MAKE IT RAIN!

GRADES 6-8

This activity was designed as a companion for the music video "Old MacDonald Had A Farm."

BACKGROUND

This video takes the classic Old MacDonald song and showcases conservation practices that can be used on farms to protect natural resources. These conservation practices are important in building healthy soils and keeping water clean for Iowans in the present and future. In Iowa most of our farmland is producing crops such as corn and soybeans. We are the #1 producer of corn and soybeans compared to all other states in the US! However, intensive tillage of farmland leads to compaction, loss of helpful organisms and leaves soil bare and prone to erosion. By practicing no-till or strip-till (tilling only a strip for planting), the majority of the plant residue stays on the land to protect the soil. These reduced-tillage practices lead to less erosion and runoff, more infiltration, more organic matter to build healthy soils, and a better habitat for helpful organisms such as earthworms.

The strategic planting of grasses (e.g. buffer strips) is another conservation practice that protects soil from erosion, while the grasses act as filters to remove pollutants from water flowing over the grass or underground through the root system. Riparian buffers use grass along the sides of a stream for bank stabilization and to slow down the movement of runoff water. The deep and dense root systems of switchgrass, bromegrass, and other perennial vegetation species can catch pollutants before they get to the stream. Grassed waterways provide paths for water to run off fields in areas where deep gullies would otherwise develop.

The video shows pictures of farms which are using conservation practices to protect Iowa's natural resources. These practices will help build healthy soils, protect the land from erosion, and keep the waters clean for all living things, including humans, that use it.

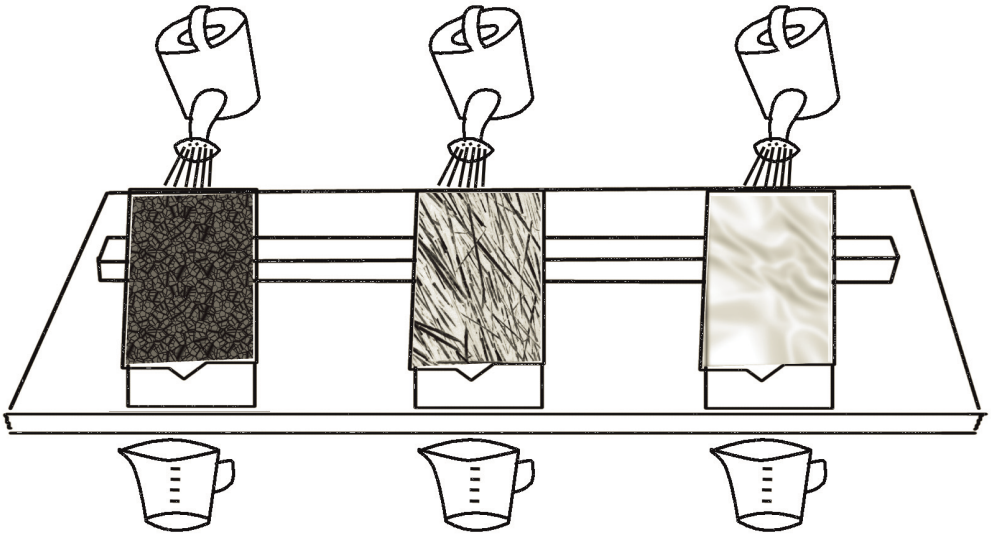
In this activity students will observe the processes of runoff, infiltration and erosion and how they affect water quality. By comparing three different models of land use, the students will discover how land management practices affect water resources.

MATERIALS

Three shallow boxes for each group – aluminum foil roasting pans or shoe boxes lined with garbage bags
One watering can for each group
Beakers or wide mouth measuring cups for each group to collect runoff from pans
A wooden board (2x4 or something similar) to place under one side of tray to create a slope
Loose soil for each tray
A piece of sod to cover the entirety of one of the trays
Aluminum foil or plastic wrap to cover the third tray
Two stopwatches for each group
Main It Rain! data sheet for each group

TEACHER PREPARATION

Prepare three aluminum foil roasting pans for each group with 2-4cm notches on one end. Fill one pan with soil to represent bare surface, put sod atop the soil in the second pan to represent cover crops or buffer strips, and put plastic wrap or foil atop the soil in the third to represent impervious surfaces such as parking lots. Wood blocks or books can be used to slope the pan. Each group will also need a watering can, two stop watches, and measuring cups to collect runoff.



