



SC Farm Bureau
Ag in the Classroom
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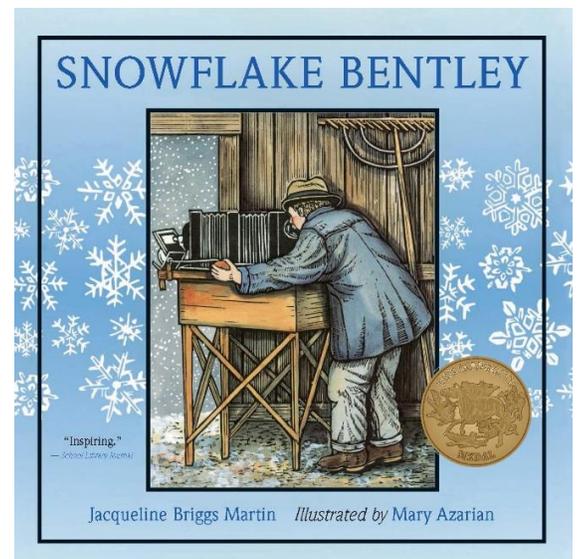


December 2021

Snowflake Bentley

By: Jacqueline Briggs Martin

Wilson "Snowflake" Bentley grew up in Vermont, where the snowfalls were plenty. Many people, including his father and brother, did not understand why he spent so much time studying snowflakes when he could be doing other things on the farm, especially when snow was not considered "unique" in the Vermont climate. However, Snowflake Bentley's work pioneered what we know about snow and snowflakes. He was one of the first farmer-scientists, incorporating photography and microscopy to his work, a practice that is very common to modern farmers today. ²



Did You Know? (Ag Facts) ²

- Snow can provide much needed moisture for the root development of dormant wheat crops, and surprisingly, snow has an insulating effect on the soil.
- Farmers who raise livestock must spend extra time caring for animals when it is very cold outside. Poultry farmers must have generators handy in case power outages occur, to keep heat steady for brooder (heated house for chicks). They must also collect eggs 2-3 times a day to prevent the eggs from freezing.
- Apples, broccoli, collard greens, kale, onions, pecans, and sweet potatoes are all crops that can be in season in South Carolina during the month of December.

Discussion Questions

- What do you know about snowflakes?
- How did Willie learn from his mistakes?
- How would Bentley's life have been different had he lived in the city?

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for ready to use slides.



Grade Level(s): 2-5

Purpose: Students will explore different types of weather and discover how weather conditions can impact farms as well as observe the change of water states as it moves through the water cycle.

Vocabulary:

- **atmosphere:** a layer of gas or layers of gases that surround the Earth or another planet
- **climate:** the prevailing weather conditions in a specific area over a long period of time
- **forecast:** a prediction or estimate of future events
- **meteorologist:** scientist who studies weather patterns and forecasts the weather
- **weather:** the state of the atmosphere at a given place and time in regards to heat, dryness, sunshine, wind, rain, etc.
- **condensation:** water that collects as droplets on a cold surface when humid air is in contact with it
- **evaporation:** the changing of a liquid into a gas
- **gas:** a state of matter where a substance (such as oxygen or hydrogen) is like air and has no fixed shape
- **infiltration:** to pass through a substance by filtering or permeating
- **irrigation:** artificial application of water to the land or soil to assist plant growth
- **liquid:** a state of matter in which a substance exhibits ability to flow freely like water; not a solid or a gas
- **precipitation:** moisture in the form of rain, snow, sleet, or hail that falls to the ground
- **runoff:** the draining away of water from the surface of an area of land
- **solid:** a state of matter where a substance has a definite shape and volume; not liquid or gaseous
- **water:** a transparent, odorless, tasteless liquid, a compound of hydrogen and oxygen, H₂O

Background Agricultural Connections: ³

One of the most important natural resources that covers the earth's surface is **water**. All living things depend on water for survival. As the world population continues to grow, more and more people, plants, animals, and other living creatures need water to live. Water is a renewable resource used over and over through **evaporation**, **transpiration**, and **precipitation**. The water that is on earth now is the same water that has always been here. No "new" water is being made.

