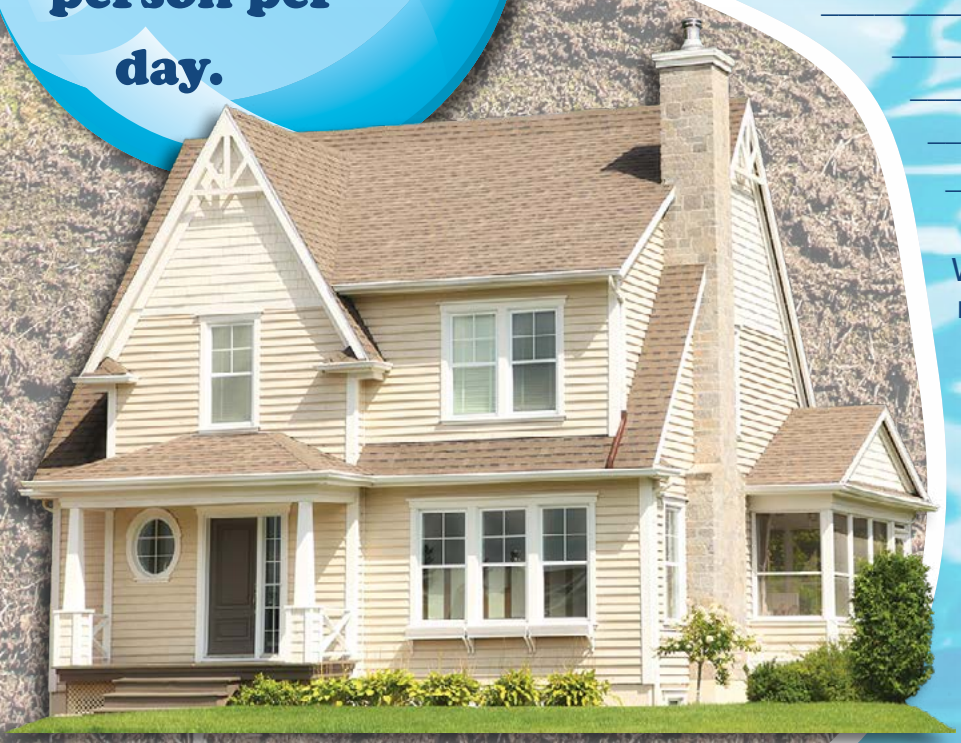
NORTH DAKOTA
Ag Mag
A Magazine about Agriculture for North Dakota Students

Spring 2020

NORTH DAKOTA AG IN THE CLASSROOM

soil and water conservation

The average U.S. household uses about 80 gallons of water per person per day.



Soil and water are essential for North Dakota's agriculture. Crops receive their nutrients from the soil, and livestock need lots of water to drink. What are some other ways agriculture uses soil and water?

_____

_____

_____

_____

_____

We must protect these natural resources. Farmers and ranchers conserve their soil and water, and you can, too. List the ways you used water in the last 24 hours.

_____

_____

_____

_____

_____

The Water Cycle

Water is continuously in movement on, above and below the surface of the Earth. Water can change states among liquid, vapor and ice at various places in the water cycle, with these processes happening in the blink of an eye and over millions of years.

Use the following definitions to label the water cycle diagram.

Accumulation – the process in which water pools in large bodies (like oceans, seas and lakes).

Condensation – the process in which water vapor (a gas) in the air turns into liquid water. Condensing water vapor forms clouds in the sky. Water drops that form on the outside of a glass of icy water are condensed water.

