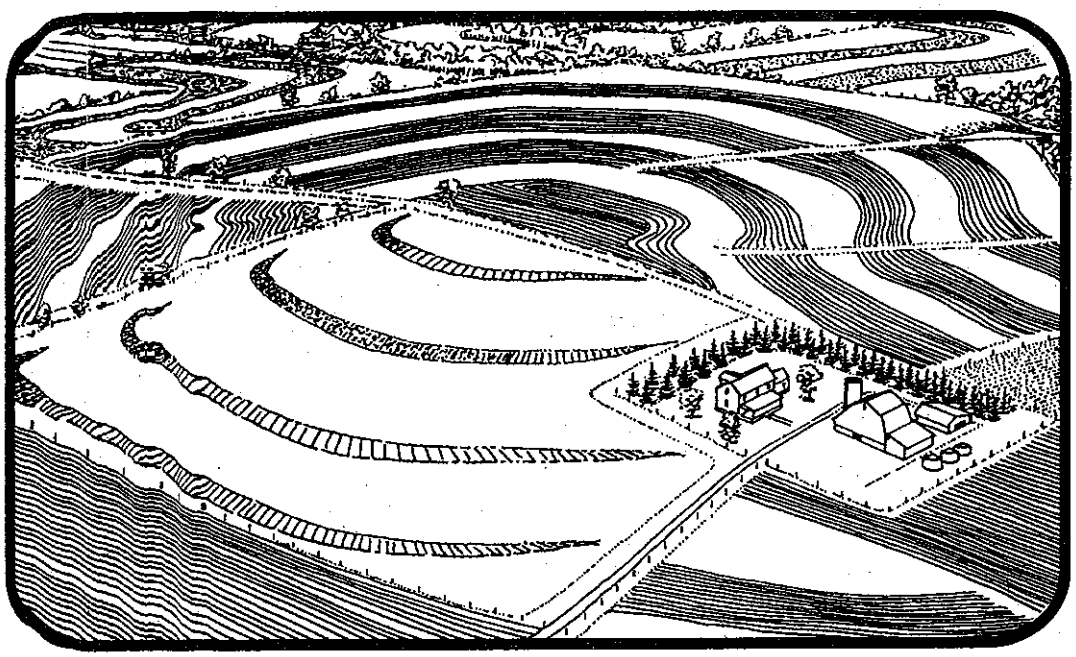
Lines on the Land

- A "hands-on" soil and water conservation learning package for 6th-8th grades



Developed by: Iowa Association of Soil and Water Conservation District Commissioners
USDA Soil Conservation Service
Iowa Department of Agriculture and Land Stewardship,
Division of Soil Conservation
Institute for Environmental Education, University of Northern Iowa
Partial funding from a Resource Enhancement and Protection grant from the state of Iowa

Distributed by: National Association of Conservation Districts

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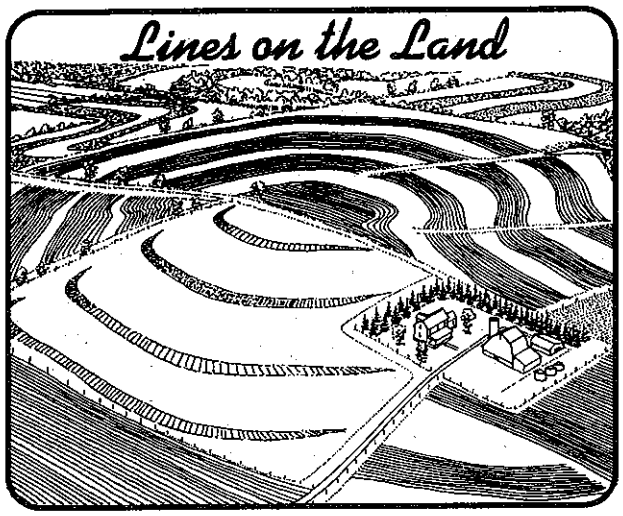
A note to educators



Discovery oriented learning package

Thank you for choosing an educational package that encourages students to discover, analyze, and learn first-hand about their natural resources. Activities in this package may be used for math, art, social studies, language arts and other areas as well as science.

The activities are designed so that the concepts your students discover will stick with them. They were written by teachers for teachers.

Lines on the Land is a soil and water conservation learning package aimed at 6th, 7th and 8th grade students. The 16 lessons included in the package are activity oriented. Through the exploration, concept development, and follow-up activities, students discover concepts, form opinions, and become more informed about how soil conservation affects everyone.

The center of the package is the ten-minute videotape produced for the students. The video can be used in a variety of ways - as an introduction, a follow-up or a part of any activity. One activity specifically integrates the videotape.

Each activity stands alone. In other words, one or all of the lessons can be integrated into your teaching units.

Developed by teachers

Lines on the Land activities were developed by a group of five Iowa teachers in conjunction with the Institute for Environmental Education at the University of Northern Iowa. The lessons were then pilot tested. As the package was developed, the writers tried to provide as much guidance as possible, but at the same time, leave enough flexibility so you can adapt the activities to your students and situation.

Inservice gives more guidance

As is the case with many new learning activities, Lines on the Land can be used much more effectively by teachers who have attended an in-service. This is particularly true because it is based on the Learning Cycle approach to teaching.

To help teachers make the best use of the activities, The University of Northern Iowa's Institute for Environmental Education has developed an inservice program. The in-service gives you the opportunity to interact with other teachers in small groups, shows how to infuse the activities into existing curricula, and offers the possibility for graduate credit. For more information, contact Dr. David McCalley, Institute for Environmental Education, University of Northern Iowa, Cedar Falls, Iowa 50614, telephone 319-273-2581.

More information, materials

Each activity lists several resources you may want for more information. In addition to the resources listed, your local conservation district and Soil Conservation Service office can provide resource information. Look in the government section of your telephone directory under USDA Soil Conservation Service.

The National Association of Conservation Districts also has a variety of educational materials including other conservation learning activities, resource pamphlets, and a videotape and film rental library. Call 1-800-825-5547 or write NACD Service Department, Box 855, League City, TX 77574.

Another source is the Soil and Water Conservation Society, 7515 NE Ankeny Road, Ankeny, IA 50021. Their toll-free number is 1-800-THE-SOIL.

Package is a result of cooperative effort

Lines on the Land is a cooperative project between the Iowa Association of Soil and Water Conservation District Commissioners, the USDA Soil Conservation Service, the Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation, the National Association of Conservation Districts, and the Institute for Environmental Education at the University of Northern Iowa. Production of the videotape and learning package were funded in part by a Resource Enhancement and Protection grant from the state of Iowa.

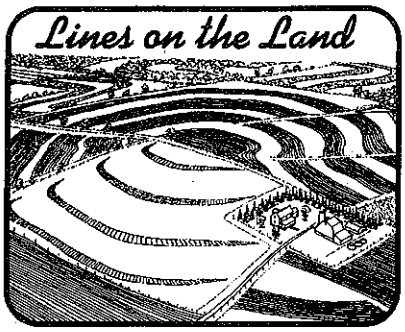
You must teach your children that the ground beneath their feet is the ashes of our grandfathers. So that they will respect the land, tell your children that the earth is rich with the lives of our kin. Teach your children what we have taught our children, that the earth is our mother. Whatever befalls the earth befalls the sons of the earth. If men spit upon the ground, they spit upon themselves.

The earth does not belong to man; man belongs to the earth. All things are connected like the blood which unites one family.

Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself.

Chief Seattle

The Soil Connection



Activity in brief:

Students will create a web to show the interdependency of urban and rural businesses on soil.

Subject area

Science
Social Studies
Language Arts

Learning outcome

Students will demonstrate the interdependency of urban and rural businesses on soil.

Site

Classroom

Suggested time

2 - 3 periods

Materials

newspaper print
colored pencil
markers
stencils

Exploration

Students will brainstorm and make a list of tools and resources important in helping the farmer carry out farming. The student's thinking will focus on the most important resource on the list for a farmer (soil). They should also list where the farmer can obtain the other tools and resources required to work the soil.

Concept development

Students will create a mural centering around soil which shows the web-like nature of how each student's parents' jobs directly or indirectly depend on the soil.

Application

Each student will write a story describing the events that would occur and how this would affect their parents' jobs, if the farming community would have a severe drop in productivity due to extensive soil erosion.

Teacher notes

For your information

Exploration

Have the students individually make a list of tools and natural resources important to farmers. Then have the students get into small groups and share their lists. Create a class list on the board, drawing on group lists. As a class have the students decide the farmer's most basic resource. (Soil)

Examples:

Tools	*Natural Resources*
tractor	*soil*
combine	*water*
plow	*coal*
disc	*wood*
planter	*gasoline and oil*

Concept development

Take a class poll to determine how many students' parents farm as a profession. Lead the discussion to enable the students to realize the farming parents are directly linked to the soil. Possible questions:

How is a farmer's life dependent on the soil?

What are some of the products produced from the soil?

Once this concept is established, have the other students relate what their parents' jobs are. Ask the students, Are these jobs related to the soil in any way? If so how?

After a brief discussion, have the students work in groups of 3 or 4 and produce a web to show how their parent's job is dependent on soil. Draw the web on butcher paper.

Things to consider for the webbing activity:

1. Encourage pictures and labels as much as possible.
2. Work backwards from the parent's job to the soil so the variety of jobs needed to produce a product are explained in the web. Or you may begin with the soil and the product and work outward to the parent's job.

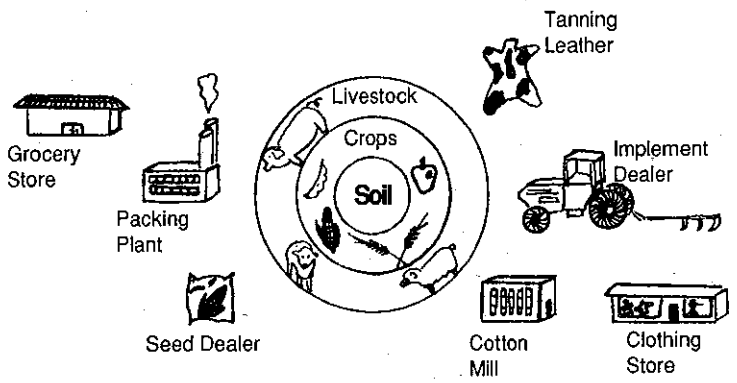
Application

Now the students are ready to hypothesize in writing what will happen to their parent's job and to them if the soil continues to erode. To help them understand the realities of what is happening to our topsoil, include the following information in your discussions:

In parts of the country like Iowa, half the original topsoil, 6 to 8 inches has been lost from unprotected sloping soils in the 100 years they have been farmed. At this rate, the remaining 6 to 8 inches could be gone within the next 100 years.

Topsoil is being lost much faster than it is being replaced. Nature needs 250 to 1000 years to build an inch of soil.

Webbing Example:



Follow-up suggestions

Label the webs further with the resources used or needed for each step leading to the parent's jobs.

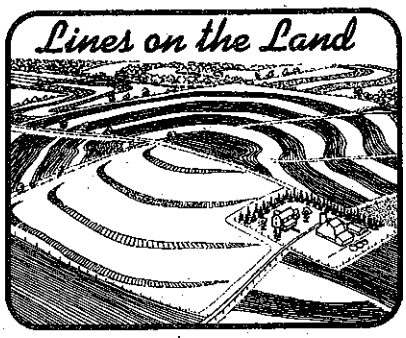
Label the webs to show interdependence between each of the 3 to 4 parental jobs given on each mural.

Resources

** Adapted from "Aggie's Web," Outlook, Iowa Natural Heritage Foundation, Iowa Department of Public Instruction and the University of Northern Iowa, 1983.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Lines on the Land



Activity in brief:
Students will become aware of lines and patterns of lines in their everyday surroundings and be able to relate these lines to soil conservation.

