Bats of WI & PR

Summary: During a unit on mammals, Wisconsin (WI) students will research bats of WI and Puerto Rico (PR) students will research bats of PR. Each group will make a video or DVD of their PowerPoint presentation, tour a local cave, provide a video or DVD of their experience, translate it into Spanish or English, and exchange the tape or DVD. Students will learn about the importance of bats in their WI and PR ecosystems.

Background Information:

IMPORTANCE OF CAVES

Karst regions are notorious for environmental problems, and a knowledge of caves is one of the most important assets in being able to solve them. The most serious are described here: 1) land instability -- as caves enlarge, the overlying land tends to subside into them. This causes sinkholes, cracking of foundations and roads, disruption of pipelines, and diminished property values. 2) Problems of water supply -- most of the groundwater flow in a karst area is through caves, and unless these cave locations are known, the patterns of groundwater flow cannot be predicted. Well yield tends to be high (if solutional openings are encountered) or rather low. 3) Poor water quality -- the unfortunate thing about wells with high yield in cave areas is that their water quality is almost always low. Wells with smaller yield are generally of higher quality. Contaminants travel rapidly through caves and undergo very little filtering. Every effort should be made to avoid spills, leakage, or dumping of wastes in sinkholes. On a more positive note, caves give us information about the distribution of certain oil reservoirs and ore deposits.

It is clear that a knowledge of caves is essential for a proper assessment of any of these phenomena. The study of caves is rapidly growing in importance, and only recently has it been recognized as a truly significant science of its own.

CAVE CONSERVATION

Every cave is sensitive, whether the cave is open to the public as a show cave or is an unexplored, wild cave. This fragile environment cannot repair itself like the environment on the surface. Because the cave is not visible to people living on the surface we often assume

Grade Level:
High School 9-12, can be adapted to middle school

Goal: Bats are essential members to the ecology of caves and the region surrounding a cave.

Key Concepts:
Echolocation, adaptation, ecology, geology

Objectives: Upon completion of this lesson, students will:

1) Learn about the biology of bats.
2) Learn about cave ecology.
3) Explain their research and cave experience with students in PR.

Teaching Location:
Classroom and cave

Lesson Time:
Introduction – 30 minutes
PowerPoint – 90 minutes
Presentations – 30 minutes
Tour of Cave – 90 minutes
Time to view corresponding classroom's video or DVD – 75 minutes

Subject Areas for Infusion: Science, Environmental Education

Standards:

Science – F.12.1, F.12.5

Environmental Education B.12.2

our actions will have no effect on the subsurface. This is as far from the truth as one can imagine.

One of the most damaging environmental problems facing caves today is water pollution. Water is as vital to the life of a cave as it is to the life of humans. We have learned how caves are developed by groundwater seeping into the subsurface. Many caves also have rivers which start on the surface and enter the cave through a sinkhole or other entrance. Therefore, any materials that will dissolve in a liquid can enter the cave environment. Rain water and runoff carry pesticides from farming. Industrial wastes dumped into rivers may enter the cave if the river itself runs underground farther downstream. In many communities, raw sewage is pumped into caves with the idea that it will be cleaned up by the cave system. If any potential pollutant is allowed to remain on the surface over a cave, eventually, the pollutant will reach the cave environment. All of these factors will contribute to the destruction of the cave and any life present.

An even more serious threat is to the water we drink. In western Wisconsin and eastern and southern Minnesota, much of the water we drink comes from aquifers which are riddled with caves. Much of the water that replenishes these aquifers comes from rainwater seeping into the ground. Caves provide a more direct route for the water to reach the water table through soil and rock. As a result, contaminants reach the water table in a matter of a few hours or days rather than months or years. In rural areas, people will have wells and septic systems. This also may be true of small towns and villages. It is not unusual to find a homestead or even a village or town pumping well water from the same rock unit as they dispose of the sewage. We must keep in mind that anything we put into the ground will eventually reappear in our drinking water. In one instance, dye flushed down the toilet in a house reappeared in the kitchen sink in less than 45 minutes. How much filtering has THAT water seen?

