



Exploring the Changing Surface of Land

The Effects of Weather and Climate

UCCE Master Gardener Program of Riverside County
Vetted by Riverside County Office of Education-STEM



Why Is This Important?

...One inch of topsoil can take several hundred years or more to develop. Soil formation rates vary across the planet: the slowest rates occur in cold, dry regions (1000+ years), and the fastest rates are in hot, wet regions (several hundred years).

--Soil Science Society

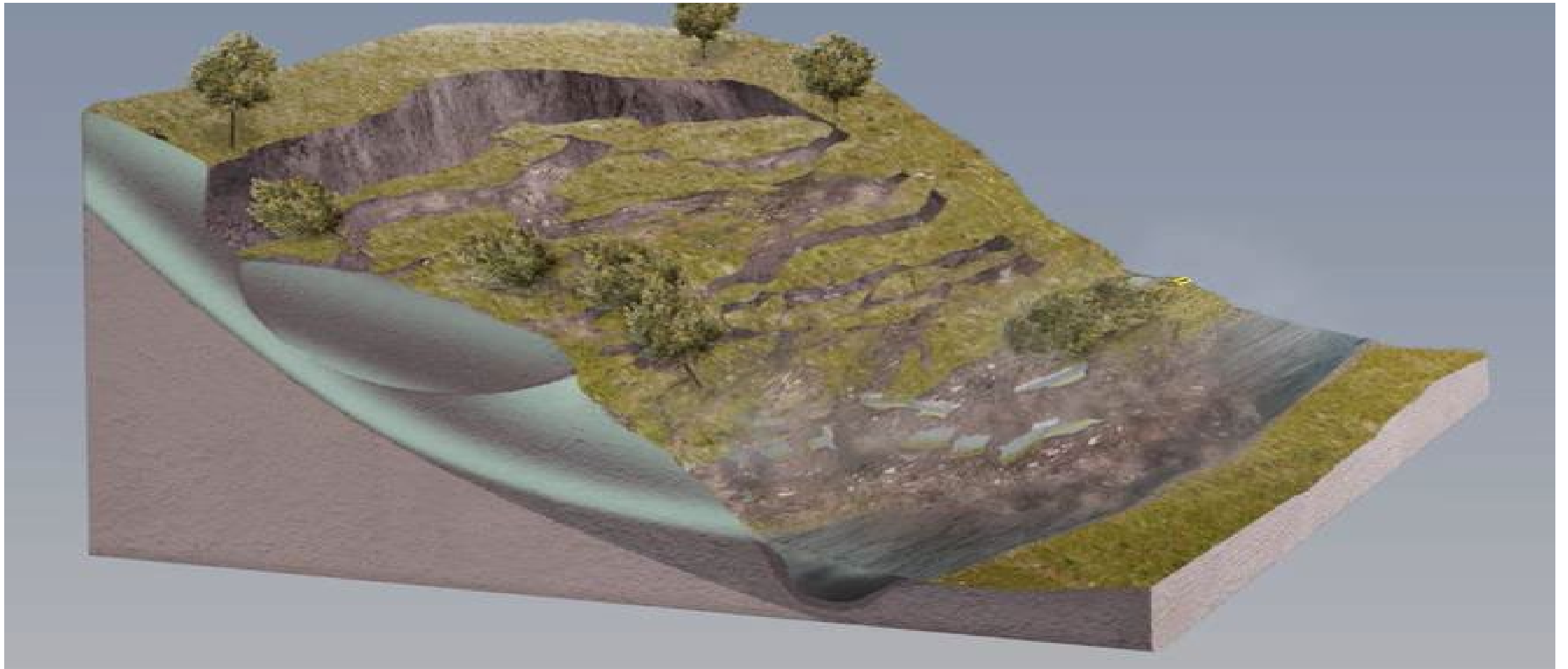


Learning Goals

Students will learn how weather and climate contribute to:

- changing the land
- forming soil

Anchor Phenomena: Landslide





Develop a Model To Describe the Phenomena

Draw a diagram showing the role of weather and climate in changing the land and forming soil. 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 how weather and climate can affect the landscape and soil.

Our Changing Land:

What Does Weather Have to Do With This?

Weather is the day to day and the hourly changes in Earth's atmosphere, which is the air around us. We observe these changes in the form of:

Water: Moisture ranging from humidity to rain to snow or ice.

