

A photograph of a desert landscape. In the foreground, a large, gnarled, and leafless tree stands on a sand dune. The background features rolling sand dunes under a clear blue sky with some light clouds. The overall scene is arid and desolate.

# Habitat, Soil and Plant Adaptations

*Exploring soil's role in ecosystems*

*Grades 2-3*

*Vetted by Riverside County Office of Education-STEM*

UCCE Master Gardener Program of Riverside County

# Master Gardeners

The University of California Cooperative Extension (UCCE) Master Gardener Program (MGP) is an educational program designed to teach and effectively extend information to address home gardening and non-commercial horticulture needs in California.

UCCE is the outreach arm of UC's division of Agriculture and Natural Resources (ANR). Master Gardener volunteers (MG volunteers) promote the application of basic environmentally appropriate horticultural practices through UCCE-organized educational programs that transfer research-based knowledge and information.



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## *For Teachers*

The anchor phenomena introduces students to a variety of habitats. For the initial and revised model development activities, students will focus on one land habitat.

Consider breaking students into small groups and assigning each group a land habitat, and/or allowing each student to select the habitat of their choice.

Throughout the rest of the lesson, which can be broken over several days, students will apply the lens of their habitat to what they are learning about soil and plant adaptations.



## Learning Goals

### **Students will learn:**

- soil changes overtime within a habitat;
- and in order to survive, plants must adapt to the new growing conditions.

# Anchor Phenomena: Habitats



**Habitats Song**



# Develop a Model To Describe the Phenomena

**Pick a land habitat. Draw a diagram showing the relationship between soil and plants in the habitat. Include both observable and unobservable details.**

- Label all important parts of the diagrams.
- Use arrows to show how all parts interact.
- Write an explanation describing the relationship between the soil and plants in the habitat.

# What is a habitat?

**A habitat is a location where living things, called organisms, make their home.**

**A habitat provides food, water, shelter and space that an organism needs to survive.**

- For an animal, that means everything it needs to find and gather food, select a mate, and successfully reproduce.
  - For a plant, that means everything it needs to grow, receive nutrients, and produce seeds or spores.
- ***Compare two of these habitats. How are they alike? How are they different?***



# What is soil?

**Soil is the result of rocks breaking down over a very long period of time into smaller particles.**

- Most soils are a mix of sand, silt and clay particles.
- The mix of the particles depends on where the rocks, called the **parent rocks**, were originally formed. So, different locations have different soils.
- Overtime, the soil can change due to weather, climate and movement of land.

- *How does the soil look like the parent rock outcropping above it?*
- *How does it look different?*
- *What type of habitat do you think this could be?*






# What causes soil to change overtime?

- **Land movement:** Land movement can be caused by falling rocks, flooding rivers, and earthquakes.
  - **Weather:** Daily weather can affect soil. Rain can wash soil away. Wind can blow soil away. Sunshine and heat can dry out soil particles.
  - **Climate:** Climate is weather over a long period of time. Climate can become hotter or colder; wetter or drier.
- ***Which of these factors do you think could affect soil the most? Explain why.***

