

AgMag

Agriculture: Helping you every day!



Caring for Our Natural Resources

Minnesota, the "Land of 10,000 Lakes,"

is really the land of nearly 20,000 lakes, ponds, and marshes of five acres or more. Forests cover one-third of our state. End to end, our rivers could reach around the world. Our cropland would cover all of Rhode Island, Massachusetts, Connecticut, and Vermont. Fresh air, rich soil, lots of rain most years, good climate, crops, livestock—our state has them all.

Minnesota's agricultural industries depend on these natural resources. We depend on agriculture. That's why our farmers and others must act as **stewards** of the land, protecting these important resources.

- When we prevent water pollution, we help keep water safe for cooking, swimming, drinking, and aquatic life.
- When we protect our soil, it can grow good food, fiber, and fuel (energy) for the future.
- When we clean up our air, we make life healthier for people, plants, and animals.

Nearly three-fourths of the land in Minnesota is owned by farmers and other private landowners. Why is it important that all landowners and users be good stewards of the land?

Find teacher guide and student resources at www.mnagmag.org





Celebrating Our Natural Resources

Water

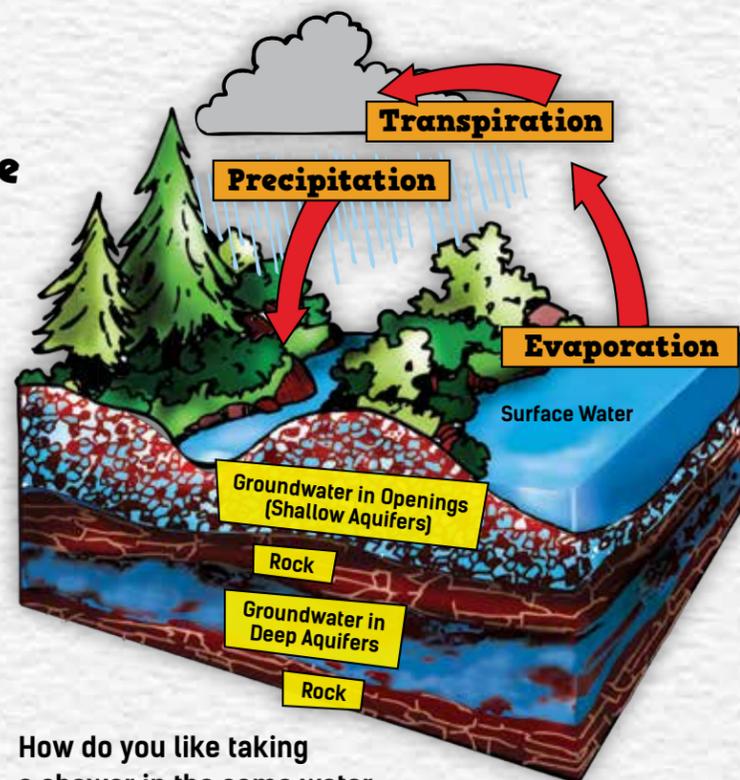
Where Does Our Water Come From?

Water is so important for agriculture. Plants need it to grow. Animals need it to live. But where does it come from? Water comes to us through precipitation in the form of rain or snow. The water moves through our landscape in rivers, lakes, wetlands, and **groundwater**. Groundwater is water that exists underground. The biggest use for groundwater is to irrigate crops. That is why groundwater is important for agriculture.

That is also why it is important for groundwater to be clean. **Aquifers** are underground areas that are made of gravel, sand, or fractured rock. When water moves through an aquifer, the aquifer acts like a filter. It helps take impurities out of the water. Aquifers can be small or large. Sometimes we find water just a few feet below the ground. Other times the water may be hundreds of feet deep. No one knows for sure how much water is in our aquifers. It is affected by how much rain we get and how much water we pump from wells. Today 75% of Minnesota's drinking water and nearly 90% of the water used in crop irrigation is pumped from groundwater aquifers.

Protecting the Water

In Minnesota, there is a program called the Minnesota Agricultural Water Quality Certification Program. Farmers who are interested in protecting water sources on or near their farms can apply for certification. Certification is like earning a driver's license. It means they have learned how to make fishing, swimming, and drinking water better for everyone. To earn certification, the farmers need to follow a number of requirements for how they conserve their land and water.



How do you like taking a shower in the same water molecules the dinosaurs waded in?

It's true! The water we use today is the same water that has been recycled for millions of years since the earth was formed. We will never have any MORE water. That's why we need to keep our water clean. We want it to be safe for all human uses and for aquatic creatures, too.