Wind: From breezes to strong gales; tornadoes and hurricanes.


Temperature: Hotter or colder. Temperature has an affect on both water and wind.

What is today's weather like where you live?


How Does Water Change the Land?

Observe how water from weather can change the land.

- Read the questions under each slide, then play the short videos.
- Describe the effects of water on the land.

Water Changes Earth's Surface 

River Erosion, Akutan River, Alaska Slide 1 of 7



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How Does Wind Change the Land?

Observe how windy weather can change the land.

- Read the questions under each slide, then play the short videos.
- Describe the effects of wind on the land.

Wind Changes Earth's Surface 

Wind Blowing Sand onto Dunes Slide 1 of 4



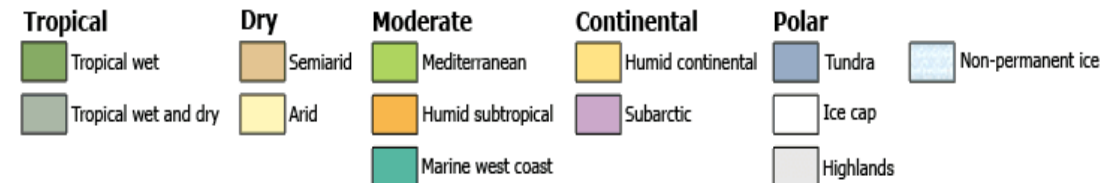
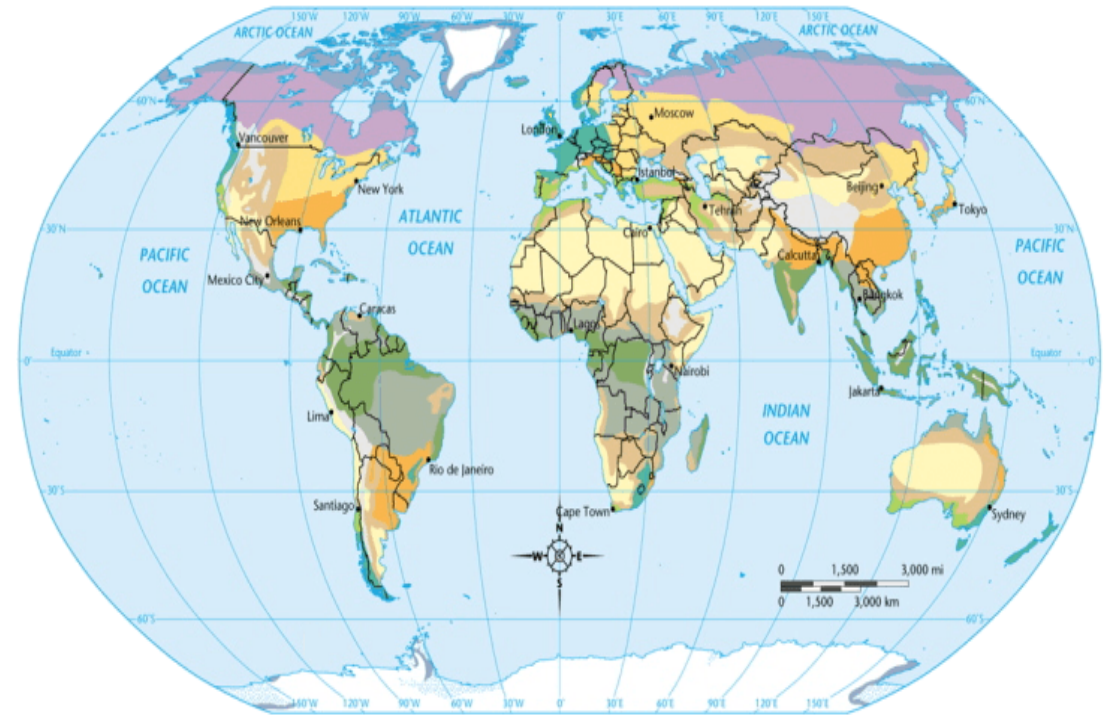
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Why Are Some Areas Wetter and/or Windier Than Other Areas? *Climate*

Climate is the term used to describe *weather in an area over a long period of time* -usually 30 or more years.

