

Outdoor Science! Week 1

Day 1: Investigating Natural and Disturbed Environments

Teacher/Parent Background:

- In this activity, In this activity, students will perform an investigation comparing two environmental sites, one in a natural setting, and one that has been disturbed or disrupted. You will collect data comparing biotic and abiotic factors such as: air, water, and soil quality, percentage of producers, evidence of animal life, invasive species, and pollution.

Related Standards:

- Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems.

Key Terms:

Pollution

Climate

Long Term vs. Short Term Environmental Change

Biodiversity

Materials List:

- Thermometer
- Tape Measure
- Hand lens
- Graph Paper
- Paper
- Pen/Pencil

Activity Description:

Choose two sites of approximately equal area, one natural and one disturbed from which to collect data. A state or county park could be a great place to start!

1. Map out the natural area site. Draw and label water sources, plants and other features that impact the ecosystem.
2. Take digital photographs to document your investigation.
3. Make observations and complete the data table attached to this activity.
4. Repeat the steps for the disturbed area site.

Water	Natural Site	Disturbed Site
Source		
Temperature		
Clarity		

Soil	Natural Site	Disturbed Site
Temperature		
Percent Exposed		
Other Observations		

Plants	Natural Site	Disturbed Site
Percent Ground Cover		
Percent Grasses		
Percent Shrubs		
Percent Trees		
Percent Invasive Species		

Animals and Insects	Natural Site	Disturbed Site
Number of Animals and Plants Observed		
Other Observations		

General	Natural Site	Disturbed Site
Estimated Biodiversity		
Estimated Pollution and Litter		
Other Observations		

Closure:

Students should choose a way to graphically represent their data and then use their data to answer the following questions:

- What are the biggest differences you observed between the two environmental test sites? *Answers will vary. Some examples of large differences would be the presence of man-made structures (i.e. concrete) or evidence of short or long-term changes (i.e. flooding) in the disturbed sites.*
- Based on your data, did you see evidence of a short- or long-term environmental change? *Answers will vary. Evidence of short-term changes can be large pools of water from flooding. Evidence of wind erosion would be an example of long-term environmental changes.*

Extension:

- Watch & Play!
 - TED ED: [Invasive Species](#)
 - Bioman: [Ecological Degradation](#)

Outdoor Science! 6-8



Outdoor Science! Week 1

Day 2: Investigating Ecosystem Interactions

Teacher/Parent Background:

- In this activity, students will complete an investigation to describe the levels of organization in your community's ecosystem. Student's will make observations of the ecosystem and use their knowledge of biotic and abiotic factors to explain how the organisms interact.

Related Standards:

- Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.

Key Terms:

Abiotic Factors

Biotic Factors

Ecosystems

Biosphere

Habitat

Niche

Species

Population

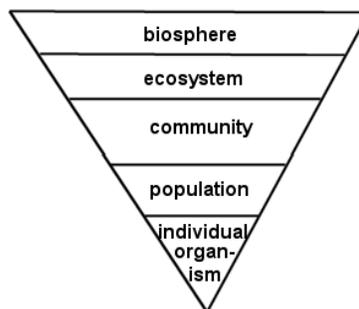
Materials List:

- Thermometer
- Spoon
- Hand lens
- Gloves
- Hula hoop

Activity Description:

Identify an area outside to be used for the field investigation. Look for areas that would have a variety of species. Coat hangers, wooden skewers, or hula hoops work well to stake an area.

- Identify one organism in your ecosystem. Draw a picture of your organism.
- Count the number of organisms you chose, in your investigation site, as accurately as possible. Draw a population of your organisms and describe the characteristics of the population.
- Identify other living organisms in your ecosystem. Think about how they interact with each other. Draw a picture of the community of your organisms and list all of the populations.
- Identify abiotic factors within your ecosystem. Record any data that you collect. This can include the temperature, soil color, and the presence of water.
- Describe the interactions of the different populations with each other in the space provided for biotic factors and the interactions with the non-living aspects of the ecosystem in the space provided for abiotic factors. Draw a picture of the ecosystem.



Closure:

Ask students the following questions:

-What is an ecosystem? How is it distinguished from a population and a community?
An ecosystem is a complete community of living organisms and non-living factors in a particular region. A population is one species. (Examples are lions, zebra, particular type of plant, etc.) A community is more than one species living in the same area.

