

Organisms and Their Environment

4-2 Students will demonstrate an understanding of the characteristics and patterns of behavior that allow organisms to survive in their own distinct environments. (Life Science)

4-2.1 Classify organisms into major groups (including plants or animals, flowering or nonflowering plants, and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.

Taxonomy level: 2.3-B Understand Conceptual Knowledge

Previous/Future knowledge: This is the first time students have been introduced to the concept of vertebrates and invertebrates. In 2nd grade (2-2.2), students were introduced to the characteristics of mammals, birds, amphibians, reptiles, fish, and insects. Students will study in further detail the invertebrates in 6th grade (6-3.1).

It is essential for students to know that many organisms can be classified into two major groups—plants or animals—based on their physical characteristics.

- Plants can further be divided into flowering or nonflowering plants.
- Animals can be divided into vertebrates and invertebrates.
- Vertebrates can further be divided into fish, amphibians, reptiles, birds, and mammals.

Plants are organisms that are made of many parts and are capable of making their own food. Many different types of plants have been identified. Some plants produce flowers while other plants do not produce flowers.

Flowering plant

- Flowering plants are those plants that make seeds within flowers.
- Some flowers become the fruits that contain seeds.
- Examples are grasses, roses, oak trees, fruit trees, tomatoes, or bean plants.

Nonflowering plants

- Nonflowering plants are those plants that make seeds within cones or produce spores instead of seeds.
- Some examples of nonflowering plants are pines, spruce, or cedar trees that produce cones, and ferns, mosses, and lichens that produce spores.

Animals are organisms that can be made of many parts but cannot make their own food. They must get energy from eating plants or other animals. Animals are classified according to whether or not they have a backbone.

Vertebrates

- Animals with backbones.
- Vertebrates share other physical characteristics, for example, a protective skin covering, an inside skeleton, muscles, blood that circulates through blood vessels, lungs or gills for breathing.

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- Vertebrates are divided into five groups based on physical characteristics:
 - *Fish* breathe with gills; (most) have scales and fins; most lay eggs; have a body temperature that changes with its environment
 - *Amphibians* spend the first part of their life they breathe with gills in water, and the adults breathe with lungs on land; have smooth, moist skin; most lay eggs; have a body temperature that changes with its environment
 - *Reptiles* breathe with lungs; have scales or plates; most lay eggs; have a body temperature that changes with its environment
 - *Birds* breathe with lungs; have feathers, a beak, two wings, and two feet; lay eggs; have a constant body temperature
 - *Mammals* breathe with lungs; have fur or hair; can nurse their young with milk; usually give birth to live offspring; have a constant body temperature

Invertebrates

- Animals without backbones.
- Some have a hard outer covering or a shell, for example insects, crabs, or clams.
- Others do not have a hard outer covering or a shell, for example jellyfish or worms.
- Other examples of invertebrates are spiders, shrimp, crayfish, sponges, sea stars, or snails.

It is not essential for students to know the scientific classification system or the difference between plant and animal cells. Students do not need to classify invertebrates into specific groups (for example, mollusks, arthropods, or arachnids). They do not need to identify the parts of flowering plants.

Assessment Guidelines:

The objective of this indicator is to *classify* organisms according to their physical characteristics; therefore, the primary focus of assessment should be to determine the major group an organism is in based on the description. However, appropriate assessments should also require students to *recognize* organisms of each of the major groups; *summarize* the physical characteristics of the major groups of plants and animals; *compare* the characteristics of the groups of vertebrates; *exemplify* vertebrate and invertebrate animals, and flowering and nonflowering plants; or *illustrate* the major groups using pictures or words.

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4-2 Students will demonstrate an understanding of the characteristics and patterns of behavior that allow organisms to survive in their own distinct environments. (Life Science)

4-2.2 Explain how the characteristics of distinct environments (including swamps, rivers and streams, tropical rain forests, deserts, and the polar regions) influence the variety of organisms in each.

Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/Future knowledge: Students have previously studied environments in 1st grade (1-2.5, 1-2.6) in relation to plants and in 2nd grade (2-2.3) environments in relation to animals. In 5th grade (5-2.3) students will study ecosystems including estuaries/salt marshes, oceans, lakes and ponds, forests and grasslands.