Subject area

Science
Art

Learning outcome

Students will be able to relate human-made lines with lines in nature.

Students will be able to relate lines of the outdoors to the concepts of soil conservation.

Site

Classroom
School grounds
Park

Suggested time

1 to 2 periods

Materials

drawing paper
colored pencils
paper towel tube
Soil Conservation Service booklets and pamphlets
magazines
encyclopedias
farming publications
"Lines on the Land" videotape

Exploration

Students will locate various lines and patterns of lines in the classroom and outdoors by focusing their sight through a paper tube.

Concept development

Students will determine the basis for lines observed and what produces them.

Application

Students will sketch at least four scenes from the outdoors as viewed through their paper tube and relate some of these lines to soil conservation.

Teacher notes

For your information

Background

What are all those lines on the land? What do these lines mean to students and citizens?

Often we spend hours a day in a room or outdoors and never really notice what makes up our surroundings. This activity will attempt to make the students aware of their surroundings and how these surroundings are formed. By concentrating on the lines which make up their surroundings, they can move from an inside environment to an outside environment observing the same things. Discussing with students the patterns which are formed outside leads nicely into the processes of soil conservation which are being practiced or which could be employed to reduce soil erosion.

Resources

*Videos: "Lines on the Land" and "Conservation On Your Own", available through your local Soil Conservation Service or Conservation District office.

Videos are available from local Iowa Area Education Agencies:

America's Soil: The Eroding Foundation, 1983.

Conservation Down On the Farm, 1981.

We Are of the Soil, 1977

Exploration

Show the video "Lines on the Land." Ask students to view different areas of the classroom through a paper tube. The following questions for the students might be helpful:

What do you notice about the lines that you see?

Do the lines form a pattern?

Do the lines continue or are they interrupted by other lines?

Are most of the lines straight? Why?

Where else might you view these same patterns?

Where might these same lines appear outdoors?

Ask the students to view the lines as edges and that these edges are the endings of a scene, or a purpose for the land. Also, they should concentrate on the land that is contained within these edges.

The students will continue to view their environment in an outdoor setting. Ask them to focus their sight with their paper tube on several different scenes and objects. Continue to question the students as before.

What do you notice about the lines outdoors?

Do any lines form a specific pattern?

Do any patterns of lines seem to repeat themselves more than others?

Who or what made the lines you are noticing?

What purpose do the lines serve?

, Are most of the lines straight? Why or why not?

Do any of the lines outdoors remind you of any of the lines from the classroom?

What do you personally own or use that has the same line patterns that you have seen today?

How do the lines or edges of land appear differently from the lines seen in the classroom?

Concept development

The students will locate various lines and patterns as found on the land. Many pictures and diagrams can be found to demonstrate lines and patterns in the Soil Conservation Service booklets, encyclopedias, farming publications, and magazines. Invite a district conservationist, a vocational agriculture teacher, a farmer or an agronomy student to discuss what the students' line discoveries mean. This resource person can further explain how the lines relate to the conservation of soil.

Application

Have students fold a piece of drawing paper into four sections and flatten it out on a book or clipboard. They will use their paper tubes and a pencil or colored pencils. Ask them to select four of their best scenes that represent lines on the land. Tell them you will be looking for a variety of line formations, not just straight lines.

Challenge the students to try to sketch scenes that could represent soil conservation practices.

*Urban area teachers may have to take the students away from the school or show a video that they can stop in select places (see resource list). The teacher could describe the "perfect" farm or farmland and let students sketch the description as they perceive it.

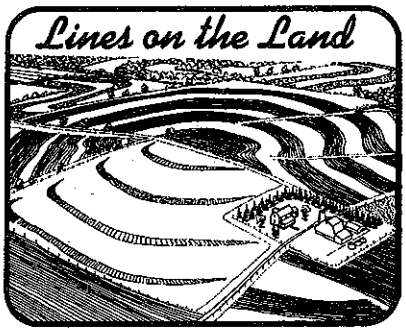
These sketches could be displayed in the classroom as reminders of lines on the land.

Follow-up suggestions

A field trip to a farm to view lines through a tube would further demonstrate lines on the land in a concrete way. Have a soil conservationist come and talk to the class.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

"Look Mom, No Hands!"



Activity in brief:
Without using their hands or tools, students will discover ways to erode soil - by wind and water.

Subject area

Science

Learning outcome

Students will be able to develop the concept of erosion.

Students will be able to give examples of erosion in their environment.

Students will be able to identify two causes of erosion.

Site

Classroom/Outdoors

Suggested time

2 to 3 periods

Materials

magazines
1/2 pint milk carton
potting soil
one 9 x 12 inch pan/per group
one water container/per group
large sheets of paper
markers
straws
hand held hairdryer
fan

Exploration

Students will be asked to discover two methods of moving soil without using their hands.

Concept development

Students will develop the concept that wind and water move the soil (erosion).

Application

Students will seek out examples from "nature" in which water has moved soil and in which air has moved soil. They can develop a picture collage, a story or song, or interview an older person about the effects of storms in their community. (The great flood).

Teacher notes

For your information

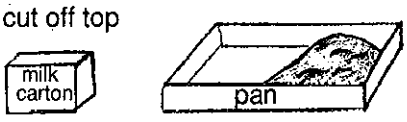
Exploration

Divide the students into small groups and ask them to fill a milk carton half full of soil. They should dump the soil into one end of the pan. Have the students draw a diagram of the soil in the pan. Impose the following challenge:

Demonstrate how you can move the soil without directly touching the soil or the pan.

Hopefully the students will think of blowing the soil or using water to remove it. If students are having a difficult time, brainstorm how other things in nature are moved.

Illustration



Concept development

Students should draw the results of their investigation. They should also explain what methods were used to move their soil. Students will present the results of their findings to the other groups.

Note to teacher: Be sure the students associate and use the term erosion with what was happening in their experiments.

Application

Let the groups decide how they want to show the different examples of erosion in their environment. Suggestions could include: a poster, a collage, a list, a personal interview of an older person telling how erosion has affected the community in the past (floods, tornadoes), a play, television talk-show, or some other form of conveying their message. Their product can be shared with the other groups.

Follow-up suggestions

Using markers, have the students make three or four X marks on the bottoms of their shoes. Have them check their soles every hour and record their observation. The next day, hold a discussion about the erosion of their marks.

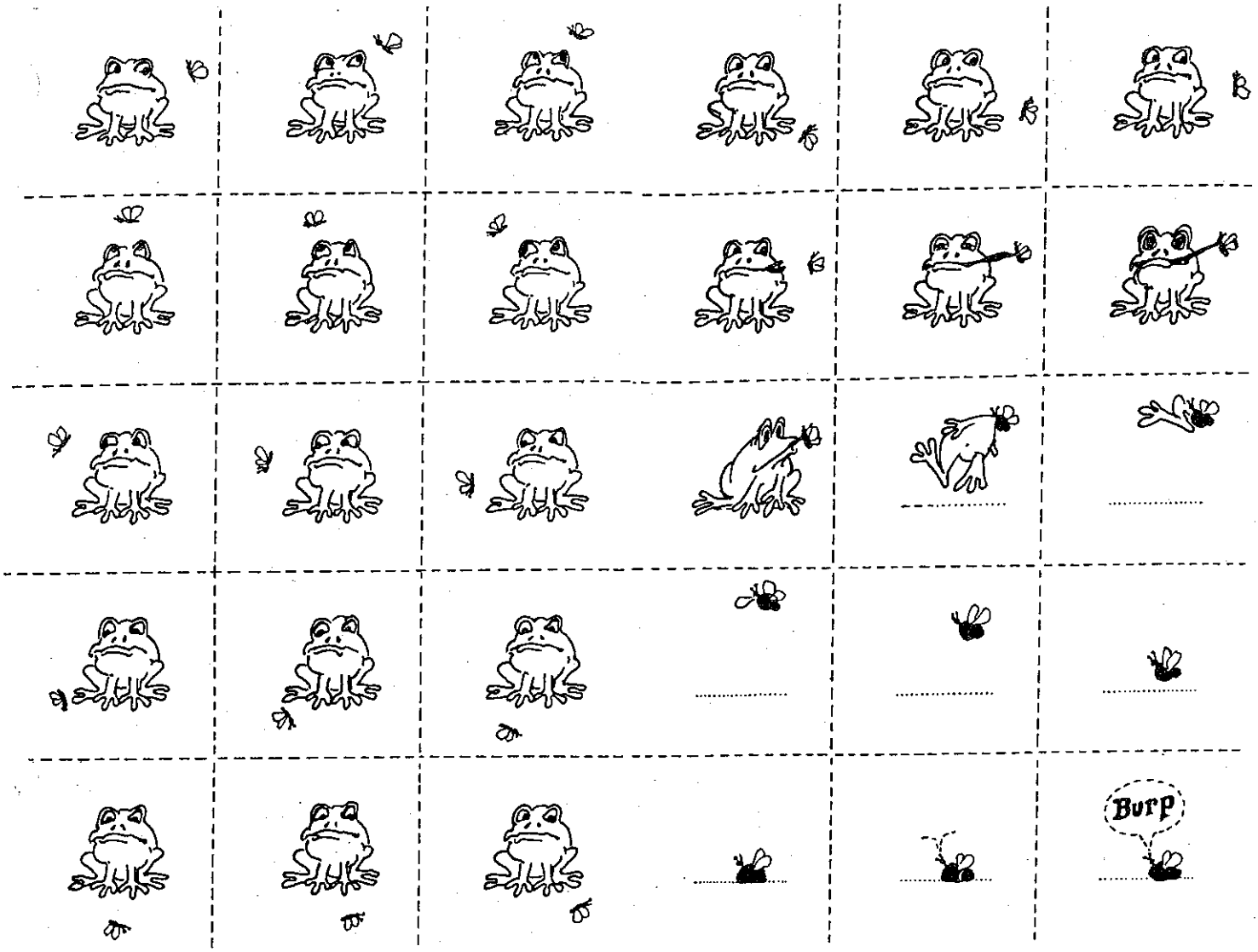
Students can take a walk around the school yard to look for signs of erosion. They should record their findings for later discussion on causes of erosion in this area.

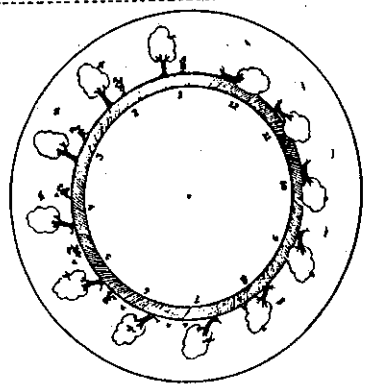
Resources

*Protecting Agricultural Land, Minnesota's Ag-Stravaganza, Minnesota Association of Soil and Water Conservation Districts, 1987. "Soil Erosion", Science Scope, Sept. 1989, by Tom Graika.

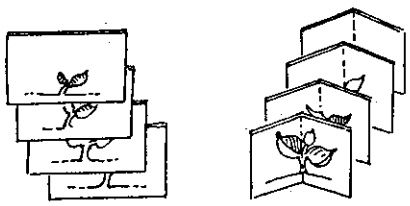
Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Examples of Motion Picture Booklets

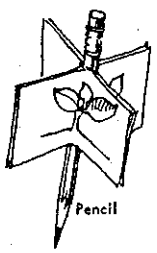




Make moving plant pictures next. You will need 4 white cards the size of a postcard.