-How are you able to tell the difference between biotic and abiotic components, and why they are important to one another? *Biotic factors are living. Biotic components of an ecosystem are all living organisms, such as plants and animals. Abiotic factors are non-living components, such as sunlight, soil, water, and temperature. Living things rely on non-living things for survival.*

-Explain why it is not possible for different population types in the community to occupy the exact same niche within an ecosystem? *A niche is a very particular environment in which organisms of a population have evolved to live. Its position within the ecosystem is unique and as such does not support the needs of different populations within the community.*

Extension:

Watch & Play!

[-Levels of Organization](#)

[-Abiotic and Biotic Factors](#)

Using Technology-Energy Pyramids: Take pictures of all levels of organization in your ecosystem. Upload all images to a computer and create an energy pyramid using the images.

Outdoor Science! Week 1

Day 3: Investigating Photosynthesis

Teacher/Parent Background:

- In this activity, students will review photosynthesis and examine and separate leaf pigments using chromatography.

Related Standards:

- Construct an explanation for how some plant cells convert light energy into food energy.

Key Terms:

Photosynthesis
Carbon Dioxide
Radiant Energy
Chemical Energy
Glucose
Chlorophyll

Materials List:

- Small Cups or Baby Food Jars
- Isopropyl Alcohol
- Coffee Filter
- Aluminum Foil
- Casserole Dish

Activity Description:

Collect two or three large leaves from different trees.

- Tear or chop leaves into very small pieces and put them into cups labeled with the name or location of the tree.

- Add rubbing alcohol to each cup to cover the leaves and then carefully grind the leaves in the alcohol.
- Cover the cups loosely with aluminum foil and place cups into a shallow tray containing one inch of hot water.
- Leave cups in water for at least 30 minutes. Twirl each jar about every 5 minutes and replace hot water if it cools off.
- Cut filter paper strips for each cup.
- Remove jars from the water and place a coffee filter strip into each cup so that one end is in the alcohol and the other is bent over the edge of the cup and secured with tape.
- After 30-90 minutes you should be able to see different shades of green or possibly different colors depending on the leaf type.

Closure:

Ask students to discuss the following:

-What role does the Sun's energy play in the process of photosynthesis?

Radiant energy from the Sun is required for photosynthesis to occur; it is transformed to chemical energy as a result of the process.

-How could you create a flowchart showing the relationship between plants and animals and their interaction with oxygen and carbon dioxide? *One example would be to show the flowchart as a cycle, with plants giving off oxygen, animals using oxygen and giving off carbon dioxide, and back to plants taking up carbon dioxide.*

Extension:

Watch & Play- [Photosynthesis for Kids](#)

Outdoor Science! Week 1

Day 4: Investigating Inherited Traits

Teacher/Parent Background:

- In this activity, students will differentiate between learned and inherited traits by collecting and analyzing data from their surroundings.

Related Standards:

- Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.

Key Terms:

Physical Trait

Inheritance

Heredity

Genetic material

Materials List:

- Paper
- Pencil
- Colored Pencils
- 2 Pennies

Activity Description:

Students will work through an activity to help them recognize that inherited traits are the results of genetic material being passed from one generation to the next through genes, which are stored within chromosomes in the nucleus.

- Have students read the following:

“Genetic instructions control how traits are passed from one generation to the next. Genetic instructions are like a set of directions and traits are like the results of following the directions. For example, directions (genetic instructions) are needed to bake a cake. The flavor of the cake (trait) and the way the color of the cake (trait) are the result of following the directions for the assembly of the cake. Cells follow genetic instructions provided by deoxyribonucleic acid, or DNA, that determines their form and function. For example one cell may be directed to be a red blood cell, another to be brown eye pigment, while a third may be directed to form bone cells. DNA forms strands that are made up of smaller pieces, or segments, called genes. It is these genes that govern the many traits of an organism. Traits are inherited qualities of an organism and can be divided into three types:

- a. physical traits such as height, eye color or hair color
- b. behavioral traits such as protective instincts
- c. predisposition to a medical condition such as cancer, heart disease, sickle cell anemia, or diabetes. The same trait can be shared by many organisms yet it is the combination of traits that makes every individual unique.”

