

LESSON: What? No Soil?**INSTRUCTOR:** Stephen Bunker**E-MAIL ADDRESS:** sbunker@alpine.k12.ut.us**DISTRICT:** Alpine School District**GRADE LEVEL:** 4**CORE CURRICULUM**

Science Standard 3: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 3: Observe the basic components of soil and relate the components to plant growth.

Intended Learning Outcomes:

1. Use science process and thinking skills.

Lesson Objective:

The students will be able to show how plants can help control soil erosion.

The students will be able to show how plant growth needs can be achieved without soil.

Content Connections:

Writing, Mathematics

INTRODUCTION**Soil Erosion**

Plants do a great job of holding soil in its place. Agricultural practices of contour planting, where furrows are made along the contour of a hill; terraces, or wide ridges that prevent water from running down the hill; and windbreaks, where trees are planted on the edges of farmland to reduce the amount of wind that blows soil away are all ways of using plants to hold the soil.

Background Information

In nature plants grow in soil right? Well, not all plants do. Some plants float around in oceans and ponds and grow without soil. There are even plants that grow on the sides of trees or in the crooks of branches in the rain forest.

So, what is it that plants need to grow? Plants need water, air, nutrients and structural support. Historically, plants were grown without soil in the hanging gardens of Babylon, in China as observed by Marco Polo, and by the Aztecs on floating rafts in Mexico. The word *hydroponics* comes from the Greek words *hydro* for water and *ponos* for labor.

Support for seed germination and plant support can be attained by many different methods. For our investigation we'll be using vermiculite, Sodium Polyacrylate, paper towels and peat moss.

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Discuss with the student how much they think soil is worth. Do the "Slicing Up Earth" resources activity from the *Dirt: Secrets in the Soil* curriculum book.

INSTRUCTIONAL PROCEDURES

1. Ask questions to foster discussion of the "Slicing Up Earth" activity, such as "What do you think about the activity we just completed?" or "What do you know about soil now that you didn't know before?"
2. Introduce the idea that preserving our soil is an important area of scientific study. Tell the students that they will do some experiments with soil to learn more about it.
3. Complete *Activity 1 - "Splash Zone"* with the students.
4. Discuss questions in *Dirt: Secrets in the Soil* listed after this activity.
5. Introduce students to the types of erosion using the erosion section in the *Dirt: Secrets in the Soil* video and the background information provided in this lesson.
6. Complete *Activity 2 - "Soils on the Move"* with the students.
7. Introduce students to the methods for controlling erosion using the erosion section in the *Dirt: Secrets in the Soil* video and the background information provided in this lesson. You could also duplicate the demonstration using the erosion tray "turkey pans" in the video.
8. Complete *Activity 3 - "Erosion Control Practices"* with the students.
9. Introduce the next activity by telling students they will do some planting experiments.
10. Complete "Soil-Less Seed Germination" with the students.

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- Apple
- Knife
- Cutting board
- *Slicing Up the Earth* master
- Pencils
- "Splash Zone Target" master, made into 5 transparencies (one per group)
- 5 eyedroppers
- 5 small containers of water
- 5 teaspoons of dry soil
- Teaspoon
- "Splash Zone Graph" master – one copy per student
- *Soils on the Move* master, made into transparency or copied for handouts
- "Erosion Control Practices" master, made into transparency or copied for handouts
- Osmocote fertilizer
- Water
- Plastic cups, 3 per student
- Permanent markers
- Compressed peat pellets, one per student
- Measuring cups for water
- Vermiculite
- Sodium polyacrylate
- Sunflower seeds, 6 per student
- Science journals

ASSESSMENT SUGGESTIONS

- Create journal entry prompts for each activity.
- Have students create an erosion flipbook, with a page for each type of erosion and each type of erosion control. Have students draw pictures, label, and write explanations.
- Have students take photographs of their plants as they grow and change, and make a poster describing the different growth mediums and the measurement results the students noticed. Include graphs and background information.