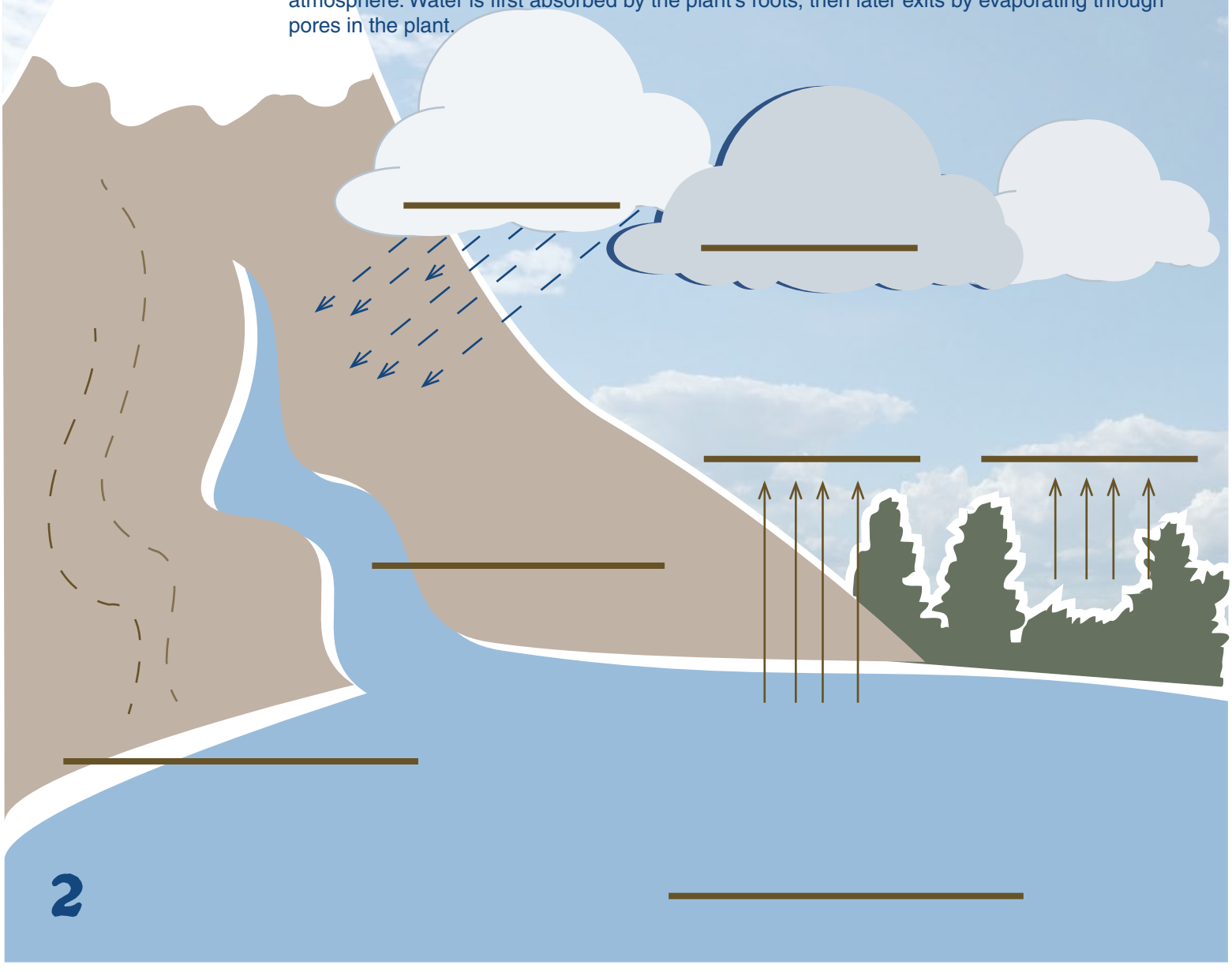
Evaporation – the process in which liquid water becomes water vapor (a gas). Water vaporizes from the surfaces of oceans and lakes, from the surface of the land and from melting snow fields.

Precipitation – the process in which water (in the form of rain, snow, sleet or hail) falls from clouds in the sky.

Subsurface or Groundwater Flow – rain, snowmelt or other water infiltrates into the soil and either collects in aquifers or flows underground through porous soil to streams, rivers or lakes. (Very few places in the world have actual underground "rivers" or "streams." Where they do occur is in limestone formations.)

Surface Runoff – rain, snowmelt or other water that flows over the land surface into streams, rivers or canals.

Transpiration – the process in which some water within plants evaporates into the atmosphere. Water is first absorbed by the plant's roots, then later exits by evaporating through pores in the plant.



Jill Helmuth

Senior Project Manager, Moore Engineering, Inc.
Based in Williston, ND

As a consulting engineer, Jill Helmuth works with teams on rural water and road projects.

"Being the project manager, I contact clients, find the right specialist to plug into ideas, develop plans, make decisions and coordinate projects," Helmuth said.

For example, in northwest North Dakota, which is typically a dry area of the state, she helps get fresh water to people at their property or home.

"Let's follow a drop of water," Helmuth said. "It must go from the Missouri River at Williston to the water treatment plant where workers ensure it's potable (safe to drink). They analyze it continuously and make changes to the time and process if it is not safe to use and drink. Then it goes into the distribution system all over the northwest corner of our state to homes and businesses.

