



**AGRICULTURE
IN THE
CLASSROOM Level II**

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**LESSON PLAN
BY
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Lesson 14

Standards 3.1a.b.c., 3.1.7 a.b., 3.2.4 a.c.d.,
3.2.7 a.b.c., 3.5.4 a.b., 3.7.4 a.,
3.8.4 b.c., 4.1.4 e., 4.8.4 c.

PLANTS: PROTECTING SLOPED LAND FROM EROSION

Time Recommendations: three 30 min. classes

Objectives:

1. The students will be able brainstorm possible roles of plants in land and water interactions.
2. The students will be able to predict and investigate how plants affect water flow and erosion.
3. The students will be able to discuss and compare results.
4. The students will be able to apply their knowledge to real world situations.

Materials:

1. Science Teacher's Guide for **Land and Water** the kit program for **Science and Technology for Children**. (Lesson 14)
2. The materials provided in the box kit that pertain to Lesson 14. **Science and Technology for Children**.
3. An earth fact sheet generated from an online resource (OAC) Oregon Association of Conservation District (five pages)
4. Local soils such as: rock, sand, clay, and humus for the follow up activity.

Procedure:

1. The students will investigate the how plants affect the flow of water on land. (follow the procedure on page 155 of the teacher's manual) First 30 min. class
2. Use record sheets 14A to gather data for the investigation. Second 30 min. class
3. Have the groups meet at the end of the investigations and compare their stream flow and Runoff. Third 30 min. class.
4. Use the (OAC) fact sheet to compare with the findings of the investigations done in the lessons.

Follow-up Activity:

1. Have the students test the suitability of a local soil sample for growing plants.
2. Can the students determine the components of the local soil? If so, do students understand why the soil was or was not suitable for plant growth?

Small Acreage Factsheet # 13

Protecting Your Land from Erosion

"It can take a 1,000 years to form an inch of soil."

The Soil Is Alive

Every cubic inch of topsoil may contain over a billion creatures – mostly bacteria, microbes, and fungi. This tiny ecosystem recycles dead plant matter back into nutrients that support plant growth. When the upper 8 inches of soil stays put, this living layer produces:

- **Nutrients:** Studies show a healthy soil has up to 200 percent more nitrogen and phosphorus and 20 percent more potassium than an eroded soil.
- **High Plant Yields:** In general, healthy, protected soils have 25 percent higher yields than severely eroded soils. Studies have shown 31 percent higher alfalfa yields and 86 percent higher barley yields on protected soils versus eroded soils.
- **Clean Waterways and Fish Habitat:** Studies show that we can save \$1 for each ton of soil that stays on the land. With erosion control, clean gravel beds produce healthy fish populations, cities reduce filtration costs for drinking water, and harbors can lower their dredging costs.

Some soil erosion is natural, but accelerated erosion is not. A canopy of trees and shrubs, a thick leaf layer, or dense stand of grass protects soil in its natural state when raindrops fall or winds blow. We speed up erosion by removing this protective blanket when we use poor management during tillage, grazing, timber harvest, or construction. Wind and water erosion create sterile soils, fill the air with dust, plug road ditches, carry pollutants, and clog fish habitat. It pays economically and environmentally to keep soil in place.

Dirt Alert: Signs of Erosion

A raindrop is like a miniature water bomb: it hits the ground at 20 miles per hour. When raindrops hit bare soil, water can splash soil up to 6 feet away, carry particles off the field, and drop sediment into drainageways. Wind also dislodges, moves, and transports soil particles, especially in dry, windy climates.

Most Oregon soils begin to lose their ability to support plants when they erode more than 5 tons of soil per acre each year. This usually occurs through a process called sheet erosion, the gradual wearing away of a thin layer or "sheet" of soil. Since 10 tons of soil lost per acre equals the thickness of a dime, sheet erosion can be very hard to see! Look for these clues of sheet, gully, and streambank erosion:

- Cloudy or muddy water flows down the field, road, or driveway.
- Pebbles and plant pieces are supported on "pedestals" of soil because the surrounding soil has been eroded away.
- Small rills or gullies begin to show.
- Dust clouds appear.