- Different locations on the planet have different climates depending on how close they are to the equator, poles, and oceans.
- Climates are usually described by how **hot or cold, and wet or dry** a location is over a long period of time.

Study this map of the climate zones. What is the climate where you live?



Quick Check For Understanding

- What is weather?
- Describe one way we observe weather.
- Describe one way water changes the land.
- Describe one way wind changes the land.
- Explain the difference between climate and weather.



Our Changing Land: *Soil Formation*

The land we walk on, the land our homes are built on, and the land plants grow in took a *very long time* to develop.

- This is because all soil begins as *rocks*. These rocks are broken down over a long period of time into smaller particles.
- The mix of the particles depends on where the rocks, called the **parent material** of soil, were originally formed.



Soil Formation:

From Rocks to Tiny Particles

Overtime, the parent material is broken down into smaller particles which form soil due to:

- **Water** which moves and wears down land formations and rocks. The freezing and warming of water in the cracks of rocks causes them to break down.
- **Wind** which blows small particles that act like sandpaper that wear down land formations and rocks.

Can you identify the effects of wind or water in this picture?



Soil Formation:

A Mix of Soil Particles

Most soils are a mix of sand, silt and clay particles.

- **Sand** is the largest particle in the soil. When you rub it, it feels rough or gritty.
- **Silt** is a soil particle whose size is between sand and clay. Silt feels smooth and powdery.
- **Clay** is the smallest of particles. Clay feels smooth when dry, and sticky when wet.



A Closer Look At Soil

Examine these pictures carefully.

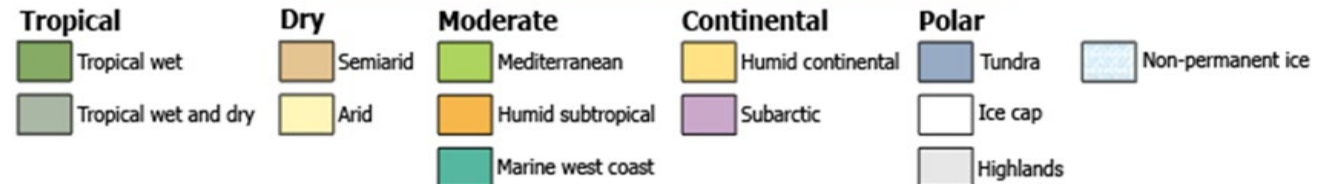
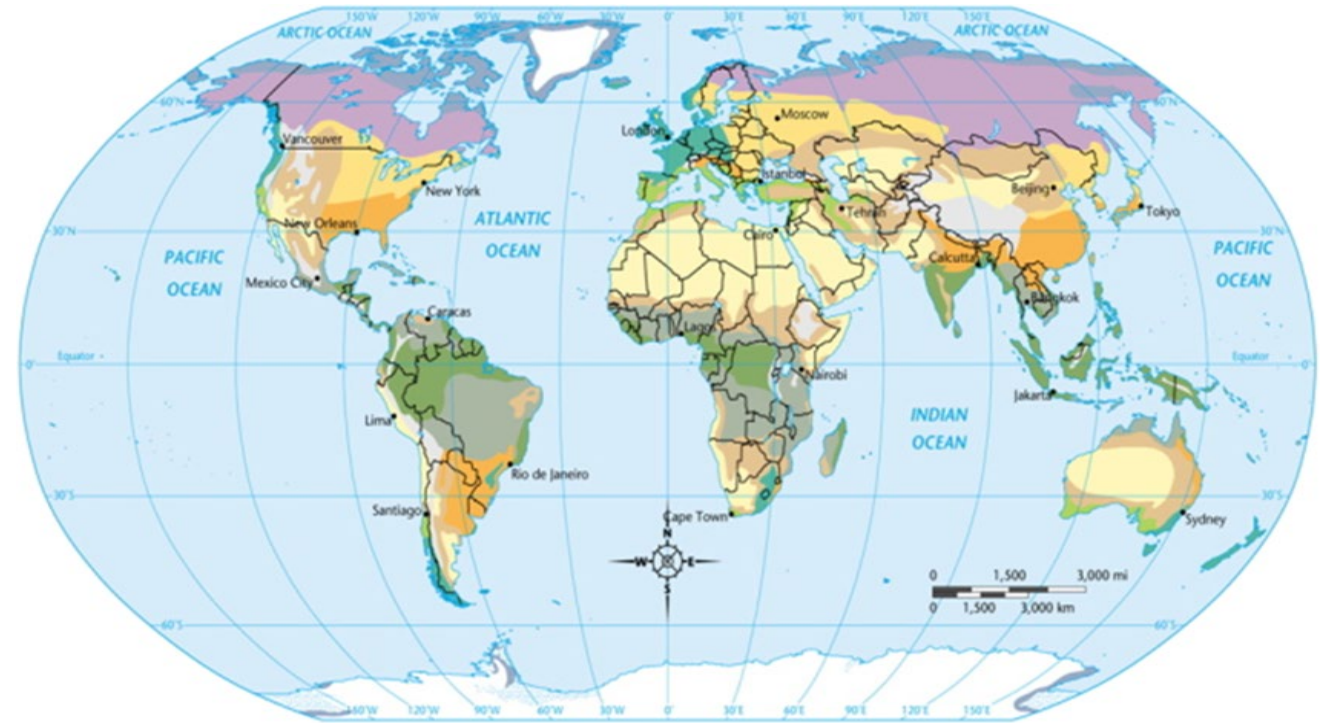
- How are the soils different?
- How are the soils the same?
- Which soil do you think has mainly sand particles?
- Which soil do you think might have the most clay particles?