"Along the way, it travels though miles of pipes. Pumps keep it moving, and storage tanks make sure the water is available on demand. The same water drop that started in the Missouri River comes out of kitchen faucets in towns like Keene and Crosby as well as farm homes in five counties in northwest North Dakota."

Helmuth says the water is used not just in our homes, but for agricultural uses such as for livestock water, in agricultural spray tanks and for gardening.

Helmuth also provides engineering for rural roads. For example, she determines where to place culverts to pass water under roads to reduce erosion along the road.

In addition to engineering, Helmuth ranches with her husband and two sons near Watford City. In 1992, she was just the third woman to graduate from North Dakota State University in Agricultural and Biosystems Engineering. She worked for the federal government's Natural Resources Conservation Service and another private engineering firm before joining Moore.

Helmuth encourages students to prepare for a career similar to hers by taking as much math and science as possible.

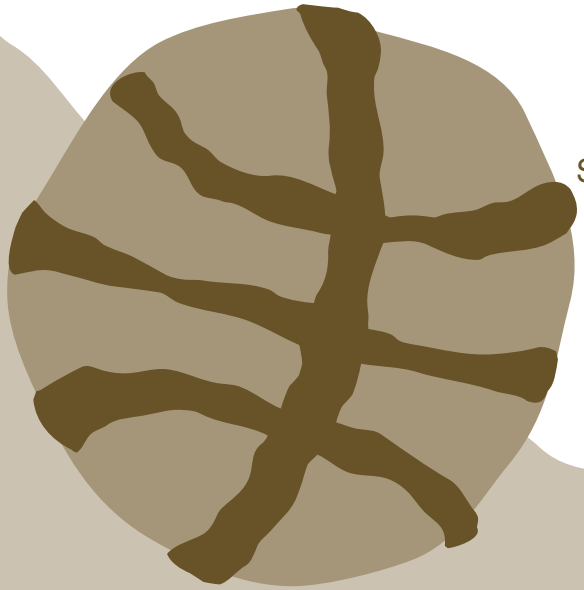
"Don't underestimate math and science. They're broad fields. Engineering also is very broad. There's even video game engineering. Don't limit yourself. You may not use calculus often, but a subject like that creates pathways to help you think about things logically," Helmuth says.

Soil and Water Math

1. A milking dairy cow drinks a bathtub full of water (about 40 gallons) every day. How many gallons does she drink in one week? _____ In one year? _____
2. A farmer is irrigating crops, but 45 gallons of water are leaking from the pipe each day. How many gallons are being lost each week? _____
3. Nature requires about 500 years to build 1 inch of topsoil. How many years are needed to develop 1/2" of topsoil? _____
4. In North Dakota, about 2/3 of soil erosion is caused by wind, and the rest is caused by water. What fraction is caused by water? _____
5. Washing one load of clothes takes about 30 gallons of water. If your family washes 8 loads a week, how many gallons of water are used? _____
6. A 10-minute shower uses about 30 gallons of water. If you cut your shower in half to 5 minutes, how many gallons of water are used? _____
7. Leaving the water running when you brush your teeth uses about 1 quart of water. Turning the water off uses about 1 pint. How much water do you save by turning off the water? _____ If you brush your teeth twice a day, how many quarts will you save in a week? _____
8. Many water-efficient toilets use 1.6 gallons of water per flush. If each member of a family of four flushes the toilet 6 times a day, how much water do they use with a water-efficient toilet? _____ Before 1950, most toilets used 7 gallons of water per flush. How much less water is needed per flush with today's water-efficient toilet? _____

Sizing Up Soil

Soil consists of various sized particles, with sand being the largest, silt the next and clay the smallest. By comparison, think of sand as the size of a basketball, silt a baseball and clay a marble. Air spaces are between these particles. Soil must contain at least 12 percent oxygen for roots to grow. If soil is compacted, the particles are pressed together, leaving only 2 to 5 percent of the necessary oxygen in the spaces.



Sand

Silt

Clay

Plants Need Soil

Plants absorb nutrients from the soil with their roots. Their roots also drain water from the soil, which keeps the soil from staying too wet. Roots help make soil, too. They split rocks into pieces that later become soil.

Soil Layers

Use these definitions to label the soil layers.