It is essential for students to know that the characteristics of a *distinct environment* (the surroundings where an organism lives) influences the organisms found there. Examples of distinct environments include:

Swamps

- Located in areas with warm temperatures.
- Because swamps have thick plant growth such as ferns and reeds, small bushes and small trees do not thrive due to lack of sunlight.
- The surviving trees are very tall, reaching for sunlight. Standing water causes the trunks of the trees to spread out to provide support.
- An example of a tree found in the swamp, the cypress has “knees”, or roots that come to the surface for oxygen.
- The animals that live in the swamp are very adapted to a water environment, for example alligators, turtles, ducks, frogs, and egrets.

Rivers and streams

- Moving bodies of water that can be found in warm or cold areas.
- They can be fast or slow moving water.
- The speed of the water flow determines the types of plants and animals that live in them or use them.
- There are many plants (bushes and trees) along the banks as well as water plants.
- Many animals (for example fish, crayfish, snakes, and insects) use these plants for food or shelter.

Tropical Rainforests

- Are very humid and warm and have an abundance of rain that leads to lush plant growth (for example, tall trees, vines, ferns, orchids, and other colorful flowering plants).
- Animals that live in the rainforest are often very colorful, to match the variety of plants.
- Many animals are also tree dwellers (for example birds and monkeys), moving across the tree canopy, rather than traveling on the ground.

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Deserts

- Are dry with extreme temperature ranges.
- Some deserts are covered with sand.
- During the day it is very hot, whereas the nights are very cold.
- Most of the plants (for example cacti), and animals (for example lizards, scorpions, and jackrabbits) have ways to conserve moisture, are able to go long periods without water, or can withstand the extreme temperature changes.

Polar Regions

- Are very cold and the amount of daylight varies greatly throughout the year.
- Winters are mostly dark with only moon and starlight, whereas in the summers, there is up to 24 hours of daylight.
- There is little variety of plant life (for example, small plants, lichens, and mosses).
- Animals that live in the polar region (for example reindeer, seals, polar bears, arctic foxes, and penguins) are adapted to these conditions by having extra fat or thick fur for insulation.
- Polar regions include the tundra, arctic and Antarctic areas.

Summary of Characteristics of Distinct Environments					
	Swamps	Rivers and Streams	Tropical rainforests	Deserts	Polar regions
Temperature	Warm-hot	Varies	Hot	Hot-cold	Cold
Water	Abundant	Water environment	Humid	Dry	Dry/ Frozen
Plant life (examples)	Cypress trees, Ferns, Water lilies	Bushes/Trees on banks, Water plants	Abundant Trees, vines, Lush growth	Scarce Cactus	Mostly Lichens, mosses
Animal life (examples)	Alligators Water birds Turtles	Fish, Crayfish Snakes Insects	Birds, Frogs, Monkeys	Lizards, Scorpions, Rabbits	Seals Polar bears Penguins

It is not essential for students to know distinct climate characteristics about biomes or characteristics about estuaries/salt marshes, oceans, lakes and ponds, forests and grasslands (5th grade).

Assessment Guidelines:

The objective of this indicator is to *explain* how the characteristics of environments affect the variety of organisms; therefore, the primary focus of assessment should be to construct a cause-and-effect model of the distinct environmental characteristics (temperature and water) influencing organisms found there. However, appropriate assessments should also require students to *recall* characteristics of the distinct environments listed in the indicator; *summarize* characteristics of and life found in the distinct environments listed in the indicator; or *match* or *illustrate* typical plants or animals with their distinct environment.

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4-2.3 Explain how humans and other animals use their senses and sensory organs to detect signals from the environment and how their behaviors are influenced by these signals.

Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/Future knowledge: In kindergarten (K-3.2), students identified the functions of the sensory organs (including eyes, nose, ears, tongue, and skin). In 6th grade (6-3), students will further develop the concept of animal behaviors responding to their environments. In 7th grade (7-3), students will study the human body systems.

It is essential for students to know that animals, including humans, have sensory organs that allow them to detect changes in their environments. After these changes are detected, the organism responds with certain behaviors. A *behavior* is a response to a change in the environment.

Senses tell animals what they need to know about their environment.

- *Sensory organs* are any part of the body that receives signals from the environment.
- They help to keep them out of danger and enable them to find food and shelter.

Many animals have the same type of sense organs as humans. In some cases, animals do not have all the sense organs that humans have.