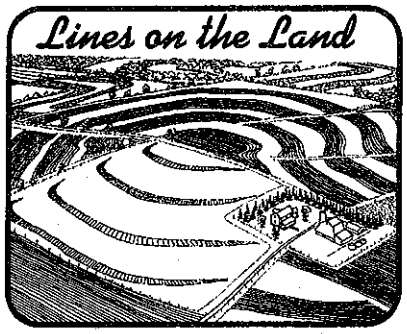


Draw a picture of a young plant on the first card. Draw the sequence of growth on the other cards, keeping to the center.



Fold the cards back to back. Clip or paste together. Leave a narrow space so a pencil can fit through the center. Twirl your pencil and watch the action. Try motion pictures of someone planting, watering, or cutting a flower. Think of more!

Erosion Motion



Activity in brief:
Students will design a motion booklet to illustrate the effects of erosion over time.

Subject area

Science
Art
Language Arts
Social Studies

Learning outcome

Students will be able to describe erosion as a process occuring over time.

Students will be able to produce a motion booklet depicting erosion.

Site

Classroom

Suggested time

2 to 3 periods

Materials

film
projector
paper
colored pencils
3 x 5 note cards
hole punch
medium brass fasteners

Exploration

Students will brainstorm examples of fast changes and slow changes. Responses should be recorded on the board with examples of each change listed in a separate column. Following the brainstorming, a film or video on soil erosion should be shown.

Concept development

After viewing the film or video, students will be asked to classify erosion as either a fast or slow change and defend their positions.

Application

Students will be asked to design a motion booklet depicting erosion as a gradual change over time. After the booklets have been completed, the students will write a story explaining their booklet.

Teacher notes

For your information

Exploration

Students can work in groups of three to brainstorm examples of slow and fast changes. After groups have completed their brainstorming, have them choose their three best ideas from each list to share with the class. A "master" list can be compiled on the board. A list of films and videos are included in the resource section.

Concept development

Students should return to their groups after the film or video and discuss their ideas on classifying erosion as a slow or fast change. Ideas should be recorded and shared with the class.

Application

An example of a motion booklet is provided. The frames of the booklet should be cut out and placed in envelopes. The students working in groups of 3, should first be challenged to arrange the pictures in sequence. After the booklets have been collated with brass fasteners, the students could be asked the following questions:

What is the difference created between a slow flip and a fast flip?

What happens when the flipping is reversed?

Students should create their own motion booklets to depict erosion. After the booklets have been completed, they could choose their own way to express the idea communicated in their booklet.

Possible examples:

poem
story
tape record or videotape story or poem
song
video or board game

Follow-up suggestions

The students can make different kinds of motion booklets.

The students can exchange booklets and be challenged to arrange their pictures in the proper sequence and/or write a story to accompany it.

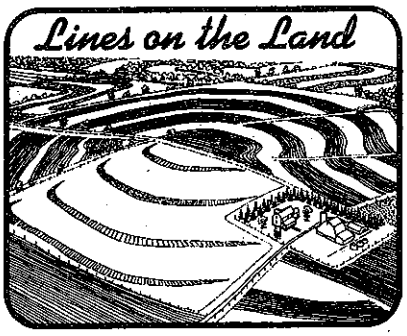
The students could take their motion booklets to an elementary class and share their booklets and stories with groups of children.

Resources

*DeVito, Alred and Krockover, Gerald H., Creative Sciencing, Little, Brown and Company, Boston, Toronto, 1980.
**Choices on the Land, available through your local Soil and Water Conservation District.
***Understanding Our Earth: Surface Change, Coronet/Centron, 1977.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Splish - Splash



Activity in brief:
Students will discover the destructive force of rain on soil and how to prevent it.

Subject area

Science

Learning outcome

Students will be able to explain rain's destructive force on the soil.

Students will be able to demonstrate a variety of ways to minimize rainfall's destructive force on the soil.

Students will be able to relate the effects of rain's destructive force to soil conservation practices.

Site

Classroom

Suggested time

2 periods

Materials

soil (different types)
water
eye dropper
white paper or newspaper
resource material
tablespoon
ruler
container for water

Exploration

Students will examine the outcome of rain dropping onto soil.

Concept development

Students will develop the concept of erosion and the mechanics which may cause it to occur.

Application

Students will demonstrate a variety of ways to minimize rain's destructive force on soil and relate these to soil conservation practices.

Teacher notes

For your information

Background

Soil will not erode if rainfall cannot reach the soil to create the splash. Different kinds of cropping systems are assigned values for the amount of cover they provide the soil during the period we receive the most rainfall.

Row crops (corn and soybeans) allow the most erosion because they expose more soil. Crop residue can be left on the soil surface as cover. It also helps to rotate crops (corn one year, soybeans the next, oats the next, alfalfa another year) because oats and hay give more ground cover.

There are two basic ways people can control soil erosion; either place a protective cover on the soil or slow the rate at which water runs off the soil.

Soil particles must be dislodged before they can be moved. This is one part of the erosion process. When raindrops fall on bare soil, much energy is expended. Small clods and soil granules are broken down by the impact of the falling drops of water. Studies made by the Soil Conservation Service show that from 1 to 100 tons of soil per acre may be splashed into the air during one rain. This splashed-up soil consists of single particles that have been dislodged from the soil mass. Thus, they are easily transported from their original location by any water movement on the surface, no matter how slight. There need not be a steep slope for this kind of erosion since fine particles can be carried by slow-moving water.

The effects of splash erosion can be observed after any hard rain. Small pebbles will be perched on pedestals. You can also see splashed soil in gardens and schoolyards, on sidewalks, on vegetables and flowers, on basement windows and picket fences. One of the reasons for mulching strawberries is to keep splash off the fruit. Any kind of crop cover cuts down soil movement. But close-growing crops and mulches are the best protection against this type of soil erosion.

Exploration

Give each group of three students a 12" x 18" sheet of white paper or newspaper, an eyedropper, a small container of water, and a spoon of soil. Place the soil in the middle of the newspaper. Release the water drop by drop from chest height and record observations about what is happening.

Record and report as a group what was observed. Examples.

1. *Distance of splash from soil.*
2. *Area where most of the splash occurs.*
3. *The effect of the water on the soil.*
4. *Compare the effect of water on the dry soil versus the saturated soil.*
5. *The height of the splash.*

Concept development

Through questions, focus the students thinking on observed phenomena, helping them to create the concept of erosion.

Application

Repeat the process using new soil and a new sheet of paper. Challenge the students to develop ways to minimize the force of the water on the soil. Have them record their observations and evaluate the effectiveness of minimization processes.

Then have each group share their findings with the class. Make a list of the various preventative methods students used in their experiment.

Discuss if and how these methods could be used by farmers.

Have the students use resource materials to research methods of soil conservation that farmers are using to minimize the force of water on their soil. List and describe these methods. Then have the students list all the similarities between the methods they used and the methods they researched.

Soil conservation methods that minimize the force of water on soil - taken from Lines on the Land:

1. *conservation tillage*
2. *mulch tillage*
3. *no-till or slot-till*
4. *crop rotations*
5. *terraces*
6. *contour farming*
7. *contour stripcropping*
8. *grass waterways*
9. *grass field borders*
10. *contour buffer strips*

Follow-up suggestions

Interview a soil conservation district officer and discuss the soil conservation practices that are used in the county.

Invite a conservation farmer or district conservationist to speak to the class.

Write a short story from the perspective of the soil with an approaching thunderstorm.

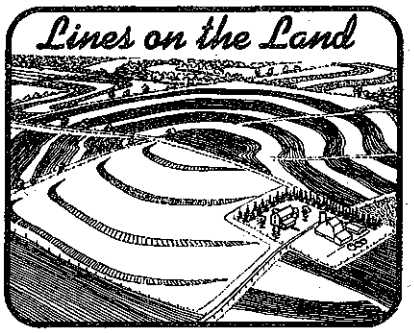
Paint 8" x 11" pieces of board white and place them around the school. Have the students predict where the area of greatest and least splash will be.

Resources

**Adapted from the Outlook Environmental Education Enrichment Program, 6-8 packet, "Water the Destructive Force," 1983.
Film ** Splash Erosion, 8 min., 1987. (Available from Iowa Area Education Agencies)

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Rate the Loss



Activity in brief:
Students will design and carry out experiments which will measure soil loss due to erosion.

Subject area

Science
Math

Learning outcome

Students will design and carry out an experiment which will measure soil loss due to erosion.

Students will be able to develop a measurable relationship between slope and amount of erosion.

Students will gain an understanding of ways to reduce soil loss.

Site

Classroom

Suggested time

3 periods.

Materials

soil
2 - plastic shirt boxes OR
2 - 9 x 13 cake pans
1 piece of wood to block holes
several small blocks of wood
balance
funnel
filter paper
graduated cylinders

Exploration

Students should design and then carry out experiments which will measure soil loss due to erosion caused by differences in the slope of the soil.

Concept development

Students will develop an equation which illustrates the rate of soil erosion from their models.

Application

Students should repeat the experiment using methods which will reduce soil loss and compare their results.

Teacher notes

For your information

Background

Almost no one benefits from soil erosion. It is costly to all of us. It often raises the price of food, increases the possibility of flooding and increases the need for dredging our waterbodies.

There are two basic ways people can control soil erosion. They can either place a protective cover on the soil or change the slope of the land. Both slow the rate at which the water runs off the land. This can be done by growing plants, covering the soil, terracing, contour planting, etc.

Exploration

The students will have the materials listed available to them. One of the plastic or metal containers should have a slit cut in one end which runs the entire width of the container. The second container will be used to catch the runoff. (Students could bring in shoe boxes and line them with plastic or contact paper as an alternative.)

If the students haven't done the activity on slopes, allow them to investigate the factors which will change the rate of erosion. Then they can develop their experiment. Check to make sure they are controlling the variables before they begin the actual experiment. They should place the piece of wood over the holes until they are ready to pour the water.

They should be reminded to keep accurate records of their observations and their data. You might want them to construct a data table which will include a place for the results found in the application portion of this activity.

Concept development

Guide the students toward the idea that there are two basic ways people can control soil erosion. Lead them through by questioning them about their results.

What relationship did you discover between slope and rate of soil loss?

This is where they will show you the equation they developed to measure soil loss. You should introduce the Revised Universal Soil Loss Equation so the students can see how professionals measure soil loss.

A = R K L S C P

A = soil loss predicted
R = rainfall factor
K = soil erodibility
LS = length and steepness of slope
C = cropping and management
P = conservation practice

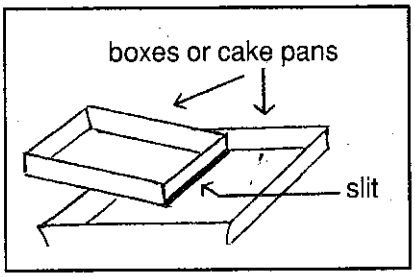
How might you change the conditions to decrease soil loss?

Depending on their response to the question above you may need to ask more leading questions such as:

When you ride in the country, what do you see in the farm fields? In winter? In spring? In summer? After a hard rain?

Some of the responses may be corn and bean stubble, plants growing, grass waterways, gullies, plants under water.

How do farmers plant their crops? Up and down hills or around hills? Which is best?



Application

Again you will want to be sure they control the variables. You might want to put some of their results on the board to see if there are some conservation practices which are better than others in preventing soil loss.

How did the rate of loss change with each different conservation method you chose?

Follow-up suggestions

Interview a district conservationist or soil expert about the soil loss rate in their area.

Read, summarize and give their opinion of a newspaper or magazine article about soil loss.

An enrichment activity for better math students: (Using the formula of

$$\text{flow} = \frac{\text{length of hill}}{\text{height of hill}}$$

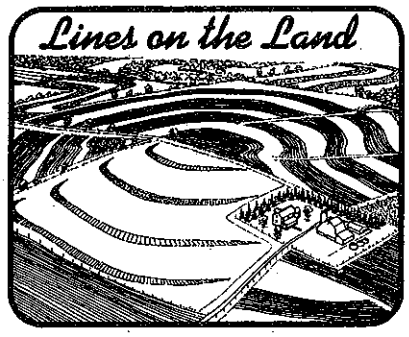
calculate the change in the rate as the height or length of the slope changes).