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POSSIBLE EXTENTIONS/ADAPTATIONS/INTEGRATION

- Repeat the "Splash Zone" activity with drops from 1 meter high. Complete another graph and compare the results. Draw conclusions.
- Repeat the "Splash Zone" activity with wet soil instead of dry. Complete another graph and compare the results. Draw conclusions.
- Make Erosion Boxes from Core Academy 2008 by Stephen Bunker.
- Add a fourth cup containing soil from the student's home to the "Soil-less Seed Germination" activity. Have students compare the different growth rates between mediums.

RESOURCES: BOOKS, MEDIA, ARTICLES, WEB SITES, AND ORGANIZATIONS

BOOKS

Dirt: Secrets in the Soil, by Utah Agriculture in the Classroom,
<https://extension.usu.edu/aite/cart/details.cfm?ProdID=69&category=0>



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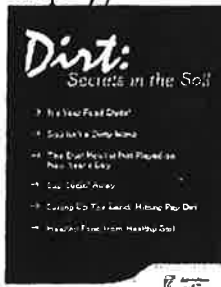
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MEDIA

Dirt: Secrets in the Soil, by Utah Agriculture in the Classroom,
<https://extension.usu.edu/aitc/cart/details.cfm?ProdID=230&category=0>



ARTICLES

WEB SITES

Retrieved from the World Wide Web on January 16, 2010.
National Gardening Association's Exploring Classroom Hydroponics
<http://www.kidsgardening.com/HYDROPONICSGUIDE/hydro1-1-intro.asp>

ORGANIZATIONS

National Gardening Association, 1100 Dorset Street, South Burlington VT 05403;
(802) 863-5251; <http://assoc.garden.org>

FAMILY CONNECTIONS

- Families can visit the web sites listed and start their own hydroponics exploration gardens.

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- Each lesson is 55 minutes.
- Each activity is 30 minutes.
- Total lesson and activity time is 90 minutes.

ACTIVITY CONNECTED TO LESSON

These activities are used, with permission, from *Dirt: Secrets in the Soil*
Slicing-up Earth's land resources:

1. Demonstrate the following: Imagine that the apple is planet Earth.
2. Students should fill in their pie chart as you begin to tell them what each slice means.
3. Cut the apple in quarters. Oceans occupy 3/4 of our earth. One-quarter of our earth is our land area. Take this quarter and cut it in half; now you have two 1/8th sections of land. One-eighth of our land is not suitable for producing food; this is the deserts, swamps, mountains and Arctic and Antarctic regions. The other eighth represents land where people can live. Slice this 1/8 section lengthwise into four equal parts. Now you have four 1/32nds of an apple. The first section represents the areas of the world which have rocky soil that is too poor for any type of food production. The next two sections represent land that is too wet or too hot for food production. The fourth section represents the area of the world developed by man. Carefully peel the last 1/32 section. This small bit of peeling represents the amount the soil of our earth that humans depend upon for food production.

Activity 1-"Splash Zone"

1. Divide the class into five groups.
2. Give each group a "Splash Zone Target", eyedropper, and a small container of water.
3. Instruct student to put enough soil (about a teaspoon of dry soil) in the center of their target to just cover the center circle.
4. Fill the eyedropper with water.
5. Hold the eyedropper about 12 inches (30 cm) above the soil sample.
6. Drop 5 drops of water directly onto the soil sample. If a drop misses the soil, continue until 5 drops hit the soil.
7. Record the number of water droplets containing soil that have "splashed" into each zone; write them on the Splash Zone Graph.
8. Complete the graph to show your results.

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Activity 2-"Soils on the Move"

1. Provide each student with a copy of the "Soils on the Move" handout or make a transparency.
2. Label the handout or transparency. Discuss how the types of erosion differ.

Activity 3 - "Methods for Controlling Soil Erosion"

1. Students should complete the "Erosion Control Practices" activity sheet, or use it as a transparency for discussion.
2. Discuss the various methods and why they are used.
3. Answers: (1) stream bank erosion, (2) gully erosion, (3) wind erosion, (4) rill erosion, (5) sheet erosion.