Cool water facts

- There is the same amount of water on earth as there was when the **earth was formed**.
- **75%** of the human brain is water, and **75%** of a living tree is water.
- Water **expands** when it freezes, making it less dense. That is why ice floats in water.
- Water **helps regulate** temperature of large things, like the Earth, and smaller things, like the human body.

Soil

Why is Soil Important?

Farms need soil to grow plants. Soil holds roots in the ground so plants don't fall over or blow away. It also helps plants absorb moisture, and it holds minerals and nutrients that plants use for food. Soil is also home to other living things helpful to plants. Some of those plants are used to feed animals.

The soil beneath our feet is as important as the air we breathe and the water we drink. Farms and forests make up two-thirds of our state's landscape. Who should care for the soil? Farmers and foresters have a big role to play. But we must also help. Here are things we all can do:

- Cover bare soil with new plants or mulch so soil won't wash or blow away.
- Stay on sidewalks and trails.

Air

Take a deep breath. Can you tell the difference between fresh air and polluted air?

Plants and animals grow and thrive better with clean air. Air moves, so polluted air can blow in from near and far. There are many people who work hard to clean up the air. Car makers build engines that pollute less. Laws set rules for companies to dispose of waste. Many people—including farmers—are making electricity from cleaner, renewable energy sources instead of coal or petroleum. They are using solar power, wind, and field crops as energy sources for our cars, homes, and factories. It all adds up to cleaner air!

Thanks, plants!

Did you know that green plants help to clean air? They take in carbon dioxide, trap fine dust, and release oxygen during **photosynthesis**. Those green plants include grasses on prairies, algae in oceans, crops in fields, and trees in forests. About one-third of the oxygen released comes from grasses and other non-woody plants. One-third comes from ocean plants. Another third comes from forests. Take a breath—and thank the plants!



Technology and Techniques to Protect Water

There are many kinds of technology and techniques farmers can use to protect water:

- Satellite technology allows farmers to apply nutrients and crop-protection products in just the right places and amounts.
- Grass waterways, terraces, buffers, and other structures help reduce erosion and runoff.
- Tracking weather conditions helps avoid spreading chemicals when large rains are likely.
- Learning and using the safest ways to use and handle crop-protection chemicals helps avoid overuse or incorrect use.
- Leaving plant remnants (stalks and leaves) at or near the field surface reduces erosion and helps the soil hold water and nutrients better.
- Adjusting irrigation timing and amounts to account for rainfall and crop needs.
- Planting cover crops to keep the soil protected throughout the growing season.
- Keeping manure safely contained prevents the manure from getting into the water supply.

Why do farmers do these things?

Some good reasons are listed below. Write the letter from the list above next to one or more reasons that match it.

- Help keep pollution out of water supplies. (Find 6.)
- Help reduce loss of soil to wind or water erosion. (Find 3.)
- Conserve and protect water. (Find 8.)
- Help keep animal manure out of rivers, wetlands, and lakes. (Find 1.)



Farmers Taking Care of Natural Resources



Now that you know how important water, soil, and air are to farmers, you can see why it is important to take care of them. Farmers everywhere continue to learn more about technologies to keep our natural resources in good shape so they can continue to provide us with the agricultural products we need and use every day.

Tiffany Family Farm, Redwood Falls, in Redwood County

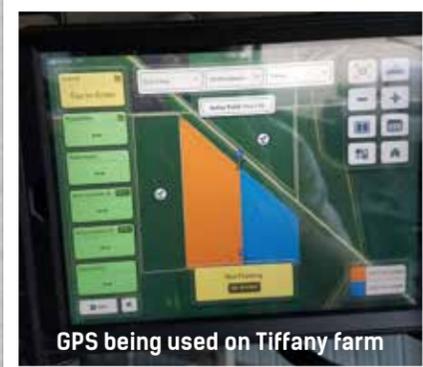
Matt Tiffany and his father Bruce grow field corn, sweet corn, and soybeans. His farm uses many techniques and technologies to protect the soil, air, and water. One technology that is important on his farm is Global Positioning System (GPS). GPS allows Matt to locate himself in his crop fields. He uses these locations to collect soil samples in a grid pattern. The soil is analyzed and maps are created that show management zones. These management zones help Matt determine the precise locations where the soil needs more nutrients. The large equipment Matt uses on his farm has software that can read the maps and identify the management zones. This equipment uses the GPS maps and sensors to automatically apply fertilizer or soil nutrients precisely where it is needed and not where it is not needed. This process is called Variable Rate Application or VRA.

Matt also uses GPS to capture data on the yield of his crops. "Yield" is a word that describes how much is being produced. Corn and soybean yields are both measured in bushels. The information that GPS collects tells him where things are growing most successfully. Matt also uses the maps and information from GPS to design and construct water control structures. These structures work to drain water from the field so that crops do not get flooded during heavy rain storms.