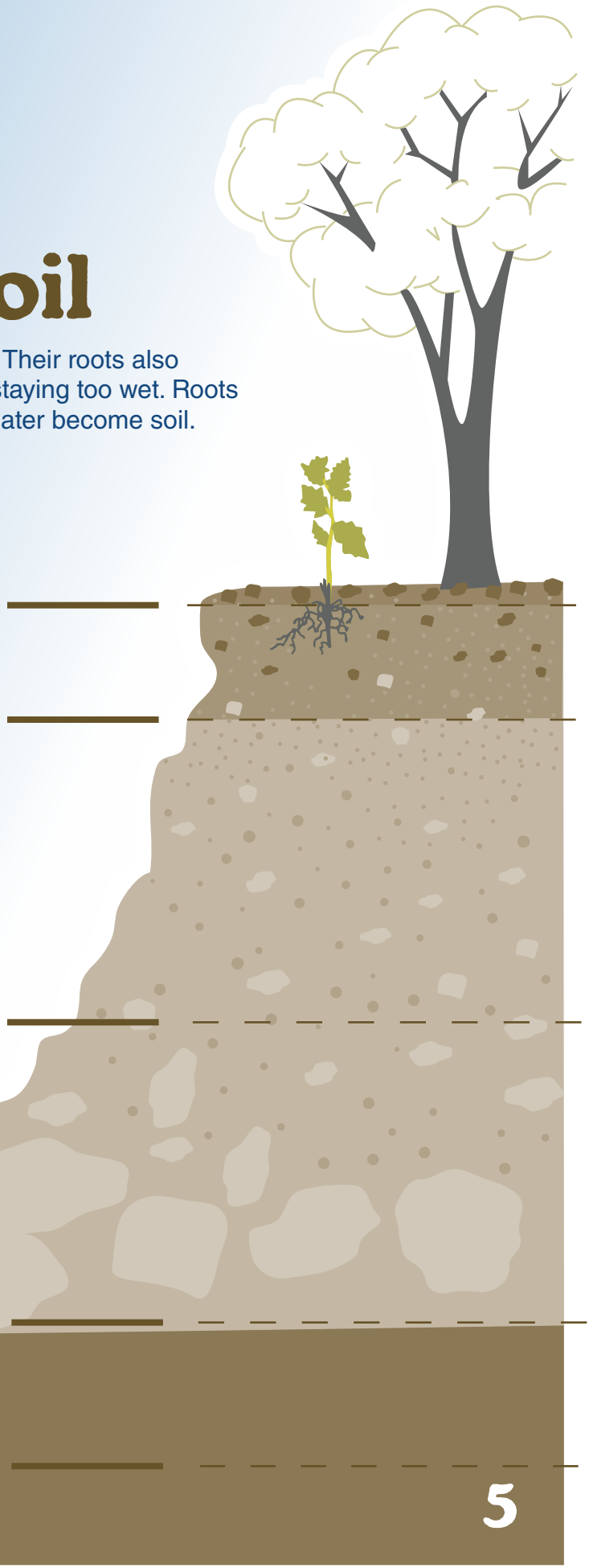
B Horizon – Also called the subsoil, it contains clay and mineral deposits (like iron, aluminum oxides and calcium carbonate) that it receives from layers above it when water drips from the soil above.

R Horizon – The unweathered rock (bedrock) layer that is beneath all the other layers.

O Horizon – Organic layer of soil, made up mostly of leaf litter and humus (decomposed organic matter).

C Horizon – Slightly broken-up bedrock. Plant roots do not penetrate into this layer, and very little organic material is found in this layer.

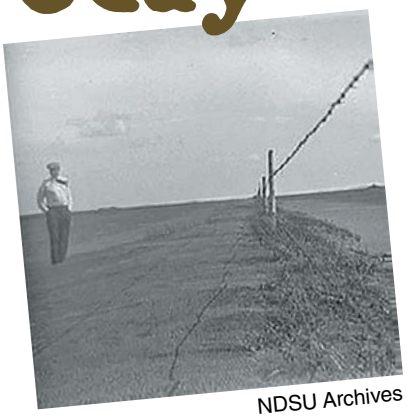
A Horizon – The layer called topsoil. Seeds germinate and plant roots grow in this dark-colored layer. It is made up of humus (decomposed organic matter) mixed with mineral particles.



