Unit Six

Winter Storms / Infrastructure Failure

Overview

In this unit, you will learn about the effects of winter storms on farms. You will also work through a case study to determine how you can prepare for and mitigate against infrastructure failure.

Objectives

Upon completion of this unit, you should be able to:

- List common effects of winter storms on farms
- Identify preparedness and mitigation measures for winter storms
- Identify critical infrastructure to your farm
- Identify methods to protect critical infrastructure on your farm
- Determine your vulnerability to the effects of winter storms
- Determine your vulnerability to infrastructure failure

Winter Storms

On average, 100 to 120 storms deposit significant amounts of snow on the U.S. About 15 percent of these storms deposit more than 6 to 12 inches of snow at a time. Approximately 70 percent of all snow falls between December and February. Every part of the nation has experienced snowfall at some time in recorded history.

Categories of storms

There are three categories of winter storms.

1. A blizzard is the most dangerous of all winter storms. It combines low temperatures, heavy snowfall, and high winds that blow the snow into drifts and reduce visibility to only a few yards.
2. A heavy snowstorm drops 4 or more inches of snow in a 12-hour period or 6 or more inches in a 24-hour period. High winds may accompany the storm, resulting in blowing the snow into drifts and causing poor visibility.

3. An ice storm occurs when moisture falls from clouds and freezes immediately upon impact. This type of storm makes driving, and even walking, extremely hazardous.

Winter storm damage

Depending on the degree of preparedness, even small amounts of snow or unexpected low temperatures and wind can have devastating effects on animal health and survival, animal care businesses and personal life. Cold winter weather may be the disaster that causes the most deaths in animals.

Snow will often accumulate at a rate of 0.5 inches an hour. Snow falling at over 1 inch per hour will lead to rapid disruption. More than 2 inches per hour will invariably disrupt community activities altogether.

The National Weather Service makes snow forecasts. Measurement of snowfall is conducted at local offices of the national weather stations. Prediction of snowfall from radar weather detection systems can be difficult, as snow often falls in narrow bands where there are large differences in temperatures.

Local forecasts usually provide the most accurate information on snowfall and winter conditions. Therefore, it is best to rely on local forecasts for preparing and responding to the effects of winter weather.

Common Consequences of Severe Winter Weather

Heavy snowfall and blizzards can trap motorists in their cars, causing major traffic accidents and trapping people and animals inside buildings. The loss of livestock during heavy snowfall and blizzards can be very high.

Ice storms can break power lines, causing widespread blackouts. This can be a serious problem for dairy farmers, making it difficult for them to milk their cows. Intensive farm industries, such as swine and poultry operations, may suffer during these storms if their heating systems fail or if fuel cannot be delivered for power generators.

Frozen water troughs and snow covering feed bunkers and pastures predisposes animals to malnutrition and dehydration. Fire during winter storms presents a great danger because water supplies may freeze and fire-fighting equipment may not be able to get to the fire.

The water supply can be compromised due to frozen pipes and pipes that burst as they thaw. This can be localized to a building or an area of a town.

Large amounts of snow can also lead to localized flooding when warmer temperatures melt the snow in a short period of time.

What Can You Do?

Mitigation of winter weather snow drifts

Any wind blowing over 10 mph has the potential to form drifts. Problems with snowdrifts typically occur around buildings, ditches, machinery, and stacks of feed.

The simplest way to avoid drifts from blocking vital access to building, feed, and machinery is to ensure that they are placed at least 60 feet apart. Special attention should be paid to maintaining this distance when planning building locations, starting a hay or straw stack, or when parking machinery and large equipment at the end of each day and for winter storage.

Building construction

Other ways to prevent snow from blocking animal and human access to buildings and feed is to construct the buildings in such a way that they are least prone to hindered access from snow. Sheds should be built so that their openings face away from the prominent direction of the wind in winter. In North America, this means that openings should usually face east (local climates may affect the choice of this direction).

The depth of the shed should only be about 30 feet, so that sunlight can penetrate into its entire depth. At the back of the shed (the wall facing the wind) there should be a slot in the wall, just below the roof, to allow wind to pass. This prevents wind from creating a vacuum in the shed and drawing snow into it. The front of the shed can also be covered with canvass in severe weather.