Resources

Local SCS, conservation district or Extension Service office.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Settling the Soil Soup



Activity in brief:
Students will examine water samples for sedimentation and relate the effects of sedimentation to their community.

Subject area

Science

Learning outcome

Students will be able to relate sedimentation to soil erosion.
Students will be able to state ways sediment affects their community and suggest ways to reduce sedimentation.

Site

Classroom

Suggested time

2 to 5 days

Materials

jars
water samples (from different streams and farm ponds)
ruler
tape
paper
pencil
clock

Exploration

Students will collect water samples and observing the containers of water over a period of two or three days. They will compare and contrast the samples with tap water treated in a similar manner.

Concept development

Students will explain the relationship of sedimentation to soil erosion.

Application

After a presentation by a local soil conservationist, the students will state 3 ways sediment affects their communmity and suggest ways to reduce sedimentation.

Teacher notes

For your information

Background

Sediment washed from farmland, construction sites, and streambanks hurts both the farmer and the city dweller. Much of the sediment carried by streams is topsoil, the best soil for growing crops. A lot of sediment also comes from gullies, construction sites, and roadside ditches. Listed below are several ways sediment affects everyone:

Water supply reservoirs are losing water-storage capacity each year to sediment. Water bills are higher because the water must be filtered.

Some of the electric power generated in the United States comes from hydroelectric plants. The storage reservoirs serving these plants are gradually filling with sediment.

Sediment fills road, railroad, and field ditches, plugs culverts, and clogs stream channels so they must be cleared or the bridges raised. All this raises taxes.

Floods are more frequent and more serious, partly because the streams are choked with sediment, resulting in less capacity to hold and carry floodwaters.

Sediment harms fish by covering up their spawning grounds and shading out light. Many fish die during floods when their gills are clogged with sediment.

Many harbors and river channels must be dredged. The purpose of dredging is to keep the main channel free of sediment to permit commercial river and pleasure boat traffic. According to the St. Paul District Corps of Engineers, "On the Upper Mississippi River during 1984, 8,333,024 cubic yards of sediment were removed from Minneapolis - St. Paul to Guttenberg, Iowa and the cost of the dredging totaled $5,700,400". They also reported "Material introduced into the navigation channel has two main origins -- the uplands and the streambanks. Heavy rains wash sediment from farm fields into streams and tributaries, where it is carried into the main river channel ... Water scours unstable river banks and transports sediment and deposits it on the inside of bends in the navigation channel."

Sediment is a national problem as well as a global one. Nationally, sediment damage amounts to millions of dollars annually.

Soil and water conservation measures applied to rural and urban areas within a watershed will greatly reduce sediment. Erosion that causes sediment deposition can be reduced up to 90 percent with soil and water conservation measures. Watershed management practices to reduce soil erosion include growing grasses and trees (which reduce erosion greatly), contour farming, contour stripcropping, more grass and legumes in crop rotations, and terracing.

Exploration

In groups of three, have the students collect samples of water from different locations. *(Note: when taking a water sample from a steam, position the bottle below the water surface and fill it completely.)* The optimum time for collection is after a hard rain, but this does not always work out. Have the students label the samples with the following information.

A. A description of the location
B. Use of the land near the collection site (industry, farming, housing, pasture, woodland)

Use a quart jar of tap water for a control. Shake each jar for five seconds, then compare the samples to the control sample.

Have the students brainstorm criteria for their observations:

A. color of water
B. amount of particles (sediment) appearing to settle
C. contents
D. where the particles came from
E. time for sediment to settle
F. make-up of material

Have the students observe the water samples for three to four days and record their findings.

Resources

*Adapted from Protecting Agricultural Land, Minnesota's Ag - Stravaganza, "Stream Sediment", Minnesota Association of Soil and Water Conservation Districts, 1985.

Concept development

To attain the desired learning outcomes have the students discuss the following questions.

A. Why did the particles settle?
B. Where did the particles originate?
C. What had to be done to tap water to get rid of particles?
D. Where do you think these particles might be deposited and what types of problems could they cause?
E. What caused the variation in water samples?

Other possible questions:

Water which is filled with sediment must be filtered. Does this affect you?

Storage reservoirs serving hydroelectric plants are gradually filling with sediment. Does this affect you?

Stream channels, railroads, drainage ditches, and culverts are becoming clogged with sediment. Does this affect you?

Many harbors must be dredged annually. Does this affect you?

Excess nutrients, pesticides, and fertilizers that wash off city lawns and agricultural lands are attached to the sediment. Does this affect you?

Streams and wetlands choked with sediment have less capacity to carry floodwaters. Does this affect you?

Sediment carried by streams in rural areas might be a farmer's topsoil. Does this affect you?

Sediment covers up fish spawning grounds and shades out light. It may also clog the gills of fish during floods. Does this affect you?

The national sediment damage amounts to millions of dollars annually. Does this affect you?

Follow-up suggestions

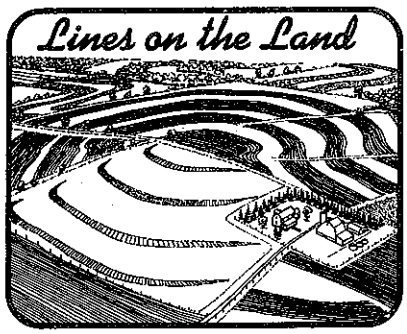
Have the students collect a sample each month from a specific location. Then compare and discuss the differences.

Have the students publish an article about the problems with sedimentation and methods to prevent sedimentation.

If a stream table is available, allow students to experiment and collect sediment.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

It's All Down Hill From Here



Activity in brief:

Students will explain the effects water has on soil and develop the relationship between slope and erosion.

Subject area

Math
Science

Learning outcome

Students will be able to explain the relationship between the slope of the land and erosion by water.

Students will be able to locate examples of slope erosion on the school grounds or in their community.

Students will be able to predict which slopes would be most susceptible to erosion factors.

Site

Classroom

Suggested time

2 class periods

Materials

plastic trays or pans
soil
water
small paper or plastic bathroom cups
paper
pencil

Exploration

Students will observe the effects of water ("rainfall") on different arrangements of soil

Concept development

Students will develop the relationship between slope and erosion through questioning by the teacher.

Application

Students will go outside in the school yard and look for examples of slope erosion and/or areas which may be susceptible to erosion. They should record detailed observations of these areas.

Teacher notes

For your information

Background

The slope of land is its steepness. Slope and length of slope are two of the more important features of land because they affect the erodibility of the soil and its suitability for many uses.

Slopes can be expressed as a percentage. Percent slope is a measure of the vertical rise or fall of the land over a horizontal distance of 100 feet.

The length of a slope is the distance between the point where water begins to flow to a point where the slope decreases enough so that soil is deposited, or to a point where water enters a well-defined channel or water-course.

The longer or steeper the slope, the more easily runoff can move soil particles. The soil loss increases as slope length increases because of the greater accumulation of runoff. Slope steepness also affects soil loss. As the velocity of the runoff water increases, greater erosion occurs.

Slope is important in deciding proper land use. It often determines whether a piece of land should be used for grass, trees or cultivated crops. It also must be considered when selecting sites for houses, trails, campsites, buildings, highways, septic tanks, sanitary landfills and parks. The chart attached lists suggested uses for sloped land. *(See illustration).*

Exploration

Students will be given a plastic tray or pan, soil and a small paper cup with water. They will arrange the soil in different ways and then observe the effect that water has on each soil arrangement.

Make sure the cups you use are not too large. Paper or plastic 3 oz. bathroom cups should work well. Observe students as they work and encourage them to try many different arrangements of the soil. Students should be making hills and valleys, flat, gradual and steep landforms to show how the different forms are affected by water erosion. As they work, pose the question: How does water affect the movement of soil?

Concept development

Draw examples of what the students have discovered on the board to reinforce the idea of the greater the slope the more erosion present. Key questions to ask:

What happened when you poured water over the soil?

How did the soil arrangement affect soil movement?

What is the relationship between the height of the soil and the amount of soil moved?

Once height of hill and increased erosion is understood, the term "slope" can be introduced.

Application

Have the students turn in their observations after drawing some conclusions about what they found out about the erodibility of the land on their school yard. Students can return to these areas in the future and observe changes. Ideal times to return would be after a rain or a snow melt.

Follow-up suggestions

Have students take pictures of examples of slope erosion in the county and design a way to display them.

Interview an officer from the Soil and Water Conservation District to find out about slope erosion in their county and what is being done to reduce it.

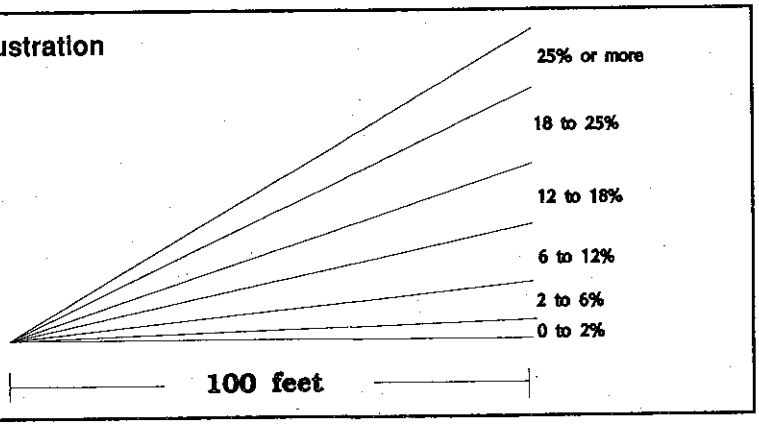
Find examples of slope erosion within the city limits and prepare a report to be shared with the class.

Have students develop an experiment to measure the relationship between the slope of the land and how much erosion is taking place.

Resources

*Protecting Agricultural Land, Minnesota's Ag - Stravaganza, "Measuring the Slope of the Land", "Soil is Lost by Water Erosion", Minnesota Association of Soil and Water Conservation Districts, p. 59-65 and 821-85, 1985.

Illustration



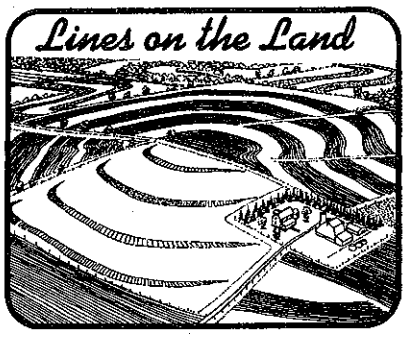
Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Measuring the Slope of the Land

Agricultural Uses	**Slope**
Farm crops -- cultivation Good soil management practices	0 - 3%
Farm crops -- few to several Special cultivation practices	3 - 20%
Occasional cultivation Many special practices	20 - 30%
Pasture - woodland and cultivation Limited use of machinery	20 - 30%
Pasture, timber growing, woodland wildlife Limited use of cultivation machinery	30 - 90%
Wildlife, recreation	All

Developmental Land Uses	**Slight Limitations**	**Moderate Limitations**	**Severe Limitations**
Roads and Streets Slopes	0 - 12% Slope	12 - 30% Slope	over 30% Slope
Building Sites Slopes	0 - 12% Slope	12 - 30% Slope	over 30% Slope
Septic Tank Filter Field Slopes	0 - 7% Slope	7 - 12% Slope	over 12% Slope
Picnic and Camp Areas Slopes	0 - 7% Slope	7 - 15% Slope	over 15% Slope

Buried Treasure



Activity in brief:
Students will find that there are different layers of materials in core samples taken from the inner curve of a river or stream bank and will describe the events which may have transported the materials to this location.