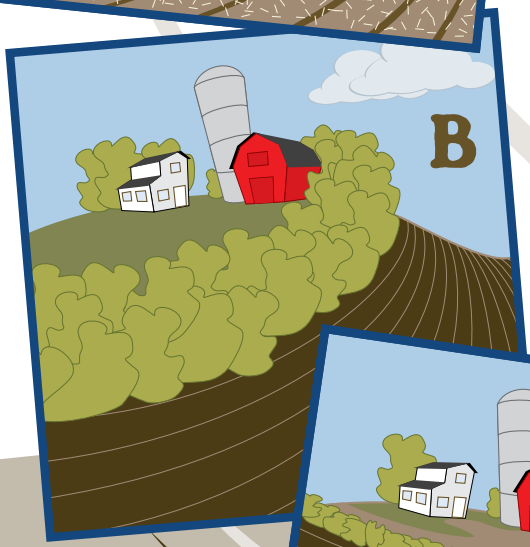
The Dirty '30s to Today

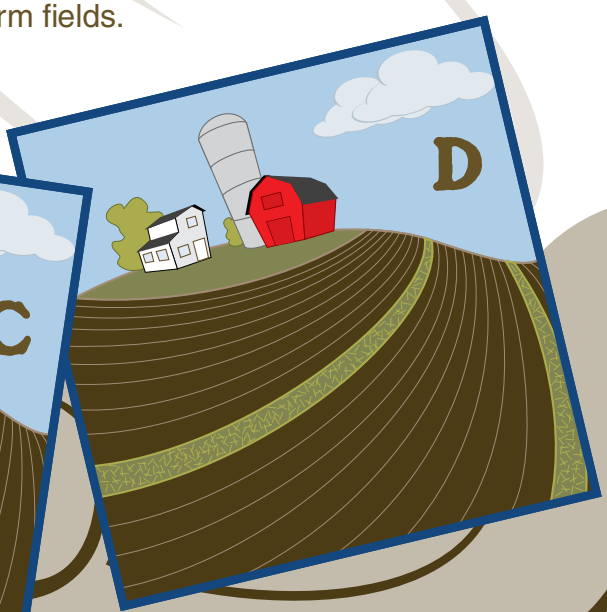
Erosion is the process of breaking things down. In agriculture, chunks of soil are moved by water or wind and broken into finer soil that washes or blows easily.

Drought during the 1930s resulted in dry soil, crop failures and devastating dust storms throughout the Midwest. The soil on many farms was destroyed for crop production, and many farm families moved away. After the Dust Bowl, farmers and ranchers received financial aid from the federal government and information on how to adopt soil conservation practices.



NDSU Archives





Match the graphic to the term that describes a conservation technique to reduce wind erosion.

____ **Vegetative wind barriers** – strips of perennial or annual grass planted to hold soil in the ground.

____ **Living snow fences** – a line of short trees, shrubs, crops and/or native grasses primarily along roads that trap snow as it blows across fields, piling it up before it reaches the road.

____ **Reduced-tillage farming** – any farming method that keeps tillage operations to a minimum and leaves at least 30 percent of the soil surface covered with plant residue after planting to reduce soil erosion by water or wind.

____ **Windbreak or shelterbelt** – rows of trees that protect a farmer's homestead or reduces wind erosion in farm fields.

Water Erosion

The erosion rate by water on U.S. croplands has been reduced by 24% in the last 15 years.

