Introduction to
ECOLOGY

BACKGROUND INFORMATION—ECOLOGY

Protists, fungi, plants, and animals don't live in isolation. They interact with each other and with non-living systems to form a unique and intricate world. **Ecology** is the study of these complex interactions.

Ecologists have various ways of categorizing groups of living and non-living things. An **ecosystem** is a group of living things that interact with each other and with the non-living components in the environment. Ecosystems can be as small as a rotting log or as large as the whole world.

Biomes are major ecosystems that are characterized by either a dominant plant type or by the climatic and physical characteristics of the area. For example, grasslands and pine forests are biomes with a dominant plant type. Biomes that are characterized by climate or physical attributes include tropical rainforests and deserts that have a wide variety of plant types, but very particular rain patterns.

A **habitat** describes a natural area in a slightly different way. A habitat is the place *where* a particular animal or plant lives. An ecological **niche** is *how* that animal lives or *what* it does. In other words, the habitat is the animal's home and the niche is the animal's job.

Relationships Between Organisms

Organisms in an ecosystem can interact in a number of different ways. Sometimes organisms have a **symbiotic relationship** where both species benefit from the relationship. A flower and a butterfly are an example of a symbiotic relationship. The butterfly benefits by gathering the flower's nectar for food. The flower benefits because pollen is carried from flower to flower by the butterfly.

In other relationships, one individual benefits at the expense of the other. **Predators** obviously benefit when they are able to capture, kill, and eat their **prey**. In the case of **parasites** and their **host**, it is in the parasite's best interest to take what it needs without killing the host, but the host can still be harmed.

The feeding relationships and energy flows between organisms are represented as **food chains** and **food webs**. The driving force behind all life processes is energy from the sun. **Producers** (mostly plants) are able to capture and convert the sun's energy.

Animals that eat producers are **primary consumers**. An example of a primary consumer would be a deer, which only eats vegetation. **Secondary consumers** are predators, scavengers, or parasites that eat other animals. Cougars are secondary consumers. Some animals are **omnivores**, which eat both plants and other animals. **Decomposers** feed on animals and plants once they are dead.

The string of feeding relationships—producer, primary consumer, secondary consumer—form a food chain. Often those relationships are not so simple, however. For instance, deer eat a variety of plants, other animals eat plants, cougars eat a variety of animals, and deer are eaten by several kinds of predators. These interwoven food chains are called food webs.

Cycles

Cycles are also an important concept in ecology. Individual organisms have life cycles that include birth, growth, reproduction and death, but there are cycles in ecosystems as well. The **carbon cycle** and the **water cycle** are two cycles that have an obvious impact on our everyday life.

Carbon is found in the atmosphere in the form of carbon dioxide. During photosynthesis, plants take in carbon dioxide. When an animal eats the plant, some of the carbon is passed to the animal. Carbon can then be passed to a predator. Some carbon goes back to the atmosphere when animals respire and it is also returned to the atmosphere when living things decompose or burn.

Water is also found in the atmosphere. Water **condenses** to form clouds, and as those clouds get heavy with water, the water is released in the form of rain, snow, hail, or sleet. Some of the precipitation is used by plants and animals, but the majority of it becomes part of lakes, ponds, rivers, and oceans or seeps into the ground to become **groundwater**. Some groundwater may travel to open bodies of water as well. Water then **evaporates** from the surface of the Earth or is **transpired** by plants, where it becomes part of the atmosphere again.

In addition to the carbon and water cycles, oxygen, nitrogen, sulfur, and phosphorous cycle through **biotic** and **abiotic** systems.

Succession

Groupings of animals and plants change in a community over of time. Those changes most often occur in a predictable sequence called **succession**, which is the change in the variety and numbers of organisms in a community over time. There are two types of succession. **Primary succession** takes place in an area where living things don't already exist, such as on bare rock or newly formed lava beds. **Secondary succession** occurs in areas where there are already some living things. Secondary succession most often takes place in areas that have been disturbed, such as after a fire or flood.

The first animals and plants to move into an area are called **pioneer species.** They are typically hardy, adaptable plants and animals. They are followed by a series of other animal and plant communities, eventually becoming a **climax community**. The climax community is the final stage of succession—the animals and plants replace themselves rather than being replaced by different species.

Human Impacts

Ecosystems are naturally in a state of **dynamic equilibrium**. They are constantly changing, but there is a certain balance that is maintained. When changes are large, it may be more difficult or impossible for an ecosystem to maintain that balance. Unfortunately, ecosystems are changing dramatically because of human activities.

One way people are changing the global environment is through various pollutants. Burning fossil fuels and burning forests to make way for farms or developments releases carbon dioxide into the atmosphere. This increase in carbon dioxide, in addition to some other gases, is changing the global climate. Other pollutants have affected the ozone layer (the protective blanket of gases high in the atmosphere) that surrounds the Earth. As the ozone has been depleted, more of the sun's rays reach the Earth's surface. This not only affects people by causing more sunburns and skin cancers, but also can harm plants and other animals (especially amphibians).

Pollutants can also affect ecosystems on a smaller scale. They enter our rivers, streams, lakes, oceans, soil, and air. Pollutants can affect the way plants and animals grow, reproduce, and function during their daily activities.

Currently many species of animals and plants are threatened or endangered because of **habitat loss.** As the human population grows, habitat is being lost at a faster pace.

Activities such as agriculture, logging, urbanization, gathering fuelwood, and overgrazing are just some of the ways that habitat is being converted or damaged.

Because of these large-scale changes to the Earth's ecosystems, the field of ecology has gained importance. Understanding how healthy ecosystems function will be key if we are to understand how to manage the changes that are occurring to them now and find solutions for the future.

INFORMACIÓN BÁSICA—LA ECOLOGÍA

Los protistas, los hongos, las plantas y los animales no viven aislados sino que interactúan unos con otros y con los sistemas no vivos formando un mundo único e intrincado. La **ecología** es el estudio de estas complejas interacciones.

Los ecologistas tienen varias maneras de categorizar los grupos de seres vivos y no vivos. Un **ecosistema** es un grupo de seres vivos que interactúan tanto entre sí como también con los componentes no vivos del medio ambiente. Los ecosistemas pueden ser tan pequeños como un tronco en descomposición o tan grandes como el mundo entero.

Los **biomas** son grandes ecosistemas que se caracterizan, ya sea por un tipo de plantas dominante o por los factores climáticos y físicos del área. Por ejemplo, las praderas y los bosques coníferos son biomas que poseen un tipo de plantas dominante. Los biomas caracterizados por factores físicos o climáticos incluyen las selvas tropicales húmedas y los desiertos. Éstos tienen una amplia variedad de tipos de plantas pero las características pluviales son muy particulares.

Un **hábitat** describe un área natural de una manera levemente diferente. Un hábitat es el lugar *dónde* vive un animal o planta en particular. Un nicho ecológico es *cómo* vive el animal o *qué* es lo que hace. En otras palabras, el hábitat es el hogar del animal y el nicho es el trabajo del animal.

Relación entre los organismos

Los organismos en un ecosistema pueden interactuar de muchas maneras diferentes. A veces, los organismos tienen una **relación simbiótica**, en la cual ambas especies se benefician de dicha relación. Una flor y una mariposa son un ejemplo de una relación simbiótica. La mariposa se beneficia al recolectar el néctar de la flor para alimentarse. La flor se beneficia porque la mariposa lleva el polen de flor en flor.

En otro tipo de relaciones, un individuo se beneficia a expensas del otro. Los **predadores** obviamente se benefician cuando son capaces de capturar, matar y alimentarse de su **presa**. En el caso de los **parásitos** y de su **huésped**, el parásito se beneficia ya que toma lo que necesita del huésped sin matarlo, pero es posible que el huésped se vea perjudicado.

Las relaciones alimentarias y la transferencia de energía entre los organismos se representan como **cadenas alimentarias** y **redes alimentarias.** La fuerza motora que yace tras todos los procesos vitales es la energía del sol. Los **productores** (la mayoría de las plantas) son capaces de capturar y de convertir la energía del sol.

Los animales que comen productores se llaman **consumidores primarios**. Un ejemplo de consumidor primario sería un ciervo, que sólo se alimenta de materia vegetal. Los **consumidores secundarios** son los predadores, los animales que se alimentan de carroña o los parásitos que se alimentan de otros animales. Los pumas son consumidores secundarios. Algunos animales son omnívoros, es decir, se alimentan de plantas y también de otros animales. Los **descomponedores** se alimentan de otros animales o plantas que ya han muerto.

Los eslabones de las relaciones alimentarias (productor, consumidor primario, consumidor secundario) forman una cadena alimentaria. Sin embargo, a menudo esas relaciones no son simples. De hecho, el ciervo se alimenta de una variedad de plantas, otros animales comen plantas, los pumas se alimentan de una variedad de animales y los ciervos constituyen el alimento de varios tipos de predadores. Estas cadenas alimentarias entrelazadas se llaman redes alimentarias.

Ciclos

Los ciclos también son un concepto importante en ecología. Los organismos individuales tienen ciclos de vida que incluyen nacimiento, crecimiento, reproducción y muerte, pero también existen ciclos en los ecosistemas. El **ciclo del carbono** y el **ciclo del agua** son dos ciclos que tienen un gran impacto en nuestro diario vivir.

