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RiverXchange 2009 Curriculum (14 weeks, ~1 activity per week)

NOTE: RiverXchange is a pilot project that requires the use of copyrighted activities developed by Project WET (www.projectwet.org) and the Bosque Education Guide (http://www.nmnaturalhistory.org/BEG/index.html . Project WET is a preliminary partner and in-kind sponsor. No part of the RiverXchange curriculum or associated hands-on activities may be copied or reproduced by any means without prior written permission.

Language Arts Standards:
All activities, because they involve students posting written information on the wiki, meet NM Grade 4 Language Arts Benchmarks II-B&C (Writing). If you choose to have your students do videos on any of these topics, you can also address NM Grade 4 Language Arts Benchmark II-A: Demonstrating competence in speaking to convey information.

Field Trip (1 hr, anytime during the semester)

River Walk, Bosque Discovery Booklet and Bosque Scavenger Hunt (Bosque Education Guide)
Students go on a nature walk, take pictures of the riparian environment and search for signs of human impact on the river ecosystem. Each class posts photos, or video if possible.

Standards addressed:

Science:
4.1.2 Differentiate observation from interpretation and understand that a scientific explanation come in part from what is observed and in part from how the observation is interpreted.
4.3.1 Know that science has identified substances called pollutants that get into the environment and can be harmful to living things.

Social Studies:
3.D.1 Explain the difference between rights and responsibilities, why we have rules and laws, and the role of citizenship in promoting them.

RiverXchange Unit 1 – Understanding a Watershed (4 weeks – February 10-March 13)

Geography

Guiding questions: ***Where does our river come from before it reaches us? Where does our river go after it leaves our area?***

1. River Maps (introducing the classes to each other) ~1-2 hrs

Each class posts map(s) showing their location (identifying city, county and state), and their river from headwaters to ocean. Major local tributaries (such as Pecos, Conejos, Alamosa for the Rio Grande) should be identified.

Students' posts can ask questions of the other group, discuss climate of different regions, and show pictures of their area. This may be a good time to try live chatting via webcam.

Standards addressed:

Social Studies:
2.A.1 Apply geographic tools of title, grid system, legends, symbols, scale, and compass rose to construct and interpret maps.
2.A.2 Translate geographic information into a variety of formats such as graphs, maps, diagrams, and charts.
2.A.3 Draw conclusions and make generalizations from geographic information and inquiry.
2.B.1 Identify a region as an area with unifying characteristics (e.g., human, weather, agriculture, industry, natural characteristics).
2.B.2 Describe the regions of New Mexico, the United States, and the Western Hemisphere.
2.C.2 Understand how visual data (e.g., maps, graphs, diagrams, tables, charts) organizes and presents geographic information.

2.D.2 Describe the four provinces (plains, mountains, plateau, and basin and range) that make up New Mexico's land surface (geographic conditions).

Watershed

Guiding questions: ***What is a watershed (or drainage basin)? What is the water cycle? Where does the water in our river come from? How does pollution get into the river? What makes water dirty? How can I protect our water?***

2. Watershed Map *(Project WET - Seeing Watersheds)* ~1 hr

Each class posts a map showing their watershed (see USGS website for finding your watershed). Look up watershed address on USGS website http://water.usgs.gov/wsc/map_index.html. Lots of other good information at http://ga.water.usgs.gov/edu/. *Seeing Watersheds (Project WET)* can be modified to help guide this project.

Each student posts pictures of parts of their watershed and describes whether they have ever been to or seen these features – such as tributaries/creeks, lakes/dams, floodplain/levees, wetlands/riparian areas, levees, arroyos/storm drainage system, mountains (very close in our area, but in other areas they may be far away - kids may never have seen them). Focus on "what is a watershed?"

Standards addressed:

Social Studies

2.A.3 Draw conclusions and make generalizations from geographic information and inquiry.
2.C.2 Understand how visual data (e.g., maps, graphs, diagrams, tables, charts) organizes and presents geographic information.

3. Tributary Role-Play *(Project WET - Blue Beads)* ~30 min

Students act out the movement of water from headwaters and tributaries into the main river. Discuss seasons, weather and where river water comes from (for example, in our area we receive only 9 inches of precipitation per year, mostly in summer). Each class posts pictures/video and discussion, answering the question "where does the water in our river come from?" (discuss the water cycle).