- Go outside and find 3 inherited traits and 3 learned/acquired traits, in nature.
- Now, investigate some inherited traits that may or may not be shared by your family members by playing, “Family Traits Trivia!” from the Genetic Science Learning Center.
 - Invite your family to sit in a circle. Hold up one game card at a time to show the picture of a trait.
 - All family members that have this trait should stand or raise their hand.
 - Continue with each game card to find similarities and differences among family members.
 - » Did you have a trait in common with a parent?
 - » Did you have a trait that a parent does not have?
 - » Did each person in your family have a different combination of the traits described?

Once the group is familiar with all of the inherited traits described in this activity, try this second activity!

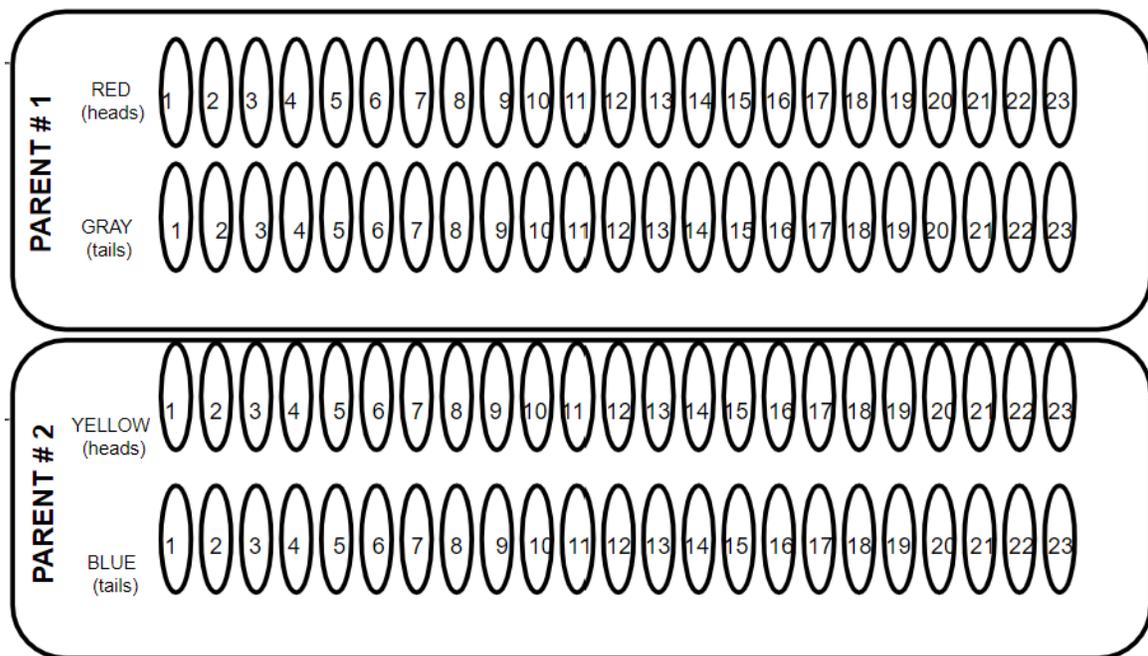
- Shuffle the game cards and place the deck face down. Invite your family to stand up and form a circle. Draw a card and hold it up to display the picture of the trait.
- All family members who have this trait should stay standing. Those who do not have the trait should sit down. Once a person sits down, they should not get up again. Continue with each game card until only one person is left standing.
 - » How many cards did it take to find one person with a unique combination of traits?
 - Shuffle the cards and play again as many times as you would like.
 - Family Traits Activity Sheet
- Have students read the following:

“Not all inherited traits are easily observed. Other unseen traits also contribute to unique individuals, for example: blood types or the way information is processed in the brain. Human traits and diversity result from the differences in a mere .1 of genetic material. It is amazing that 99.9% of the genes governing the many traits of the human organism are identical, yet that small percentage, .1 is what makes every human unique. Genes are tightly packed and stored in chromosomes within the nucleus of eukaryotic cells. When the process of heredity occurs asexually from a single parent, the offspring receive an exact duplicate of the parents genetic material. When the process of heredity occurs from the sexual reproduction of two parents, the offspring receives half of the genetic material from the mother and half from the father. Chromosomes are found in pairs in eukaryotes, and are different in number for various organisms. For example: humans have 23 pairs of chromosomes (46 in total), carp fish have 52 pairs (104 in total) and broad beans have 6 pairs (12 in total). This means that humans pass 23 individual chromosomes from one parent (mother) and 23 individual chromosomes from the second parent (father) to form the 23 pairs of chromosomes in the offspring. The result is an offspring that shares some traits from each parent, but are not identical to either parent. The exact chromosome a parent passes on to form a pair in an offspring is random, yet each pair must receive one from the mother and one from the father.”

