



**Contributing Teacher Ranger Teacher:** Shevaun Adams- Valentine Rural High School, Valentine, NE

**Subject:** Life Science, Biology, or Advanced Biology

**Grades:** High School

**Standards:** Science [NE] 12.3.3a, 12.3.3c, 12.3.3d, 12.3.4a, 12.3.4b, and 12.4.2c

### Ecology Unit

**Description:** This unit focuses on the ecology and biodiversity of the Niobrara River Valley. It contains a field experience component in addition to pre and post experience classroom work.

#### **In Classroom [Pre-Field Experience]**

Explain what an ecosystem is: terminology, food chains, biogeochemical cycles, examples, etc. If using this unit for a general Biology class, spend lots of time here. A review should suffice for Advanced Biology Classes.

Next, overview the seven main world biomes

Focus on the six microbiomes found in the Niobrara River Valley\*\*. The Niobrara River Corridor is located on the 100<sup>th</sup> meridian. This is the area of the United States where East meets West. This is also the geographic center of North America so North meets South as well. Therefore, there are an abundance of different species. Many of these species are found at the extreme ends of their normal ranges.

\*\*The 6 microbiomes are: short-grass prairie, mixed-grass prairie, western coniferous forest, eastern deciduous forest, northern boreal forest, and tallgrass prairie.

#### **Field Experience**

Visit the river and take invertebrate samples. Classify the invertebrates found using dichotomous keys. (This may be done in the classroom, if needed, due to transportation or weather issues. Bring samples into the class)

While at the River, chart the different plant and animal life that can be seen. (Use a digital camera to record data, then come back to classroom and identify.)

Also, take oxygen and nitrate concentrations, as well as pH levels and temperature of the water. (VCS has probes that will measure these). If that doesn't work, the Middle Niobrara Resource District has this information, or can obtain it. The MNRD's phone number is (402) 376-3241. The Niobrara Council also has kits available that measure these components. Call (402) 376-2793. (Several schools already have these kits, but may need refill components. Most of these components are available for purchase online.

Classify the invertebrates. Compare the species that were found with the amount of oxygen needed for survival. Also, compare the invertebrates found with the level of pollution that can be tolerated. (See reference material)

If polluted, discuss possible whys. Non-specific source, point source, water removal, etc.

**In Classroom [Post-Field Experience]**

Have each student (or group) then draw a biome found in the Niobrara River Valley from a hat, jar, or other container. Each student or group then researches the following:

- Climate
- General area found (worldwide).
- 6\* different plants – at least 2 of which can be found in the Niobrara River Valley (Native species only. Invasive species are a whole different story). Include scientific and common names as well as some “fun facts\*\*” about each.
- 24\* different vertebrates – at least 8 of which can be found in the River Valley. (Again, native species only.) Vertebrates need to be from the fish (6), birds (6), reptiles (3), amphibians (3), and mammals (6). Have a good variety from all the vertebrates in your final product. Again, include scientific and common names as well as some “fun facts” about each.
- 6\* different invertebrates (from the first portion). These should all be native species as well. Again, scientific and common names as well as “fun facts”.
- Recreational activities found throughout the biome.

Each student or group will then create and present a power point showcasing the research that has been done.

When everyone has presented, as a class, take pieces from everyone’s power point and create an educational power point about the Niobrara River’s natural diversity.

Finally, based on the cleanliness of the River, analyze people’s effects on the biodiversity of the region.

\*Numbers are easily modified for younger students, or limited time. \*\*Fun facts could be usage of, where located on the food chain, some specific habit, life cycle, etc.

**Tools and Equipment Needed:**

- Attached worksheets and dichotomous keys.
- 4 large tubs – labeled small invertebrates with shells; small invertebrates without shells; invertebrates with shells; and other (tadpoles, worms, etc.). Works well for field studies.
- Dipping nets – 1 per group of 2 to 3 students
- Magnifying glasses or magnifying bug boxes
- Dichotomous keys of invertebrates – laminated
- Digital cameras – students can also bring their own, but at least 1 per group
- Tree, plant, and animal guide books
- Testing equipment or probes for oxygen, pH, nitrates, and temperature. (LaMotte’s Kits work well for testing)

Note: If samples need to be brought into the class, use an ice cube tray to sort the invertebrates into groups. Label each pair of cubes with a piece of tape on the side and then sort the invertebrates. It makes each type of invertebrate much easier to count.

## Niobrara National Scenic River

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National Park Service  
U.S. Department of the Interior

[www.nps.gov/niob](http://www.nps.gov/niob)  
[www.facebook.com/NiobraraNSR](http://www.facebook.com/NiobraraNSR)



### Options for Expanding the Unit

1. Have student's create a tri-fold brochure about their individual biomes, using appropriate computer programs. (They will need to showcase fewer species.) Then take pieces of everyone's brochures, and create an educational brochure about the Niobrara River that is suitable for visitor use.
2. Have student's create a *Biome Zoo*\*\* . They will need to choose a "host city" for their zoo and research transportation, lodging, food, and other recreational activities available to world travelers coming to visit. Create a power point showing, climate, species, and explaining their reasons for choosing the city they did. Draw out plans for the zoo, being mindful of the plant and animal habitat, while including attractions and comforts needed for visitors.

\*\*Have student's be creative, and tell them money is not a roadblock for their zoo.

3. After analyzing people's effects on the river, hold a "Town Hall" meeting about water quality, maintaining river attractions, and meeting residential and agriculture needs of the area. (This could be an opportunity to combine with Social Studies classes).

### References

#### Print

Borman, U., Korth, R., & Temte, J. (1997). *Through the looking glass, a field guide to aquatic plants*. Univ of Wisconsin Pr.

Johnsgard, A. A., Farrar, J., & Gudge, D. (2008). *The niobrara, a river running through time*. Bison Books.

Murdoch, O., Cheo, M., O, K., & Foundation, A. (1996). *The streamkeeper's field guide, watershed inventory and stream monitoring methods*.

Reid, E. K., Zim, H. S., & Fichter, E. S. (2003). *Pond life, a guide to common plants and animals of North American ponds and lakes*. Golden Guides from St. Martin's Press.

Voshell, R. (2002). *A guide to common freshwater invertebrates of North America*. McDonald & Woodward Pub Co.

#### Web

National Park Service. (n.d.). *Niobrara national scenic river*. Retrieved from <http://www.nps.gov/niob>

World climates. (n.d.). Retrieved from <http://www.blueplanetbiomes.org/climate.htm>

Note: The *Streamkeeper's Field Guide* Chapter 6 contains well-developed dichotomous keys showing macroinvertebrates and Mayfly, Stonefly, and Caddisfly families. (You may also contact me at Valentine High School, and I will get you the book).