INSTRUCTIONS

1. Introduce the following terms:

   a. Runoff – When water from precipitation flows over the surface of the land. Runoff will eventually collect at the lowest point in a watershed, such as a stream, river or lake. Runoff water can pick up and carry pollutants to the waterbody.

   b. Erosion – The displacement of soil by wind or water.

   c. Infiltration – Water soaking into the ground due to gravity flow.

   d. Impervious surface – Surface that allows no water to soak in or pass through, such as a parking lot.

2. Divide the students into groups of 5-6 or work as a class.

3. Photocopy the Residue/Buffer Strips Data Sheet (p.5) and distribute one per group. Discuss variables in the experiment and how to control them. Pans must be tilted equally, water must be poured from the same height and at the same rate, and close attention must be paid to keeping time accurately. Teacher can demonstrate how to simulate the rainfall with the watering can. Explain what data the students will collect.

   a. Starting amount of water in watering can – measure how much water you place in watering can.

   b. Ending amount of water in watering can – measure how much water is still left in the watering can after raining on a pan.

   c. Water Input – The amount of water in the watering can before the start of the experiment minus what is left at the end.

   d. Time until runoff – Using a stopwatch, record the time, starting when water is poured from the can until the water starts to trickle out of the notch.

   e. Runoff time – A second stopwatch will start when the water starts to run out of the box and stop when the water is no longer flowing out but dripping.

   f. Water output – The amount of water that ran out of the pan into collection cups.

   g. Water absorbed by the soil – The starting amount of water in the watering can minus water out put (the amount of water collected in the runoff cup). The "missing" water that was previously unaccounted for was absorbed into the soil.

h. Soil erosion – Rate the amount of soil lost as none, a little, a lot.

4. Have each group designate the following roles: a cloud (to pour the water over the pan), time keeper #1 (measuring time until runoff), time keeper #2 (measuring runoff time), water reporter (measuring water input and output), and a data recorder (writing down results on data sheet). The students can take turns in the roles for each of the three experiments.

5. Have the groups conduct the experiment. As a group they can discuss the results and work through the worksheet questions.

6. As a class discuss the three different pans and how they affect water quality. Discuss where we see examples of the three land uses in real life. Reference the music video and display pictures of farming practices. No-till, grassed waterways and buffer strips are all examples of soil with vegetation that result in less runoff and erosion as well as better water quality. Compare the bare soil to impervious surface. Were the rates similar? Is the impervious surface runoff really as clean as it appears in the experiment? Discuss possible sources of urban pollution.

Adapted from
http://www.stlmsd.com/portal/pls/portal/!PORTAL.wwpob_page.show?_docname=352439.PDF

MAKE IT RAIN! DATA SHEET

Data	Bare Soil	Soil with Vegetation	Impervious Surface
Starting amount of water in watering can (mL)			
Ending amount of water in watering can (mL)			
Water input (mL) = Starting amount of water in can minus Ending amount of water in can			
Water output (mL) = Amount of water collected in the runoff cup			
Water absorbed by the soil (mL) = Water input minus Water output			
Time until runoff (seconds) - Start the stopwatch when teammate begins pouring water over the pan, and stop when water begins to run off the pan into collection container			
Runoff time (seconds) - Start the stopwatch when runoff water begins to flow from pan into collection cup and stop when water lessens to a drip from the pan			
Soil erosion (none, a little, a lot)			

How does the type of material covering the surface of the ground affect the amount of runoff?

How can runoff affect water quality?

How might the amount and speed of the runoff affect erosion and water quality?

How does the presence of vegetation affect runoff, erosion, and water quality?

How does water quality affect you?