In this next activity students will investigate how traits are inherited by passing the gene containing chromosomes from one generation to the next.

- Color one set of the 23 paired chromosomes from parent #1 red.
- Color the second set of the 23 paired chromosomes from parent #1 gray.

- Color one set of the 23 paired chromosomes from parent #2 yellow.
- Color the second set of the 23 paired chromosomes from parent #2 blue.
- Produce an offspring from parent #1 and parent #2. Obtain 2 pennies, 1 to represent each parent.
- Toss the parent #1 penny. If it is heads color the first chromosome red on the top line of Offspring A. If it is tails, color the first chromosome gray on the top line of Offspring A.
- Next, toss the parent #2 penny. If it is heads, color the first chromosome yellow on the bottom line of Offspring A. If it is tails, color the first chromosome blue on the bottom line of Offspring A.
- Continue with the same process for the remaining 22 pairs of chromosomes to provide Offspring A with a complete set of 23 pairs of chromosomes, one from parent #1 and one from parent #2.
- Next produce a second offspring (a brother or sister) from parent #1 and parent #2. Repeat the entire process to produce Offspring B with random chromosomes by using the coin toss method. Remember the individual chromosome the parent passes from the pair is random but the offspring must receive one from each parent, #1 and #2.



Closure:

Ask students the following questions:

-Do either of the offspring have identical genetic material as compared to parent #1 or parent #2? *No*

-Is the genetic material of offspring A identical to offspring B? *No*

-Why would offspring A have different traits than offspring B if they both have the same parents? *An offspring shares some traits from each parent but is not identical to either parent. The exact chromosome that a parent passes on to form a pair in an offspring is random, yet each pair must receive one from the mother and one from the father. Because the exact chromosome that a parent passes on is random, it makes each resulting offspring unique.*

Extension:

Watch & Play-[TED ED: Understanding Genetics](#)

Explore- [What are DNA and Genes?](#)

Outdoor Science! 6-8



Outdoor Science! Week 1

Day 5: Investigating Natural Selection

Teacher/Parent Background:

- In this activity, students will match physical or behavioral traits to how the trait provides a survival advantage. Then, students will use a PhET Simulation to observe the effect of adaptations on a bunny population.

Related Standards:

- Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time.

Key Terms:

Fitness

Mutation

Generation

Materials List:

- Computer
- Paper
- Pen/Pencil

Activity Description:

Use prior knowledge to practice matching how a trait can provide a survival advantage.

- First, go outside and identify traits in plants or animals you see that help the organism survive and list 6 traits with matching survival advantages.
- Choose one of the six traits you listed above and it's corresponding survival advantage to complete the chart below:

<ul style="list-style-type: none"> Choose a trait from your list 	Write the trait here:
<ul style="list-style-type: none"> Find the corresponding survival advantage 	Write the survival advantage here:
<ul style="list-style-type: none"> Think of one specific example organism that has that trait 	Write the organism name here:
<ul style="list-style-type: none"> Describe how your example relied on that trait to help it survive. 	Write details here:

In our next activity students will understand how adaptations help organisms survive by interpreting line graphs of the population of a species over time.

- Have students access the [Natural Selection PhET simulation](#) and then simply explore the simulation.
- Students will complete the [worksheet](#) that gives them instructions on how to run the PhET simulation.

Closure:

Ask the students the following questions:

-If you were a scientist, when would a computer simulation be useful? *Answers will vary. To predict trends that can help people make decisions. To see predicted results of processes that would normally take a long time to occur.*

-Why do you think scientists study adaptations/natural selection/mutations? *Answers will vary. To develop new, innovative products inspired by adaptations found in nature. To better understand evolutionary changes that develop over millions of years and how new species come into existence.*

Extension:

Outdoor Science! 6-8



Watch & Play- [Crash Course for Kids: Living Things Change](#)

Read- [Natural Selection](#)

Explore- [Canine Similarities and Differences](#)