River Erosion, Akutan River, Alaska Slide 1 of 6



Media Credits

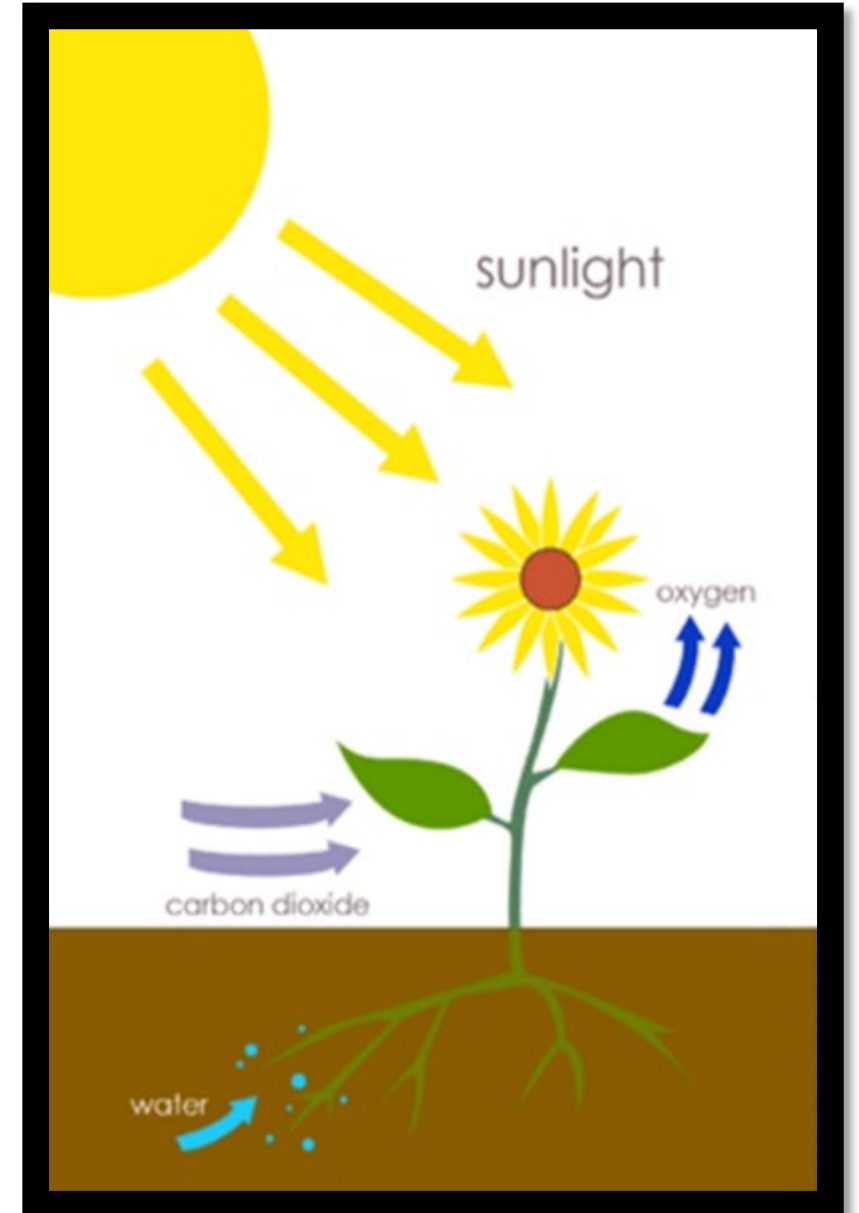
- Watch this [slide show](#) on factors that can change soil overtime. What is an example of fast change and what is an example of a slower change?

# What is a plant?

**A plant is a living thing. There are three basic parts to most plants.**

- **Leaves** capture energy from sunlight and carbon dioxide from the air. The leaves release oxygen into the air.
- The **stem** is the main structure that supports leaves and moves food and water around the plant. Plants often store food in their stems.
- The **roots** of a plant usually grow underground. Roots help to keep the plant from falling over and gather water and minerals from the soil. Some plants store food in their roots.

