
   Campaign against Three Gorges Dam

   PBS

   Probe International Website, Campaign against Three Gorges Dam
   [http://www.probeinternational.org/pi/3g/index.cfm?DSP=subcontent&AreaID=60](http://www.probeinternational.org/pi/3g/index.cfm?DSP=subcontent&AreaID=60)

   Three Gorges Probe: the latest news about the Three Gorges Dam
   [http://www.threegorgesprobe.org/](http://www.threegorgesprobe.org/)
4. Video


5. Books


IV. Closing Activities

A. Objectives

Students will:

- Synthesize information learned throughout the unit using a Venn Diagram
- Create and present a list of guidelines for nations to follow for dam construction
- Make a list of solutions to the dam debate and enact one solution if possible

B. Activities

1. Using a Venn diagram, have the students compare and contrast the Three Gorges Dam and the Baraboo River Dams. If the students don’t come up with it on their own, bring the students’ attention to the fact that these are two very different situations. For example, the Baraboo Rivers Dams were small defunct dams and the Three Gorges Dam is a large dam and a potential source of energy. This might also lead to a discussion of how decisions about dams may change over time. Additionally, it is important to discuss the economic benefits of the construction of the Three Gorges Dam and the removal of the Baraboo River Dams.

2. Help students combine what they have learned about the Baraboo River Dams and the Three Gorges Dam by creating a list of guidelines for nations to follow when constructing dams.

   a. Have the students read the relevant parts of the following documents as examples of appeals and declarations about general environmental issues:

b. Have students read the following examples of declarations about global dam construction:

- *Rasi Salai Declaration of 2003* from the Second International Meeting of Dam-Affected People and Their Allies in Rasi Salai, Thailand, [www.irn.org/riversforlife](http://www.irn.org/riversforlife)

c. Play the following KPFA radio program for the students that discusses Rivers for Life Meeting in Rasi Salai, Thailand (From KPFA’s *Against the Grain* program Wed., 1/7/04, Struggles Against Destructive Dams, order for $9 at [http://www.againstthegrain.org/archive.htm](http://www.againstthegrain.org/archive.htm))

d. In small groups, have students discuss the following questions: What similarities and differences do you notice among the documents? Who is the audience and what is the purpose of each document? In your opinion, what are the most important demands in each document? What would you add or remove from each document?

e. Using the *Children’s Appeal to World Leaders* as a guide, have students create their own appeal to world leaders for international dam construction guidelines. These guidelines should ensure environmental sustainability (Goal 7 of the UN Millennium Development Goals), as well as social and economic sustainability. Have students write these guidelines in rough draft form.

f. For their final draft, have students create colorful posters listing their guidelines.

g. Each group should present to the class imagining that they are presenting to the United Nations.

3. Have the students use the information they have learned in this unit to brainstorm solutions to the dam debate. Have students come to a consensus for what they see as the best solutions. Then, have the students brainstorm ways they can take action to enact their solutions. Some ways to take action might include:

- Participation in International Rivers Network’s International Day of Action. Every year people around the entire world protest dams in their region. Students could show their solidarity with people around the world by planning activities for their community and/or communicating by email with people in other countries who are involved in the event (see [http://www.irn.org/dayofaction/](http://www.irn.org/dayofaction/)).

- Participate in a river cleanup. Many are planned through River Alliance. Here is a link to their calendar: [http://www.wisconsinrivers.org/announce.html](http://www.wisconsinrivers.org/announce.html). America Outdoors sponsors River Cleanup Week every May. [http://www.americaoutdoors.org/nrcw/](http://www.americaoutdoors.org/nrcw/).

- Donating money to or volunteering for a group of their choice.

- Writing letters to their local representatives and/or writing letters to the local newspaper.
V. Other Dams

Dams in other parts of the world might be more relevant to your curriculum. Here is a list of other controversial dam projects. The International Rivers Network website is a great resource for more information about these dams:

**Africa**
- Bujagali Falls Dam, Victoria Nile River, Uganda
- Epupa Dam, Kunene River, Namibia
- Lesotho Highlands Water Project, Orange River, Lesotho
- Mphanda Nkuwa Dam, Zambezi River, Mozambique
- Okavango River Basin, Botswana and Namibia

**Asia**
- Sardar Sarovar Project & Maheshwar Dam, Narmada River, India
- Zipingpu Dam, Min River, China
- Mugecuo Lake & Nujiang/Salween River Dams, China
- Mekong River Dams, China, Myanmar, Thailand, Cambodia, Laos, Vietnam
- San Roque Dam, Agno River, Philippines
- Bakun Dam, Balui River, Malaysia
- Hoa Binh Dam, Yali Falls Dam, and Son La Dam, Vietnam

**Europe/Central Asia**
- Rogun Dam, Tajikistan

**Latin America**
- Xingu River, Brazil
- Araguaia-Tocantins River Basin
- Paraguay-Parana Basin
- Biobio River, Chile
- Sinu River, Columbia
- Chixoy/Negro River, Guatemala
- Itaipu Dam, Brazil, Argentina, Paraguay

**North America**
- Columbia, Snake Rivers, and Elwha River, Pacific Northwest, U.S.