El carbono se encuentra en la atmósfera en forma de dióxido de carbono. Durante la fotosíntesis, las plantas absorben dióxido de carbono. Cuando un animal come una planta, parte del carbono pasa al animal. Luego el carbono pasa a un predador. Cuando los animales respiran, parte del carbono vuelve a la atmósfera. Además, el carbono vuelve a la atmósfera cuando la materia viva se descompone o se quema.

El agua también se encuentra en la atmósfera. El agua se **condensa** formando nubes y cuando esas nubes se llenan de agua, ésta se libera en forma de lluvia, nieve, granizo o aguanieve. Una parte de la precipitación es utilizada por las plantas y por los animales, pero la mayoría pasa a formar parte de lagos, lagunas, ríos y océanos o se filtra en la tierra y se transforma en **agua subterránea**. Una parte del agua subterránea puede

desplazarse también hacia las grandes masas de agua en la superficie de la Tierra. Luego el agua se **evapora** de la superficie de la Tierra o **transpira** desde las plantas y llega nuevamente a la atmósfera.

Además de los ciclos del carbono y del agua, el oxígeno, el nitrógeno, el azufre y el fósforo tienen ciclos a través de los sistemas **bióticos** y **abióticos**.

Sucesión

Las agrupaciones de plantas y animales cambian con el tiempo en una comunidad. Estos cambios ocurren con mayor frecuencia de una manera predecible llamada **sucesión**. La sucesión consiste en el cambio en la variedad y en el número de organismos en una comunidad a través del tiempo. Existen dos tipos de sucesiones. La **sucesión primaria** ocurre en un área donde no existen seres vivos, como por ejemplo sobre una roca al descubierto o en formaciones recientes de lava. La **sucesión secundaria** ocurre donde ya existe algún tipo de materia viva. La sucesión secundaria se produce más a menudo en áreas que han sido alteradas, como por ejemplo después de un incendio o de una inundación.

Los primeros animales y plantas que se trasladan a un área se llaman **especies pioneras**. Son plantas y animales típicamente resistentes. Luego les sigue una serie de otras comunidades de animales y de plantas, transformándose finalmente en una **comunidad clímax**. La comunidad clímax es la etapa final de una sucesión, los animales y las plantas se reemplazan a sí mismos en vez de ser reemplazados por especies diferentes.

Consecuencias de la actividad humana en el medio ambiente

Los ecosistemas están naturalmente en un estado de **equilibrio dinámico**. Esto quiere decir que están cambiando constantemente pero se mantiene un cierto equilibrio. Cuando los cambios son grandes, puede ser más difícil o imposible que un ecosistema mantenga ese equilibrio. Desgraciadamente, los ecosistemas están cambiando dramáticamente debido a las actividades de los seres humanos.

Una de las maneras en que el ser humano está cambiando el medio ambiente global es a través de una variedad de contaminantes. Cuando se queman combustibles fósiles y bosques para instalar granjas y urbanizaciones se libera dióxido de carbono a la atmósfera. El aumento del dióxido de carbono, además de otros gases, está cambiando el clima global. Otros contaminantes han afectado la capa de ozono (la capa

protectora de gases en la parte alta de la atmósfera) que rodea la Tierra. A medida que el ozono se reduce, más rayos solares alcanzan la superficie de la Tierra. Esto no sólo afecta a las personas causando más quemaduras de sol y cáncer de la piel, sino que también daña a las plantas y a otros animales (especialmente a los anfibios).

Los contaminantes también pueden afectar a los ecosistemas en una escala menor. Ellos llegan a nuestros ríos, arroyos, lagos, océanos, tierra y aire. Los contaminantes pueden afectar la manera en que las plantas y los animales crecen, se reproducen y cumplen sus funciones diarias.

Actualmente, muchas especies de animales y de plantas se han visto amenazadas o están en peligro de extinción debido a la **pérdida del hábitat**. A medida que la población humana crece, el hábitat se pierde con mayor rapidez. La agricultura, la tala de árboles, la urbanización, la recolección de combustible derivado de la madera y el exceso de pastoreo, son algunos ejemplos de las maneras que han transformado o dañado el hábitat.

El campo de la ecología ha adquirido importancia debido a esta gran escala de cambios en los ecosistemas de la Tierra. Para poder enfrentar los cambios que están ocurriendo en los ecosistemas actualmente y buscar soluciones para el futuro, debemos entender cómo funcionan los ecosistemas.

FOOD CHAIN MOBILE

Móvil de la cadena alimentaria

Grades		
K–3	Whole Class	45 minutes

Purpose

Students will create a mobile that represents a simple food chain.

Materials

Food Chain Picture Sheet
Scissors
Coat hangers (each student can bring one from home)
String (cut into 6 inch pieces, 8 pieces per student)
Straws (one per student)
Crayons or markers
Tape

Concepts

- Food chains and food webs represent the feeding relationships of organisms in an ecosystem.

Conceptos

- Las cadenas alimentarias y las redes alimentarias representan las relacíones alimentarias de los organismos en un ecosistema.

Safety

Remind young students to be careful with scissors and coat hangers.

Vocabulary

Food chain
Food web
Producer
Consumer
Decomposer
Predator
Prey

Vocabulario

Cadena alimentaria
Red alimentaria
Productor
Consumidor
Descomponedor
Predador
Presa

In Advance

Tell students a few days in advance to bring a coat hanger to school and be sure to bring in a few extras in case some students forget. Make one copy of the Food Chain Picture Sheet for each student (preferably on heavy paper). Gather other materials.

Procedure

1. Explain concepts

Introduce **food chains**, **food webs**, **producers**, **consumers**, **decomposers, predators**, and **prey**. Ask students to name an animal, identify what that animal eats, and whether or not it is eaten by other animals. Tell students they will be making a mobile that represents a simple food chain.

2. Hand out materials. Color and cut pictures.

Give each student a copy of the Food Chain Picture Sheet, 8 pieces of string, a straw, scissors, and crayons or markers. Also distribute tape to share. Have students color the pictures, then cut each picture along the lines.

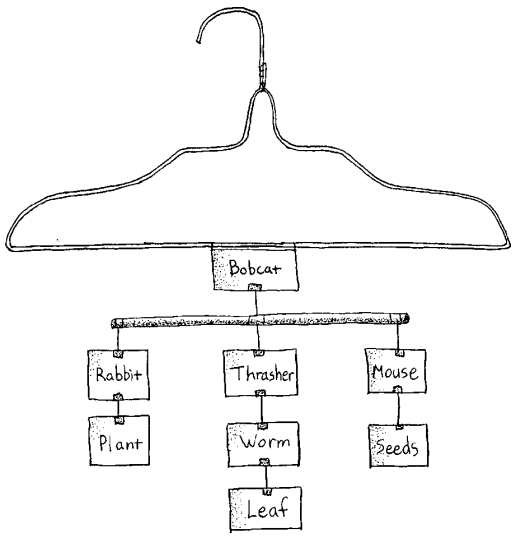
3. Organize the pictures into food chains

Begin assembling the food chains by having students tape a string to the top of each picture. Then have students tape the bobcat picture to the bottom center of the coat hanger. Next, have students tape another string to the bottom of the bobcat picture. Attach that string to the center of the straw.

Now, ask students if they know what bobcats eat. Do they eat only one type of prey? In fact, bobcats eat a variety of items including rabbits, mice, and birds. Tell students to tape each of these prey animals to the straw. (Have students tape the curved-billed thrasher to the center of the straw and the rabbit and mouse on each end.)

Next, ask students what each of these prey animals eat. They also eat a variety of things, but in this case the rabbit matches with the plant, the thrasher eats the worm, and the mouse eats the seeds. Have students tape each of these items to the animal that eats them.

There is one picture left. It is a decomposing leaf. Ask students what animal helps the leaf decompose. Once they have figured out that the worm helps the leaf decompose, have students tape the leaf to the worm picture.



4. Discuss food chain mobiles

Using the food chain mobiles, ask students to identify several food chains. When these food chains are brought together, they form a simple food web.

Questions to Ask During the Activity

1. Are there any other animals or plants that could be added to the food chain mobile? (Bobcats might eat other kinds of birds, mice eat more than just seeds, and the thrasher also eats insects and berries.)

2. Would it make sense for a person to be added into the food web? (Yes. People eat plants, some types of seeds, and occasionally rabbits.)

Preguntas sobre el tema de la actividad

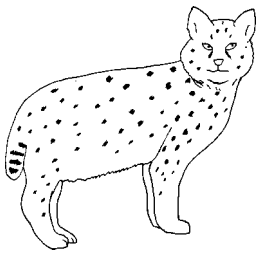
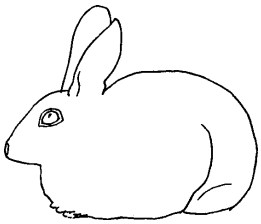
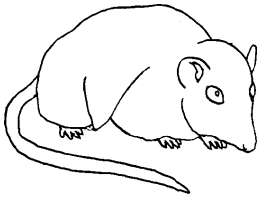
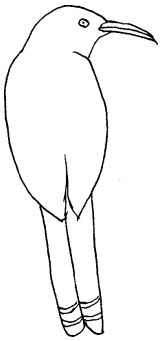
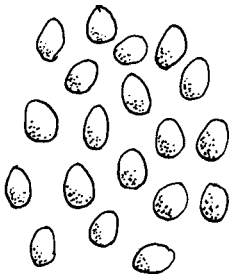
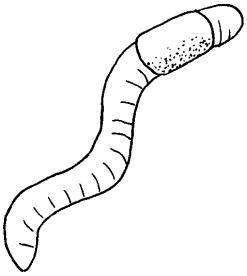
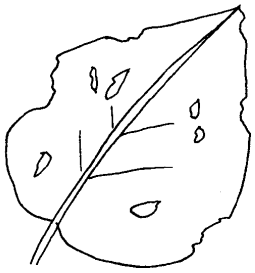
1. ¿Hay algún otro animal o planta que te gustaría agregar al móvil de la red alimentaria? (El lince o gato montés puede comer otros tipos de pájaros, el ratón come otras cosas además de semillas y el sinsonte también come insectos y bayas.)