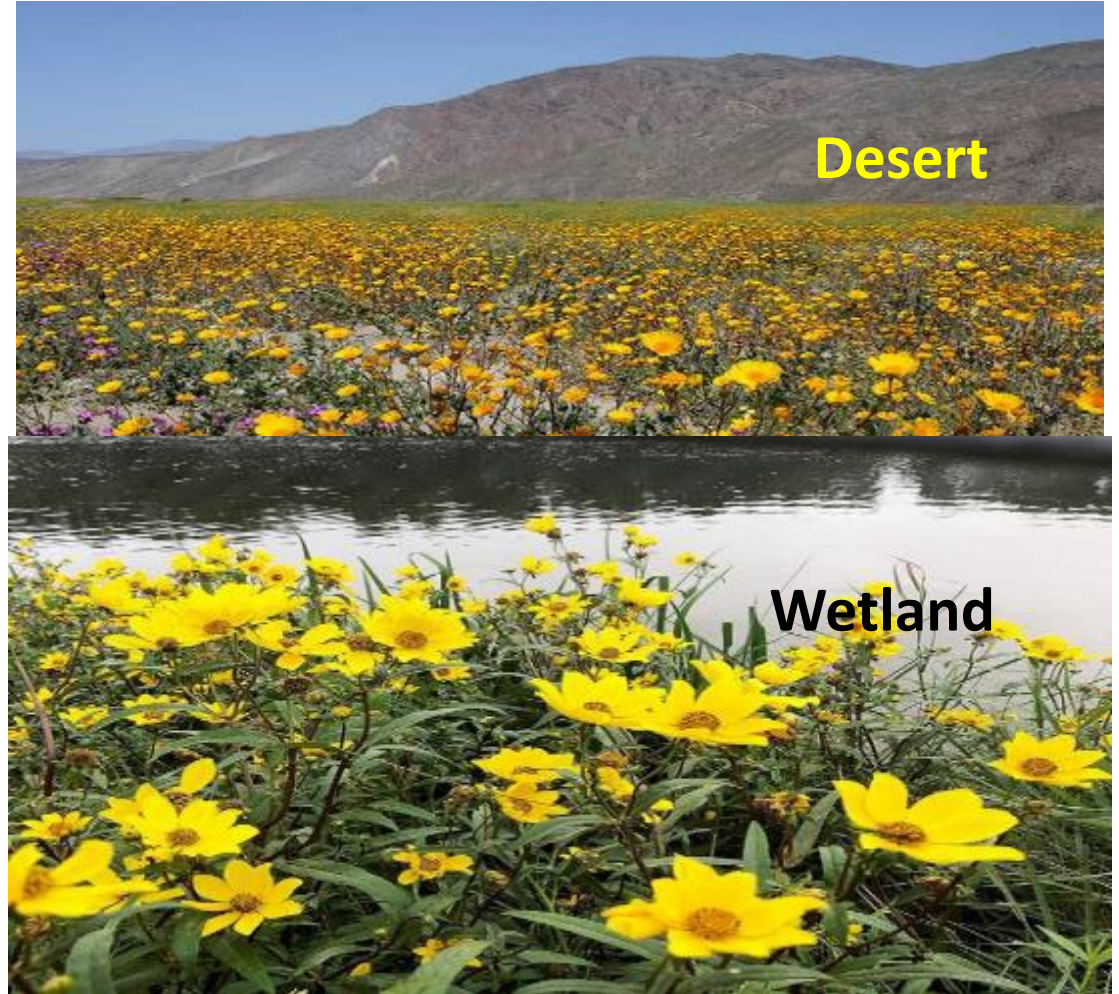
➤ ***Do you think a sunflower could live in more than one type of habitat?***



# Why are there so many types of plants?

Scientists have found that there are about 435,000 unique land plant *species* (types of plants) on Earth!

- In order to survive plants must *adapt* to the growing conditions of the habitat.
- **Adapt** means to make changes in order to survive.
- There are 52 species of sunflowers. Sunflowers have adapted to the growing conditions of the desert, grassland and wetland habitats.



## What kind of soil is in a Desert habitat?

- Desert habitats can be hot or cold, but what they all have in common is very little rainfall.
- Most desert soils are called **aridisols** which means dry soil. The soil of the desert is primarily sand particles which do not retain moisture.



## How do plants adapt to this habitat?

**When it does rain, seeds sprout and quickly form desert blooms.**

**Plants have developed adaptations to living without moisture for long periods of time.**

- **Cacti**, which are succulents, have thick stems that can store water.
- Shallow roots spread out further to quickly capture rainfall on fast draining, sandy soil; or very deep tap roots to reach water far underground.
- Smaller leaves that are thick and waxy to reduce moisture loss.
- Spines that provide both shade and protection from animals.