- Soil collects along fences or snowbanks.
- Soil splashes on windows, walls, and plants.
- Sediment builds up on pavement or at low spots in the field.
- Streams and rivers run cloudy after a rain.
- Streambanks crumble and fall into stream. (See [Factsheet No. 4 - Protecting Streambanks from Erosion](#))

Keeping Soil on Your Land

Here's how conservation measures reduce erosion:

- **Create a Protective Cover:** Plant cover, more than anything else, keeps soil erosion in check. Leaves cushion the impact of wind and rain while roots anchor the soil. Other covers like mulch, bark dust, rock, and concrete also protect soils.
- **Erect Barriers to Wind and Water:** Barriers slow wind and water and trap eroded soils. If you cut water speed in half, you will have four times less erosion! Barriers can be as simple as grass strips in a field crop, silt fences around a construction site, or a windbreak.
- **Reduce Slope Length and Steepness:** In general, plants can protect slopes that are less than 50 percent (2:1 gradient or 2 foot run for every 1 foot drop), mulches protect slopes less than 33 percent (3:1 gradient), and erosion control structures like terraces may be needed for slopes more than 50 percent. Cropland terraces are usually used on slopes less than 12 percent. The low dams formed by terraces shorten the distance where water can gain speed. Metal or concrete erosion control structures safely drop water to a lower elevation and reduce the steepness of the remaining slope.

One conservation practice does not fit every erosion problem. Your soils, climate, topography, and land use will require a unique set of measures. Here's a sampling of conservation measures that can be used whether you have a large garden or a field crop. They are often more effective in combination than alone:

- **Buffers of trees, shrubs, and/or grass** slow water speed, filter pollutants, and trap sediment. They are used to protect streams, lakes, ponds, and ditches, and to stop sediment at the lower edge of field crops. Grass filter strips are effective on slopes less than 10 percent. Contour buffer strips combine contour farming with strips of permanent grass. A ratio of cultivated to buffer strip width between 4:1 to 9:1 is best. Riparian buffers are tree, shrub, and/or grass strips that protect streams, ditches, lakes, and ponds and may be 35 to 300 feet wide, based on site conditions and your goals. For more information on riparian buffers see [Factsheet No. 5 - Managing Streamside Areas with Buffers](#).
- **Conservation Tillage** reduces the amount of tillage and leaves at least 30 percent cover from crop residue after harvest and during winter months. Soil loss is reduced by 50 percent compared to bare soil. (Stretch a 100-foot tape across the field and count how many times a stem, leaf, or root touches the 1-foot marks. The total equals the percent cover.)
- **Contour Farming** runs rows "on the level" around the hill rather than up and down the slope. Crop rows form hundreds of small dams that slow water and reduce soil loss up to 50 percent compared to farming up and down a slope. Cover crops temporarily protect the soil until the main crop is planted. Cover crops also add organic matter, hold nitrogen, and reduce weed growth. Plant cereal grains and legumes for winter cover crops. Buckwheat is a good summer cover crop.

- **Crop Rotation** changes crops each year in a certain order. A rotation that includes grasses, legumes, or small grains will break pest cycles and reduce erosion compared to continuous row crops that may build up pest populations and leave soil open to erosion.
- **Erosion Control Structure** drops water safely to a lower elevation. Rock, metal, or concrete structures prevent the soil from forming gullies. The structure takes the erosive force of the water and can reduce the remaining slope. Use this practice as a last resort because of the design and construction expense.
- **Grassed Waterway** is a flat-bottomed channel with grass that slows water and prevents gullies. Farm equipment can drive over gentle side slopes and wildlife can use grasses for nesting and cover. Waterways may need to be combined with rock linings or drop structures on steep slopes.
- **Pasture Management** balances livestock numbers, forage, and water for a healthy farm income and environment. Pastures with at least 70 percent plant cover have little erosion and produce more forage. Set aside a "sacrifice area" where animals are held to protect pastures when soils are wet or plants are recovering from grazing. For more information, see [Factsheet No. 6 - Managing Pastures in Eastern Oregon](#) or [Factsheet No. 7 - Managing Pastures in Western Oregon](#).
- **Special Plantings in Critical Areas** protect especially erosive areas with special plantings. This erosion measure combines plants, fertilizer, and mulch to protect areas such as construction sites, road banks, and steep slopes. Here's a typical recommendation:
 1. **Plants:** Use plants native to your area whenever possible. Native plants are adapted to local conditions and are more drought-tolerant, pest-resistant, and lower maintenance than non-native plants. Grasses usually provide the most erosion control and are planted in a mix with 10 to 50 percent legumes, forbs, and/or shrubby species. A mix of six to ten species can fill voids and adapt to varying conditions. Trees reinforce slopes at greater depths, but don't work as well for surface erosion. Combine trees with slow-growing grasses or add trees after area is stabilized. Plant shrubs 2 to 5 feet apart and trees at 6 to 10 feet apart.
 2. **Site Preparation:** This can make or break a planting. If possible, spread 4 to 6 inches of topsoil over site. A smooth surface is needed if the area is for a grassed waterway or to be mowed. Otherwise, a rough surface will work for broadcast or hydroseeding. Fertilize according to a soil test or apply 10 pounds of 10-10-10 per 1,000 square feet. Mulch grass plantings with two bales of straw per 1,000 square feet. Water as needed until grass is 2 inches tall. Mulch shrub and tree plantings with leaves, bark dust, or compost.
- **Terraces** are long, low dikes of earth that follow the contour of the hill. They break long slopes into shorter runs, slow runoff, and trap sediment. If terraces aren't practical, consider planting 1-foot strips of stiff, perennial plants that are perpendicular to the slope of the land with the same spacing as terraces.
- **Wind Barriers** are strips of grass, shrubs, or trees that slow wind. Grass barriers are one to two rows of tall grass planted perpendicular to the wind to protect crops, provide wildlife food and cover, and trap snow. The strips should be planted no more than ten to 12 times the grass height for maximum effectiveness. Windbreaks are tree or shrub rows that slow wind, manage snow, protect livestock, and provide wildlife habitat. Windbreaks are spaced at intervals of five to 20 times the height of each windbreak and perpendicular to the prevailing winds.