Standards addressed:

Science:

4.2.26 Describe how weather patterns generally move from west to east in US.
4.2.27 Know that local weather information describes patterns of change over a period of time (e.g., temperature, precipitation symbols, cloud conditions, wind speed/direction).
4.3.1 Know that science has identified substances called pollutants that get into the environment and can be harmful to living things.

4. Watershed Model *(Project WET – Branching Out)* ~1-2 hrs

Students build a paper (or modeling clay) model of a watershed and spray with water ("rain") to demonstrate drainage in a watershed. This is part of the water cycle, which students may have already learned about. *Extension (third paragraph)*: focus on how nonpoint-source pollution (such as oil, soap, trash, pet waste, pesticide/fertilizer, and soil erosion) gets into river via runoff. Make houses, farms and roads out of modeling clay to put on the model. Talk about oil, automotive fluids, soap from washing cars, fertilizer and pesticides, animal waste and trash. Simulate by sprinkling cocoa powder in different places on the model to represent these types of pollution, then making it "rain" by spraying with water. Discuss ways to reduce nonpoint-source pollution.

Each class posts pictures of their models, discussion of "what makes water dirty?"/"what is the water cycle?" and a list of ways to prevent pollution, focusing on "how can *I* protect our water?"

Standards addressed:

Science:

4.3.1 Know that science has identified substances called pollutants that get into the environment and can be harmful to living things.

Social Studies:
3.D.1 Explain the difference between rights and responsibilities, why we have rules and laws, and the role of citizenship in promoting them.

RiverXchange Unit 2 – Human Connection to the River (6 weeks – March 16-April 24)

Resources

Guiding questions: ***Where does our drinking water come from? Where does our waste water go? How much water does my family use each day? How can I protect our water?***

5. Drinking Water – Research or Guest Speaker ~1-2 hrs

Students research where their drinking water comes from. Groups post information about different aspects of how drinking water is obtained and treated. For example: groundwater wells, chlorination and fluoridation, Albuquerque's new San Juan Chama drinking water project and treatment plant (steps of the process include settling, flocculation, filtration, ozone/peroxide).

Standards addressed:

Social Studies:
1.C.1 Explain how historical events, people, and culture influence present day Canada, Mexico, and the United States (e.g., food art, shelter, language).
2.C.1 Explain how geographic factors have influenced people, including settlement patterns and population distribution in New Mexico, past and present.
2.C.2 Describe how environments, both natural and man-made, have influenced people and events over time, and describe how places change.
2.E.2 Describe how geographic factors influence the location and distribution of economic activities.
2.F.1 Identify the distributions of natural and man-made resources in New Mexico, the Southwest, and the United States.
3.C.1 Compare and contrast how the various governments have applied rules/laws, majority rule, "public good," and protections of the minority in different periods of New Mexico's history.

6. *Project WET - Pass the Jug* ~30-60 min

Students act out different ways of allocating water rights to all the water users in our society, and learn about the history of water rights in their community. This activity demonstrates another part of the answer to "where does our drinking water come from?" Students post on what they learned.

Standards addressed:

Social Studies:
1.C.1 Explain how historical events, people, and culture influence present day Canada, Mexico, and the United States (e.g., food art, shelter, language).
3.D.1 Explain the difference between rights and responsibilities, why we have rules and laws, and the role of citizenship in promoting them.
4.A.3 Illustrate how resources can be used in alternative ways and, sometimes, allocated to different users.
4.A.4 Explain why there may be unequal distribution of resources (e.g., among people, communities, states, nations).
4.A.5 Understand and explain how conflict may arise between private and public incentives (e.g., new parks, parking structures).
4.C.1 Identify patterns of work and economic activity in New Mexico and their sustainability over time (e.g., farming, ranching, mining, retail, transportation, manufacturing, tourism, high tech).
4.C.2 Explain how New Mexico, the United States, and other parts of the world are economically interdependent.

7. Wastewater – Research or Guest Speaker ~1-2 hrs

Groups research wastewater treatment and post information. Topics could include: the treatment process, how treated wastewater can be recycled (such as watering golf courses), discussion about how our treated wastewater is put back into the river and used by downstream communities, comparison of the sewer system

with the stormwater system (and effects of nonpoint-source pollution). Either have groups post their research, or have a class discussion to answer the question "where does our wastewater go?"

Standards addressed:

Social Studies:

3.C.1 Compare and contrast how the various governments have applied rules/laws, majority rule, "public good," and protections of the minority in different periods of New Mexico's history.
3.D.1 Explain the difference between rights and responsibilities, why we have rules and laws, and the role of citizenship in promoting them.
4.A.3 Illustrate how resources can be used in alternative ways and, sometimes, allocated to different users.
4.C.1 Identify patterns of work and economic activity in New Mexico and their sustainability over time (e.g., farming, ranching, mining, retail, transportation, manufacturing, tourism, high tech).
4.C.2 Explain how New Mexico, the United States, and other parts of the world are economically interdependent.