Shelter

Yards with buildings and where fences connect to sheds should be constructed so that snow drifts in predictable ways and to non-interfering sites. This can be achieved by building "swirling chambers." A swirling chamber creates an area where snow will settle. Where fences meet sheds, the swirling chamber should be as wide as the shed is deep.

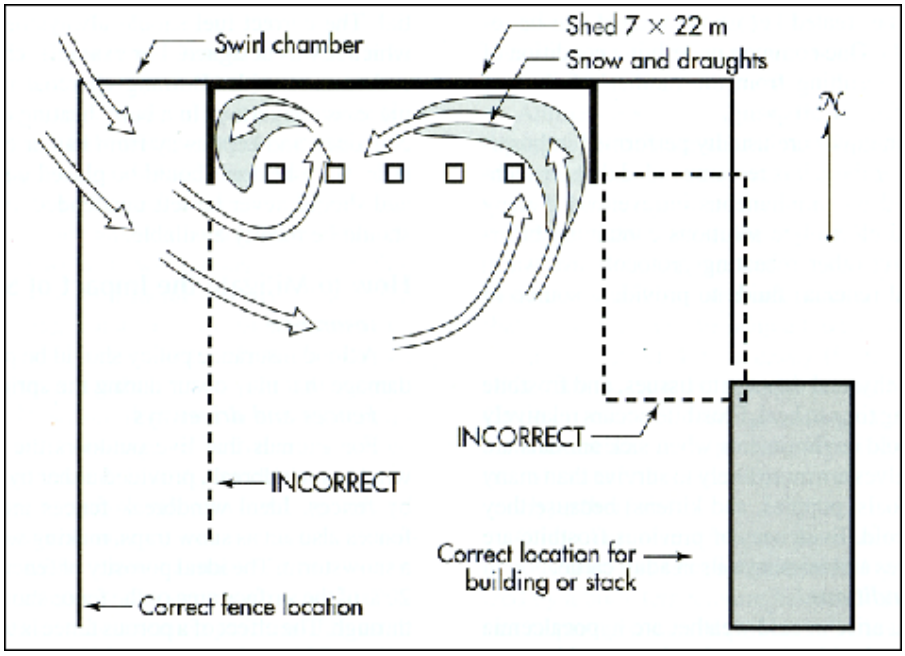


Diagram of structural factors that affect snow deposition. (Modified from Agriculture Canada: Snow and wind control for farmstead and feedlot, Ottawa, 1978).

Fencing

For animals that live outdoors, the best protection against wind is a windbreak, either provided by an enclosed building or fences. Ideal windbreak fences are porous, because solid fences also act as snow traps, making them ineffective in a snowstorm.

The ideal porosity of fencing is about 20 percent, i.e., 20 percent of the surface area of the fence should be free for air to pass through. Fences that are 2.5 m high and with a 20 percent porosity provide effective wind protection for livestock for up to 100ft distance. The length of the fence should be based on the number of animals that will need to seek shelter in a storm.

Driveways

Mark driveways, route access areas, and feed troughs with flags on poles, so that they can still be found and cleared after a snowstorm. If flags are not placed in advance, this can often be difficult if there has been a lot of drifting.

Building collapse

Common sites where the snow accumulates is on the lower of two roofs, roofs lower than surrounding trees, and the wind downside of gable roofs.

The other main reason for uneven distribution of snow is thermal. Snow melts as it passes into a warm area of air and precipitates. This is a common problem when there is insufficient insulation of roofs and can be prevented by adding insulation to the roof.

Constructing buildings strong enough to withstand the weight of the snow can prevent building collapse. Alternatively, buildings should be constructed so that there is a low probability of snow drifting on the roofs.

To prevent building collapse from ice dams and icicles, it is best to insulate the roof adequately and to reduce the size of the roof overhang. Alternatively, reinforcement of the eaves is helpful to prevent damages from snowmelt. In some cases, large icicles can be removed before their weight becomes critical.

Preparedness for winter storms

Preparedness actions before winter storms include following weather conditions, insulating the areas where animals are kept, and ensuring that family members know how to use emergency lighting and heating equipment. Use the following guidelines for further preparation.