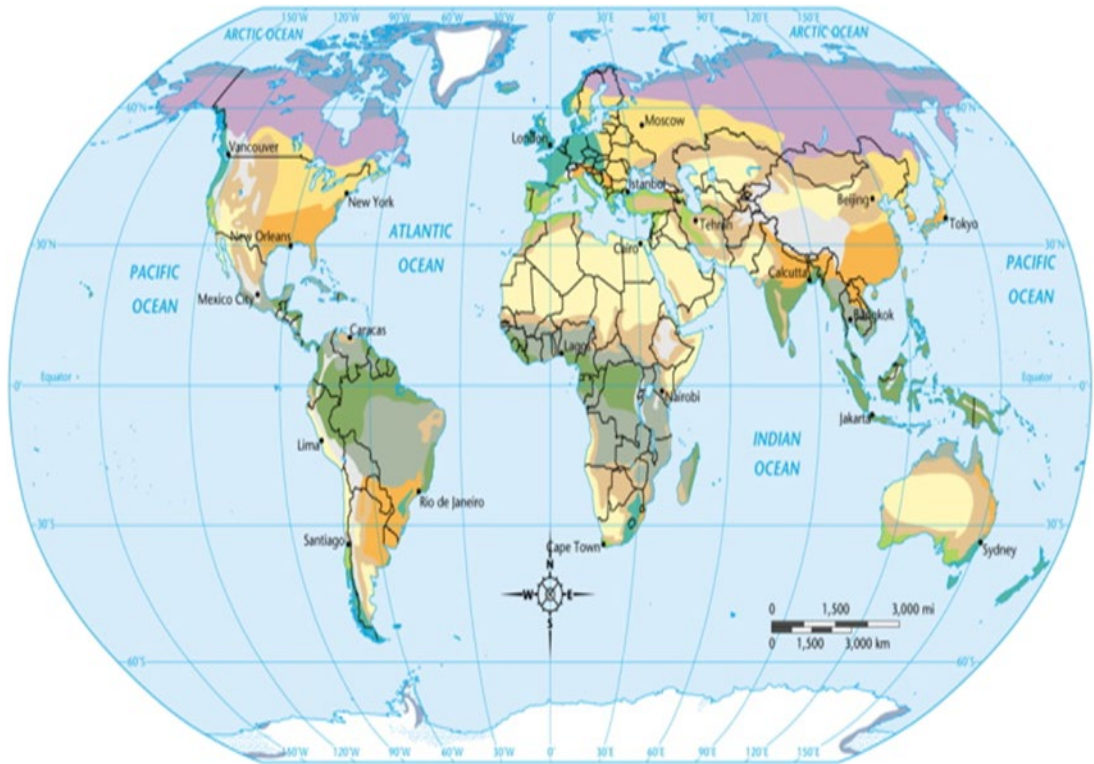
Climate's Effect on Soil Formation

Because soil takes a long period of time to develop, climate has a significant influence on that development.