CAVE ENVIRONMENT

CAVE TEMPERATURE

The temperature of a cave is directly related to the outside temperature. Rock is an excellent insulator but does allow some heat to enter into the ground and also be released. This is most evident during the spring when the ground thaws after a cold winter. The ground temperature will slowly adjust to air temperature changes but this process takes thousands of years. Because the change is so slow, we find that the ground temperature is approximately equal to the average annual surface temperature. In other words, if you know the average daily temperature (in a 24 hour period) for each day of the year, add them all together (365 temperatures) and divided by 365 (number of days in one year), you will arrive at the annual average temperature. This number is approximately equal to the temperature in the cave, or ground temperature. This temperature will be influenced by where the cave is located both in altitude and where on the earth. The average temperature of caves in Texas is close to 70 degrees. Our cave is at 49-50 degrees. Wisconsin caves will average from 49-52 degrees depending on where in the state the cave is located. Crystal Cave can have temperature fluctuations of as much as two degrees depending on where you are in the cave and what the atmospheric conditions are at that time (more on that, later). Contrary to popular belief, the Refrigerator Room is not any colder than the rest of the cave. The temperatures of pools of water in the cave will also be equal to the temperature of the cave air. Any water entering the cave will be warmed or cooled to the cave temperature. The water dripping from the ceiling of the cave is 49 degrees.

CAVE HUMIDITY

The air in Crystal Cave is essentially saturated with water vapor which makes the relative humidity close to 100%. This high humidity is the result of moisture (water and carbonic acid) constantly seeping

through the roof, walls, and floor of the cave. The constant temperature of the cave allows the high humidity to be maintained indefinitely.

The only place humidity may be slightly lower is on the first and second levels. This is because the outside humidity is usually lower and the air on these two levels can be diluted through mixing with surface air.

AIR CURRENTS

Visitors frequently ask if the cave will ever run out of oxygen or if noxious gases like methane or carbon dioxide can build to the point of toxicity. In Crystal Cave the answer is NO! Most caves are very well ventilated and Crystal Cave is no exception. The cave is ventilated by exchanging air with the outside. This process is accomplished through the changing barometric pressure. Outside the cave, air is warmed during the day. As it warms it becomes less dense and the barometric pressure falls. When the outside pressure falls, the air flows out of the cave. At night the air is cooled, becoming more dense causing the pressure to rise. Air will be drawn into the cave during the night. Other pressure changes are related to the weather like those changes which accompany the passage of a storm front. These pressure changes are superimposed upon the daily fluctuation. The cave pressure adjusts to conform to the resultant effect of both.
Temperature will also affect air movement. If the cave air is colder (more dense) than the outside, as in summer, the air will flow out of the cave through the lower Tree Fork Entrance into the gully, pulling warmer air in through the upper Service Entrance. If the cave air is warmer (less dense) than the outside air as in winter, air flow will be upward and out the upper Service Entrance and colder air will be pulled in through the lower Tree Fork Entrance. This type of air flow is similar to the "Chimney Effect". The cave air is in constant motion as it attempts to adjust to surface changes. Usually these air currents are so slow that they can be detected only with barometers or very sensitive wind gauges. However, there are times when the air currents are quite obvious as light breezes and strong gusts moving through the Cave Door and the store's stairwell.

BATS OF CRYSTAL CAVE

Crystal Cave is home to four species of bats. They can generally be seen in the cave throughout the year but are most common during the winter months. Bats are gentle, intelligent creatures that rarely interact with humans.

Bats are mammals. They are the only true flying mammal in the world. The wing of the bat is composed of the forearm and extended "fingers" of the hand. The third, fourth and fifth fingers support most the very thin wing membrane, a piece of delicate skin laced with veins. The thumb is seen as a tiny hook on top of the wing. The wing membrane connects with the body, hind limbs and, in most bats, encloses the tail.

There are over 900 species of bats found throughout the world. Wisconsin and Minnesota are home to seven species, all insect eaters. Three species spend only summer months in our area. The remaining four species are cave bats, are the most common, and remain here throughout the year. These bats are the little brown bat, big brown bat, eastern pipistrelle, and northern myotis. They are found in caves, abandoned mines, and buildings.

Cave bats range in size from three to five inches in length with wingspans of eight to thirteen inches. They weigh very little, from a tenth of an ounce to one-half an ounce. Bats can live to be twenty to thirty years old and usually have only one young, called a pup, each year. Because they are mammals,

the baby bat is born alive and fed milk by the mother. The mother bat will nurse for about six weeks or until the pup can fly and catch insects on its own. Bats found in Crystal Cave give birth in late May and early June. The female bats gather together in large groups called maternity colonies. These colonies generally occupy an attic or old abandoned building where temperatures will be warm enough to protect the hairless newborns. All pups are born about the same time and can be found clinging to the ceilings. Each female can locate her infant among thousands of others by sound and smell. Immature pups that fall from the ceiling cannot be rescued by the adults and usually die soon after.