It would be much harder to farm without things like GPS and other technology. "Being able to manage our soil and water without technology would be impossible," says Matt.



3 generations of the Tiffany family



GPS being used on Tiffany farm



Technology in a tractor cab on the Tiffany farm

Photos on these pages courtesy of the Tiffany family, the Schmeling family, and the Popp family.

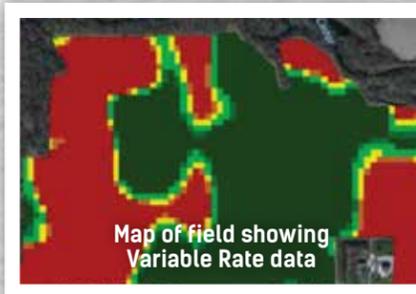
River Oak Farm, Inc., Blooming Prairie, in Steele County

The Schmeling family's River Oak Farm Inc. is in the southeastern part of Minnesota. It is a fifth-generation family farm with three generations currently farming together. The Schmeling family grow corn and soybeans.

They test their soil every four years to check the nutrient levels and make sure the soil is healthy. They use Variable Rate technology to apply fertilizer in only



The Schmeling Family



Map of field showing Variable Rate data



Applying fertilizer using Variable Rate technology

the spots that need it and only at the levels that it needs to produce good crops. The farm is in the Minnesota Agricultural Water Quality Certification Program. That means they have been recognized by the state of Minnesota as being good stewards of water quality.

The Schmeling family use Variable Rate technology because it is the best way to know what effect they have on the land they farm. Their family has been farming some of the same ground since 1896, so they have a long history with it. That is why it is important to them that the next generations have the chance to take care of it too.

Windy Creek Acres, Royalton, in Morrison & Benton Counties

Windy Creek Acres is a third-generation family farm run by Doug and Jane Popp, and their children Emily and Nick. They have 220 acres of crop land where corn, soybeans, and alfalfa are grown. They also raise 40 dairy cows and many other animals, including chickens, goats, sheep, and peacocks. The Popp children raise sweet corn and pumpkins to sell in the community.

The Pops use a highly efficient irrigation system in order to conserve water. They also use buffers to protect water ways and make sure their soil does not erode. They also have a 150-foot-tall wind turbine. The turbine produces energy that powers lights, coolers, and various machines used to milk cows. They also use solar panels to power their grain bins and grain drying processes. The panels are very low maintenance and have reduced energy costs

In the future, the Pops hope to build an education center on their farm to help people understand how wind energy and solar energy provide power and are helpful to the environment. They hope that their children will continue to be involved in agriculture.

Think and Discuss

1. What are some of the ways farmers use Variable Rate technology?
2. Why is it a valuable piece of technology?
3. Why is it important for farmers to protect the air, soil, and water?



Doug and Jane Popp

Cause and Effect

Do you know what cause and effect are? That is when something happens (cause), and that causes something else to happen in response (effect).

Read the text on pages 4 and 5 again. Then list 3 examples of cause and effect that are described in the text.

Example: Variable Rate technology shows where the soil does or does not need extra nutrients (cause). That way, the farmer does not apply too many chemicals (effect).

1. Cause: _____

Effect: _____

2. Cause: _____

Effect: _____

3. Cause: _____

Effect: _____

Grown in Minnesota: Shrimp



Have you ever eaten shrimp? Nearly 90% of the shrimp eaten in the U.S. comes from other countries. Minnesotans have always eaten shrimp that was flown here from the ocean. But now there is a farm in Belton, Minnesota, in Lyon County, that safely raises shrimp. It is called trū Shrimp.

Farming things like shrimp or other aquatic life is called **aquaculture**. Aquaculture was developed as the seafood industry needed to find new ways to farm seafood. Wild seafood has been overfished in many places. The ocean is polluted in places, which makes it hard for seafood to grow on their own.

trū Shrimp raises shrimp indoors. That means the farmers do not have to worry about weather conditions. Disease is less of a problem as well. When shrimp are raised indoors, their climate and surroundings are closely monitored and controlled. This allows shrimp to be grown in the safest environment possible.

This form of aquaculture reduces the carbon footprint usually involved in importing shrimp from far away. The farm also uses a special kind of shrimp tanks that allows them to recycle and reuse the water that the shrimp live in. This way the shrimp have access to fresh and clean water, while water is not wasted.