- Use your radio, television, and newspapers to keep informed of current weather conditions in your area.
- If possible, insulate any buildings used to house livestock.
- Keep simple tools and other equipment to fight a small fire easily accessible. The chance of fire may increase when wiring and ventilation is inadequate. Winter storms may interrupt fire department services.

- Carry in your car a winter care kit that includes food and water, a windshield scraper, a flashlight with extra batteries, a tow chain or rope, a shovel, tire chains, a blanket, a bag of sand, a fluorescent distress flag, and an emergency flare.
- If you have to travel, keep a supply of high-energy foods, candles, and matches with you. Keep extra mittens, hats, boots, socks, and outerwear in the car.
- Be sure that all family members know how to use your emergency heating and lighting equipment. Proper ventilation in homes and barns is essential.
- Never use fuel in equipment that was not designed for that fuel. Burning charcoal indoors will give off deadly carbon monoxide.
- If you are trying to heat a barn, use something with a safely contained heating element. Do not place it near hay or any other combustible material or leave a heater unattended in the presence of livestock. Keep fire extinguishers nearby.

Impact of Winter Weather on Animals

There is considerable under-reporting of many issues that arise due to winter weather because the places affected are inaccessible, or attempting to reach them is dangerous. Cold and snow-related problems may also be spread out over a large area.

In the winter of 1996-97 the Dakotas and upper Midwest were covered by heavy snow and prolonged periods of extreme cold. This was followed by extreme flooding in the spring.

Many grazing livestock were stranded after farmers found themselves unable to provide feed and water. This led to poor body conditions in many animals that predisposed them to hypothermia resulting from the later floods. Eventually 123,000 cattle died. More than 1,000 carcasses were pulled from water in which they had drowned. Approximately 15,000 were buried.

Adaptation to cold

Animals that do not adapt well to cold are at greatest risk of exposure to cold. Animals can inadvertently be exposed to cold temperatures if they are moved from the southern U.S. to the north in the fall, winter, or spring. Animals that have been housed or excessively blanketed may be at risk as well as animals that were hospitalized and became accustomed to warmth.

Similar to wildlife, livestock and horses that have adapted to cold can survive extreme conditions if they are protected from wind, given sufficient feed, and their coats are not muddy or wet. Guidelines for feeding livestock under different temperature extremes are provided in Appendix A in this unit.

Mitigation measures

- Be prepared for isolation at home, particularly if you live in a rural area. It is highly possible that a severe winter storm could isolate you for one or two weeks.
- Stock an emergency supply of food and water for yourself and your animals. Keep foods that do not require cooking or other preparation. If you or your animals are on continual medications, be sure to always have at least a two-week supply on hand.
- Stock a battery-, hand-cranked or solar-powered radio and extra batteries in case of a power failure. Have flashlights ready for use. A generator may be necessary to prevent the loss of life in livestock production facilities.
- Only keep animals outdoors that have had sufficient time to acclimatize to the cold weather. Provide extra feed and wind breaks for any animals kept outdoors. See Appendix C in this unit.

Impact and Consequences

There are many problems associated with severe winter weather and snow. The following table presents some commonly reported problems that arise in severe winter weather and snow and the unit in which you can learn more about the consequences.

Impact	Consequence	Refer to Unit #
People who venture out into snow storms can easily become isolated	Communications are challenged	5
Downed power lines and other utilities can fail	Infrastructure failure	This unit
Incorrect use of kerosene heaters can start fires	Threat to public and animal safety	7
Melting snow can cause flooding	Need to evacuate people and animals	8
Avalanches can occur	Displacement of animals	9
Incorrect use of outdoor heaters can cause poisoning in people and animals	Threat to public and animal health	10
Snowmelt can cause lagoons to overflow	Adverse effects on the natural environment and wildlife	11
Trapping of animals in ice can cause them to die	Need for carcass disposal	12
Severe cold, especially if combined with disease, can cause serious illness in animals	Need for euthanasia	13
Severe cold may prevent animals from maintaining proper body heat	Threat to the well-being of animals	14
Blizzards can distress animals	Public concern	15

Critical Infrastructure

A functional infrastructure is the basis of successful farm operations. A functional infrastructure allows for access to a farm for delivery of feed and supplies, as well as for animals, goods, and other items to be taken from the farm, e.g., for sale at market.