The movement of water in and around the earth is called the water cycle. The water cycle is continuous. Rain or snow falls on oceans and land as precipitation. The soil will soak up some of the water. Plants will take up some of this water through their roots, and some water will move down through the soil to become groundwater. Some of the water from the rain and snow will run off the land into streams, marshes, lakes, and oceans. The water that remains on the earth's surface is called surface water. The surface water will return to the atmosphere through evaporation. Then water vapor may form clouds that cause precipitation—rain or snow—to occur again. The precipitation will return to the surface of the earth, and the cycle will continue. Through different stages of the water cycle, water can be **liquid**, **solid**, or **gas**.

Water is extremely important for crop production because crops (plants) need water to grow. A good crop of corn or soybeans needs at least 20 inches of water a year. Yet, almost every year,

the corn and soybeans' water is limited to some degree by drought. Drought occurs when there is a lack of water. Some years the summer rainfall is below normal, and some years there are varying amounts of rainfall throughout the season. For this reason, more and more farmers are installing **irrigation** systems to ensure that their crops receive an adequate amount of water. Irrigation means watering land with artificial methods, or man-made watering. Water is taken from lakes, rivers, streams, and wells, transported to croplands, and used to water the crops. Irrigation is used in areas that go without rainfall for a long time. Places such as the southwestern United States, Egypt, and Italy use irrigation during dry periods or all year.

Weather describes the state of the **atmosphere**, the thick blanket of air surrounding the Earth, at a certain place and time.⁴ Weather is caused by heat, water, and air. Temperature, the amount and type of moisture in the air, and the strength of the wind are different components of the weather. The average weather pattern in a location over several decades is called **climate**. Climates differ depending on the region of the world.

Severe weather events such as floods, extreme cold or heat, intense winds, hail, or tornadoes can negatively impact farms and ranches. The USDA estimates that 90% of crop losses are relate to extreme weather.⁵ Weather **forecasts** predict what the weather will be on a particular day and can help farmers and ranchers know what to expect and plan for extreme weather. Severe weather warnings can help farmers prevent damage to crops, animals, and properties.

Meteorologists are scientists who study weather patterns and forecast the weather by observing air temperature, wind direction, humidity, wind speeds, clouds, precipitation, visibility, and atmospheric pressure. Weather instruments, such as thermometers, weather vanes, wind socks, rain gauges, barometers, hygrometers, radars, satellites, and weather balloons, are used to record the weather.

How Weather Impacts Farms ³

Materials:

- [Severe Weather Information Sheet](#)
- [Farmers Wait for Dry Weather](#)
- [How Farmers Protect Crops Against Winter Weather](#)
- [Hot, Dry Weather Takes Toll on Farm Animals](#)
- [Area Farm Crops Damaged by Severe Weather](#)
- [Tornado Smacks Iowa Farm](#)

Procedures:

- Ask the students, "What are examples of severe weather?"
- Have the students consider how weather conditions can affect farms.
- Organize the students into six groups. Assign each group a type of severe weather and provide them with a [Severe Weather Information Sheet](#) that correlates with their assigned type of weather. Have the groups go through the reading, watch the weather video, and create a weather report to warn farmers and ranchers about the weather event.
 - Flooding: [Farmers Wait for Dry Weather](#)
 - Extreme Cold: [How Farmers Protect Crops Against Winter Weather](#)
 - Hot and Dry: [Hot, Dry Weather Takes Toll on Farm Animals](#)
 - Wind: [Iowa Farmers Face Aftermath of Powerful Derecho Windstorm](#)
 - Hail: [Area Farm Crops Damaged by Severe Weather](#)

- Tornado: Tornado Smacks Iowa Farm
- Weather reports can be performed live for the class or recorded. The report should describe the weather event, what to expect, and how farmers can prepare.
- Allow time for the groups to share their weather reports with the class.
- Discuss the impacts of weather to farms and how detailed forecasting can help farmers know what to expect and prepare for severe weather.

Water Cycle Demonstration ²

Materials:

- Large glass bowl (that can hold a small Tupperware container inside)
- Small Tupperware container
- Hot water
- Salt
- Plastic cling wrap
- Ice

Procedures:

1. Explain to students that the water we have on Earth (our oceans, lakes, ponds, and even puddles) is the same water that falls from the sky when it rains or snows? The process that makes this possible is called the Water Cycle.
2. Pour the hot water into the large glass bowl, and add plenty of salt (you are immolating the ocean). Stir well.
3. Place the small Tupperware container in the middle of the glass bowl on top of the salt water (this is where you will “collect” the rain that falls.
4. Cover the top of the glass bowl with cling wrap. This will provide a place for your water to condense into “clouds.”
5. Place several cubes of ice on top of the center of the cling wrap. The cool ice in the “sky” will cause the evaporated water to condense when it rises up.
6. After several minutes, you should see the water condensing into “clouds” on the underside of the cling wrap.
7. Once enough water has condensed into “clouds,” precipitation will begin. Water will drop from the cling wrap back into the “ocean” and some of that water will fall into the small Tupperware container.
8. Once you have collected sufficient rain water into your small container, take a drink. Notice how it isn’t salty compared to the “ocean water” you began with. This illustrates how only water evaporates, not the salt that’s in the water. Thus, rain water is okay to drink even though it has evaporated from all sources of water on Earth.