2. ¿Tiene sentido que un ser humano forme parte de la red alimentaria? (Sí. Los seres humanos comen plantas, algunos tipos de semillas y a veces, conejos.)

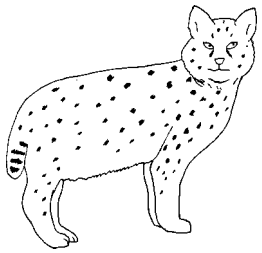
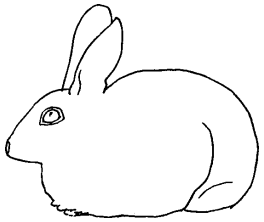
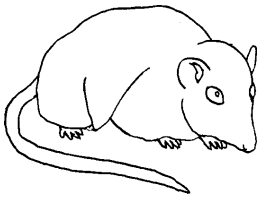
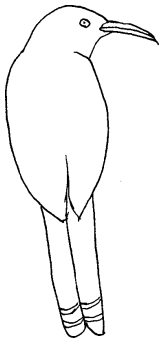
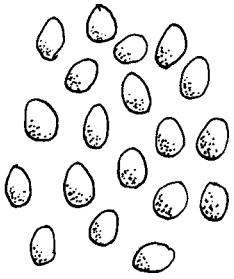
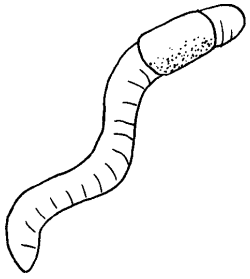
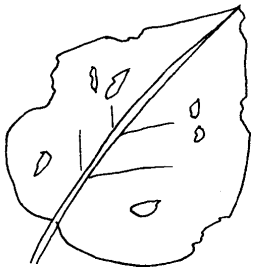
Extensions

When an owl eats a small rodent, the owl cannot digest all the bones and fur. The undigested parts are formed into a pellet and coughed up. Owl pellets can be purchased from a biological supply company and dissected by your students for a first-hand look at part of a food chain. Older students can try to organize the bones into complete skeletons.

FOOD CHAIN PICTURE SHEET

BOBCAT 	**RABBIT** 	**MOUSE** 	**THRASHER** 
PLANT 	**SEEDS** 	**WORM** 	**DECAYING LEAF** 

ILUSTRACIONES DE INTEGRANTES DE LA CADENA ALIMENTARIA

LINCE O GATO MONTÉS 	**CONEJO** 	**RATÓN** 	**SINSOTE** 
PLANTA 	**SEMILLAS** 	**GUSANO** 	**HOJA EN DESCOMPOSICIÓN** 

THE WATER CYCLE
El ciclo del agua

Grades		
K–2	Whole Class	45 minutes

Purpose

Students will learn about natural cycles by making a wheel that demonstrates the water cycle.

Materials

Copies of the Student Activity Sheet (one per student)
Lightweight paper plates (9 inch diameter, two per student)
Crayons or markers
Scissors
Glue or glue sticks
Tape
Paper fasteners (brads)

Concepts

- Some ecological events occur in a repeating pattern called a cycle.
- Water moves from the air to the land, then back into the air.

Conceptos

- Algunos eventos ecológicos ocurren con un patrón que se repite llamado ciclo.
- El agua se desplaza del aire a la tierra y luego vuelve al aire.

Safety

Remind young students to be careful with scissors and paper fasteners.

Vocabulary

Cycle
Water cycle
Condensation
Precipitation
Runoff
Groundwater
Evaporation
Transpiration

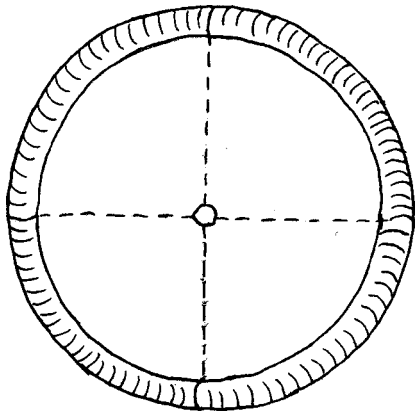
Vocabulario

Ciclo
Ciclo del agua
Condensación
Precipitación
Afluencia o escurrimiento
Agua subterránea
Evaporación
Transpiración

In Advance

Make copies of the Student Activity Sheet. Follow the instructions below to make triangular patterns for students to use:

1. Cut out the circle from the Student Activity Sheet and tape it lightly to the back of a paper plate.
2. Cut out each of the four segments along the straight lines without cutting out the center circle. You should have four triangular shaped patterns. (See diagram.)
3. Remove the Student Activity Sheet that was lightly taped, so you have blank patterns.
4. Repeat with another plate or two so you have more patterns for students to share.



Procedure

1. Introduce the activity

Begin by asking students if they can define a **cycle**. Explain that there are many types of cycles in nature including life cycles, nutrient cycles, and the **water cycle**. Tell students they will be making a special wheel that shows how water cycles from the sky to the ground and back into the sky.

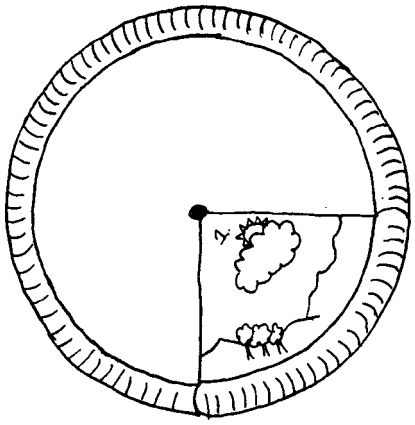
Using the following steps, walk students through the procedure for making their water cycle wheel. Hand out the materials for each step as you go along.

2. Make the water cycle wheel

Give each student a copy of the Student Activity Sheet and crayons or markers. Tell students to color the pictures, then cut out the complete circle along the outer line.

Give each student a paper plate. Using a thin layer of glue, tell students to glue their circle to the back of the paper plate. Set these plates aside.

Give each student another paper plate and hand out the triangular patterns. Have students lay a triangular pattern on the back of the new paper plate so the edges line up. Tell them to trace the pattern and cut out the triangular shape. They should only cut out one triangle. While students are working with their patterns, poke a hole with a pen or scissors through the center of all the paper plates.



Tell students to put the cut paper plate on top of the plate with pictures so they stack together snugly. Give each student a paper fastener and explain how to put the fastener through the holes, then bend the ends so it keeps the plates together.

3. Discuss the water cycle

Have students turn their water cycle wheel to the section marked with the number "1." Explain that this picture shows water in the air, called **condensation**. Sometimes the water forms clouds, as seen in the picture, but there is also water in the air that is not seen as clouds.

Now, tell students to turn their water cycle wheel to the second section. Explain that when clouds become heavy with water, the water falls to the ground in the form of rain, snow, hail, and sleet. This is called **precipitation**.

Next, have students turn their water cycle wheel to the third section. Explain that when water lands on the ground, some of it becomes **runoff** and flows to streams, rivers, lakes, and oceans. Some of the water soaks into the ground (**groundwater**) and stays there, or flows underground and eventually resurfaces.

Finally, have students turn their water cycle wheel to the fourth section. This picture shows how water **evaporates** from lakes, oceans, and other bodies of water. It also evaporates from the surface of the ground. Water **transpires** from the surfaces of leaves back into the air. When enough water accumulates in the air and clouds become heavy with water, the cycle begins again.

Questions to Ask During the Activity

1. When we drink water, does that mean it's no longer part of the water cycle? (No. Some of the water we drink leaves our body when we breathe, sweat, or go to the bathroom.)

2. What happens to the water cycle when large forests are cut down? (When large areas of tropical rainforest are removed, there are fewer trees to transpire, less water gathers in the air, and the whole area receives less rainfall. With less rainfall, it is harder for the forest to grow back.)

Preguntas sobre el tema de la actividad

1. Cuando bebes agua, ¿te parece que ésta ya no forma parte del ciclo del agua? (No. Parte del agua que bebemos sale de nuestros cuerpos cuando respiramos, transpiramos o vamos al baño.)

2. ¿Qué ocurre con el ciclo del agua cuando se talan grandes bosques? (Cuando se eliminan grandes áreas de selva tropical húmeda, hay menos árboles que transpiran, menos agua pasa al aire y toda el área recibe menos lluvia. Con menos lluvia, es más difícil que el bosque vuelva a crecer.)

