LESSON PLAN #3: How is the Driftless Ecosystem Unique?

Overview:

The Ecosystem of the Driftless region is unique. The landscape in this area is called "karst". It is made of limestone, which is very porous, like a sponge. With the land being like a sponge, water soaks in easily, and sinkholes are formed. This makes pollution of groundwater a danger. Since we have limestone, there are also areas called "Algific Slopes." This combination of landforms has developed unique plants and animal species, such as the Pleistocene Snail and the Northern Monkshood.

Duration: 30 minutes

Subject Areas: Earth Science, Physical Science, Life Science, Geology, and Ecosystems

Standards Addressed: 4-ESS2
5-LS2
MS-LS2
MS-ESS2

Objectives:

- Identify unique wildlife and plants
- Define karst and why it is important to our area
- Identify the significance of sinkholes in the area

Teacher Background: The word "karst" describes a landscape that over time, water has dissolved part of the rock, which is usually limestone. The movement of water creates fractures, sinkholes, and even over longer periods of time has created caves and caverns. The water moves so quickly through these features that it caries sediment, nutrients, pathogens and other contaminants into the groundwater.

Sinkholes are areas where the water has dissolved the limestone or bedrock, thus allowing the soil to fall in. The sinkholes start as very small fractures, about the size of a chipmunk burrow, and over longer periods of time, can grow to be an acre or more in size. Small ones often appear each year, but with tilling of the farmlands, are often covered back up. These small sinkholes provide a direct route for surface water to enter the groundwater. In the past, some farmers would route drainage tiles directly into the sinkholes, but this is now considered illegal.

Algific talus slopes are an amazing mini-ecosystem. We are lucky enough to be in an area where these exist. "Algific" means cold producing, and "talus" means broken rock. The Algific talus slope is also known as a cold air slope – which is much easier to remember. The slopes were first noted in the early 1980's and can be found here in Illinois, along with the Driftless region in Minnesota, Wisconsin, and Iowa.

Limestone, with its sinkholes and crevices that run through the many layers of the rock, is the first of three factors needed to create an algific talus slope. The second item needed is very dense vegetation. The vegetation provides cool air and moist shade. The last thing needed is a north facing slope, the less sun the slope receives the less radiant heat the slope will receive. With this unusual topography, the slopes stay cool in the summer and warmer in the winter, allowing for many species not found in other parts of the Midwest and even the world to thrive.

The Driftless area as we have come to learn is an area that the glaciers have not touched and is located between the Eastern Forests and Western Prairies. This area's rugged topography supports a wide range of habitats today, however it was previously more prairie and savannah. Only about 1/10 of 1% of the original prairies still exist here today; what does remain prairie wise is known as "hill prairies". The "hill prairies" are considered "globally rare" and contain many unique, but declining species of plants and animals.

One of the unique animals that can be found in the area is the Iowa Pleistocene snail. This snail is smaller than a shirt button (about ¼ of an inch in diameter). This snail has survived in small areas where the temperature, moisture and food have been suitable for them. They seek the cool, rocky slopes around coldwater streams, cliffs, valleys, and sinkholes. Since their habitat is considered fragile, the total population is very small. With the small size of their population this snail has been put on the Federal Endangered Species List. As of right now, there are only thirty-seven known colonies left of the Pleistocene Snail, of which, thirty-six colonies are in northeast Iowa, with only one population located in northwest Illinois. The areas inhabited by this snail are closed to the public in order to protect it.

One of the unique plants that can be found in the area is the Northern Monkshood, which belongs to the buttercup family. It grows on the Algific slopes and is found mainly in northeast Iowa. The Monkshood is know for its blue hood-shaped flowers that are about 1 inch long, and many of the blooms can be found on one single stem. The stems, themselves, can range in size from 1 foot to 4 feet. The leaves that are found on the stem are very broad and have toothed lobes. The flower is considered a perennial and reproduces from both tubers and seed. The flowers bloom between June and September and are pollinated by the bumblebees. With the problems facing the bumblebee population, the Monkshood has been on the endangered species list as well.

Glossary:

Karst: an area of limestone terrain, characterized by sinkholes, caves, and underground streams
Sinkhole: a hole formed in soluble rock by the action of water, serving to conduct surface water to an underground passage
Fracture: a break in the bedrock
Limestone: consists chiefly of calcite from concentrated shell, coral, algae, and other debris.
Algific Talus Slope: a cold air slope, not touched by glacier movement
Prairie: tract or area of grassland; meadow
Savanna: a grassland region with scattered trees grading into either open plain or woodland

Activity: Making a Sinkhole

Adapted from "Project Underground: A Natural Resource Education Guide"

Supplies needed:
8 oz. foam cup
scouring pad or very thin sponge
empty 2-liter soda bottle
sugar
sand
scissors
piece of paper

Activity Background:

Sinkholes are natural depressions in the land caused when limestone and soils dissolve. They form when groundwater removes rock underground. They can form by slow gradual sinking or by sudden collapse of an underlying hole.

Sinkholes are common in about one quarter of the U.S. You can usually identify them as circular or oval low spots in fields that may gather standing water after rains. They can be small or larger than a football field. A sinkhole of any size indicates there was a cavity in the bedrock near the surface. Sinkholes are evidence of a subsurface groundwater, either in the past or present. Formation of a new sinkhole or continued collapse of an existing sinkhole indicates present day groundwater.

People can affect the location and rate at which sinkholes form. One way sinkholes form is by the removal of large amounts of water from the ground for human use, livestock, or irrigation. This may lower the water table rapidly. Because of the loss of the water, the land surface can collapse into holes already formed in the underlying limestone.

Time needed: One hour (if you set it up earlier in the day, less time is needed).

Activity Steps:

1. Make a hole about the size of your thumb in the bottom of the foam cup.
2. Cut a circle the size of the cup bottom from a thin scouring pad. Place this circle in the bottom of the cup.
3. Place a column of sugar in the center of the cup and surround it by sand. To do this, make a tube by rolling up a piece of paper and place it in the center of the cup. The paper tube should be about the same height and one half the diameter of the cup. Fill the inside of the tube with sugar and the outside of the tube with sand (the sand should be between the paper tube and the sides of the cup). Carefully remove the paper tube. Place a thin layer of sand over the sugar.

4. Cut the bottom off a two-liter soda bottle at about the same height as the foam cup to create a dish. Fill it about one-third full of water. This will symbolize groundwater.
5. Place the cup with the sugar and sand in the water. Watch as the water fills into the cup and the sugar dissolves and runs out. A sinkhole is formed in the cup as the surface sand sinks into the area where the sugar dissolved. (You may need to remove the cup from the dish of water to allow the water to drain out of the cup and the sinkhole to form).

Discussion Questions:

- What type of rock does the sugar represent?
- What characteristics does a rock have to have to be suitable to form sinkholes and caves in algific slopes?
- What has made the ground so unique in this area?
- Why is it so important to protect our groundwater?