# What kind of soil is at the South Polar Cap?

- Deserts are defined as being very dry. Not all of them are hot or sandy. The Antarctic continent is considered a dry, **polar desert!**
- Antarctic soil is frozen like northern arctic soil. But it is also extremely dry like soils in the hottest deserts.
- This makes the soil, called **Gelisol**, some of the most unusual in the world. The only organic soils found are in penguin colonies where their droppings mix with the soil.



**Lichens growing in Antarctica**

# How do plants adapt to this habitat?

**There are about 800 species of plants at the South Pole. Two of these are flowering plants and the rest are non-flowering: algae, liverworts, mosses and lichens. 350 of the species growing there are lichens.**

**Lichens are well adapted to Antarctica.**

- They can survive long periods of drought in an inactive state called dormancy.
- Snow cover provides protection from the elements. Most growth occurs when lichens are beneath a thin protective layer of snow.
- Many lichens are able to absorb water vapor from snow and ice.

## What kind of soil is in a Wetland?

- A wetland habitat is land covered by water. The water can be salty, fresh, or somewhere in between.
- The soil is called **Hydric** which means water has filled the pores between soil particles replacing air in the soil. This soil is a dull grey color.



## How do plants adapt to this habitat?

**Plants need oxygen and hydric soil has no oxygen. Wetland plants have adapted by developing:**

- Spongy tissues that form air channels inside of their stems.
- Roots that stick out of the swampy soil and supply air to the submerged roots.

**Wetland plants also need sunlight and have adapted by developing:**

- Long stems that grow above water to reach sunlight.

## What kind of soil is in a Grassland?

- Temperate grasslands have cold winters and warm summers, medium to low rainfall, and windy conditions.
- They form in areas that are too dry to be forested, but too wet to be desert.
- The *prairie grasslands* in North America have soils called **Mollisols**, which means soft. This is because of the deep, dark **fertile** layer of topsoil. This is created when the grasses die back in the winter, but their leaves and roots remain, providing a **mulch** for the soil.

## How do plants adapt to this habitat?

**Grassland plants have adapted to the amount of moisture the soil receives and winds that blow across the land. In the North American prairies:**

- Tall grasses grow in eastern prairies.
- Short grasses grow in western prairies.
- A mix of grass heights grow in central areas.



## What kind soil is in a Tropical Rainforest?

- Heavy rainfall increases flooding, soil erosion, and washes most of the nutrients out of the red soil called **Oxisols** and **Ultisols**.
- Instead, nutrition for plants to grow comes from **a thick layer of dead plants and animals laying on top of the soil. They** decay quickly in the heat and moisture.



## How do plants adapt to this habitat?

**This habitat is very warm and wet with 80 to 150+ inches of rain each year. This encourages dense growth that blocks sunlight. To adapt:**

- Some plants climb or grow on others to reach the sunlight

**To cope with so much rainwater plant adaptations include:**

- Smooth bark that water quickly slides off.
- Leaves have *drip tips* and waxy surfaces that allow water to run off easily.
- Long stilt roots to help hold up plants.



## What kind of soil is in a Temperate Deciduous Forest?

- **Deciduous** trees provide nutrition for the soil by shedding their leaves. The leaves decompose on the forest floor, and the nutrients contained in the leaves are absorbed by the soil. This makes the soil called **Afisol** very fertile.



## How do plants adapt to this habitat?

**There are four seasons with temperatures hot in the summer to below freezing in the winter. It rains from 30 to 50 inches per year. Adaptations include:**

- Wildflowers grow on the forest floor early in the spring before the trees leaf-out.
- Trees are deciduous. As weather cools, the leaves cause too much water loss and can be weighed down by too much snow, so the tree drops its leaves.
- The leaves are thin, broad, and light-weight and capture sunlight to make a lot of food for the tree in warm weather.
- Trees have thick bark to protect against cold winters.