A functional infrastructure is also necessary for a power supply to operate feeding and watering equipment, lighting, fans, heaters, and specialized equipment such as milking machines.

Each farm has its own infrastructure that allows people and animals to move about, e.g., to have access for feeding, milking, and providing health care. Included in a farm's infrastructure are the buildings that should be strong enough to withstand the impact of common disasters, such as heavy snowfall.

Infrastructure failure results from many types of disasters. Here we will use the example of severe winter weather to illustrate how disasters can cause infrastructure failure and what you can do to mitigate the impact of infrastructure failure.

Let's look at the following case studies. As you read through each one, keep in mind the mitigation measures discussed earlier.

Case 1: Access to the barns

Obstructed access

A severe blizzard in Pennsylvania results in heavy snowfall and drifting. On a dairy farm, the snowdrifts obstruct access to the farm, the calf barn, and the milking parlor. There are 25 calves in the barn and 80 cows need to be milked. In two hours the milk truck is due to arrive to collect the milk. In some areas the snowdrift is so high that the paths are not visible.

Are you at risk?

If you were faced with an obstructed access to your farm and animals (e.g., because of a snow drift, fallen tree, landslide, or washed-out road) what equipment do you have to clear the path?

Which of the following would you assign highest priority?

Clearing access to the farm so that the milk can be collected?

Clearing access to the milking parlor so the cows can be milked?

Clearing access to the calf barn so that calves can be fed and watered?

In this case, the farmer was able to use a front-end loader to clear debris away from the milk tank. However, when the milk truck arrives the farmer is still removing snow, and the trucker advises him that the snow has already caused great delays and that he cannot wait. The farmer now faces the challenge of having to either dump the stored milk or not milk his cows that day. Either option will be costly for him.

What do you think could have been done to prevent the drifting of snow that prevented access to the barns? (Review the sections on mitigation earlier in this unit.)

Case 2: Power outage

As the farmer is digging his way through the snow with his tractor, he inadvertently hits a utility pole. This causes the power cables to break, and now the farm is without power.

Are you at risk?

Do you have a generator to operate your farm?

What size generator do you need to run the high priority operations on your farm?

There is a backup generator that he could use. However, it has been more than a year since he last used the generator. When he goes to start it, the starter motor turns over sluggishly. Although there is gasoline in the tank, the generator will not start.

What are some possible causes of why the starter motor turns over slowly (battery) and why the engine won't start (clogged spark plugs, insufficient battery power, and stale gas in carburetor)?

Eventually the farmer can get the generator to start. However, he is unsure of the proper safety procedures to hook up the generator.

Are you at risk?

Do you know how to hook up a generator to run your farm?

What are the risks of hooking up a generator before disconnecting the farm from the power grid?

How much gasoline/diesel fuel do you need to run a generator on your farm for 24 hours?

When did you last run your farm from your generator?

To be safe, the farmer contacts his local Cooperative Extension Service agent and revises how to hook up his generator. He is then able to operate his farm for several days.

Case 3: Building collapse

Fortunately, no more snow falls, and over the next few days the weather begins to warm. As the snow melts off the roof, large icicles form. Eventually, the weight of the icicles tears down part of the barn roof.

The damage is severe. Approximately 25 percent of the roof covering and supporting walls are demolished. As a result, the cows due to calve are now exposed to the harsh weather. Several of the cows affected were recently purchased and have had only limited time to adapt to weather conditions in the area.

The shock of the roof collapsing causes two of these cows to calve early. It soon becomes clear that their calves are not well-adapted to the cold. One of them refuses to eat and becomes severely lethargic. Because the cows and their calves are now exposed to the severe weather, the farmer decides to move them.

Are you at risk?

If you had to move your animals from their usual place, where would you move them?

Would you be able to provide them with feed and water at that location?

What measures might have reduced the likelihood of building collapse after the icicles have formed?

What mitigation measures can you think of to reduce the likelihood of building collapse?

What Can You Do?

Power supply

Have fuel and a safe type of emergency heating equipment available in case of power failures that would shut down standard furnaces — a camp stove with fuel or a supply of wood or coal for your fireplace could be used. Be prepared to keep at least one room of your house warm enough to live in for at least a week.