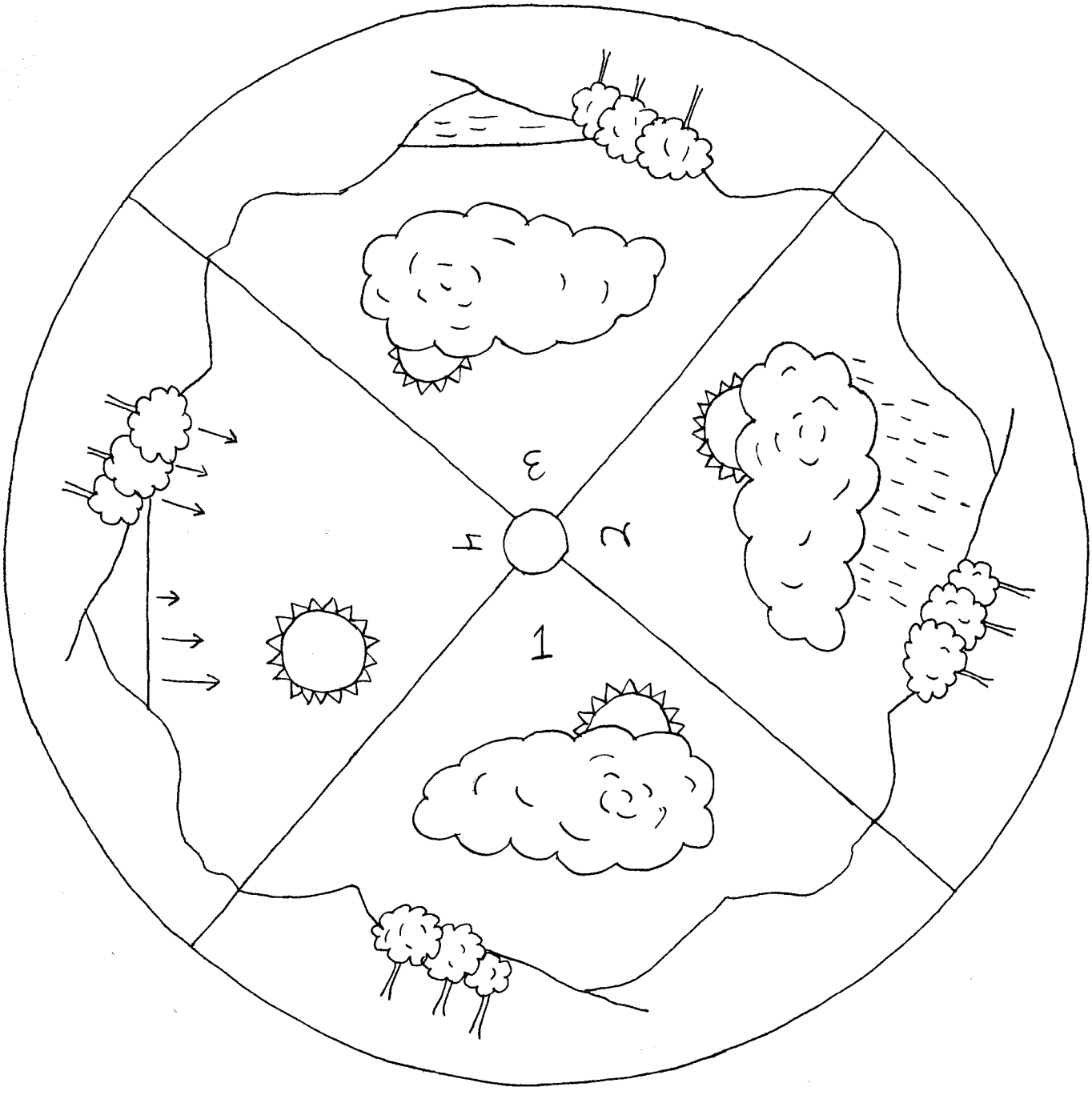
Modifications

This same type of wheel can be used to explain other types of natural cycles, including the carbon cycle and the life cycles of different organisms. Have students draw the steps in the cycle in triangular-shaped sections, then figure out how to assemble them in order on the wheel.

Extensions

Shortly after a rain shower, take the class on a water cycle walk. See how many parts of the water cycle your students can observe.

STUDENT ACTIVITY SHEET
The Water Cycle/El ciclo del agua



ECOSYSTEM SCAVENGER HUNT

Búsqueda de tesoros ecológicos

Grades		
K–8	*Whole Class*	*60 minutes*

Purpose

Students will look around their school campus to find examples of the interactions between plants, animals, and humans.

Materials

Student Activity Sheets
Pencil

Concepts

- Plants support all forms of animal life.
- Some organisms live together for mutual benefit (symbiotic relationship).
- Food chains are feeding relationships that transfer energy through a natural community.
- Wildlife and humans often share the same environment and are all subject to environmental problems.

Conceptos

- Las plantas sostienen a todas las formas de vida animal.
- Algunos organismos viven juntos para beneficio mutuo (relación simbiótica).
- Las cadenas alimentarias son relaciones alimentarias que transfieren energía a través de una comunidad natural.
- La vida silvestre y los seres humanos a menudo comparten el mismo medio ambiente y todos deben enfrentar problemas ambientales.

Safety

Remind students they should avoid picking up any unknown plants, animals, or debris. Define boundaries that students are not to cross.

Vocabulary

Ecosystem
Food chains
Food webs
Producer
Consumer
Decomposer
Predator
Prey
Symbiotic relationship

Vocabulario

Ecosistema
Cadenas alimentarias
Redes alimentarias
Productor
Consumidor
Descomponedor
Predador
Presa
Relación simbiótica

In Advance

Make copies of the Student Activity Sheet appropriate for your grade level. (With very young students, consider reading each question on the Student Activity Sheet and have them draw their answers on a sheet of paper.) Identify an outdoor space suitable for the scavenger hunt.

Procedure

1. Define vocabulary words

Using the list of definitions below, discuss the vocabulary words that students will need to know to do their scavenger hunt.

Ecosystem–a community of living organisms that interact with each other and the non-living environment. An ecosystem can be as large as a rainforest or as small as a rotting log.

Food chains–the feeding relationships that transfer energy through a community of organisms, starting with producers and moving through herbivores and carnivores.

Food webs–an interwoven series of food chains.

Producer–an organism that makes its own food using the energy from the sun. Most producers are plants.

Consumer–an organism that gets its energy from eating other organisms.

Decomposer–an organism that feeds on dead organisms.

Predator–an animal that kills and eats other animals to obtain energy.

Prey–an animal that is hunted and eaten by a predator.

Symbiotic relationship–a condition where two organisms live together for mutual benefit.

2. Describe the scavenger hunt and take students outside

Tell students they will be going on a scavenger hunt to look for examples of the different components and relationships within an ecosystem. Give each student a copy of the Student Activity Sheet and be sure all students have a pencil or pen. (See Modifications section for ideas about how to conduct the scavenger hunt with very young students.) Divide students into groups of four and tell the groups they will be working together to find the items on the scavenger hunt.

Take students outside. Describe the boundaries for the scavenger hunt and remind students to leave natural areas undisturbed. Tell students to meet you at a designated area when they are finished or when they need help, and begin the scavenger hunt.

3. Review findings

Return to the classroom. Review each item on the scavenger hunt list, asking students what examples they were able to find.

Questions to Ask During the Activity

1. What was the easiest thing to find on the scavenger hunt?

2. What was the hardest thing to find on the scavenger hunt?

3. Was there anything on the list that you did not find?

4. Are there other types of ecosystems where the items on the scavenger hunt would be easier or harder to find?

Preguntas sobre el tema de la actividad

1. ¿Qué fue lo más fácil de encontrar en la búsqueda ecológica?

2. ¿Qué fue lo más difícil de encontrar en la búsqueda ecológica?

3. ¿Hubo algo de la lista que no hayas podido encontrar?

4. ¿Hay otros tipos de ecosistemas donde habría sido más fácil o más difícil encontrar los elementos de la búsqueda ecológica?

Modifications

For grades K-3, select one or two versions of the scavenger hunt. With younger students who are not yet able to read or write, give each student a sheet of paper and a pencil. Using Student Activity Sheet 2, read one item on the scavenger hunt and have students look for an example of the item. When they have found an example, tell them to make a drawing of the item on their paper. Read several more items from the scavenger hunt, one at a time, giving students time to search in between. Return to the classroom and discuss the items they found.

Extensions

Have students take a copy of the Student Activity Sheet home. With their family, ask students to look for the scavenger hunt items near their home. In the classroom, compare the ecosystem at the school with the ones near students' homes.

References

The New Mexico Museum of Natural History and Science. Proyecto Futuro Life Science Curriculum. First Edition. Albuquerque, NM, 1996.

STUDENT ACTIVITY SHEET

Ecosystem Scavenger Hunt (4-8)

Without disturbing the plants and animals, see how many of the scavenger hunt items you can find and write your discoveries on the line below each item.

1. Find an example of how a plant *directly* supports the life of an animal.

_____

2. Find an example of how a plant *indirectly* supports the life of an animal.

_____

3. Find evidence that an animal lives here.

_____

4. Find an example of a predator.

_____

5. Find an example of a prey animal.

_____

6. Find evidence of a food chain and write down, in order, the organisms in this food chain.

_____

_____

7. Find evidence of a symbiotic relationship (two organisms that live together and benefit from the relationship).

_____

8. Describe how both organisms benefit from the symbiotic relationship.

_____

9. Find an example of how an insect has damaged a plant.

_____

10. Find an example of a plant that has been damaged by disease.

_____

11. Find an example of something that is decomposing.

_____

12. Find an example of how wildlife and humans are sharing this environment.

_____

13. Find an example of an environmental problem in this area.

_____

14. Explain how humans are dealing with the environmental problem.

_____

STUDENT ACTIVITY SHEET

Ecosystem Scavenger Hunt (K-3)

Without disturbing the plants and animals, see how many of the scavenger hunt items you can find. Write or draw your findings in the box next to each item.