Subject area

Science
Social Studies

Learning outcome

Students will be able to distinguish different materials in core samples.

Students will be able to evaluate the data collected to determine that periodic deposition occurred.

Students will be able to reconstruct past flooding history.

Site

Classroom/outside.

Suggested time

2 to 3 class periods.

Materials

soil core samples
rulers
pencil
paper
newspaper
coring device

Exploration

Students will take several core samples from the flat bank at the inside curve of a creek or river. Observations, measurements and comparisons will be made of the various core samples.

Concept development

Students will interpret the data to show periodic deposition due to flooding.

Application

Students will research past events to discover how and when materials were transported.

Teacher notes

For your information

Background

Erosion is the process which moves soil from one location to another by wind, water or other natural action. It is a natural process accelerated by human action. Erosion has several harmful effects. Farmers may harvest a smaller crop per acre. Fields become less productive and more difficult to cultivate if large gullies develop. Gardens and lawns may need more fertilizer to provide lost nutrients to the soil. Sediment from eroded land fills our rivers, ditches, streams, wetlands, etc. causing more frequent flooding and destroying fish and wildlife habitats. Costly dredging is often required to correct sedimentation problems. A sandbar forms during this sedimentation process. Typically, in the flooded area of the bank, you will find layers of sand over silt. Thickness of each will depend on intervals between flooding and length of flooding period.

Exploration

Get soil samples from a steam or river bank. It is important to get the soil samples from the flat portion of the bank on the inside curve of the river or stream where deposition takes place. Take several samples so the students can observe the different materials present, calculate the width of each layer and compare within each sample and between samples.

A post hole digger could be used to dig samples. You could ask your district conservationist for help or to put you in touch with someone who could help you.

Concept development

Students will use the data collected in the exploration to show the periodic deposition of material due to flooding.

They should be able to see the different layers of material deposited during each episode of flooding.

Application

Students will use diaries or journals, newspaper articles and weather records to find out what types of events occurred to determine how the materials were deposited and when deposition occurred. Check your local governmental records for periods of flooding.

Follow-up suggestions

Write an article for the newspaper describing the findings.

Develop a soil profile for the core samples that were investigated.

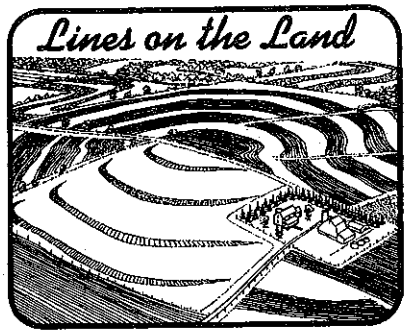
Repeat the activity using core samples taken from an area where wind has deposited material.

Resources

*Protecting Agricultural Land, Minnesota's Ag - Stravaganza, "Soil Lost by Water Erosion", Minnesota Association of Soil and Water Conservation Districts, p. 81-82, 1985 or Soil Conservationist from the local district office.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Don't Blow It



Activity in brief:
Students will produce a model that will prevent wind erosion.

Subject area

Science
Math

Learning

Students will be able to identify evidence of erosion and that wind is one cause.
Students will be able to recognize and implement factors that help prevent wind erosion.

Site

Classroom

Suggested time

class periods

Materials

Hand-held hair dryer
large cardboard boxes
aluminum pans
cutting instrument
scale
soil
poster board
markers

Optional items
paper
toothpicks
buttons
wood chips
evergreen needles
clay
crop residue
straws

Note: you should use several items from the optional list.

Exploration

Working in groups of three, the students will observe and measure the amount of erosion on uncovered ground.

Concept development

Students will interpret their observations and data to show that wind is involved in the process of erosion.

Application

Working in groups of three, the students will construct a model to limit soil erosion.

Teacher notes

For your information

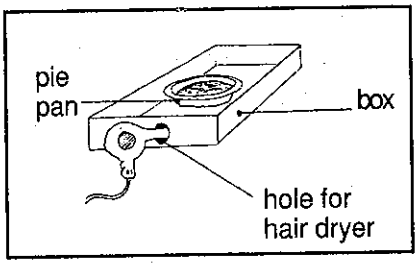
Exploration

In groups of 3, the students should set up their investigation to test the amount of erosion on uncovered ground. Each group should be given 1/2 cup of soil. Weigh and record the weight of the soil. A thin layer of soil should be placed in each pan and weighed. The pan should then be placed inside the box. *(See diagram below).*

Place the blow dryer in the hole in the box. Turn the blower on low for 30 seconds to simulate wind. Lift the pan out of the box, collect the soil and weigh it in the pan. Record your results.

To extend the activity, have the students test other variables, such as the speed of the hair dryer, temperature of the air, the humidity, and the amount of cover on the soil. The wind velocity of the hair dryer could be compared to actual wind speeds. The effects of humidity could be seen by using a vaporizer to add humidity to the box and then repeat the exploration.

If cardboard boxes are not available, you could use large cake pans or a poster board frame. Boxes could also be constructed by cutting up cereal boxes and taping them together. Industrial Arts teachers may also be able to make the boxes for this activity.



Concept development

Students will share their observations and data with the class. Through questioning they will develop the concept that soil can be eroded by wind. Suggested questions might be:

Where did the soil come from that you measured?

How did it get there?

What does the hair dryer represent?

What happens when a farmer plows his field and then the wind starts blowing?

Where might this soil go?

What does the land look like after the wind dies down?

Application

A variety of materials from the optional list should be available for each group. The teacher may wish to have them in one area and let each group decide which materials they wish to use. Each group should put together a model that will limit the amount of erosion. Test their findings and record the weight of the eroded soil. Be sure they separate the soil from the ground cover they use. Record their findings and write a conclusion based on this information.

Follow-up suggestions

Research a past era when wind erosion played a major role in people's lives.

Study the surface features and weather patterns of the United States and decide where wind erosion is most common. You may wish to go beyond the U.S. in this study.

The students can draw a poster to represent their ideas on erosion control.

A spring field trip through the countryside to look at the effects of wind erosion on bare land.

Resources

Protecting Agricultural Land, Minnesota's Ag-Stravaganza, "Soil is Lost by Wind Erosion", Minnesota Association of Soil and Water Conservation Districts, p. 89-95, 1985. Local SCS offices.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Blowing in the Wind

Activity in brief:
Students will become aware of the causative factors of the Dust Bowl Era and relate today's conservation practices to the prevention of another "Dust Bowl".

Subject area

Social Studies
Language Arts
Science

Learning outcome

Students will be able to describe the effects of erosion on the land as well as people during the Dust Bowl Era.
Students will be able to identify the causes of the "Dust Bowl".
Students will be able to list conservation practices employed today and explain how they are helping prevent the recurance of the "Dust Bowl".

Site

Classroom

Suggested time

3 class periods

Materials

film
projector
The Grapes of Wrath book
large sheets of paper
markers

Exploration

The teacher will read chapter 1 from The Grapes of Wrath and have the students answer questions based on how they interpret what happened and the causes for it.

Concept development

Students will identify, from the reading, causes of the "Dust Bowl" and how it affected people and places.

Application

Students will prepare a list of questions to be answered by a guest speaker concerning the possible recurrence of the "Dust Bowl".

Teacher notes

For your information

Background

Wind erosion causes soils to move from one location to another. Most wind erosion occurs in areas of high prevailing wind speeds, light soils (composed of particles that are easily moved by the wind) and limited vegetation cover. Wind erosion is a particular worry on large-sized open fields (without trees, grass strips, crop residue).

Soil from a large open field, where winds can get a good sweep, is more likely to blow than soil from a small open field. And the damage often spreads. Windblown soil may fill drainage ditches and pile up along fence rows and on roads. Blowing soil may even create highway driving hazards by limiting vision.

The most dramatic example of how wind erosion affected individuals and society occurred during the 1930's -- the Dust Bowl Era.

Before the 1930's much of the tough, drought-resistant prairie grasses that grew naturally in the Plains states were plowed under. In place of these grassses, which were ideally suited for this environment, corn and wheat were planted. These crops were less drought-resistant and could not protect the soil from erosion as effectively as the native grasses. Also, after the harvest of these crops, the land was left without vegetation. In addition, some of the rangeland in the Plains was overgrazed by cattle and sheep, leaving weakened vegetation and bare soil.

In 1931, the first of several severe droughts of that decade hit the region. Crops failed and as the weakened plants died, vast areas of bare soils were exposed to the strong prairie winds. The autumn of 1933 marked the first of many dust storms. Soil was picked up and blown as far away as Washington, D.C. and to other East Coast areas. From two inches to one foot of topsoil were lifted and eventually piled up over roads, houses, farm equipment and trees. The summer temperatures were hot, the weather dry and the sun shown red through the gray haze caused by the dust. There was a sense of gloom, confusion, misery and hopelessness among the many people who lived in the Dust Bowl Era. This era was caused by a combination of three factors: The Great Depression, drought and poor agricultural practices.

This activity would be a good interdisciplinary lesson involving science, social studies and language arts.

Exploration

The teacher should read chapter 1 of The Grapes of Wrath, by John Steinbeck to the students. Before beginning the reading, ask the students to try to put themselves in the situation that is described in the book. You may want them to close their eyes and just listen carefully.

When the reading is completed, the following questions should be given to and answered by the students.

When do you think this will or would have taken place? Why do you think so?

How would you feel if you were involved in this situation?

How would this have changed your life? Your family's life?

How did you feel as you heard this story?

How must the sky have looked?

Where did the blowing soil collect?

The teacher may wish to have the students interview a grandparent or other person to get some input to these and other questions.

The students should share their answers to these questions in small groups or as a whole class. Record a master list of answers.

The teacher may wish to have a "Dust Bowl" area marked or a U.S. map so the students can see where it occured.

Showing a film that covers the "Dust Bowl" would be beneficial to the students at this time. A list of suggested films is located in the resources.

The Grapes of Wrath would also be an excellent film to show the students the hardships the people of that time faced.

Concept development

Once the term "Dust Bowl" has been identified using a film or other resources, each group should be given these questions and asked to compile a list of ideas for each.

What caused the Dust Bowl Era?

What effects did the "Dust Bowl" have on peoples' lives?

Do we have the potential for the Dust Bowl Era to return today? Why or why not?

After compiling their list a "master" list should be recorded on the board. Discuss students' responses.

Application

Ask your district conservationist to come and discuss the conservation practices being done today to reduce the chances of the "Dust Bowl" reoccuring. Students should prepare three questions to ask the speaker.

Follow-up suggestions

Play Woody Guthrie songs, "So Long It's Been Good to Know You", "Talking Dust Bowl" and "This Land is Your Land" to express the feelings of that era. Have the students write their own stories, poems or songs to represent how they feel.

Encourage or assign students to research the Dust Bowl Era. Have students interview people who were directly involved in the Dust Bowl Era and tape record the interview. Share it with the class. You may wish to bring someone into the classroom.

Put on a play to recreate the Dust Bowl Era. Invite elementary classes.

Resources

*Protecting Agricultural Land, Minnesota's Ag-Stravaganza, "Soil is Lost by Wind Erosion", Minnesota Association of Soil and Water Conservation Districts, p. 89-95, 1985.

*Steinbeck, John, The Grapes of Wrath, 1939.