# Check For Understanding

- What is a habitat and what does it provide?
- Name one of the land habitats.
- What is soil?
- Describe one cause for soil changing over time.
- What are the characteristics of the soil in your selected habitat?
- Pick one part of a plant and describe its function.
- What does adapt mean?
- Give an example of how a plant in your selected habitat has adapted.



# Phenomena in the Garden:

## *What kind of soil do you have in your habitat?*



Soil texture by feel

**Learn how to test the texture of soil by feel.**

- Most soils are a mixture of sand, silt and clay. Some have more sand, some more silt and some more clay.
- Loam soil is ideal for many plants grown in a garden. It is mix of sand, silt, clay **and organic matter.**

**Conduct the Soil Texture Test on your school's soil.**

- ✓ Collect samples from three different areas.
- ✓ Record your observations on the data chart.

# Texture Test Data

	<b>Location</b>	<b>Makes a Ribbon?</b>	<b>Makes a Ball?</b>	<b>Gritty or Smooth?</b>	<b>Conclusion: Soil Type</b>
<b>Sample 1</b>					
<b>Sample 2</b>					
<b>Sample 3</b>					



# Develop a Model To Describe the Phenomena

**Revise or draw a new diagram showing the relationship between soil and plants in the habitat. Include both observable and unobservable details.**

- Label all important parts of the diagrams.
- Use arrows to show how all parts interact.
- Write an explanation describing the relationship between the soil and plants in the habitat.

# Extend Your Thinking:

## *Most of us live in an Urban Habitat!*

### **What soil is in an urban habitat?**

- If you live in a city or a suburban housing development, it was once a vast habitat of plants and animals living on and in soil that developed from parent rock over a long period of time.
- People change things in order to build, farm, and grow. As a result, all urban soils are changed due to human activity.
- Most of the soils found in recently developed land are Entisols (newly formed soil), with the surface texture of fine sandy loam.

**The original soil of the urban habitat forms an important foundation for the buildings, roads and new soil (called fill) being placed on it.**