Scavenger Hunt 1

A producer.		Something recycled.	
Something older than you.		An animal sign.	
Something younger than you.		A decomposer.	
Something left over from last winter.		Something yellow, red, or blue.	
Something that feels smooth.		Something that shouldn't be here.	

STUDENT ACTIVITY SHEET

Ecosystem Scavenger Hunt (K-3)

Without disturbing the plants and animals, see how many of the scavenger hunt items you can find. Write or draw your findings in the box next to each item.

Scavenger Hunt 2

A seed.		Something that shows an insect was here.	
Something that smells good.		A leaf with smooth edges.	
Something younger than you.		The largest living thing.	
An animal home.		Something really weird.	
Something that feels fuzzy.		Something that shouldn't be here.	

STUDENT ACTIVITY SHEET

Ecosystem Scavenger Hunt (K-3)

Without disturbing the plants and animals, see how many of the scavenger hunt items you can find. Write or draw your findings in the box next to each item.

Scavenger Hunt 3

A producer.		Something recycled.	
Something older than you.		An animal sign.	
The tiniest living thing.		Something really weird.	
Something with wings and six legs.		Something yellow, red, or blue.	
Something that feels smooth.		Something that shouldn't be here.	

STUDENT ACTIVITY SHEET

Ecosystem Scavenger Hunt (K-3)

Without disturbing the plants and animals, see how many of the scavenger hunt items you can find. Write or draw your findings in the box next to each item.

Scavenger Hunt 4

A producer.		Something that stores water.	
Something that is older than you.		A leaf with rough edges.	
A seed.		Something being decomposed.	
Something that shows a consumer was here.		Something really weird.	
Something that feels fuzzy.		Something that shouldn't be here.	

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Búsqueda ecológica (4-8)

Sin perturbar ni a las plantas ni a los animales, trata de encontrar la mayor cantidad posible de tesoros ecológicos y anota tus descubrimientos en la línea correspondiente.

1. Encuentra un ejemplo de cómo una planta colabora *directamente* con la vida de un animal.

_____

2. Encuentra un ejemplo de cómo una planta colabora *indirectamente* con la vida de un animal.

_____

3. Encuentra alguna prueba de que un animal habita en esta área.

_____

4. Encuentra un ejemplo de un predador.

_____

5. Encuentra un ejemplo de un animal de presa.

_____

6. Encuentra alguna prueba de la existencia de una cadena alimentaria y anota en orden los organismos que forman parte de esta cadena.

_____

_____

7. Encuentra alguna prueba de una relación simbiótica (dos organismos que viven juntos y se benefician de su relación).

_____

8. Describe cómo se benefician de la relación simbiótica ambos organismos.

_____

9. Encuentra un ejemplo de cómo un insecto ha dañado a una planta.

_____

10. Encuentra un ejemplo de una planta que haya sido dañada por una enfermedad.

_____

11. Encuentra un ejemplo de algo que se esté descomponiendo.

_____

12. Encuentra un ejemplo de cómo la vida silvestre y los seres humanos comparten este medio ambiente.

_____

13. Encuentra un ejemplo de un problema del medio ambiente en esta área.

_____

14. Explica por qué los seres humanos están enfrentando problemas del medio ambiente.

_____

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Búsqueda de tesoros ecológicos (K-3)

Sin perturbar ni a las plantas ni a los animales, trata de encontrar la mayor cantidad posible de tesoros ecológicos y anota tus descubrimientos en la línea correspondiente.

Búsqueda ecológica 1

Un productor.		Algo reciclado.	
Algo más viejo que tú		Un indicio de un animal.	
Algo más joven que tú.		Un descomponedor.	
Algo que haya quedado del último invierno.		Algo amarillo, rojo o azul.	
Algo que se siente suave al tacto.		Algo que no debería estar aquí.	

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Búsqueda de tesoros ecológicos (K-3)

Sin perturbar ni a las plantas ni a los animales, trata de encontrar la mayor cantidad posible de tesoros ecológicos y anota tus descubrimientos en la línea correspondiente.

Búsqueda ecológica 2

Una semilla.		Un indicio de que un insecto estuvo aquí.	
Algo que huele bien.		Una hoja con bordes lisos.	
Algo más joven que tú.		El ser vivo más grande.	
El hogar de un animal.		Algo realmente raro.	
Algo que se siente velloso.		Algo que no debería estar aquí.	

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Búsqueda de tesoros ecológicos (K-3)

Sin perturbar ni a las plantas ni a los animales, trata de encontrar la mayor cantidad posible de tesoros ecológicos y anota tus descubrimientos en la línea correspondiente.

Búsqueda ecológica 3

Un productor.		Algo reciclado.	
Algo más viejo que tú.		Un indicio de un animal.	
El ser vivo más pequeño.		Algo realmente raro.	
Algo con alas y seis patas.		Algo amarillo, rojo o azul.	
Algo que se siente suave al tacto.		Algo que no debería estar aquí.	

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Búsqueda de tesoros ecológicos (K-3)

Sin perturbar ni a las plantas ni a los animales, trata de encontrar la mayor cantidad posible de tesoros ecológicos y anota tus descubrimientos en la línea correspondiente.

Búsqueda ecológica 4

Un productor.		Algo que almacena agua.	
Algo más viejo que tú.		Una hoja con bordes irregulares.	
Una semilla.		Algo que se está descomponiendo.	
Un indicio que un consumidor ha estado aquí.		Algo realmente raro.	
Algo que se siente velloso.		Algo que no debería estar aquí.	

SMALL ECOSYSTEMS ON CAMPUS

Pequeños ecosistemas en la escuela

Grades		
3–8	2–4	75 minutes

Purpose

Students will plot, study, and compare small ecosystems on campus.

Materials

For each group:

- 4 paper clips
- String (5 meters long)
- Thermometer
- 1 meter stick
- 500 ml of water
- Hand lenses
- Tin can with both ends cut off (all cans must be the same size)
- Student Activity Sheet

For you:

- Stopwatch or watch with second hand

Concepts

- An ecosystem is a community of living things that interact with each other and with non-living components in the environment.
- Ecosystems can be large or small.

Conceptos

- Un ecosistema es una comunidad de seres vivos que interactúan tanto entre ellos como con los componentes no vivos del medio ambiente.
- Los ecosistemas pueden ser grandes o pequeños.

Safety

Remind students not to touch insects, spiders, or other animals in the study area. Students should wear sunscreen and protective clothing. Define the boundaries that students are not to cross.

Vocabulary

Ecosystem
Biotic
Abiotic
Adaptation

Vocabulario

Ecosistema
Biótico
Abiótico
Adaptación

In Advance

Gather materials and identify some areas outside for your students to work.

Procedure

1. Review concepts

Begin by asking students to define an **ecosystem** and name some examples of ecosystems. Tell them that an ecosystem can be very large or very small. Explain that they will be working in groups to study tiny ecosystems and compare their study plot with those of other groups.

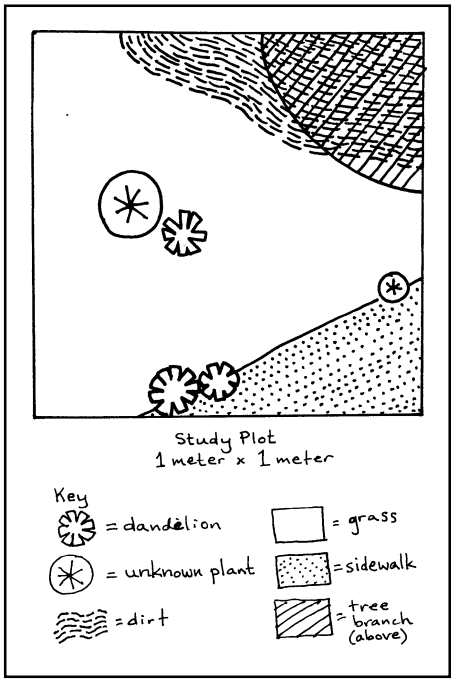
2. Review the Student Activity Sheets

Divide the class into groups of 2-4 students. Give each group a copy of the Student Activity Sheet. Review the items they will be studying and recording on the Student Activity Sheet.

3. Take students outside and demonstrate how to set up a study plot

Take the class and all the materials outside to the area you have selected. Review the rules for handling living organisms and describe the boundaries they need to stay within.

Tell students they will be selecting their study plot at random. Demonstrate that one way to do this is to throw a small rock over your shoulder and center the plot around the rock. Using the meter stick, form a square of string, one meter-long on each side. Anchor the string to the ground with the paper clips. Now have students make their own study plot.



Sample of a study plot

4. Gather data

Following the procedure on the Student Activity Sheet, have students gather information on all but the soil absorption rate. When they are ready to test the soil absorption rate, use your stopwatch or watch to count the seconds when students pour the water into the can.

5. Compare information

Return to the classroom and use the "Questions to Ask During the Activity" section to guide a discussion about the comparison of different small ecosystems.

Questions to Ask During the Activity

1. Describe your ecosystem and list all the **biotic** (living) and **abiotic** (non-living) factors you observed.

2. What are some biotic and abiotic factors that make the small ecosystems different? (Different animals and plants may inhabit different areas, depending on soil moisture and slight differences in temperature and light.)