Cave bats feed at night, catching insects such as moths, flying beetles, and mosquitoes. They use ultrasonic sound, called echolocation, to locate their food. This echolocation involves emitting a high frequency sound which bounces off obstacles. Bats are able to hear these echoes and locate, identify, and capture moving prey while flying through the dark. The large ears on bats aid them in hearing these echoes. Contrary to popular belief, bats are not blind. They see as well as humans and, if flying in the presence of light, will use their eyes rather than the echolocation.

Many people think bats are dirty, disease-carrying creatures. Again, this is largely based on false information. Bats are actually clean, relatively disease-free. People are most concerned with bats and rabies. This falsehood began more than forty years ago when erroneous testing procedures resulted in all bats testing positive for rabies. After additional testing, it was discovered that the bat carries a harmless virus that caused the same reaction as the rabies virus. Unfortunately, the damage was already done and this peaceful little creature was labeled as a menace to society. We must understand that because bats are mammals, there is the possibility of contracting the disease, but in this part of the United States, rabid bats are very rare. In any case, if a bat is on the ground you should assume it is sick. It should only be handled by a professional and sent to a lab to be examined for any diseases.

Bats are not an animal of which to be frightened. They will eat up to 500 insects each hour they feed in an evening, ridding us of real unwanted pests. You should never disturb bats when you find them sleeping in caves or mines. Unless they become a nuisance, consider them as welcome guests! But remember, they are wild animals so never try to pet them or catch them for fun. They will bite in self-defense. If a bat happens to get into your house remain calm. Allow the bat to land, then take a heavy towel, gently cover the bat, and remove bat and towel to the outside.

Materials:

- internet
- data projector
- video camera
- educational handouts from the cave
- a few students who are willing to translate

Set-Up:

Students will be presented with background information from their teacher about the cave they will be visiting. In groups they will create a PowerPoint presentation describing a bat found in the cave. They will present the PowerPoint to the rest of their class. The PowerPoints will be recorded on video camera. They will then tour the cave, along with a few senior students who will be translating the information presented at the cave. Students will then send their DVD to the corresponding classroom.

Vocabulary

Echolocation: ultrasonic sounds used by some animals to locate food; a high frequency sound is emitted that bounces off obstacles

Karst: an irregular limestone region with sinkholes, underground streams, and caverns

Procedure:

Introduction

Students will first be presented with background information summarized by the teacher through a PowerPoint presentation. This presentation will be about cave ecology and basic bat biology.

Activity 1 – Bat Presentations

1. Students will be placed into groups of 2-3 students. Each group will research one of the species found in a local cave.
2. Students will create a colorful, creative PowerPoint to share their bat with both WI and PR students. Their PowerPoint must have the following information in it to earn the most points:

   Names: _____

   - Common name of bat _____ / 4
   - Scientific name of bat _____ / 4
   - Pictures of bat(at least 7) _____ / 7
   - Food web/diet with pictures _____ / 5
   - Habitat _____ / 3
   - Geographical distribution _____ / 3
   - Mating _____ / 3
   - Interesting facts (at least 3) _____ / 6

   Total: _____ / 35 points

3. PowerPoint presentations will be taped with a video camera. Each group will have a senior student with the group to translate the presentation.

Activity 2 – Cave Tour

1. Students will take a trip to a local cave where they will receive a guided tour. The tour will be videotaped and translated by accompanying senior students.
2. The video or DVD will be sent to a corresponding classroom.

Conclusion

After completing the introduction, bat presentations, and cave tour, students will have a better understanding of why caves are important, the biology of bats and why they shouldn't be afraid of bats. They will also have a better understanding of the adaptations bats have in different parts of the world (WI and PR).

Assessment

Students will be assessed on the quality and content of their PowerPoint presentation on bats. After the tour of the local cave, they will view the video or DVD from the corresponding classroom's country. This information will also be assessed when they take a test on mammals at the completion of the unit.

Adaptations: This lesson could be modified for younger grades by having them construct paper models of a bat or of the bat species found in their local cave. This activity is also easily modifiable for students with special needs by having such a student work on a portion of the PowerPoint that uses his or her strengths, such as finding good pictures of the bats, food web, habitat, etc.

References:

Crystal Cave in Spring Valley, WI – www.acoolcave.com