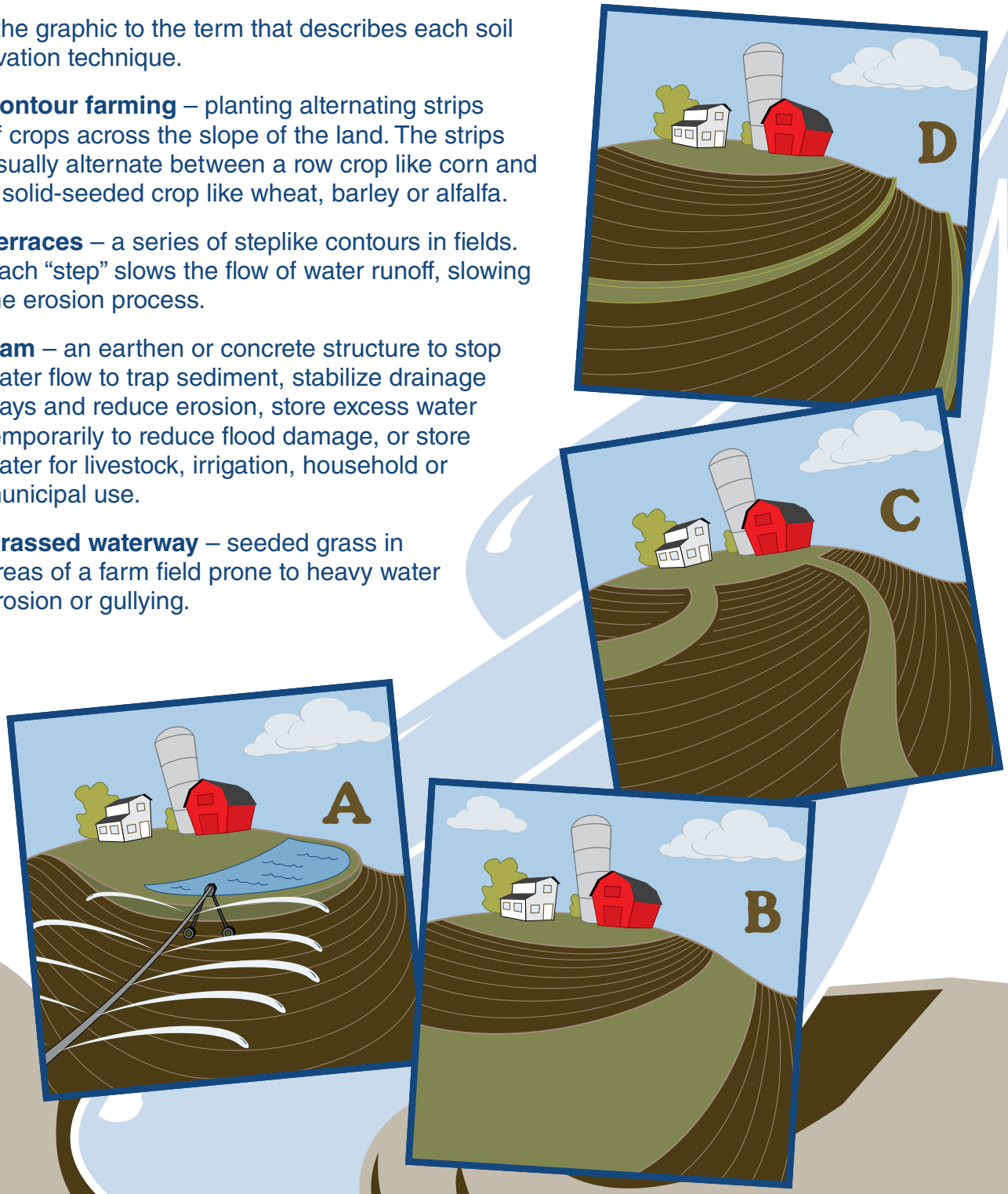
Match the graphic to the term that describes each soil conservation technique.

____ **Contour farming** – planting alternating strips of crops across the slope of the land. The strips usually alternate between a row crop like corn and a solid-seeded crop like wheat, barley or alfalfa.

____ **Terraces** – a series of steplike contours in fields. Each "step" slows the flow of water runoff, slowing the erosion process.

____ **Dam** – an earthen or concrete structure to stop water flow to trap sediment, stabilize drainage ways and reduce erosion, store excess water temporarily to reduce flood damage, or store water for livestock, irrigation, household or municipal use.

____ **Grassed waterway** – seeded grass in areas of a farm field prone to heavy water erosion or gullying.



Erosion Hunt

When you are outside this spring and summer, take some time to look down at the ground. If you are in a rural area or in a city, you can look for erosion in your neighborhood. Is there erosion? What are some ways the erosion could be stopped? Is there no erosion? What do you think are things in your neighborhood that helps conserve the soil?

Dave Franzen, NDSU

Thank you to the following for providing information for this issue of North Dakota Ag Mag:

North Dakota State University

Natural Resources Conservation Service/Emmons County

USDA Natural Resources Conservation Service

N.D. Career and Technical Education/Agricultural Education

Project Learning Tree

N.D. Project Food, Land and People

Utah Newspapers in Education/Utah Agriculture in the Classroom

Enchanted Learning

Conservation Technology Information Center

Soil and Water Management Textbook

Take this issue of Ag Mag home to share what you've learned about soil and water conservation.

NORTH DAKOTA AG IN THE CLASSROOM

The North Dakota Ag Mag is a project of the North Dakota Agriculture in the Classroom Council, which is organized through the North Dakota Department of Agriculture.

N.D. Department of Agriculture
600 E. Boulevard Ave., Dept. 602
Bismarck, ND 58505-0020
701-328-4764
800-242-7535
mgaebe@nd.gov
www.nd.gov/ndda
www.facebook.com/ndaginclassroom

Ag Mag Production by North Dakota State University Agriculture Communication: Becky Koch, Editor, and David Haasser, Graphic Designer