3. How are the different animals and plants **adapted** to their environment?

4. Do all (or most of) the ecosystems have some living things in common? If so, what are they?

5. Which soil absorbed the water most quickly? Which one was slowest?

6. What differences in the ecosystem affected the rate of water absorption?

7. Which ecosystem had the greatest variety of living things? Why do you think that is?

8. What would change in your small ecosystem if an environmental factor were to change?

9. How can human activity change the ecosystem? Can you see any evidence of human activity within your study plot?

Preguntas sobre el tema de la actividad

1. Describe tu ecosistema y haz una lista de todos los factores **bióticos** (vivos) y **abióticos** (no vivos) que observaste.

2. Nombra algunos de los factores bióticos y abióticos que otorgan diferentes características a ecosistemas pequeños. (Diferentes plantas y animales pueden habitar en distintas áreas, dependiendo de la humedad del suelo y de leves diferencias en la temperatura y en la luz.)

3. ¿Cómo se **adaptan** las diferentes plantas y animales a su medio ambiente?

4. ¿Tienen todos los ecosistemas (o la mayoría de ellos) seres vivos en común? Si es así ¿cuáles son?

5. ¿Qué suelo absorbió el agua más rápidamente? ¿Cuál fue el más lento?

6. ¿Qué diferencias en el ecosistema afectaron la velocidad de absorción del agua?

7. ¿Qué ecosistema tenía la mayor variedad de seres vivos? ¿Por qué crees que es así?

8. ¿Qué cambios observarías en tu pequeño ecosistema si cambiara un factor del medio ambiente?

9. ¿De qué manera pueden cambiar el ecosistema las actividades de los seres humanos? ¿Has observado alguna evidencia de actividad humana en tu pequeño terreno?

Why It Happens/More on the Topic

An ecosystem is a community of living things (biotic) that interact with each other and with non-living (abiotic) components of the environment. The biotic and abiotic factors in an ecosystem are constantly affecting one another. Water, sunlight, temperature, soil composition, water quality, and air quality all affect the types and numbers of living things in that area. In turn, living things have an impact on the non-living environment by affecting water, soil, and air.

Algo más sobre el tema…

Un ecosistema es una comunidad de seres vivos (bióticos) que interactúan tanto entre ellos como con los componentes no vivos (abióticos) del medio ambiente. Los factores bióticos y abióticos en un ecosistema están constantemente produciendo efectos unos sobre otros. El agua, la luz del sol, la temperatura, la composición del suelo, la calidad del agua y del aire afectan el tipo y el número de seres vivos en esa área. A su vez, los seres vivos producen un impacto sobre los componentes no vivos del medio ambiente, lo cual afecta el agua, la tierra y el aire.

Modifications

If your school campus is dry and well-used, there may not be a lot of variety of living organisms. Consider taking a field trip to the bosque, mountains, or a park to conduct the small ecosystem study.

Extensions

Have students repeat this activity at home with parent involvement. Families can make observations about the temperature, moisture, and biotic features of their study plot throughout the day. Then have students bring their data to the classroom so students can compare what they discovered.

References

The New Mexico Museum of Natural History and Science. Proyecto Futuro Life Science Curriculum. First Edition. Albuquerque, NM, 1996.

STUDENT ACTIVITY SHEET
Small Ecosystems on Campus

Follow the directions below to gather and record data from your small study plot in the charts below.

1. Carefully put a thermometer about 3 cm (about an inch) into the soil and let it sit for about 5 minutes before recording the temperature reading in Chart 1 below. Also take the temperature of the air at the level of a medium-sized plant and record.

2. In Chart 1, describe the dampness of the soil and the amount of light reaching your study plot. Also describe any other non-living factors you notice.

3. Count and record the various living things in your study plot in Chart 2. If you don't know the names of the animals or plants you see, draw a picture in the chart.

4. When the whole class is ready, you will be finding out how fast the soil can absorb water. To prepare for this experiment, put one end of your can about 3 cm into the soil. When your teacher is ready with the stopwatch, you should quickly pour the water into the can and time how many seconds it takes for the water to soak into the soil. Record this number on Chart 1.

CHART 1

Environmental Factor	Observations
Temperature of soil	
Temperature of air	
Dampness of soil	
Amount of light	
Time for water to be absorbed by soil	

CHART 2

Description of **Animal**	Number found	Description of **Plant**	Number found

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Pequeños ecosistemas en la escuela

Recolecta los datos de tu pequeño terreno y anótalos en la tabla siguiente, de acuerdo con las instrucciones.

1. Cuidadosamente, inserta un termómetro aproximadamente 3 cm. (alrededor de una pulgada) debajo de la tierra y déjalo ahí por cinco minutos. Luego anota la temperatura en la Tabla 1. Además, toma la temperatura del aire a la altura de una planta mediana y anótala.

2. En la Tabla 1, describe la humedad del suelo y la cantidad de luz que llega a tu terreno. También describe cualquier otro factor no vivo que hayas notado.

3. Cuenta y anota en la Tabla 2, los organismos que existen en tu terreno. Si no sabes los nombres de los animales y plantas que ves, haz un dibujo en la tabla.

4. Cuando toda la clase esté lista, realizarán un experimento para descubrir con qué rapidez pueden absorber agua los distintos tipos de suelo. Para prepararte para este experimento, coloca un extremo de tu tarro a aproximadamente 3 cm. de la tierra. Cuando tu maestro esté listo con el cronómetro, vaciarás rápidamente el agua en el tarro y contarás cuántos segundos tarda la tierra en absorber el agua. Anota tus resultados en la Tabla 1.

TABLA 1

Factor del medio ambiente	Observaciones
Temperatura de la tierra	
Temperatura del aire	
Humedad de la tierra	
Cantidad de luz	
Tiempo que demora en absorberse el agua en la tierra	

TABLA 2

Descripción del **animal**	Número de animales que has encontrado	Descripción de la **planta**	Número de plantas que has encontrado

SUCCESSION IN POND WATER

Sucesión en agua de estanque

Grades		
6–8	2	1–3 weeks: 10–20 mins./day

Purpose

Students will observe ecological succession when dried pond vegetation is placed in tap water.

Materials

Large, tall jars with loose fitting lids (one per group)
Aged tap water (let tap water stand uncovered for at least 24 hours)
Dried leaves and other vegetation from a pond
Microscopes
Glass slides and cover slips (three per group)
Eye droppers
Student Activity Sheet

Concepts

- Succession is the change in the variety and numbers of organisms in a community over time.
- Primary succession is sucession in an area where no previous organisms existed.
- Pioneer species are organisms that are the first living things to live in an area.
- A climax community is the final stage of succession.
- When a climax community is partially disturbed and succession resumes, it is called secondary succession.

Conceptos

- Sucesión es el cambio en la variedad y en el número de organismos en una comunidad a través del tiempo.
- Sucesión primaria es una sucesión en un área donde no existían organismos previamente.
- Las especies pioneras son los organismos que constituyen los primeros seres vivos en un área.
- Una comunidad clímax es la etapa final de una sucesión.
- Cuando una comunidad clímax se altera parcialmente y la sucesión se reanuda, ésta se llama sucesión secundaria.

Safety

Review safety procedures for handling microscopes and slides. Have students wash hands thoroughly after handling pond vegetation.

Vocabulary

Succession
Primary succession
Secondary succession
Climax community
Pioneer species

Vocabulario

Sucesión
Sucesión primaria
Sucesión secundaria
Comunidad clímax
Especies pioneras

In Advance

Collect and dry plants (leaves, twigs, algae, etc.) and pebbles from a pond. Gather other materials and organize a set of supplies for each group of students. Age tap water by allowing it to stand at least 24 hours.

Procedure

1. Discuss succession

Using the "Why It Happens" section for this activity, introduce the ecological concept of **succession**. Have students give examples of how succession might progress in forest or beach ecosystems. While most examples of succession take place over hundreds of years, they will be watching an example of succession that takes only a few weeks.

2. Set-up

Divide students into pairs and give each pair a large jar, aged tap water, dried pond vegetation, three glass slides, three cover slips, an eye dropper, and a microscope. (Groups can share microscopes if necessary.) Also give each pair a copy of the Student Activity Sheet. Tell older students to follow the procedure outlined on the Student Activity Sheet. With younger students, you may want to read each step and have students follow the instructions as you go.

3. Observe

Over the next several weeks, have students follow the procedure on the Student Activity Sheet to observe the changes in their water. Be sure students are recording their observations.

4. Discuss observations

When you are finished making observations, have students compare the changes they noticed in their water. Use the "Questions to Ask During the Activity" to guide the class discussion.

The water and pond vegetation can be collected and returned to the pond.

Questions to Ask During the Activity

1. What organisms did you see in your water samples?

2. Which types were the most and least common?

3. Were the most organisms found in the top, middle, or bottom of the jar?

4. Were some organisms present in the samples from the beginning to the end of the study? If so, which ones?

5. If the water samples changed over time, describe what changed.

6. Why do you think the community changed over time?

Preguntas sobre el tema de la actividad

1. ¿Qué organismos observaste en tus muestras de agua?

2. ¿Qué tipos de organismos fueron los más comunes y los menos comunes?

3. ¿Dónde encontraste más organismos: en la superficie, en la mitad o en el fondo del frasco?

4. ¿Hubo algún organismo presente en las muestras durante todo el experimento? Si lo hubo, ¿cuál fue?