Extension Activities:

- Then and Now: Snowflake Bentley’s camera was said to cost as much as a herd of ten cows. How much did a herd of ten cows cost in the late 1800s? How much does a herd of ten cows cost today? How much did simple produce items cost in the 1800s? Did everyone have access to produce as we do today? Research the answers to these questions, and then discuss whether the modern farmer’s job is easier than the historical farmer’s job. Compare and contrast the reasons.
- Visit your local library or order from an on-line company a copy of Wilson Bentley’s book, *Snow Crystals*. Enjoy the beautiful photographs together.

- Compare the weather at your school to weather in different regions of the country or world.
- Have the students research severe weather safety tips and make posters to hang up around the school to address severe weather events that could occur in their area.
- Invite a soil and water conservationist into the classroom to talk to the students.
- Look on a world map to locate where water exists as a solid, a liquid, in the land, oceans, rivers, and lakes.
- Have the students make posters to teach other students why we should not pollute water. Hang the posters around the school.
- Learn more about how water is important to us as human beings and to all other living organisms.
- Play the My American Farm interactive game [Wild Water Adventures](#).

Suggested Companion Resources:

- [Weather Harvest Game](#)
- [Weather Wisdoms](#)
- [It Feels Like Snow](#)
- [It Feels Like Snow](#)
- [Sleep Tight Farm](#)
- [Snow Comes to the Farm](#)
- [Thunder Cake](#)
- [Thunderstorm](#)
- [Water is Water](#)
- [Winter on the Farm](#)
- [Water Pollution Demonstration](#)
- [Weather Harvest Game](#)
- [Water is Water](#)
- [Water: Sources, Use, Conservation](#)
- [The Story of Bottled Water video](#)
- [My American Farm](#)
- [Project WET](#)
- [Science in Your Watershed](#)
- [The USGS Water Science School](#)
- [Water Cycle \(UEN Sci-Ber Text for 4th Grade\)](#)
- [Water Cycle Animation](#)

Sources/Credits:

1. Briggs Martins, Jacqueline. *Snowflake Bentley*, HMH Books for Young Readers, 2009.
2. North Carolina Ag in the Classroom
3. National Center for Agricultural Literacy

Suggested SC Standards Met:

English/Language Arts:

- 2.RI.5.1 Ask and answer literal and inferential questions to demonstrate understanding of a text; use specific details to make inferences and draw conclusions in texts heard or read.
- 2.RI.5.2 Make predictions before and during reading; confirm or modify thinking.
- 2.RI.6.1 Retell the central idea and key details from multi-paragraph texts; summarize the text by stating the topic of each paragraph heard, read, or viewed.

- 2.RI.7.1 Compare and contrast topics, ideas, or concepts across texts in a thematic, author, or genre study heard, read, or viewed.
- 3.RI.5.1 Ask and answer literal and inferential questions to determine meaning; refer explicitly to the text to support inferences and conclusions.
- 3.RI.12.3 Read and respond according to task and purpose to become selfdirected, critical readers and thinkers.
- 4.RI.5.1 Ask and answer inferential questions to analyze meaning beyond the text; refer to details and examples within a text to support inferences and conclusions.
- 4.RI.12.3 Read and respond according to task and purpose to become selfdirected, critical readers and thinkers.
- 5.RI.5.1 Quote accurately from a text to analyze meaning in and beyond the text.
- 5.RI.12.3 Read and respond according to task and purpose to become selfdirected, critical readers and thinkers.

Science (2021 standards):

- 2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
- 2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.
- 3-ESS2-2. Obtain and combine information to describe climate patterns in different regions of the world.

Flooding



Flooding happens when water covers land that is usually dry. Flooding can occur from different water sources, but is typically caused by heavy rainfall or snowmelt. The heavy rains cause water to pool up quickly as the ground becomes saturated.