- Soil takes from over 100 to a 1,000 years to develop!
- Soils in warmer or wetter climates will develop faster than soils in cooler or drier climates.



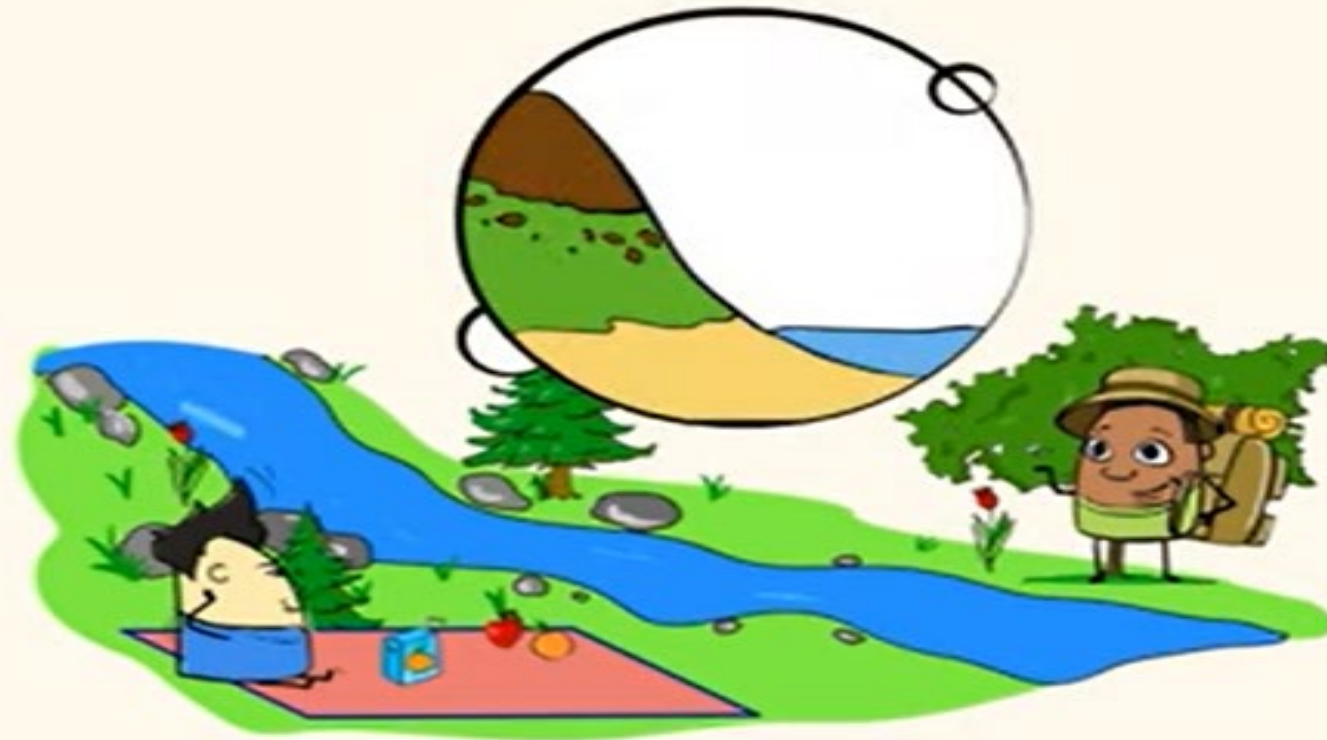
Point to Where Each of These Soils Might Be Found on Our Planet




| Tropical | | Dry | | Moderate | | Continental | | Polar | | | |
|----------|----------------------|-----|----------|----------|-------------------|-------------|-------------------|-------|---------|--|-------------------|
| | Tropical wet | | Semiarid | | Mediterranean | | Humid continental | | Tundra | | Non-permanent ice |
| | Tropical wet and dry | | Arid | | Humid subtropical | | Subarctic | | Ice cap | | Highlands |
| | | | | | Marine west coast | | | | | | |



Video: Wind and Water Whoosh



Wind and Water Whoosh: Weathering and Erosion | MightyOwl Science | 2nd Grade



Quick Check For Understanding

- What is parent material?
- How does water help form soil?
- How does wind help form soil?
- What are most soils a mix of?
- What is the largest soil particle?
- Describe the types of climates that will develop soil faster.