5. Si el agua de las muestras cambió con el tiempo, describe qué fue lo que cambió.

6. ¿Por qué crees que la comunidad cambió con el tiempo?

Why It Happens/More on the Topic

In the beginning of this activity, students observe samples of water with nothing living in it. When the pond vegetation is placed in the water, the organisms living in the vegetation are introduced to the water. Over several weeks, the populations of these microorganisms change. Other species, such as rotifers, worms, and algae affect the existing populations of organisms. When the makeup of a community changes over time like this, it is called succession. Sometimes the entire population of a community is replaced with other organisms.

Primary succession is succession in an area where no previous organisms existed. This is the type of succession observed in the tap water and also on a newly formed volcano, a new pond, or on bare rock.

The first living things to arrive in an area are called **pioneer species**. Lichens and algae are typical pioneer species because they make their own food and can grow well in harsh environments. Once pioneer species have become established, other plants and animals begin to arrive and the community develops and changes. The final stage of succession is called the **climax community**. If the climax community is disturbed by fire, storms, or human activities such as farming, ranching, construction, or logging, another type of succession occurs called **secondary succession**. When an area has been disturbed, but there are still living things, secondary succession progresses until the climax community is established again.

Algo más sobre el tema...

Al comienzo de esta actividad, los estudiantes observaron muestras de agua sin ningún organismo vivo. Al agregar vegetación del estanque al agua, también se introdujeron los organismos que viven normalmente en la vegetación. Después de varias semanas, la población de estos microorganismos cambió. Otras especies, tales como rotíferos, gusanos y algas afectaron a las poblaciones de organismos existentes. Cuando la composición de una comunidad cambia a través del tiempo, como ocurrió aquí, hablamos de sucesión. A veces toda la población de una comunidad es reemplazada por otros organismos.

Sucesión primaria es la sucesión en un área donde no existían organismos previamente. Éste es el tipo de sucesión que se observó en el agua de grifo y también en formaciones volcánicas recientes, en un nuevo estanque o en una roca al descubierto.

Algo más sobre el tema (continuación)

Los primeros seres vivos que llegan a un área se llaman **especies pioneras**. Los líquenes y las algas son especies pioneras típicas porque fabrican su propio alimento y pueden crecer bien en ambientes inhóspitos. Una vez que las especies pioneras se han establecido, comienzan a llegar otras plantas y animales y la comunidad se desarrolla y cambia. La etapa final de una sucesión se llama **comunidad clímax**. Si la comunidad clímax se altera por incendios, tormentas o actividades de los seres humanos, tales como agricultura, ganadería, construcción o tala de árboles, se produce otro tipo de sucesión llamada **sucesión secundaria**. Cuando un área ha sido alterada pero aún contiene seres vivos, la sucesión secundaria progresa hasta que se vuelve a establecer la comunidad clímax.

Modifications

With younger students (including grades 3-5), read each step of the procedure on the Student Activity Sheet and have students follow along when setting up the study and making observations. They may also need more assistance with preparing their slides and using the microscope.

Extensions

Take a field trip to a natural area that was recently disturbed by fire or construction. Have students write down (or draw) the plants and animals they find in the disturbed area and nearby areas that are not disturbed. Have students make predictions about what will happen to the disturbed area if it is left alone again.

References

The New Mexico Museum of Natural History and Science. Proyecto Futuro Life Science Curriculum. First Edition. Albuquerque, NM, 1996.

STUDENT ACTIVITY SHEET

Succession in Pond Water

Procedure:

1. Fill your jar two-thirds full with the aged tap water.

2. Add a handful of the dried pond vegetation.

3. Place the jar in an area that has plenty of light, but not direct sunlight. The water should stay at a constant room temperature and direct sunlight will make the water too warm.

4. Cover the jar loosely with the lid. It should not be airtight! If any water evaporates over the coming weeks, you can add more aged tap water.

5. Every day, take three samples from the water with an eyedropper. Take one sample from the water surface, one from the middle, and one from the bottom of the jar. Rinse the eye dropper between each sample. Place each water sample on its own slide. Carefully place a cover slip on the slides and look at them under the microscope.

6. Write your observations on the Data Table provided. If you prefer, you can make drawings of the organisms you see through the microscope. Also look for organisms in the jar that can be seen without a microscope. Observe and write down changes to the water's appearance and smell each day.

Data Table

Date	Organisms

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Sucesión en agua de estanque

Procedimiento

1. Llena dos tercios de tu frasco con agua del grifo que has dejado reposar por 24 horas.

2. Agrega un puñado de vegetación seca de estanque.

3. Coloca el frasco en un área con mucha luz, pero sin luz directa del sol. El agua debe estar a una temperatura ambiente constante y la luz directa del sol calentaría demasiado el agua.

4. Cubre el frasco con la tapa, pero ¡no lo cierres herméticamente! Si se evapora parte del agua durante las próximas semanas, puedes agregar más agua del grifo que has dejado reposar por 24 horas.

5. Todos los días, toma tres muestras de agua con un gotero. Toma una muestra de la superficie del agua, una del medio del frasco y otra del fondo. Enjuaga el gotero entre cada muestra. Coloca cada muestra de agua en su propio portaobjeto. Cuidadosamente, coloca un cubreobjeto sobre cada portaobjeto y obsérvalos bajo el microscopio.

6. Escribe tus observaciones en la Tabla de datos. Si prefieres, puedes hacer dibujos de los organismos que observaste a través del microscopio. También busca en el frasco algún organismo que pueda verse sin un microscopio. Todos los días, observa y anota los cambios en el aspecto y en el olor del agua.

Tabla de Datos

Fecha	Organismos

BIODIVERSITY
Biodiversidad

Grades		
3–8	5	60 minutes

Purpose

Students will investigate the three levels of biodiversity—genetic diversity, species diversity, and ecosystem diversity—by observing the variety of leaves on the school campus.

Materials

Small pieces of paper
Pen or pencil
A variety of leaves (can be collected by the students outside)

Concepts

- Genetic diversity is the variety of genes within a species of organism.
- Species diversity is the number and kinds of organisms on Earth.
- Ecosystem diversity is the variety of ecosystems in the world.
- Biodiversity is important for a variety of reasons. (See "Why It Happens" section in this activity.)

Conceptos

- La diversidad genética es la variedad de genes dentro de una determinada especie de organismos.
- La diversidad de especies es el número y tipos de organismos en la Tierra.
- La diversidad de ecosistemas es la variedad de los ecosistemas en el mundo.
- La biodiversidad es importante por muchas razones. (Ver "Algo más sobre el tema…" en esta actividad.)

Safety

Be sure to select an outside site that doesn't have poisonous plants or other hazards. Designate boundaries that students are not to cross.

Vocabulary

Biodiversity
Species diversity
Genes
Genetic diversity
Ecosystem diversity

Vocabulario

Biodiversidad
Diversidad de especies
Genes
Diversidad genética
Diversidad de ecosistemas

In Advance

Select a safe outdoor site where students can collect leaves.

Procedure

1. Gather leaves

Tell students that they will be going outside to gather a variety of leaves. Take students outside to the area you have identified. Have students gather at least one example of five different types of leaves. Remind them that pine needles are also leaves.

2. Return to the classroom and discuss biodiversity

Have students spread their leaves on their desk. Define the word **biodiversity** and explain that there are several kinds of biodiversity. The variety of leaves they have on their desk is an example of **species diversity**.

Now, divide the class into groups of 5 students. Have each group organize their leaves into piles of the same species. Tell the students to look carefully at the leaves that are from one species of plant. Are the leaves identical? What differences do they notice? The leaves will vary in part because of events that have occurred during the life of the leaf, but also because of genetic differences. **Genetic diversity** is the variety of **genes** within a species. Genes are the codes that are passed from one generation to the next. The characteristics of each individual are determined by that individual's genetic makeup.

Finally, ask students if they gathered leaves in a tropical rainforest or near an ocean if they would find the same leaves. Most likely they would find a very different set of leaves representing entirely different species. Rainforests, temperate forests, deserts, and oceans are examples of the variety of Earth's ecosystems or **ecosystem diversity**.

3. Discuss the importance of biodiversity

Give each student a small piece of paper and something to write with. Tell the class to write down one reason why they think it is important to conserve biodiversity. Collect the pieces of paper.

Read the first piece of paper and write a summary statement on the chalkboard. As you read the rest of the papers, organize the summaries into categories. Some possible categories might include: medical or economic reasons (new medicines, foods, and other products); maintaining ecological processes (oxygen production, pollination, flood control, etc.); recreation (hiking, camping, fishing, etc.); inspiration and beauty; and the right to exist (other species have the right to exist). Discuss the various reasons why biodiversity is important and why many people are concerned about protecting it. If some categories were not represented by the students' statements, be sure to discuss those as well.

Questions to Ask During the Activity

1. What are some examples of genetic diversity in humans? (Eye color, hair color, and height are all examples of genetic diversity in humans.)

2. What are some examples of ecosystem diversity in New Mexico? (Grasslands, desert, and forest.)

Preguntas sobre el tema de la actividad

1. ¿Cuáles son algunos ejemplos de diversidad genética en los seres humanos? (El color de los ojos, el color del pelo y la altura son ejemplos de diversidad genética en el ser humano.)

2. ¿Cuáles son algunos ejemplos de diversidad de ecosistemas en Nuevo México? (Praderas, desiertos y bosques.)