**Films: (available from area education agencies)

Dust Bowl, McGraw Hill, 1960. (26 minutes)

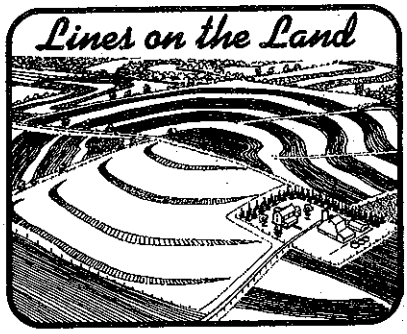
Grapes of Wrath, Zenger, 1940. (129 minutes)

We Are of the Soil, International Film Bureau, 1977. (23 minutes)

The Grapes of Wrath, CBS - BfA, 1968. (28 minutes)

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Daisy's Dilemmas



Activity in brief:
Students will resolve dilemmas posed and create their own dilemmas dealing with soil erosion.

Subject area

Values
Language Arts
Social Studies

Learning outcome

Students will be able to examine their own values and beliefs related to soil erosion.

Students will be able to recommend possible actions that may be taken to alleviate the problem.

Students will be able to produce their own dilemmas and solutions concerning soil erosion.

Site

Classroom

Suggested time

1 to 2 class periods

Materials

dilemma cards
paper
pencil
resources (optional)

Exploration

The teacher will select a dilemma card and present the situation to the class. The students, working in pairs, will choose one of the options and develop the reasoning behind their choices. Each group will present their choice and reasoning to the class.will present their choice

Concept development

The class will select and justify a resolution to the dilemma.

Application

Each student will develop a soil erosion dilemma and corresponding options.

Teacher notes

For your information

Background

There are a variety of situations which may arise concerning soil erosion that will require value judgements to be made. These situations and their solutions will vary from county to county and state to state depending on the land forms and laws involved.

The dilemma cards provided may be laminated for preservation.

Exploration

Encourage students to really think through their position and to defend it with pertinent information. You may furnish resources for them to use to defend their position. This will depend on how involved you want them to get.

Discussion should be encouraged but consensus is not recommended. Each student or group of students will have their own set of values.

Concept development

After all groups have presented their reasoning to the class, the class will select one resolution to the dilemma and justify this choice.

Application

Instruct the students to pattern their dilemma after the ones you presented. You should probably stipulate at least 3 different options plus others.

Follow-up suggestions

Write a paragraph on the positive and negative effects of each option suggested by the students in the dilemma they developed. Indicate what additional information might be needed to make responsible, informed decisions.

Repeat the activity using a different dilemma card.

Invite a representative of the SCS, conservation district, ASCS or Extension Service to your class. Have the students pose a dilemma to the representative and ask how he/she might resolve the problem.

Resources

*Project Wild, "Ethi-Reasoning", Western Regional Environmental Education Council, p. 219, 1985.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

DILEMMA CARD

You are a farmer. You've been studying and hearing about farming practices, like leaving edge areas for wildlife and organic pest control.

Although these practices may improve your long-term benefits, they may reduce your short-term profits. You are already having trouble paying your taxes and keeping up with expenses. You should:

* Sell the farm.
* Keep studying farming practices, but make no changes for now.
* Try a few methods on some of your acreage and compare the results with similar areas on your land.
* Other.

DILEMMA CARD

You live on an acreage which has a stream running through it. You notice that each year the stream becomes more clogged with soil. (sedimentation) You investigate and find the soil is coming from your neighbor's farm field. You should:

* Ignore the problem.
* Encourage your neighbor to check on soil conservation practices.
* Dredge out the stream yourself.
* Call a district soil and water conservation commissioner.
* Other.

DILEMMA CARD

You are a city dweller who has just purchased a farm. Your farmland is not flat, but has many hills and a stream cutting through it. You notice the road ditches around the farm are full of soil. You should:

* Sell the soil.
* Put the soil back on the field.
* Call a soil conservationist, the SCS or conservation district office.
* Return to the city, you have no business in farming.
* Other.

DILEMMA CARD

While plowing your fields this year, you notice several deep gullies running through them. At the end of each gully there is a large spread out fan of soil. You are working with a very limited budget, but have a good credit record with the bank. You should:

* Plow the gullies up and plant your crops.
* Put in grass waterways to reduce soil loss.
* Terrace the area to shorten the slope and reduce soil erosion.
* Call your district conservationist for an evaluation of which conservation practices would work best on your farm.
* Other.

DILEMMA CARD

You own a construction company and are in the process of building houses in a large, hilly development. The homes at the bottom of the hills were finished first. You are now in the process of constructing several homes farther up the hill. The residents at the bottom of the hill are threatening to sue you because their lawns were covered with mud and the storm drains, clogged with soil and debris, backed water into their basements during the last hard rain. How will you remedy this situation?

* Ignore the complaints.
* Tell them to talk to the city planners because it isn't your problem.
* Develop and put into effect a plan to reduce soil loss from exposed areas.
* Seed areas immediately after digging basements.
* Other.

DILEMMA CARD

You have just inherited a 500 acre farm. This farm has some land used for crops, some woodlands and some pastureland. However, some of this crop-land is hilly and shows signs of erosion. Your parents left you this farm, but it has been awhile since you were involved in farming and some of the methods have changed. How are you going to handle this dilemma?

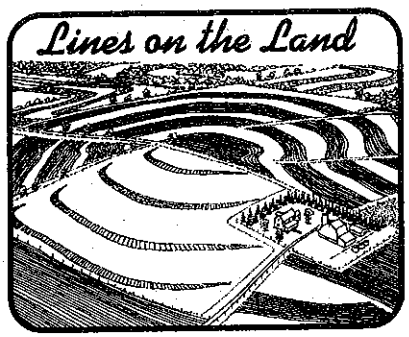
* Go to school and take some courses in farm management and erosion control.
* Allow the problem to continue, since you don't know much about it.
* Meet with your district conservationist and develop a plan of action.
* Jump right in and tackle the problem the best you can.
* Other.

DILEMMA CARD

You are a member of your town council. The XYZ Landfill Company has presented the council with a proposal for a new landfill. It will be located right along the river which runs through your town. In order to keep it as unsightly as possible they will continually cover the debris with soil. As a council member, you will have to decide if you are going to allow this landfill to be built. How will you, as a council member, decide the outcome of this proposal?

* Accept it as is.
* Accept it, but recommend changes. (Tell what changes you recommend).
* Reject it.
* Other.

Land Puzzles



Activity in brief:
Through the use of cardboard shapes, students will develop the concept of the contour map and be able to explain it to others.

Subject area

Science
Social Studies

Learning outcome

Students will be able to relate the different shaped stacks to different landforms.
Students will develop the concept of contour maps (topographic maps) and interpret the topographic map to others.

Site

Classroom or outside.

Suggested time

1 to 2 class periods

Materials

flat cardboard puzzle pieces
paper
pencils
topographic (contour) maps

Exploration

Given precut pieces of cardboard, students are asked to determine the different ways the pieces can be stacked so that each new way has a different shape. They will draw the patterns of each different stacking and relate these shapes to different landforms.

Concept development

The students will, using the drawings of their different stacks and filling in the missing information, develop the concept of topographic maps.

Application

In small groups, students will decide how to interpret a topographic map. Each group will then interpret their topographic map to the other groups.

Teacher notes

For your information

Exploration

Puzzle pieces from cardboard in several different shapes (these should be cut out ahead of time - possibly by someone in the Industrial Arts area) but designed so that they can be stacked largest on bottom, smallest on top. A drawing of each stack will be needed to keep track of the different shapes. Teacher questioning will help lead students to drawing the appearance of each stack. Depending on the time, you might ask the students to make 3, 4 or 5 different drawings. After the drawings are completed (or nearly so), have the students compare with each other the different drawings they have made. Group according to sameness. Ask the students:

How are your drawings the same as the stackings?

How are your drawings different from the stackings?

How could you make your drawings provide the missing information?

How could you show height on your drawings?

Below are some examples of puzzle shapes which could be used.

The greater the number of layers, the more complex the activity.

Concept development

Have the students revise a few of their drawings to provide the missing information. This is when they will add in the thickness of the cardboard pieces starting with the first layer = 3mm. Each layer will be 3mm greater than the last so that layer one = 3mm, layer two = 6 mm, etc. Through questioning, help them recognize that they have produced a map (a topographic map). Examine with them where this kind of map might be useful.

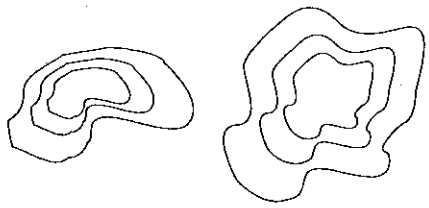
Application

Each group of students will be given a different topographic map and will have to decide how to interpret it. They will then describe their map to the other groups. Group dynamics is vital, each will teach the others in their group.

Follow-up suggestions

The students can smooth out their puzzle lines with paper mache to see what the landform will look like.

Using a topographic map, make a model of a section of the map using cardboard or styrofoam and paper mache and then write a brief description of the model.



Resources

* Maps available from your local Agricultural Stabilization and Conservation Service, SCS office or Forest Service office.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Linking Lines

Activity in brief:
Students will create a model based on the best soil conservation practices derived from a contour map.

Subject area

Social Studies
Art

Learning outcome

Students will be able to formulate land use recommendations based on landforms given on a contour map.

Students will be able to develop a plan to incorporate a variety of soil conservation practices on specific landforms.

Students will be able to construct a model to represent soil conservation practies.

Site

Classroom

Suggested time

5+ class periods

Materials

paper mache materials
1m X 1m plywood
poster board
markers
stencils
reference materials
tempera paint
cardboard
box cutters/utility knives
opaque projector
enlarged section of a contour map
miscellaneous materials from home for application and follow-up suggestions

Exploration

In small groups, students are asked to research conservation practices and closely examine a contour map to generate a list of ideas about how the land should be used.

Concept development

As a class, students will formulate a plan of a varitey of soil conservation practices that will best fit the landforms on their contour map.

Application

Students will construct a three dimensional model which will illustrate the best soil conservation methods for the area represented on the contour map.

Teacher notes

For your information

Background

Students should research conservation farming practices before generating their list of land uses. The "Lines on the Land" booklet provided with these activities contains sufficient information. A film on conservation practices and/or a guest speaker such as a conservation farmer or an officer from your conservation district could also be used as sources of information.

A contour map has been provided for your use, but you may want to choose a local area to make it more effective in helping the students relate the wise use of soil and water to their everyday lives. You can contact your local Conservation District for a conservation farmer in your area. You can also obtain a contour map through that office.

After a careful study of the land, a farmer makes a plan to use each part of the farm. This plan becomes the farmer's blueprint for his or her farming operation. After plans are made for use of each land area, plans are then made for the necessary supporting conservation practices like crop rotations, terraces, grassed waterways, stripcropping, contour farming, conservation tillage, and woodland and wetland protection.

The soil conservation plan fits the farm because it is made according to the physical nature of the land and suits the farmer's needs and abilities.

Exploration

Have the students work in small groups to examine a contour map and to generate ideas on how the land should be used.

For example:

1. Should this land be used for farming? If so, what areas are good for farming?

2. Should pasture be included?

3. Where should the farmhouse be located?

4. Is there going to be livestock on this farm?

5. Is a farm pond needed?

The students' decisions should be directly marked on their contour map. The teacher could have the same map on a transparency so students could explain their plans to the class. The class will have to come to a consensus about the land use.

Concept development

In small groups, have the students decide where the soil conservation methods should be placed on their contour maps.

Physical features and conservation practices should be considered as follows:

Where is the steepest slope?

Is erosion possible in this area?

Are streams or rivers a factor to consider?

Conservation practices to include crop rotation, terraces, grassed waterways, stripcropping, contour farming, conservation tillage, woodland and wetland protection.

Using a transparency, the students explain their decisions to the class. A group consensus will be made regarding the conservation methods to be used on the land.

Application

The following steps may be helpful in the construction of the model.