Sensory Organs and Related Behaviors			
Senses	Signals Detected	Examples of Sensory Organs in Humans and Other Animals	Examples of Behaviors of Humans and Other Animals
Sight	Detects colors, shapes, sizes, space/distance, light, movement	Humans have eyes; Other animals' eyes may differ in type, number, and in location on the body	Locate food or shelter; recognize objects or other organisms
Hearing	Receives vibrations, detects sound	Humans have ears; Other animals' hearing organs differ in type and in location on the body	Locate food; sense danger to escape enemies; communication
Taste	Detect flavors; humans detect salty, sweet, bitter, and/or sour tastes	Humans have taste buds on tongues; Other animals' taste organs differ in type and in location on the body	Judge which foods are okay to eat
Smell	Detects odors	Humans have a nose; Other animals' smelling organs differ in type and in location on the body	Avoid danger; find food; recognize other organisms

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Touch	Detects shapes, size, temperature, texture, pain, vibrations, pressure	Humans have a skin; Other animals' touching organs differ in type and in location on the body	Identify food; react to dangerous situations; care for each other
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In general, every animal has the senses it needs for its own environment and way of life. However, some animals need different information about the world to survive. They have senses that are very different from humans. For example:

- echolocation in bats,
- night vision of some snakes,
- electric senses of rays and sharks,
- magnetic senses of migratory birds, butterflies, and some whales.

It is not essential for students to know the anatomy of the structures of the five sensory organs in humans or the functioning of the central nervous system.

Assessment Guidelines:

The objective of this indicator is to *explain* the effects sensory organs play in influencing an animal's behavior; therefore, the primary focus of assessment should be to construct a cause-and-effect model of the various ways that sensory organs detect signals in the environment resulting in behavioral responses. However, appropriate assessments should also require students to *recall* types and functions of sensory organs of humans and other animals; or *exemplify* the ways that an animal's senses affects the animal's behavior.

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4-2.4 Distinguish between the characteristics of an organism that are inherited and those that are acquired over time.

Taxonomy level: 4.1-B Analyze Conceptual Knowledge

Previous/Future knowledge: In kindergarten (K-2.3), students learned that animals and plants look like their parents. In 3rd grade (3-2.2), students explained how physical and behavioral adaptations allow an organism to survive. Students have not previously identified characteristics as inherited or learned over time. This concept will be further developed in 6th grade when students explain how plants respond to external stimuli (dormancy and tropisms) (6-2.8) and compare learned and inherited behaviors in animals (6-3.7). In 7th grade (7-2.7), students will distinguish between inherited traits and those acquired from environmental factors.

It is essential for students to know that some characteristics that organisms have are *inherited* (come from their parents) and some can be acquired over the lifetime of that organism. These characteristics may be physical or behavioral.

Physical Characteristics

Some physical characteristics of organisms are passed from parents to their offspring (*inherited*).

- Some examples of animal characteristics may be type and color of body coloring, type and shape of sensory organ, or body structure.
- Some examples of plant characteristics may be type of leaf, color of flowers, or type of fruit.

Some physical characteristics of organisms change over the life of the organism.

- Some examples of animal characteristics may be weight, hair length, or changes due to injury.
- Some examples of plant characteristics may be number of leaves, length of roots, or amount of branching.

Behavioral Characteristics

A *behavior* is a response to a change in the environment. Both plants and animals respond to their environment.

Plants respond to light, water, gravity, and touch. Some examples of ways in which plants respond to their environment may be:

- Their roots grow down, while stems grow up.
- Vines will grow up a support; or some leaves close up when touched.
- Leaves grow toward the light.

Animals are born with certain behaviors that allow them to survive. In animals, these behaviors are called *instincts*. Some examples of animal instincts may be

- A duck knowing how to swim across the lake without being taught.
- Different birds build different types of nests without being taught how.
- Migration and hibernation are also instincts.

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Animals can also acquire behavioral characteristics as they grow and develop. These characteristics are usually in response to environmental conditions and are a result of learning.

- *Learning* is a change of behavior resulting from specific experiences.
- Unlike instinctive behaviors, learned behaviors are shaped by experience.
- Some examples of learned behaviors may be:
 - A dog can learn to roll over on command.
 - A baby bird is taught to fly by its parent.
 - A bear learns to fish for food.

It is not essential for students to summarize how these behaviors influence the survival of an organism. Students do not need to identify specific tropisms or dormancy in plants.