Phenomena in the Garden:

What kind of soil do you have?



Soil Ribbons

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** which is decaying plant material.

Conduct the Soil Texture Test using your school's soil.

- ✓ Collect samples from three different areas.
- ✓ Follow the directions in the [video](#).
- ✓ Record your observations on the data chart.

Texture Test Data

| Sample | What is the texture? <i>Gritty?</i> <i>Smooth?</i> <i>Sticky?</i> | Does not make a ribbon <i>Yes/No</i> | Makes a short ribbon <i>Yes/No</i> | Makes a long ribbon <i>Yes/No</i> | Conclusion: Soil Type <i>Sand, Silt, Clay or Loam?</i> |
|--------|--|---|---|--|--|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |



Develop a Model To Describe the Phenomena

Revise or draw a new diagram showing the role of weather and climate in changing the land and forming soil. 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 how weather and climate can affect the landscape and soil.

Extend Your Thinking: *Natural Weather Hazards*

Heavy rain and/or strong winds can affect your garden!

1. Survey your school garden

- ✓ Are there areas that flood in heavy rains?
- ✓ Do strong winds make it difficult to grow some vegetables and flowers?

2. Develop a plan to reduce the affect of either heavy winds or rain.

- ✓ Begin by watching the [Storms are Coming](#) video.
 - Preparing for strong winds begins at 1:40*
 - Preparing for heavy rain/flooding begins at 5:28*
- ✓ Develop a list of actions you can do to reduce damage from this weather hazard.



protect your garden from weather! - STORMS are coming!

Vocabulary

- Sand
- Silt
- Clay
- Weather
- Climate



Sand

Sand is the largest particle in the soil. When you rub it, it feels rough or gritty.



Silt

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Clay

Clay is the smallest of soil particles. Clay feels smooth when dry and sticky when wet.



Weather

Weather is the day to day and the hourly changes in Earth's atmosphere, which is the air around us.



Climate

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Next Generation Science Standards

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

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)

ETS1.C: Optimizing the Design Solution ▪ Because there is always more than one possible solution to a problem, it is useful to compare and test designs.(secondary to 2-ESS2-1)

ESS2.D: Weather and Climate ▪ Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)

Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)

ESS3.B: Natural Hazards ▪ A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1)

Next Generation Science Standards

Science and Engineering Practices

- **Modeling:** Develop a model to represent patterns in the natural world. (2-ESS2-2)
- **Asking Questions and Defining Problems:** Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)
- **Obtaining, Evaluating, and Communicating Information:** Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)
- **Engaging in Argument from Evidence:** Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1)

Crosscutting Concepts

- **Patterns** in the natural world can be observed. (2-ESS2-2), (2-ESS2-3)
- **Stability and Change:** Things may change slowly or rapidly. (2-ESS2-1)
- **Patterns** of change can be used to make predictions. (3-ESS2-1), (3-ESS2-2)
- **Cause and Effect** relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

Resources

- [California Master Gardener Handbook](#): Pettinger; Second Edition 2015
- [What's the Difference Between Climate and Weather?](#) Climate Kids; NASA
- [Forces of Change](#); Smithsonian Environmental Research Center
- [Frequently Asked Questions on the Topic of Soil](#): Dr. Dirt
- [How Is Soil Formed and How Many Layers Does It Have?](#) Anupriya Narsaria; January 22, 2022; Science ABC
- [Soil Basics](#): Soil Science Society of America
- [Soil Biomes, Chapter 7](#): Soil Science Society of America
- [Soil Basics](#): Science Trek
- [Soils and Climate](#); Megan Sindelar; November 2015; Soil Science Society of America
- [Soil Types](#): University of Illinois
- [Weather](#); Kids Britannica

Resources

Images: Creative Commons, John Kelley, USDA; Stock Images; Kiddle; Wikipedia

Videos: NASA; PBS Learning Media; Mighty Owl; Texas Garden Doc;

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.



University of California

Agriculture and Natural Resources

UCCE Master Gardener Program

Gardening Questions?

Email the UCCE Master Gardeners of Riverside County

- Email Helpline: anrmgriverside@ucanr.edu
- School Gardens: mgschoolgardens@gmail.com

Website Resources

- [Riverside Master Gardeners Website](#)



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