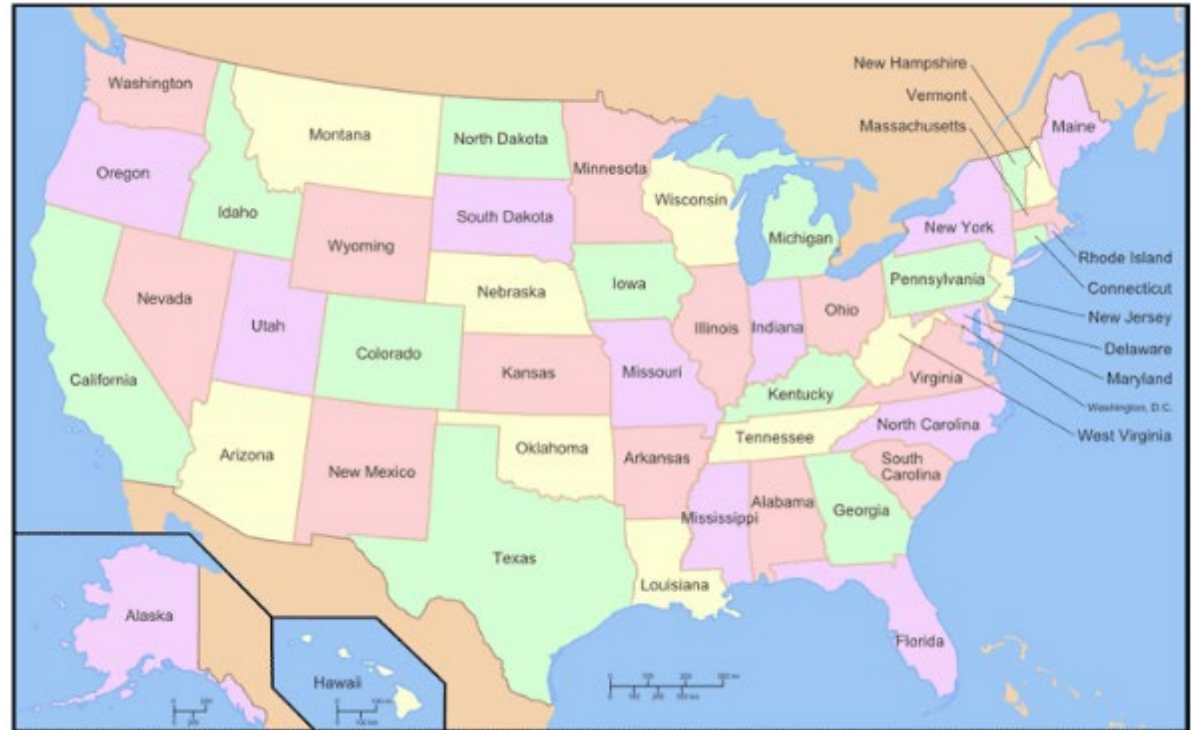


# What was the original soil of your urban habitat?

You can start by learning about the official soil of your state.

- The [State Soil Map](#) will provide you with information about your official state soil.
- The [Investigation Worksheet](#) can help you identify important information about your state soil.

*For 2<sup>nd</sup>-3<sup>rd</sup> graders this is a read aloud, guided activity led by the teacher.*



# Next Generation Science Standards- 2<sup>nd</sup> Grade

**LS2.A: Interdependent Relationships in Ecosystems:** Plants depend on water and light to grow. (2-LS2-1)

**LS4.D: Biodiversity and Humans:** There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)

**ESS2.A: Earth Materials and Systems:** Wind and water can change the shape of the land. (2- ESS2-1)

**ESS2.C: The Roles of Water in Earth's Surface Processes:** Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.  
(2- ESS2-3)

**ESS1.C: The History of Planet Earth:** Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe  
(2-ESS1-1)



# Next Generation Science Standards- 3<sup>rd</sup> Grade

**LS2.C: Ecosystem Dynamics, Functioning, and Resilience:** When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3-LS4-4)

**LS4.C: Adaptation:** For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

**LS4.D: Biodiversity and Humans:** Populations live in a variety of habitats and change in those habitats affects the organisms living there. (3-LS4-4)

# Next Generation Science Standards

## Science and Engineering Practices

- **Modeling:** Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)
- **Constructing Explanations and Designing Solutions:** Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2)

## Crosscutting Concepts

- **Structure and Function:** The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2)
- **Cause and Effect:** Cause and effect relationships are routinely identified and used to explain change. (3-LS4-2), (3-LS4-3)

# Resources

- [California Master Gardener Handbook, Second Edition 2015](#)
- [Adaptations Background Information PDF](#): Garfield Park Conservatory Alliance
- [Biomes of the World](#): Missouri Botanical Garden
- [Habitats](#): National Geographic
- [Antarctica-Plant Life](#); Encyclopedia Britannica
- [Nearly 40% of Plants Species are Very Rare](#); National Science Foundation
- [Plant Adaptations: PDF](#): Thinktrees.Org.
- [Soils and Climate](#); Megan Sindelar, November 2015: Soils.Org.
- [Soil Biomes, : Chapter 7](#); Soil Science Society of America
- [Soil Types](#): University of Illinois

# Resources

**Images:** Creative Commons, Stock Images; Kiddle; Wikipedia

**Videos:** Hopscotch; Learning Junction; PBS Learning.Org; UCDavisIPO; UC Marin County Master Gardeners

# Gardening Questions?

- Email or Call the UCCE Master Gardeners of Riverside County
- Email Helpline
  - [anrmgriverside@ucanr.edu](mailto:anrmgriverside@ucanr.edu)
- Telephone Helpline
  - 951-683-6491, ext. 232 or 231
- [Riverside Master Gardeners Website](#)



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