Assessment Guidelines:

The objective of this indicator is to *distinguish* between inherited characteristics and those that are acquired over the organism's lifetime; therefore, the primary focus of assessment should be to decide from the presented material which characteristics, physical and/or behavioral are inherited and which are acquired or learned. However, appropriate assessments should also require students to *infer* a type of characteristic, physical or behavioral, from presented information; *exemplify* inherited and acquired physical or behavioral characteristics; or *identify* the physical or behavioral characteristic as inherited and acquired based on its description.

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4-2 Students will demonstrate an understanding of the characteristics and patterns of behavior that allow organisms to survive in their own distinct environments. (Life Science)

4-2.5 Explain how an organism's patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food, and other resources, and the physical characteristics of the environment).

Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/Future knowledge: In 3rd grade (3-2.2), students learned how behavioral adaptations helped organisms survive in their environments. In 6th grade (6-3.5), students will study specific animal behaviors (including hibernation, migration, defense, and courtship).

It is essential for students to know that in order to survive within an ecosystem, plants, and animals act in distinctive ways called *behaviors*.

- For example, how animals eat, sleep, and communicate; or how plants reproduce or get what they need to make their food are all behaviors.
- Patterns of behavior are related to an organism's environment.
- Changes in the environment, like those caused by climate or pollution, can lead to changes in the behavior of living things.

Within a specific environment, an organism's pattern of behavior is related to:

- other organisms that are present,
- the availability of food and other resources, or
- the physical characteristics present.

Some examples of these patterns of behaviors are:

- Organisms may compete for space, food, or resources if too many organisms are within the same environment and need the same resources.
- The number of organisms in an environment will increase or decrease depending on the availability of food and other resources.
 - Eating behaviors of some animals may change depending on the type of food available.
 - As some tall trees are cut, smaller plants can grow as the sunlight becomes available.
- The temperature, amount of rainfall, and the vegetation in an environment can affect how an organism reacts to its environment.
 - Animals may hibernate when the temperature becomes too cold and food becomes scarce.
 - Seeds will not germinate if the proper amount of rainfall or temperature is not available.

Organisms must seek the environment that fits their structure and lifestyle. Organisms may change their behavior because of what happened in the environment around them. When the environment changes, some plants and animals survive and others die or move to new locations.

It is not essential for students to study specific animal behaviors (including defense and courtship).

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Assessment Guidelines:

The objective of this indicator is to *explain* how patterns of behavior are related to its environment; therefore, the primary focus of assessment should be to construct a cause-and-effect model of the various ways that patterns of behavior are affected by kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment. However, appropriate assessments should also require students to *recall* environmental factors that affect the organisms; *exemplify* ways that the environment affects animal behavior; *compare* patterns of behaviors due to various causes; or *summarize* patterns of behaviors that are in response to environmental factors.

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4-2.6 Explain how organisms cause changes in their environment.

Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/Future knowledge: Students have previously studied the ways environments influence plants (1-2.5, 1-2.6) and animals (2-2.6), but this is the first time that students explain how the organism causes changes to its environment. In 7th grade (7-4.3), students will explain the interaction among changes in the environment due to natural hazards, changes in populations, and limiting factors.

It is essential for students to know that all organisms cause changes in the environment where they live. Some of these changes are harmful to the organism or other organisms, while other changes are helpful to the organism or other organisms.

- Humans depend on their environments. Humans change environments in ways that can be either harmful or helpful for themselves and other organisms. Some examples of human behaviors that change environments may be:
 - polluting the air, but working to cut down emissions from cars and factories;
 - dumping toxic substances into waterways, but cleaning the water before factories put it back into the rivers, or creating river “greenways” where people and animals can enjoy the natural river surroundings.
 - cutting down trees to use the logs for building homes, but replacing the cut trees by planting new trees.
- Other organisms also impact the environments. Some of these changes can be harmful and some can be helpful. Some examples of how other organisms can change the environment may be:
 - herd animals might overgraze land leading to erosion, but they can also fertilize the fields on which they graze and new plants can grow;
 - beavers build dams which block the flow of water; but create pond environments in which new plants and animals can survive;
 - kudzu, a plant that was introduced from another environment, has overgrown many other plants and trees in their environment; but it can be used for food or other resources.

It is not essential for students to know about the effects of global warming or acid rain.

Assessment Guidelines:

The objective of this indicator is to *explain* how organisms cause changes in their environments; therefore, the primary focus of assessment should be to construct a cause-and-effect model of the various ways that an environment is affected by organisms. However, appropriate assessments should also require students to *exemplify* ways that behaviors affect environments; or *compare* harmful and helpful ways organisms impact the environment.