1. Using an opaque projector, enlarge the contour map to the actual size of the model. Using cardboard, draw and cut out each section of the contour map. (Suggested size of actual model is 1 meter by 1 meter.)
2. Using the pieces of cardboard, construct the model according to the contour map. An inch of paper mache in between each level is recommended. However, other materials could be used to elevate the layers such as small empty boxes, styrofoam, layers of cardboard, or scratch paper. Paper mache then can be used to smooth out the edges of the layers.
3. Allow the model to dry.
4. Use the individual group plans to finish construction of the model. Features to include in the landform are found in "For your information" section.

Follow-up suggestions

Design a wall chart to explain the conservation practices employed on the model. This suggestion is highly recommended as a key for the model.

Construct a similar model of the school grounds or the community.

Have a group of students find examples of the conservation practices used in the model that are in practice in the county and take pictures to display along with the model. This can also be tied in with the first suggestion.

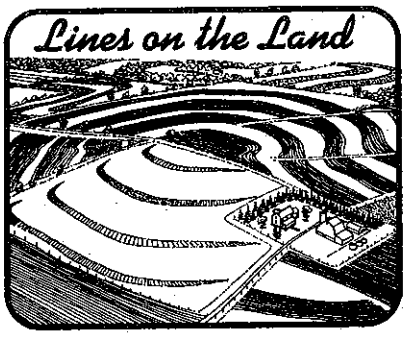
Models can be displayed at various sites in the school or community such as the school library, the county Soil Conservation Service or conservation district office, a nature center, the community library, or in agricultural classes at the high school.

Resources

Protecting Agricultural Land.
Minnesota's Ag-Stravaganza, "Conservation Farm", Minnesota Association of Soil and Water Districts, p. 181-183, 1985

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Action Speaks Louder Than Words



Activity in brief:
Students will develop a process for making a plan of action and will use their plan for completing a soil conservation project.

Subject area

Social Studies
Language Arts

Learning outcome

Students will be able to plan and carry out a project promoting soil conservation.
Students will be able to employ problem solving strategies.

Site

Classroom and outdoors.

Suggested time

3 to 5 class periods

Materials

Will vary depending on projects designed.

Exploration

In small groups, students will brainstorm and list their ideas on making a successful plan of action to promote soil conservation.

Concept development

As a class, students, using their plan of action, will design a soil conservation project.

Application

Students will carry out their soil conservation project.

Teacher notes

For your information

Exploration

In small groups, students are asked to brainstorm a list of ideas for making one plan of action to promote soil conservation. The teacher might ask:

What would be a good way to begin your plan?

How will you carry out your plan?

*Note: At this time, the teacher is trying to convey the idea of making a "how to" list and not a specific project to do as yet.

Concept development

As a class, students decide what soil conservation project(s) they wish to do. The following list includes ideas you may wish to use:

Planting a windbreak.

Develop an eroded vacant lot into a community garden.

A farm - city youth exchange.

Spend a day on a nearby farm of a conservation farmer.

Work with your district conservationist to eliminate school yard erosion.

Develop an outdoor classroom.

Design a soil - saving logo and have t-shirts printed to sell to raise money for soil conservation.

Soil conservation photo contest showing before and after photos of erosion and improvement.

Develop a set of activities to share with a class of younger students.

Produce a video, slides, etc. to arouse public awareness.

The students may also have their own ideas of soil conservation project(s). After they decide on their project(s), design the procedure for their plan of action based on what the groups brainstormed in the exploration phase. The plan of action should include these basic steps:

1. Clearly state what you wish to do.

2. Collect information to get your plan done.

3. List all materials you will need to complete your plan.

4. Do you have enough time to complete your plan?

5. What problems do you foresee and what will you do about them?

It's the teacher's decision to determine if an individual, a small group or a class project will be done. Students will use class time to work on their project(s). The teacher becomes an advisor and helper to the students based on their needs.

Application

The time and place in which the students carry out the project will depend upon the nature of what is to be done.

Follow-up suggestions

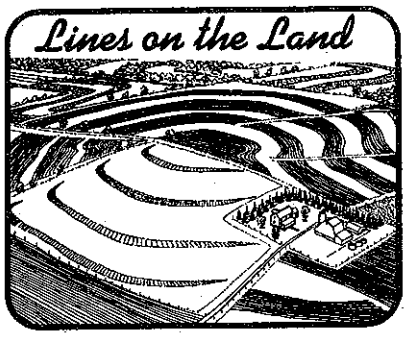
Have the students develop an advertisement about their project and turn it over to the newspaper or radio station.

Resources

**"Lines on the Land" video, available from your local Soil and Water Conservation District Office.

Designed by: Roger Beane, Donna Forsyth, Betsy Koehn, Linda Scheuermann, and Sue Smith

Digging Deeper: The Soil Has It!



Activity in brief:
Students will have the opportunity to work independently on various activities involving soil.

Learning outcome

Science
Art

Learning outcome

Students will be able to utilize the following process skills through their participation in the learning center: observing, comparing, creating, predicting, collecting and recording data.

Students will be able to recognize and review terms used in soil conservation practices.

Site

Classroom

Suggested time

Variable

Materials

See attached Learning Center Cards for a list of materials for each activity.

Learning center

This learning center contains independent and small group learning activities for students. The activities can be done independently according to the student's time and interest. There are eight different activities to choose from. The Learning Center Cards give detailed instructions for each activity.

Teacher notes

Learning Center Card

Activity in brief:
Students will create sand pictures.

Sand Art

Materials
conical paper cup | sand | string glue (optional) | construction paper

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Students should take a conical paper cup and put a small opening in the point of the cup. They should then observe how the sand comes out the hole. If the sand had difficulty coming out, the hole may need to be made larger. Next, suspend the cup with string from a chair or table. Put a sheet of construction paper under the cup. Fill the cup with sand. Keeping their hand over the opening in the cup, start it swinging. The hand should then be removed. Encourage students to swing the cup so that the sand stays on the paper. Glue can be poured over the sand picture to make it permanent or the sand can be poured back and another picture made.

Learning Center Card

Activity in brief:
Students will get to know a live earthworm as representative of a living thing in the soil.

Get Acquainted

Materials
shallow pan or tray | live earthworms | textbook

Students should put a wet paper towel in the bottom of a shallow tray or pan and obtain a live earthworm. The following questions should be answered from either observations or use of a textbook. Please be aware that this activity may involve more supervision to be sure the worms are being treated humanely. The following questions should be answered:

* *What are some outstanding features of the earthworm?*
* *How can you distinguish the head end from the rear end?*
* *Describe the difference in color on the backside and the bellyside of the worm. Suggest reasons for this difference.*
* *Carefully run your finger over the bellyside of the worm.*
* *Describe what you feel.*
* *Why do you think earthworms don't have eyes?*
* *Describe how the worm responds when you try and pick it up.*
* *How does the worm move through the soil?*
* *List all of the ways that worms benefit the soil.*

Learning Center Card

Activity in brief:
Students will be making observations, comparisons and collecting and recording data on 3 different types of soil.

Hey, Look Me Over

Materials

pails	hair dryer	water	balance
3 kinds of soil (clay, sand, loam)	strainer	pH paper	magnifying glas

---

Using any or all of the materials provided, have students make and record as many observations as they can about the three different types of soil. After that has been completed, students should be challenged to answer the following questions (As students answer each question, they should predict the answer, write down how they are going to go about finding it and what their results are).

How could you distinguish the three types of soil using your sense of smell?
Which type of soil absorbs water the best?
Which type of soil would be best for growing plants?
Which type of soil holds together best?
Which type of soil contains the most varied material?
Which type of soil would be the best for decomposing?

Learning Center Card

Activity in brief:
Students will examine a soil profile and complete an accompanying worksheet.

On the Horizon

Materials

soil profile	transparency	actual soil profile in a tube (optional)
soil horizon worksheet and chart		

(Background information obtained from Science Scope and profile information.)

Students should examine a soil profile transparency (Science Scope, April/May, 1989) and an actual soil profile, which can be constructed in a tube or even a jar. Parts I and II should be completed on the soil horizons worksheet. (Found in Science Scope).

Learning Center Card

Activity in brief:
Students will observe how various materials in the soil will settle out after shaking the container they are in.

Make Your Deposit Here

Materials
quart jar water 1 cup of soil
(optional: screen with varying size mesh and filter paper)

For this activity, students should take one cup of soil put it in a quart jar and add enough water to make it almost full. (You may want to make your own soil mixture by adding equal amounts of soil, clay, sand, gravel and pebbles.) The jar should be shaken carefully. Complete settling may not take place during one class period, therefore final observations may not be able to be completed until the following day. Before answering any questions, students should predict the order of settling. Questions to pose to students:

Which material settled out first? Propose a reason.
Which material settles out last? Propose a reason.
How well did the observations compare with the prediction?
Prepare a list of variables that would control the rate at which sediments settle.
Describe a way to reseparate the sediments and remove them from the jar. Try it and record how it worked.
Would salt water change the results of settling? Try it and record your results.
Would hot water change the results? Try it and record your results.

Learning Center Card

Activity in brief:
Students will make a Mobius strip and draw the 3 cycles in nature (air, soil and water) on the circles.

Soil in a Cycle

Materials
See attached puzzles tape scissors colored pencils
textbook 12" x 15" length of paper approximately 8" wide

After cutting the paper, students should make a half twist in the strip and tape the ends together. Have them divide the paper into thirds and then pencil lines the length of the paper reflecting this. Next, have them cut the pencil lines that were drawn. Each one of the circles represents a cycle in nature, air, water and soil. Using their textbook or other references, the cycles should be drawn on each of the circles. The completed product can be hung from the ceiling.

Learning Center Card

Activity in brief:
Pictionary game of soil terms.

Pictionary Pieces

Material
flip chart/chalkboard vocabulary list

The teacher will make a copy of the glossary found in these materials and cut them into strips. Each student will select one term and its definition from a container when it is his or her turn. Based on the game Pictionary, the class will play a soil conservation version. Divide the class into 4 teams of 6 - 8 students. Teams 1 and 2 will compete for correct answers as will teams 3 and 4. Using flip-charts or a chalkboard, a player from Team 1 will draw one term and will be given 1 minute to illustrate the term or its definition for Team 1 to guess. If Team 1 guesses the term correctly within one minute, they will earn 1 point for their team and continue their turn. If they fail to guess the term within 1 minute, Team 2 gets its turn and continues the same way. Team 3 and 4 can be playing a separate game at the same time. The team earning the most points, when everyone on each team has had a turn at illustrating, wins the game. The teacher can appoint timekeeprs from each team.

Learning Center Card

Activity in brief:
Students may choose to work on word search and/ or word scramble puzzles.

Puzzled

Material
See attached puzzles.

The students may choose to complete either one or both of the puzzles available at this center. There is a word search puzzle and a word scramble puzzle which, when completed, should increase the students understanding of soil conservation terms. The teacher should make available an answer key for each puzzle so the students can check their work.