This activity was created by Stephen Bunker

Soil-Less Seed Germination

1. Prior to the activity, mix up a solution of Osmocote fertilizer. This is the nutrient water students will use to sprout and grow their seeds.
2. Provide 3 plastic cups for every student. Have them use a permanent marker to label the cups with their names. Have them write a "P" on one cup, a "V" on the second cup, and an "S" on the third cup.
3. Give each student a compressed peat pellet. Instruct them to place the peat pellet into their "P" cup. Have the students measure the water it takes to rehydrate the peat pellet.
4. Have students fill their "V" cups with vermiculite.
5. Demonstrate how to hydrate sodium polyacrylate.
(<http://www.teachersource.com/Chemistry/HydrophilicHydrophobicPolymers/SodiumPolyacrylateDiaperPolymer.aspx>)
6. Have each student place the rehydrated sodium polyacrylate into the "S" cup.
7. Pass out 6 sunflower seeds to each student and have them plant two seeds in each of the mediums in the cups.
8. Over the following week, students should make daily observations of how their seeds germinate and grow. Have the students make journal entries, drawings, measurements, and graphs of the growth in their science journals.

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ACTIVITY MATERIALS

Slicing-Up Earth's Land Resources:

- Large apple
- Knife
- Cutting board
- Earth's Soil Resources Pie Chart Activity Sheet
- Pencils

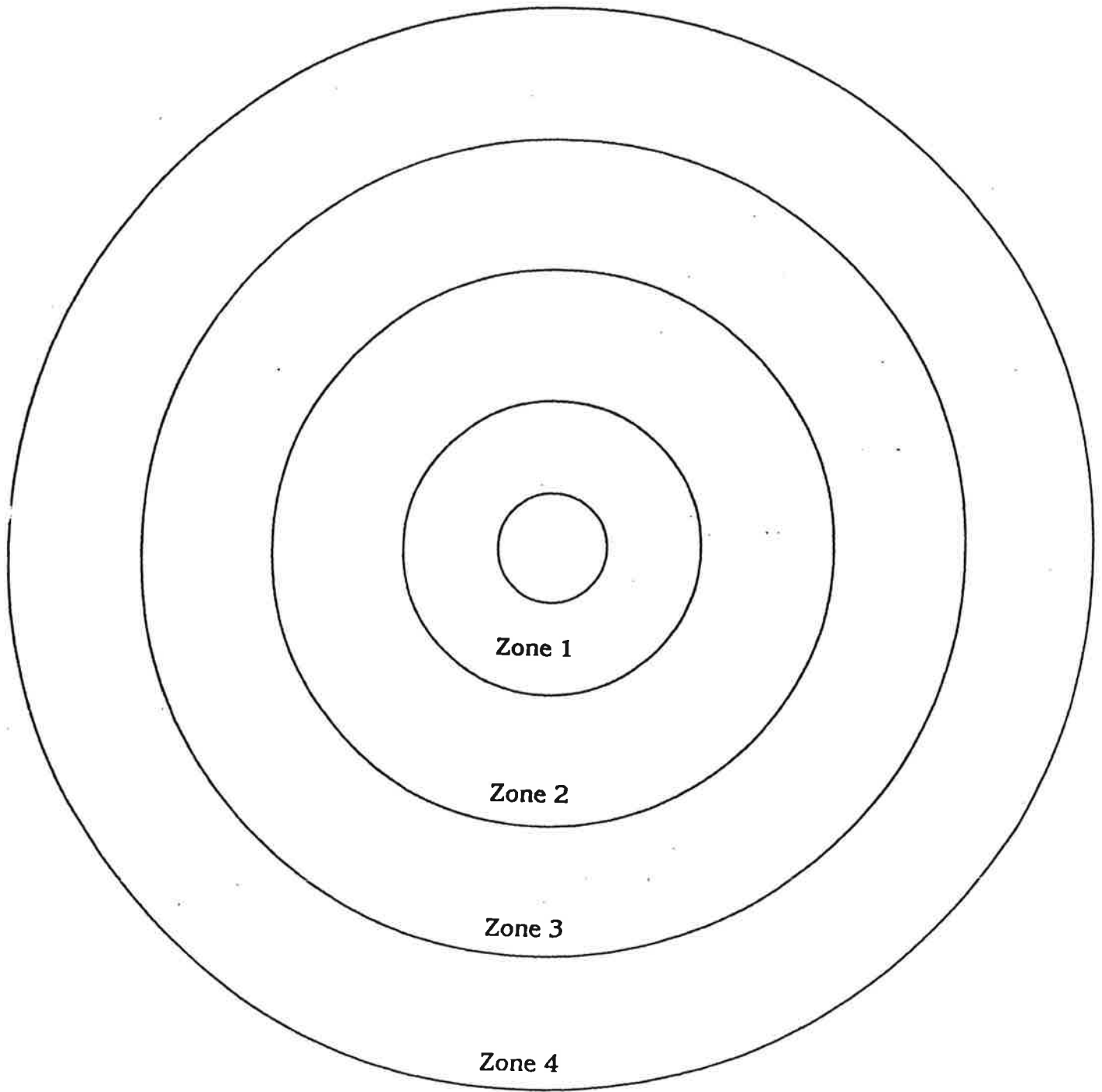
Activities 1-3:

- "Splash Zone Target" (these could be made on a transparency, this way they could be washed and used year after year)
- "Splash Zone Graph" handout
- "Soils on the Move" handout
- 5 teaspoon of dry soil
- Eyedroppers
- Water
- Rulers
- Erosion Control Practices transparency
- Soil on the Move transparency

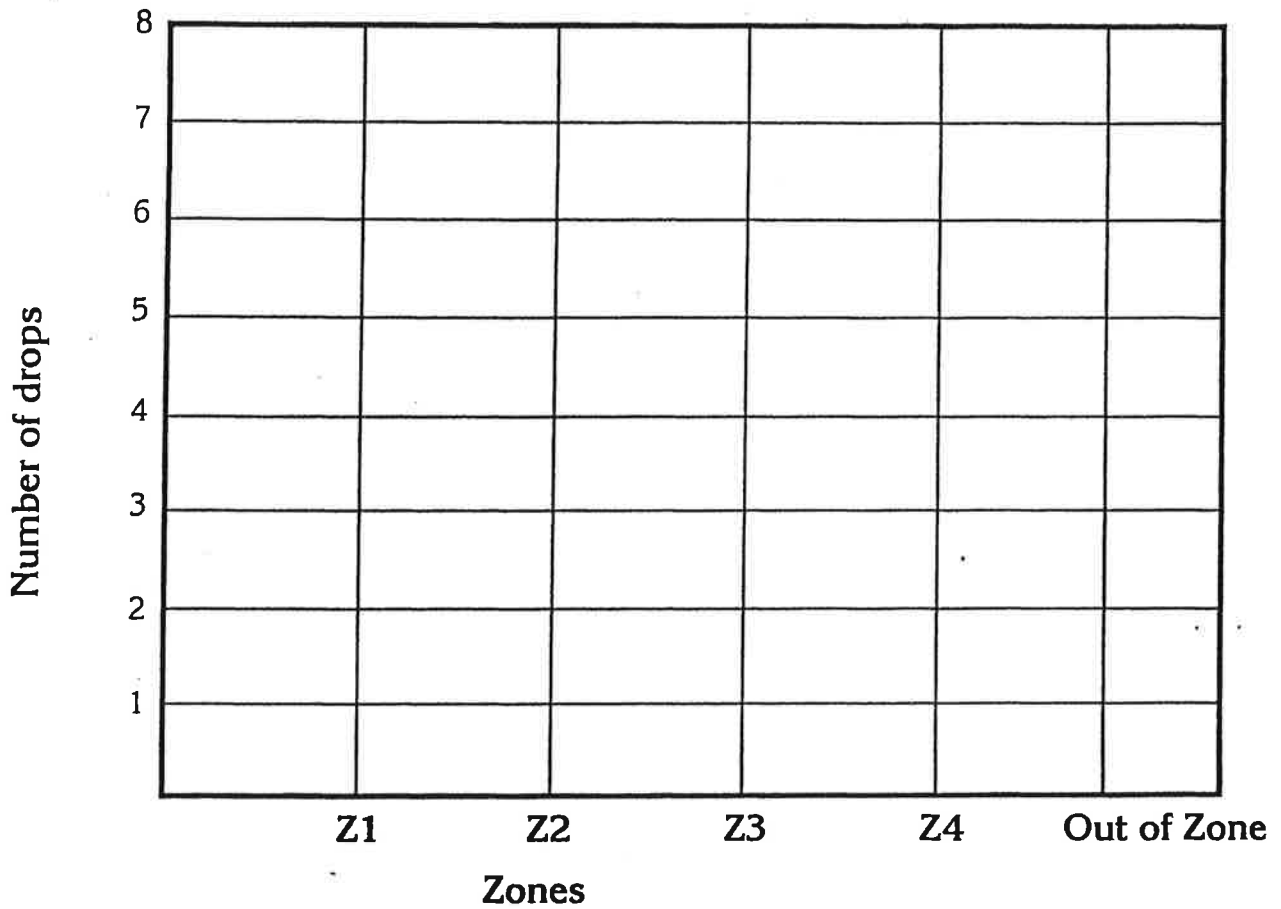
Activity 4:

- Vermiculite
- Osmocote fertilizer
- Sodium Polyacralate
- Plastic cups
- Buckets for mixing Osmocote solution
- Permanent markers
- Compressed peat pellets
- Measuring cups for water
- Sunflower seeds
- Journals
- Water

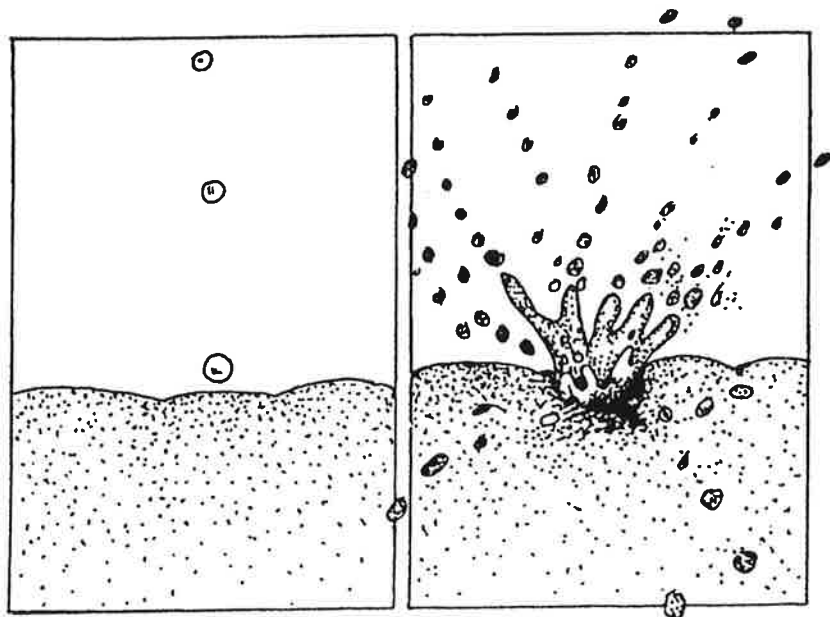