Many farms are in rural areas and may have a low priority for restoration of power supply following a disaster. Therefore, planning for power outages can make all the difference between expecting to prepare for a few days without power, or to be without power, lights, water, heating, and appliance operations for several weeks.

Purchase a generator

The best mitigation for electric power failure is for every farm to have its own alternative power supply. Generators can be secured through contractual agreements with suppliers, but a more reliable solution is for the farm to purchase a unit with sufficient power output. A representative from the electricity company or Cooperative Extension Services can advise you on the energy requirements to run a farm and the size of the generator needed to supply the appropriate amount of power, as well as provide information on sources and costs of generators.

Know how to use it safely

There is more to operating a generator than simply owning it for backup purposes. Generators need to be hooked up safely so that power is not sent back into the power grid. Power reversal can be dangerous and has led to several deaths after disasters.

Maintain your generator

Generators also need regular maintenance, which should be scheduled several times a year. To ensure that farmers and their employees know how to safely hook up a generator and that the generator is capable of supplying power for the entire farm, practice running the entire operation using only the generator for a day at least once a year.

Assess Your Vulnerability

Winter Storms	
Item	**Vulnerability Score**
1. Based on your knowledge of local conditions, how commonly are farms within your county affected by severe winter storms? 1 (never)—5 (at least once a year)	
2. What do you think the impact of a severe winter storm would be on your farm? 1 (none)—5 (severe disruption)	
3. What is your vulnerability to severe winter weather? Add 1 and 2	Enter this number on page 16-3
Infrastructure Failure	
Item	**Vulnerability Score**
1. How prepared is your farm to operate in the face of a power failure, obstructed access or other causes of infrastructure failure? 1 (very unlikely)—5 (at least once in the last 2 years)	
2. What impact would infrastructure failure, e.g, lack of access to your farm, power failure, have on your farm? 1 (minor)—5 (severe disruption)	
3. What is your vulnerability to infrastructure failure? Add 1 and 2	Enter this number on page 16-5

Learning Check

Directions: Determine if the following statements are true or false based on the material presented in this unit. When you have finished, check your answers on page 6-17.

1. Small amounts of snow falling never cause devastating effects.

   True or False?

2. Animals that have recently moved from a warmer to a colder climate are at a greater risk of hypothermia than animals that have lived in a colder climate for longer periods.

   True or False?

3. The simplest way to avoid snow drifts from blocking access to buildings, feed, and machinery is to make sure that each is placed at least 60 feet apart from the other.

   True or False?

4. A blizzard is the most dangerous of all winter storms.

   True or False?

5. A blizzard occurs when moisture falls from clouds and immediately freezes upon impact.

   True or False?

6. Severe winter weather may be the most common cause of animal death in disasters.

   True or False?

Learning Check

7. When snow falls at rates of greater than 1 inch per hour, severe disruptions can be expected.

   True or False?

8. Ideal fencing porosity to protect animals from severe winter weather is 5 percent.

   True or False?

9. Ice dams and large icicles are common causes of building collapse.

   True or False?

10. Livestock that are adapted to cold can tolerate low temperatures if they are given less food than normal.

    True or False?

11. Snowmelt can lead to localized flooding.

    True or False?

12. Examples of critical infrastructure include power supply, road access, and delivery of supplies.

    True or False?

Learning Check

13. Obstructed access to farms can be costly to farmers because feed cannot be delivered and animals cannot be moved.

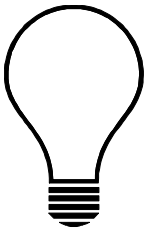
    True or False?

14. Many farms depend on electricity to operate.

    True or False?

15. Renting a generator is an adequate recovery activity for farms.

    True or False?



Answers

For every question that you answered incorrectly, review the page listed next to the answer to find out why your answer was incorrect.

1. False.....6-2
2. True.....6-7
3. True.....6-3
4. True.....6-1
5. False.....6-2
6. True.....6-2
7. True.....6-2
8. False.....6-4
9. True.....6-5
10. False.....6-7
11. True.....6-3
12. True.....6-9
13. True.....6-10
14. True.....6-12
15. False.....6-11

Summary

This unit described the severe effects of winter storms and the problems that arise when winter storms disable the infrastructure upon which farms rely. This unit also defined preparedness and mitigation measures that you can implement to better protect yourself and your animals in the future.