Floods can destroy drainage and sewage systems, buildings, and other facilities. Raw sewage and toxic materials can be released into the flood water. People may experience electricity and phone outages and be left without sanitation systems, drinking water, or even shelter.

Floods can cause major damage to crops and pastures. Planting and harvesting schedules can be delayed or canceled. After a flood, it can take several weeks before the farmland is dry enough for heavy equipment and tractors to enter the land without creating further damage. Farmers must address issues with sediment and debris, erosion, soil and nutrient management, and crop repair.

When farmers receive advance notice of a flood, they can take precautions, such as empty grain bins, move livestock and equipment to higher ground, move or chain down propane tanks, and remove power units from irrigation systems.

Engineered structures, such as dams, dikes, levees, flood gates, seawalls, drainage canals, drainage systems, pumping stations, bridges, concrete river banks, spillways, overflow basins, embankments, retention ponds, and wetlands restoration, are used to control flooding.



Watch Louisiana Farmers Wait for Dry Weather

<https://youtu.be/L8XTA0PV95w>



Extreme Cold



Extreme cold elevates the risk of damage to certain crops and stress to livestock. Farmers monitor for severe winter weather. Detailed forecasting can help farmers make decisions regarding their crops and livestock. A Winter Storm Watch means that severe winter conditions are possible. A Winter Storm Warning means severe winter conditions are expected. A Blizzard Warning means that snow and strong gusts are expected to combine, producing blinding snow, deep drifts, and wind chill.

Certain crops are especially susceptible to damage due to extreme cold. The direct impact of a cold snap may not be seen for several months. Cold can freeze the cells in a plant, causing damage and interrupting the pathways for nutrients and water to flow. Cold can have a positive effect too. Some insects and pests die off as a result of extreme cold. The benefits are apparent during the following growing season.

Livestock have the same basic needs as people—shelter, food, and water. In extreme cold, animals must be kept dry and out of the wind. When possible, animals should be brought into an indoor shelter with fresh bedding. Animals need extra food during extreme cold temperatures to provide them with more energy to stay warm. Water troughs should be heated or changed frequently to avoid icing over. Farmers and employees should also take frequent breaks to warm up during winter storms.



Watch How Farmers Protect Against Winter Weather

https://youtu.be/dM6cZ_7uUds



Hot and Dry



A drought is caused by drier than normal conditions that lead to water supply issues. Hot temperatures can worsen the issues by evaporating moisture from the soil. The severity of a drought depends on the length of time the area receives below-average precipitation.

Weather satellites are used to monitor droughts. The satellites capture infrared images of Earth. These images provide information about the heat on Earth's surface, which can be used to estimate how much water is being transferred from the land to the atmosphere through the soil and plants. From this information, scientists can make predictions and give warnings to farmers and ranchers about risks to crops and livestock.

Warm temperatures and low rainfall cause stress to growing crops. High temperatures can cause some crops to ripen faster, reducing the quality at the end of the season. Heat can also create an environment for crop diseases, pests, and weeds.

Drought and heat can devastate pastures and create livestock feed shortages. High temperatures increase animal water consumption, which may occur at the same time water availability is limited. Animals may experience diminished milk production, lower fertility rates, decreased daily weight gain, and increased susceptibility to disease and parasites.



Watch Hot, Dry Weather Takes Toll on Farm Animals

<https://youtu.be/bWVVC6oXFepc>



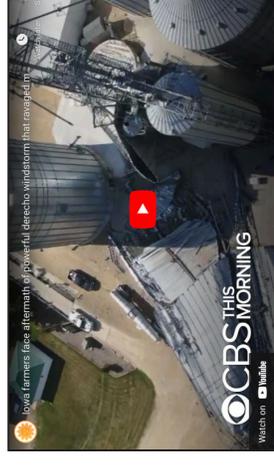
Wind



Wind storms can level planted fields and cause destruction to buildings and structures. Strong winds can pull plants and trees out of the ground or knock them over. They can also dry out plants, move soil and cause erosion, and move and disperse seeds. Winds pick up dust and dirt particles which can damage crops by creating wounds on the plant where pests (fungi, insects, disease) can enter. Uprooted and loose branches cause expensive damage when blown onto buildings and farm equipment. A severe windstorm can toss soil, sand, and larger objects at incredible speeds, causing severe damage to fields and structures.