Shrimp start out in eggs. Once they are hatched and ready to grow, they are about the size of an eyelash. Once they are bigger, they can be harvested. The smallest shrimp are sold as "salad shrimp" at the grocery store. One pound of salad shrimp has about 60 shrimp. The largest shrimp are often called "jumbo shrimp" at the grocery store. One pound of jumbo shrimp has about 16 shrimp. The shrimp are then removed from large water tanks called tidal basins and placed directly on ice. They are kept on the ice until they are brought to a trū Shrimp processing facility. There they are counted, weighed, and sorted. Then the shrimp are packaged and loaded onto trucks for delivery to the grocery store or restaurant.



Minnesota Agriculture: 1970 - Today

Imagine a farm family from the 1800s stepping onto a modern farm today. How would they respond to all the changes?

Science and Technology Take the Lead

Computers manage farm businesses, keep crop and animal records, and so much more. Computers are built into many farm machines. A robot may milk a cow. A drone may fly over fields surveying land or finding insects. Barns are temperature-controlled to keep animals comfortable.

Plant and Animal Breeding

Scientists have improved plants and animals through careful breeding for many years. Today's farmer produces a leaner meat animal, dairy cows that give more milk, and grows crops like wheat and corn that are more insect-, drought-, and disease-resistant. For example, corn that used to be knee-high by the fourth of July in 1900 is often shoulder-high by that date today. Consumers get higher quality and more abundant plant or animal food products.

Precision Farming

Technology is important to farmers today. They use digital software, drones, laptops, cell phones, and GPS systems. Electronic devices map every inch of a field and show how to manage it for best production. They control the number of seeds planted, show how much fertilizer is needed, tell exactly where to kill weeds, and more.

New Flavors in Minnesota Agriculture

Over 7% of Minnesota's population was born in another country. Some immigrants moved to small towns and rural areas to work in agriculture. For example, jobs at farms, processing, and meatpacking businesses attracted seasonal workers and new immigrants to Worthington, Willmar, and other Minnesota cities. Immigrants make huge contributions to Minnesota agriculture.

New Beginning for American Indian Agriculture

Native Americans have farmed in Minnesota for centuries. In 1987, the Intertribal Agriculture Council was created to help improve Indian Agriculture. The Council has programs that assist in adding high tunnels for a vegetable producer, support the Red Lake Nation wild rice production, and formed an Intertribal Maple Syrup Producers coop.

Today's supermarkets are packed with hundreds of foods for us to choose from, including locally grown. Some stores have whole sections of food from countries around the world. Farmers markets, food cooperatives, and restaurants also offer a great variety of foods. What do you enjoy most about the diversity of Minnesota's foods?



A robot pushes feed so cows can reach it.



A drone surveys fields.



Plant researchers studying pollination.



A tractor cab is the control center for field work.



Photos Courtesy University of Minnesota Agricultural Experiment Station, and the Tiffany family.

Meet the Scientist

Lisa Broderius:
Water Chemistry Manager

Ms. Broderius examines and maintains the water quality in the tidal basins at trū Shrimp. The water quality can affect how fast the shrimp are growing and their overall health. To prepare for this career, Ms. Broderius studied environmental science and hydrology (the study of water) at Bemidji State University, and geology at the University of Minnesota-Duluth.

Food Sails Down the River

How do foods grown in Minnesota get to other states and other parts of the world? There are trucks. There are trains. But there is another way: Shipping food by boat down the river. Corn, soybeans, and grain are the primary crops to be sent by ship from Minnesota.

Large barges can carry tons of food out of Minnesota via the Mississippi River. The food may be carried on the Mississippi all the way to the Gulf of Mexico. Or it may veer off the Mississippi onto one of two major tributaries: The Ohio River and the Illinois River, which would take the food east. Food can also be shipped from Duluth, traveling along the Great Lakes.

It is a very efficient way to ship food long distances. **A barge can tow the same amount of food as 15 train cars or 60 trucks.** It is also much less expensive than shipping by truck or train. However, traveling by boat is slower than by train or truck.

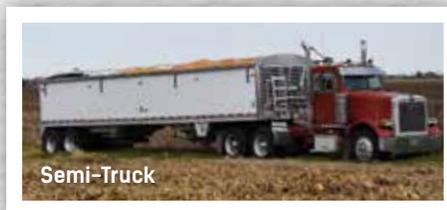
This form of shipping is also more environmentally friendly. Modern ships use far less fuel and produce fewer emissions than trucks and trains.



Rail Car



Barge



Semi-Truck

Activity: What Sails Where?

Look at the map above. Then go to mngmag.org and look for the What Grows Where page. Find the crop growing regions.

Think about these Minnesota crops: sugarbeets, wheat, potatoes, corn, soybeans, lumber, wild rice, and hay. What would be the best waterways to transport them?

Learn about and order our **FREE** educational materials at mn.agclassroom.org.

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