Construction Sites that are Watershed-Friendly

Sediment is the number one pollutant in surface water. The average homesite construction can lose

from 100 to 500 tons of soil per acre per year. This is a rate 100 times more than cropland erosion and 2,000 times more than woodland erosion! You will have healthy plants and happy neighbors if you keep topsoil on site. Here are seven steps to control erosion on construction sites:

1. **Schedule Construction Activities During the Dry Season:** Dry soils keep soil compaction, mud, and water runoff to a minimum. Septic systems installed in uncompacted soils will function properly. However, you may need to control wind erosion and irrigate plantings.
2. **Flag or Fence Off Areas to be Protected:** Protect areas such as:
 - **Septic System Locations:** Avoid parking or running heavy equipment over this area. Compaction can ruin a septic site.
 - **Steep Slopes:** Avoid disturbing steep slopes, which can be extremely erosive. Use dikes or ditches to divert water away from steep slopes and disturbed areas. Protect diversion channels with grass, rock riprap, or check dams.
 - **Trees and Their Dripline Areas:** Trees increase property values. Protect tree roots by fencing off an area two to three times the width of the branches. Equipment can tear tree roots and earth fill suffocates roots. For details, see *Preventing Construction Damage to Trees (G6885)* - University of Missouri Extension Service
3. **Use Erosion Control Measures Around the Site Perimeter:** Before construction begins, identify and install erosion controls where eroded soils could leave the site. Check with your local land development department for requirements in your area. Examples of erosion control measures to install are:
 - **Plant Buffers:** On slopes less than 6 percent, preserve a 20- to 30-foot-wide buffer of vegetation around the perimeter of the property. This will slow sediment erosion.
 - **Silt Fences:** Use silt fencing on the downslope perimeter of the site.
 - **Gravel Drive:** Restrict traffic to a gravel entry. This will keep soil from sticking to tires and washing into the street.
 - **Storm Sewer Inlets (if present):** Protect storm drains with gravel-filled, geotextile bags, straw bales, or other materials that trap sediment while allowing water to pass through.
4. **Prepare Site for Construction:** Disturb as little vegetation as possible. Remove topsoil (typically top 6 to 8 inches) and stockpile topsoil separate from the subsoil. Plant grass on soil stockpiles or place a silt fence around stockpiles to prevent erosion. Locate stockpiles away from drainage areas.
5. **Maintain Erosion Control:** Inspect installed measures at least twice a week and after storm events. Make needed repairs and clean up soil tracked or washed off-site. When gutters and downspouts are installed, consider using downspout extenders to safely carry roof water past disturbed ground.
6. **Replant Construction Site:** Redistribute topsoil 4 to 6 inches over the site. Final grading should slope water away from buildings and into drainage swales. Seed, fertilize, and mulch or sod bare areas. Water until grass is 2 inches tall.
7. **Remove Temporary Erosion Control Measures:** Remove temporary erosion control measures when the vegetation is established.

For Help

- **The local Soil and Water Conservation District (SWCD), USDA Natural Resources Conservation Service (NRCS), or local Watershed Council staff may provide technical advice on soil erosion measures on cropland, pasture, and forest. Look up your local office in the phone book's blue pages under federal government, Department of Agriculture.**
- **City or county building and planning departments may provide specifications for erosion control on construction sites. Look up your local office in the phone book's blue pages under city or county government.**

This fact sheet was produced by the Tualatin Soil and Water Conservation District and the Small Acreage Steering Committee. The Oregon Watershed Enhancement Board, Oregon Association of Conservation Districts, and the USDA Natural Resources Conservation Service funded the project. You may reproduce or copy any portion of these fact sheets for nonprofit and educational purposes by notifying the Tualatin Soil and Water Conservation District at (503) 681-0953. Please acknowledge this publication as the source.

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