Why It Happens/More on the Topic

Biological diversity is the variety of life on Earth. There are three levels of biodiversity. Species diversity refers to the variety of species. Ecosystem diversity is the variety of ecosystems, habitats, and communities in the world. Tropical rainforests, deserts, temperate forests, grasslands, and coral reefs are examples of ecosystem diversity. Genetic diversity is the variety of genetic information found within individual organisms, species, and populations of organisms.

Biodiversity is important for a number of reasons. Animals and plants help maintain the balance of gases in the atmosphere; plants help to prevent erosion and flooding by absorbing and slowing down moving water; wetlands filter sediments and pollutants from water; animals pollinate a variety of plants including food crops; plants and animals are the source of new medicines, foods, and other products; plants and animals enhance outdoor recreation experiences; and biodiversity is a source of inspiration to artists, writers, scientists, and even inventors.

Algo más sobre el tema...

La diversidad biológica es la variedad de vida en la Tierra. Hay tres niveles de biodiversidad. La diversidad de especies se refiere a la variedad de especies. La diversidad de ecosistemas es la variedad de ecosistemas, hábitat y comunidades en el mundo. Las selvas tropicales húmedas, los desiertos, los bosques templados, las praderas y los arrecifes de coral son ejemplos de la diversidad de los ecosistemas. La diversidad genética es la variedad de la información genética que se encuentra dentro de organismos individuales, especies y poblaciones de organismos.

La biodiversidad es importante por muchas razones. Los animales y las plantas ayudan a mantener el equilibrio de gases en la atmósfera; las plantas ayudan a prevenir la erosión y las inundaciones debido a que absorben el agua y reducen su desplazamiento; los pantanos filtran sedimentos y contaminantes del agua; los animales polinizan una variedad de plantas, incluyendo cultivos de alimentos; las plantas y los animales son fuente de nuevos medicamentos, alimentos y otros productos; las plantas y los animales hacen más agradables las experiencias recreativas al aire libre; y la biodiversidad es una fuente de inspiración para artistas, escritores, científicos e incluso inventores.

Modifications

Younger students will need more detailed explanations of the three levels of biodiversity. Rather than having younger students write down a reason for protecting biodiversity, have them draw a picture and explain their reason to the rest of the class.

Extensions

Have students go on an "ecosystem services" scavenger hunt. Examples of ecosystem services they can look for include pollination, pest control (some animals keep "pest" populations in check), decomposition, water purification (wetlands help filter pollutants and sediments), erosion and flood control (plants absorb and slow down water), and the maintenance of gases in the atmosphere (plants release oxygen and absorb carbon dioxide and animals do the opposite).

IT'S A SMALL WORLD
Es un mundo pequeño

Grades		
K–8	3 equal teams	Setup: 60 mins Discussion: variable

Purpose

Students will set up a terrarium and observe how conditions mimic those of the Earth as a whole. Students will also discuss how people are changing those conditions and the consequences of those changes.

Materials

Glass aquarium
Plastic wrap or tight-fitting lid
Small house plants
Horticultural charcoal
Non-sterilized potting soil
Pebbles
Vermiculite (if not in the potting soil)
Aquarium sand
Peat moss
Water
Ruler
Nylon stockings
Scissors
Shovel
Containers for mixing soil

Concepts

- An ecosystem is a community of living things that interact with each other and with non-living components in the environment.
- Changing one thing in an ecosystem often affects other parts of the ecosystem.

Conceptos

- Un ecosistema es una comunidad de seres vivos que interactúan tanto entre sí como con los componentes no vivos del medio ambiente.
- Aún cuando se modifique una sola cosa en un ecosistema, a menudo esto afecta otras partes del ecosistema.

Vocabulary

Transpiration
Condensation
Deforestation
Producer
Primary consumer
Secondary consumer
Predator
Ozone
Pollutant
Endangered species
Climate change

Vocabulario

Transpiración
Condensación
Deforestación
Productor
Consumidor primario
Consumidor secundario
Predador
Ozono
Contaminante
Especies en peligro de extinción
Cambios climáticos

In Advance

Gather materials. With younger students, pre-mix potting soil, vermiculite, peat moss, sand, and charcoal.

Procedure

1. Introduce the activity

Begin the activity by telling students that a model can be a good observation tool, especially when the model represents something as complex as an ecosystem. Established terrariums can be used to observe and test a variety of natural events.

2. Set-up terrarium

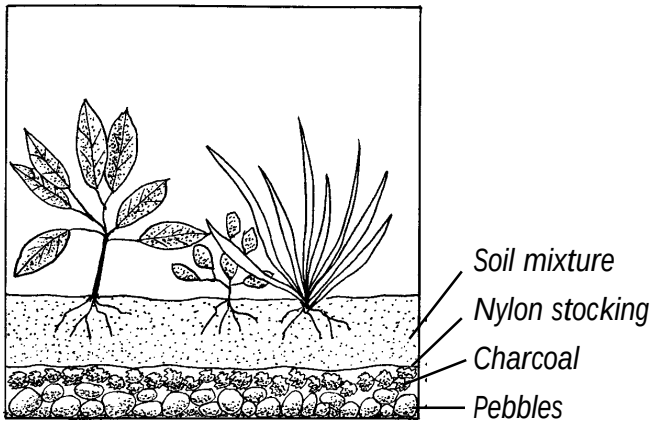
Divide the class into three teams and assign one of the following steps to each of the teams.

Group 1: Wash the pebbles and charcoal. Cover the bottom of the aquarium with a 2.5 cm layer of pebbles and cover the pebbles with a 0.5 cm layer of charcoal. Cut up some nylon stockings and use the material to cover the charcoal and pebble layers. This will keep soil from getting into the drainage area formed by the charcoal and pebbles.

Group 2: Mix together 6 parts potting soil, 2 parts vermiculite, 2 parts peat moss, 1 part aquarium sand, and 1 part charcoal. Cover the drainage area on the bottom of the terrarium with 4 cm of the soil mixture.

Group 3: Make little holes in the soil for each of the plants. Be sure to leave space in between the plants to allow for growth. Put a small amount of water in the holes. Shake as much soil as possible from the roots of the plants, then put each plant into one of the holes. Cover the roots with the soil and sprinkle some water on the soil. Place other objects (rocks, a stick, etc.) on the soil to decorate the terrarium.

Cover the terrarium with a tight-fitting lid or plastic wrap.



3. Maintaining the terrarium

The terrarium should not be kept in direct sunlight, but should be near a window. To keep plants from growing in one direction, turn the terrarium around every so often. If no water is accumulating on the lid, add some water to the soil. If the terrarium is too wet, the lid can be removed for several hours.

4. Experiment with the terrarium

Once the terrarium is established, it can be used for a variety of observations and experiments. Here are some ideas:

Observe **transpiration** and **condensation**. Inside the closed terrarium, the water that transpires from the plants is trapped inside. When enough water condenses on the lid, it will "rain" back down onto the plants and soil. The same thing happens in ecosystems like tropical rainforests!

Try "**deforesting**" the terrarium by removing most of the plants, then replace the lid. What happens to the mini-water cycle created in the terrarium? How does that relate to what happens when an ecosystem in the "real" world is deforested?

Introduce some grasshoppers or other plant-gobbling insect to the terrarium. What happens when an ecosystem has **producers** and **primary consumers**, but no **predators**? How does that relate to the "real" world when predators, like wolves, are removed from an ecosystem?

Move the terrarium into an area that receives direct sunlight. In the "real" world, **ozone** has been depleted from the atmosphere, causing more of the sun's rays to reach the Earth's surface. Now many regions of the world receive more intense sunlight. This may be affecting sun-sensitive amphibians and plants, and contributing to an increased incidence of sunburns and skin cancers in people. See how intense sunlight affects the terrarium ecosystem over the span of a few weeks.

Introduce a **pollutant** to the terrarium. Try a mixture of water and laundry soap, or a bit of used motor oil, or even salt. What happens to the plants in the terrarium ecosystem? What happens in the real world when these pollutants contact plants?

Questions To Ask During the Activity

1. How is the terrarium similar to an ecosystem outside? (Both have plants, soil, nutrients, and water. Water is cycled through both systems through transpiration and condensation.)

2. How is the terrarium different from an ecosystem outside? (Most ecosystems are not as closed off as the terrarium. Animals, plants, and people, enter and leave real ecosystems. Real ecosystems also have lakes, rivers, oceans, a variety of animals, changes in weather, etc.)

Preguntas sobre el tema de la actividad

1. ¿En qué se parece el terrario a un ecosistema al aire libre? (Ambos tienen plantas, tierra, nutrientes y agua. El agua se recicla en ambos sistemas mediante transpiración y condensación.)

2. ¿En qué se diferencia el terrario de un ecosistema al aire libre? (La mayoría de los ecosistemas no están encerrados como el terrario. Los animales, las plantas y las personas pueden entrar y salir de los ecosistemas reales. Los ecosistemas reales también tienen lagos, ríos, océanos, una variedad de animales, cambios climáticos, etc.)

Modifications

Set up several terrariums and use each one for a different experiment.

Extensions

Have students search for more information on environmental issues that are affecting different ecosystems. Deforestation, ozone depletion, pollution, **endangered species**, **climate change**, and human population growth are all affecting how natural ecosystems function. Using the information they gathered, have students plan and conduct an action project that addresses one of these issues.

References

Bosak, Susan V. Science Is...A Source Book of Fascinating Facts, Projects, and Activities. Markham, Ontario, Canada: Scholastic Canada, 1991.