Splash Zone Target



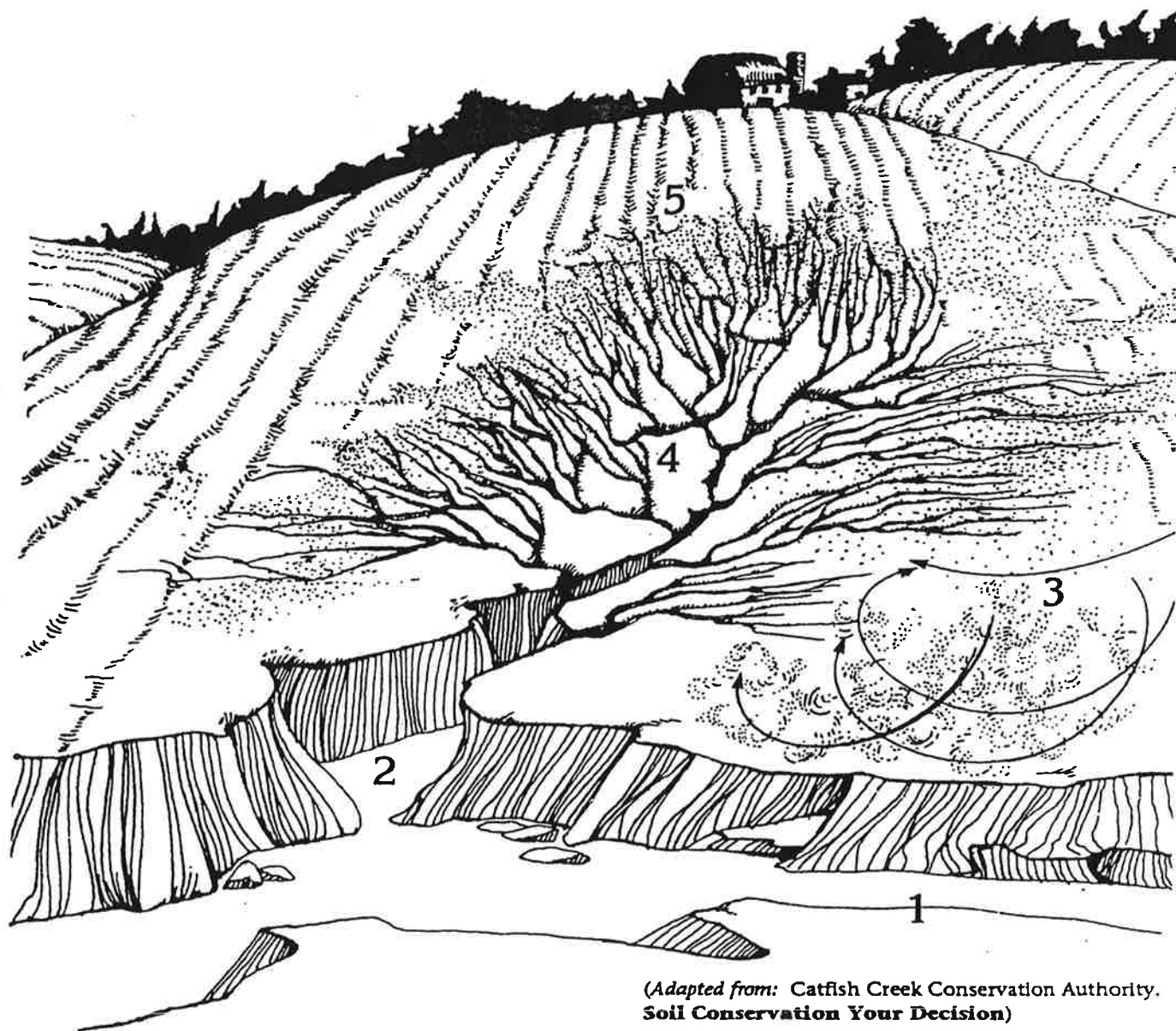
Splash Zone Graph



Raindrop splash



Soils on the Move



(Adapted from: Catfish Creek Conservation Authority.
Soil Conservation Your Decision)

Identify which area is:

___ wind erosion

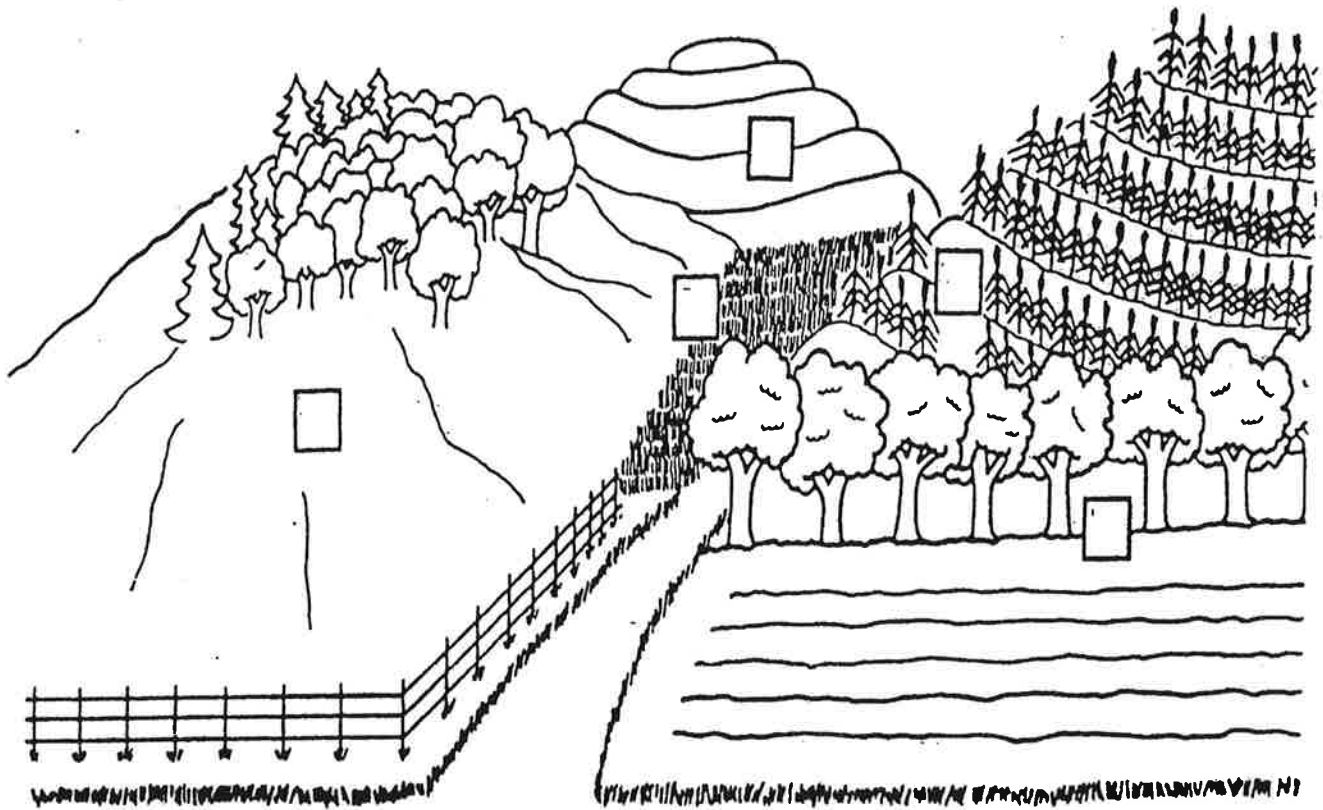
___ gully erosion

___ rill erosion

___ streambank erosion

___ sheet erosion

Erosion Control Practices



Farmers use several methods to conserve soil. Match the number of practices below in the correct box in the picture.

1. **Contour Planting:** plant crops around the curve of a hill rather than up and down the hill.
2. **Terraces:** wide ridges that go around a hill to prevent water from rushing down the hill too fast.
3. **Forest and Grass Areas:** keep steep hillsides in trees or grass rather than clear for cropland.
4. **Grassed Waterways:** plant grass and don't plow low areas in a field where water usually runs.
5. **Windbreak:** rows of trees planted to slow down the wind and prevent soils from blowing.

Earth's Soil Resources