8. *Project WET - Every Drop Counts, with Water Meters* ~1 hr (+1 week homework)

Students record their personal water use for *one week* and brainstorm ways to conserve water. Students will discover the answer to "how much water does my family use per day?" Wrap-Up: Make graphs of water usage in different categories, compare students' water use, compute average water use, convert from gallons to liters or vice versa (because other countries use metric system). Each class posts graphs to summarize data, and a list of ways to conserve, focusing on "how can *I* protect our water?"

Standards addressed:

Social Studies:

3.D.1 Explain the difference between rights and responsibilities, why we have rules and laws, and the role of citizenship in promoting them.
4.A.3 Illustrate how resources can be used in alternative ways and, sometimes, allocated to different users.
4.A.5 Understand and explain how conflict may arise between private and public incentives (e.g., new parks, parking structures).
4.C.1 Identify patterns of work and economic activity in New Mexico and their sustainability over time (e.g., farming, ranching, mining, retail, transportation, manufacturing, tourism, high tech).

Science:

4.1.5 Communicate ideas and present findings about scientific investigations that are open to critique from others.

Math:

2.A.1 Represent and analyze patterns and simple functions using words, tables, and graphs.
2.C.2 Model problem situations and use graphs, tables, pictures, and equations to draw conclusions (e.g., different patterns of change).
2.D.3 Find and analyze patterns using data tables (e.g., T tables).
4.A.2 Understand the need for measuring with standard units and become familiar with the standard units in customary and metric systems.
4.A.6 Carry out simple conversions within a system of measurement (e.g., hours to minutes, meters to centimeters).
5.A.1 Organize, represent, and interpret numerical and categorical data and clearly communicate findings: choose and construct representations that are appropriate for the data set; recognize the differences in representing categorical and numerical data.
5.A.2 Design investigations and represent data using tables and graphs (e.g., line plots, bar graphs, line graphs).
5.B.2 Use the concepts of median, mode, maximum, minimum, and range and draw conclusions about a data set.
5.B.3 Use data analysis to make reasonable inferences/predictions and to develop convincing arguments from data described in a variety of formats (e.g., bar graphs, Venn diagrams, charts, tables, line graphs, and pictographs).
5.C.1 Propose and justify conclusions and predictions based on data.
5.C.2 Develop convincing arguments from data displayed in a variety of formats.

Culture

Guiding Questions: ***How have humans changed our rivers? How have rivers impacted human settlements and culture?***

9. Commercial Uses of the River (choose different activities depending on area)

Project WET - Irrigation Interpretation (can be done by guest from Bern. Co. Coop. Ext. in NM) **~1.5 hrs**

NM students learn about local agriculture and methods of irrigation. Part 1: Act out different irrigation methods. Part 2: Build models (optional). Part 3: Learn about why Native Americans in parts of NM had to leave their homelands in 1400 A.D. Students post what they have learned about agriculture and irrigation, and personal experiences if their families are involved in farming. Compare with agricultural methods and different uses of rivers in other areas.

Standards addressed:

Social Studies:

1.C.1 Explain how historical events, people, and culture influence present day Canada, Mexico, and the United States (e.g., food art, shelter, language).
2.B.3 Identify ways in which different individuals and groups of people view and relate to places and regions.
2.C.1 Explain how geographic factors have influenced people, including settlement patterns and population distribution in New Mexico, past and present.
2.C.2 Describe how environments, both natural and man-made, have influenced people and events over time, and describe how places change.
2.E.1 Describe how cultures change.
2.E.2 Describe how geographic factors influence the location and distribution of economic activities.
2.E.3 Describe types and patterns of settlements.
2.E.4 Identify the causes of human migration.

10. Stories, Legends, and Songs ~1-2 hrs

Students research stories, legends and songs about their river, and/or collect oral histories. Individual students or groups can post video, audio or written pieces.