Word Search: Lines on the Land

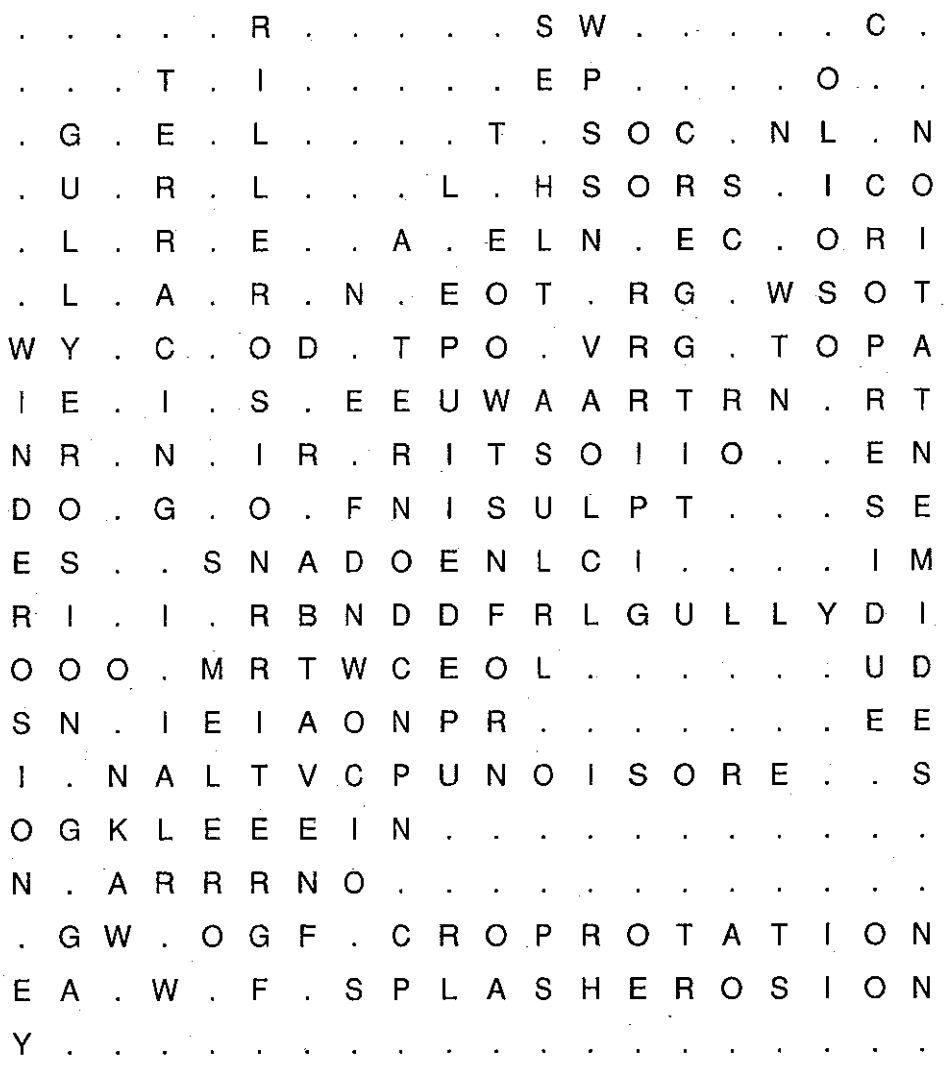
Name _____

Y X W V T R S Q P R L S W U I O H C C A
G F D T K I M E J N B E P Z L M O O N S
Q G W E V L T J Z X T E S O C F N L G N
B U I R K L U H D L R H S O R S Y I C O
P L C R A E O Y A T E L N Z E C Q O R I
W L V A P R S N N E O T L R G J W S O T
W Y K C I O D F T P O D V R G B T O P A
I E C I A S M E E U W A A R T R N U R T
N R E N X I R R R I T S O I I O Z G E N
D O D G E O C F N I S U L P T B A F S E
E S I K S N A D O E N L C I M L N S I M
R I Q I W R B N D D F R L G U L L Y D I
O O O V M R T W C E O L T J Z X G O U D
S N U I E I A O N P R H R Y P U T V E E
I W N A L T V C P U N O I S O R E Y S S
O G K L E E E I N H Z F R B N J I L C A
N G A R R R N O D K O Q X P M E W K T S
Z G W N O G F H C R O P R O T A T I O N
E A V W L F G S P L A S H E R O S I O N
Y U Q Y P R J G F D B I C 0 A X E O C S

Word List

CONTOURFARMING
GROUNDWATER
ROWCROPS
TERRACING
CROP RESIDUE
GULLY
SEDIMENTATION
WETLANDS
CONSERVATION TILLAGE
SHEETEROSION
SPLASHEROSION
EROSION
RILLEROSION
STRIPCROPPING
WINDBREAK
GRASSEDWATERWAY
RUNOFF
WINDEROSION
SLOPE
SLOPE
CROPROTATION
NOTILL
SOIL
TILL
FENCEROW
GULLYEROSION

Answer Key for Puzzle Titled:
Word Search: Lines on the Land



Word List

CONTOURFARMING
GROUNDCOVER
ROWCROPS
TERRACING
CROPRESIDUE
GULLY
SEDIMENTATION
WETLANDS
CONSERVATIONTILLAGE
CROPROTATION
NOTILL
SOIL
TILL
FENCEROW
GULLYEROSION
SHEETEROSION
SPLASHEROSION
EROSION
RILLEROSION
STRIPCROPPING
WINDBREAK
GRASSEDWATERWAY
RUNOFF
WINDEROSION
SLOPE

Word Scramble: Lines on the Land

Name _____

1	EUSPIERDORC	_____
2	ROCOPWRS	_____
3	LONIIRLEROS	_____
4	LOSPE	_____
5	CTINRAERG	_____
6	DIWNENSOIOR	_____
7	LLOITN	_____
8	ENIOSPSROAHLS	_____
9	NMITETEAINSDO	_____
10	SESORHNOETEI	_____
11	FCRINMRUTNOOGA	_____
12	EKWBRIDNA	_____
13	EONOSIR	_____
14	GIPOPITPRNCSR	_____
15	LIYROLOESUNG	_____
16	OIOPCNRTORTA	_____
17	FNUOFR	_____
18	TGYSRSAADERAWEW	_____
19	RNDROGVCUOE	_____
20	NRWEECOF	_____

CONTOURFARMING
NOTILL
STRIPCROPPING
FENCEROW
SEDIMENTATION
CROPROTATION
RILLEROSION
TERRACING
GRASSEDWATERWAY
SLOPE
EROSION
ROWCROPS
WINDBREAK
GULLYEROSION
SPLASHEROSION
GROUNDCOVER
SHEETEROSION
CROPRESIDUE
RUNOFF
WINDEROSION

Answer Key for Puzzle Titled:
Word Scramble: Lines on the Land

1	EUSPIERDORC	(CROPRESIDUE)
2	ROCOPWRS	(ROWCROPS)
3	LONIIRLEROS	(RILLEROSION)
4	LOSPE	(SLOPE)
5	CTINRAERG	(TERRACING)
6	DIWNENSOIOR	(WINDEROSION)
7	LLOITN	(NOTILL)
8	ENIOSPSROAHLS	(SPLASHEROSION)
9	NMITETEAINSDO	(SEDIMENTATION)
10	SESORHNOETEI	(SHEETEROSION)
11	FCRINMRUTNOOGA	(CONTOURFARMING)
12	EKWBRIDNA	(WINDBREAK)
13	EONOSIR	(EROSION)
14	GIPOPITPRNCSR	(STRIPCROPPING)
15	LIYROLOESUNG	(GULLYEROSION)
16	OIOPCNRTORTA	(CROPROTATION)
17	FNUOFR	(RUNOFF)
18	TGYSRSAADERAWEW	(GRASSEDWATERWAY)
19	RNDROGVCUDE	(GROUNDCOVER)
20	NRWEECOF	(FENCEROW)

GLOSSARY

Chisel plow: implement used to rough up a soil surface and keep crop residue mixed with soil to halt erosion from wind, rain and runoff.

Clay soil: refers to either the submicroscopic mineral soil particles less than 0.002 millimeters in diameter or a soil material that contains 40% or more clay, less than 45% sand, and less than 45% silt; plastic when moist but hard when dry.

Conservation tillage: any of several farming methods that provide for plant growth and weed control, while maintaining ground cover throughout the year and disturbing the soil as little as possible.

Contour farming: field operations such as plowing, planting, cultivating, and harvesting on the contour, or at right angles to the natural slope, to reduce soil erosion, protect soil fertility, and conserve water.

Creep erosion: large and heavy soil particles are rolled along the surface by the wind.

Cropland: land used primarily to produce cultivated crops, close-growing crops, and fruits and nuts.

Crop residue: the portions of annual plants left in the field after harvest.

Crop rotation: the growing of different crops in a reoccurring year to year sequence on the same land.

Cultivated land: land prepared for the raising of crops; tilled, loosened or broken up soil.

Divide: a high ridge or area separating the flow of water to two or more adjacent drainage basins.

Drainage area: the area where the removal of surface water or groundwater from land takes place.

Erodibility: the degree of a soil's susceptibility to removal by wind or water.

Erosion: the loosening and movement of soil by wind, moving water, ice, and landslides.

Fence row: grass and plants that are allowed to grow along fences. Because they are undisturbed year after year, roots are deep and able to absorb the rain readily.

Grassed waterway: a natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Ground cover: any plant producing a protective mat to prevent erosion.

Gully: a deep channel cut by flowing water from rains or snowmelt.

Gully erosion: deep wide channels reformed by flowing water; enormous amounts of soil can be lost when a large gully forms.

Horizon, soil: a layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons.

Infiltration: the flow of water into the soil.

Land operator: the term land operator refers to any person who manages or works a specific area of land. This includes a homeowner, farmer, land owner, public land manager, forester, etc.

Land use: ways in which the land is used which includes forest land, cropland, wetlands, pasture-land, and wildlife lands.

Loam soil: the name for soil containing moderate amounts of sand, silt and clay (7 to 27% clay, 28 to 50% silt, and less than 52% sand).

Mulch: a layer of plant residue or other material on the soil surface.

No-till: a conservation tillage practice that leaves the soil undisturbed prior to planting.

Percolation: downward movement of water through soil.

Permeability: the quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil.

Planning commission: an organization, made up of elected members who represent the community, responsible for preparing the community's planning program for land use.

Precipitation: rain, snow, and other forms of moisture that fall to earth.

Profile, soil: a vertical section of the soil extending through all its horizons and into the parent material.

Rill erosion: the removal of soil on slopes where the water runoff accumulates into small channels.

Row crops: agricultural crops, such as corn and soybeans, that are grown in rows.

Runoff: the precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground water runoff or seepage flow from ground water.

Saltation: medium sized soil particles move in a series of low bounces - wind erosion.

Sandy soil: individual soil particles having a diameter between 0.05 and 2.0 millimeters; usually a light tan color.

Sediment: soil deposited by water or wind.

Sedimentation: the act or process of depositing sediment.

Sheet erosion: the gradual wearing away of thin, uniform layers of soil.

Silt: individual soil particles having a diameter between 0.002 and 0.05 millimeters.

Slope: the inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 10 percent is a drop of 10 feet in 100 feet of horizontal distance.

Soil: a dynamic mixture of broken-down rocks, air, water, and plant and animal material.

Soil conservation: preserving and protecting the soil.

Soil structure: the arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Soil survey: the identification, classification, mapping, interpretation, and explanation of the soil over a given area of land.

Splash erosion: the movement of topsoil due to the striking of water.

Stripcropping: the practice of planting crops in strips, alternating row crops with plants that provide a good ground cover (i.e. clover), so as to lessen erosion.

Suspension erosion: small soil particles are lifted by the wind or carried in water and transported long distances.

Terrace: earthen ridges and channels constructed across a sloping land surface on or at a slight angle from the contour to prevent erosion by diverting surface runoff to a prepared outlet.

Terracing: a soil conservation practice in which ridges or steps are built on a steep slope to slow down runoff and increase soil moisture.

Till: to plow or work the land in preparation for raising crops.

Revised Universal Soil Loss Equation (RUSLE): an equation used to determine long-term average soil erosion by water on a specific piece of land. Each part of the equation represents a factor that influences erosion.

Water erosion: movement of topsoil by water; sheet, rill and gully erosion.

Watershed: all the land surface from which water drains into a common outlet.

Weathering: the breaking down of rock into sediment by wind, water, and living things.

Windbreak: a barrier of trees or shrubs that protects people, livestock, and soil from exposure to winds.

Wind erosion: movement of topsoil by wind. See creep, saltation, and suspension erosion.