In areas with loose soil or a lack of crops or cover crops, soil erosion can be caused by strong winds. Wind erosion moves soil from one location to another by the power of the wind. Soil loss, sand-blasted crops, transportation delays, and financial losses are the resulting effects of wind erosion. Stripping away the fertile top layers of the soil and organic matter, wind-blown soil can bury or sandblast pastures, crops, and fences.

Common across the Midwest and Great Plains, a derecho is a widespread, long-lasting, powerful wind storm. A cluster or complex of storms can be classified as a derecho if the damage path is at least 240 miles long and winds are greater than 58 mph for most of the life of the storm. The hurricane-force winds of a derecho wreak havoc on crops by bending or uprooting plants and hiding debris in fields that can damage combines.



Watch Iowa Farmers Face Aftermath of Powerful Derecho Windstorm

<https://youtu.be/k7ZrDovHrI>



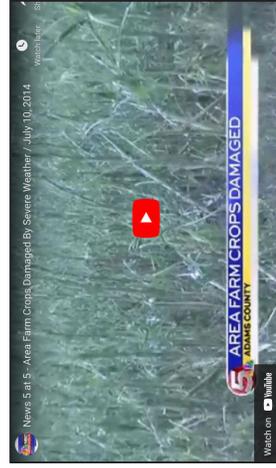
Hail



Hail is frozen precipitation formed when updrafts in thunderstorms carry raindrops up into extremely cold areas of the atmosphere. The hailstones continue to grow in size until they're too heavy to be supported by the updraft and fall to the ground. The more intense the updraft, the longer the hailstones stay in the cold atmosphere and the larger they become. Severe hail typically accompanies other severe weather such as high winds, flooding rains, and tornadoes.

A strong hailstorm can tear through a field and destroy or severely damage a farmer's crop. The damage done by a hailstorm depends on the size and the frequency of the individual pieces of hail. The bigger the hail, the bigger the damage. Hailstones can cause major damage to crops by tearing leaves, breaking or bruising stalks, knocking fruit off plants, bruising fruits and vegetables, killing seedlings, and damaging tree bark and branches. Injured plants, with leaves damaged and torn by hailstones, may not be able to complete photosynthesis. Hail that accumulates without destroying the plant may freeze the growing point, resulting in disease or death of the plant.

Farm animals are susceptible to injury and death when exposed to hailstorms. Shelters, tall brush, and trees can provide protection for animals.



Watch Area Farm Crops Damaged by Severe Weather

<https://youtu.be/CZafkQMJVbc>



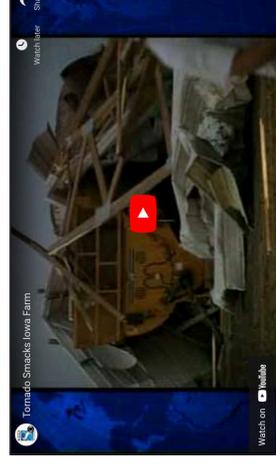
Tornado



Every year, between 600 and 1,400 tornadoes are reported in the United States. Tornadoes are violently rotating columns of air that descend from thunderstorm cloud systems in a funnel shape. Tornadoes may strike quickly, with little or no warning. They can travel at speeds up to 60 miles per hour (mph), with wind speeds as high as almost 400 mph in the tornado's center. Tornadoes are dangerous and destructive because their energy is concentrated in a small area. Wind speeds can cause vehicles to become airborne, destroy buildings, and turn debris into lethal missiles. The sound of a tornado can be compared to a freight train or jet engines. The biggest threat to living creatures during a tornado is from flying debris and being tossed around in the wind.

On a farm, tornadoes can injure, displace, or kill livestock, damage crops, disperse seeds, uproot trees, cause power outages, and damage farm equipment and buildings. Tornadoes can rip the tops from silos, level field crops, and destroy harvested products awaiting shipment.

Farmers monitor forecasts for severe weather. A Tornado Watch is issued when weather conditions favor the formation of tornadoes. A Tornado Warning is issued when a tornado funnel is sighted or indicated by weather radar. Farmers can prepare for tornadoes by securing animals and livestock, stockpiling emergency supplies of feed, water, medicine, veterinary supplies, and fuel, and tying down heavy farm equipment or placing them under cover. If a farmer is caught in their field during a tornado, they should move away from farm equipment, find a low-lying area, such as a ditch, and cover their head with their arms to protect from flying debris.



Tornado Smacks Iowa Farm
<https://youtu.be/Kf8YlgTDXM>