Standards addressed:

Social Studies:

1.C.1 Explain how historical events, people, and culture influence present day Canada, Mexico, and the United States (e.g., food art, shelter, language).
2.B.3 Identify ways in which different individuals and groups of people view and relate to places and regions.
2.C.1 Explain how geographic factors have influenced people, including settlement patterns and population distribution in New Mexico, past and present.
2.C.2 Describe how environments, both natural and man-made, have influenced people and events over time, and describe how places change.
2.E.1 Describe how cultures change.
2.E.2 Describe how geographic factors influence the location and distribution of economic activities.
2.E.3 Describe types and patterns of settlements.
2.E.4 Identify the causes of human migration.
3.B.1 Describe various cultures and the communities they represent, and explain how they have evolved over time.

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RiverXchange Unit 3 – Ecosystem (3 weeks – April 27-May 15)

Guiding questions: ***Why is water so important to life? How do living things depend on each other? Who are the other water users in our society?***

11. ***Project WET - Macroinvertebrate Mayhem (can be done by guest Matt Cross-Guillen in NM)*** **~1-2 hrs**

Students research and role-play aquatic insects and learn about their role in the ecosystem. Many animals depend on these insects for food. Some aquatic insects are sensitive to pollution, so scientists can tell how healthy a river ecosystem is by looking at which types of insect larvae are living in the water. Part 1: Groups post reports on different types of macroinvertebrates. Part 2: Each class posts photos/video of students doing the role-playing game. Each student posts what they learned about why aquatic insects are so important in the river's food web. Focus on the questions "why is water so important to life?" and "how do all living things depend on each other?"

Standards addressed:

Science:

4.2.12 Explain that different living organisms have distinctive structures and body systems that serve specific functions (e.g., walking, flying, swimming).
4.2.15 Describe the components of and relationships among organisms in a food chain (e.g., plants are the primary source of energy for living systems).
4.2.17 Know that in any particular environment some kinds of plants and animals survive well, some survive less well, and others cannot survive at all.
4.2.18 Know that a change in physical structure or behavior can improve an organism's chance of survival (e.g., a chameleon changes color, a turtle pulls its head into its shell, a plant grows toward the light).
4.2.19 Describe how some living organisms have developed characteristics from generation to generation to improve chances of survival (e.g., spines on cacti, long beaks on hummingbirds, good eyesight on hawks).
4.3.1 Know that science has identified substances called pollutants that get into the environment and can be harmful to living things.

12. Food Web ~1-2 hrs

Each student creates a post (or page) about an animal or plant found in their local area, describe any experiences they have had with these plants or animals, and describe how it interacts with other plants or animals in the ecosystem and how it depends on the river (answering the questions "why is water so important to life?" and "how do all living things depend on each other?") Students should choose from a list of species, highlighting key native species (such as cottonwood or coyote), and invasive species (such as saltcedar or raccoon), as well as endangered species (such as silvery minnow).

The class should then create a food web showing interconnections between the species they chose. Encourage students to comment on each other's posts, creating a followup discussion about issues such as changes in the ecosystem made by humans, and steps being taken to restore habitat.

Standards addressed:

Science:

4.2.12 Explain that different living organisms have distinctive structures and body systems that serve specific functions (e.g., walking, flying, swimming).
4.2.13 Know that humans and other living things have senses to help them detect stimuli, and that sensations (e.g., hunger) and stimuli (e.g., changes in the environment) influence the behavior of organisms.
4.2.14 Describe how roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight (photosynthesis).
4.2.15 Describe the components of and relationships among organisms in a food chain (e.g., plants are the primary source of energy for living systems).
4.2.17 Know that in any particular environment some kinds of plants and animals survive well, some survive less well, and others cannot survive at all.

4.2.18 Know that a change in physical structure or behavior can improve an organism's chance of survival (e.g., a chameleon changes color, a turtle pulls its head into its shell, a plant grows toward the light).
4.2.19 Describe how some living organisms have developed characteristics from generation to generation to improve chances of survival (e.g., spines on cacti, long beaks on hummingbirds, good eyesight on hawks).

13. *If I Owned the Bosque Ecosystem (Bosque Education Guide)* ~1 hr

Through role-playing various wildlife species or professions, students make decisions about the use of natural resources within an ecosystem. Teachers in other areas will have to adapt the activity for their area. Each class posts a discussion of what they learned, focusing on "who are the other water users in our society?"

Standards addressed:

Social Studies:

IV-A (1) Describe different economic, public, and/or community incentives (wages, business profits, amenities rights for property owners and renters).
IV-A (2) Illustrate how resources can be used in alternative ways and, sometimes, allocated to different users.
IV-A (3) Explain why there may be unequal distribution of resources (e.g., among people, communities, states, nations).
IV-A (4) Understand and explain how conflict may arise between private and public incentives