Animals in Disasters

MODULE A
UNIT 5

Geological Hazards: Applying the Four Phases

Overview

This unit deals with geological hazards including landslides and mudflows, earthquakes, tsunamis and volcanoes. It defines each of these hazards and provides practical information for applying the four phases of emergency management in relation to these hazards. It focuses on protecting animals during such emergencies.

Objectives

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

- Define geological hazards that threaten the United States
- Protect yourself against geological hazards
- Protect animals against geological hazards
- Apply the four phases of emergency management to geological hazards

Landslides and mudflows

Landslides occur in many parts of the country. They are characterized by the down slope movement of rock, soil, or other debris. They can be triggered during earthquakes, volcanic eruptions, storm-generated ocean waves, or other landslides. Landslides also can result from freeze-thaw cycles, shrink-swell cycles, root wedging, animal burrows, natural erosion or deposition, or the thaw of ice-bearing soils such as permafrost. While most landslides are single events, more than one third of the cases are associated with heavy rains or the melting of winter snows. Increased housing development in landslide-prone areas increases the potential damage if a landslide occurs.

Mudflows are defined as flows or rivers of liquid mud down a hillside. They occur when water accumulates under the ground, usually following long and heavy rainfalls. If there is no brush, trees, or ground cover to hold the soil, mud will form and flow down the slope. For this reason, mudflows can follow wildfires.

Mitigation

Before buying land or building on any property, check with the county land commissioner or the local office of the U.S. Geological Survey for ground composition, drainage, and stability. Surveys of land that may be susceptible to landslides should include grazing land.

Practical things you can do on your property are:

- Plant ground cover on slopes, or build retaining walls.
- Reinforce the foundation and walls of your home and barn.
- Install flexible rather than stiff pipe fittings to avoid gas or water leaks in the event of a landslide or mudflow.
- Construct channels or reinforced masonry walls to direct the mudflows around your home, buildings, or barns. Clear obstructions from waterways.

Mudflow is covered by flood insurance policies from the National Flood Insurance Program (NFIP). Buy flood insurance through your local property insurance agent.

Preparedness

Landslide warning signs include:

- Opening of cracks on hill slopes;
- Tilting of trees, poles, or walls; and
- Perceptible changes such as the formation of sags and bumps in the slope.

Mudflows are most commonly triggered by high-intensity rainstorms but can also occur following forest fires when soil is newly bare. They tend to flow in channels but will often spread out over the floodplain. They frequently recur in the same area.

If you suspect a slope is unstable have it examined by a specialist. Possible signs of slope failure include:

- Doors or windows sticking or jamming for the first time;
- New cracks appearing in plaster, tile, brick, or foundations;
- Outside walls, walks, or stairs beginning to pull away from the building;
- Slowly developing, widening cracks appearing on the ground or on paved areas such as streets or driveways;
- Underground utility lines breaking;
- Fences, retaining walls, utility poles, or trees tilting or moving; and
- Water or bulging ground appearing at the base of a slope.

If you live in an area where landslide or mudflows can occur, and you notice any of the above signs, be prepared to evacuate your home, barn and stables.

Response

Several actions can be taken to ensure a safer and more effective response to a landslide or mudflow. Listed to follow are some of these actions.

- If you are warned of an impending landslide or mudflow, evacuate at once with your animals to stable ground. Do not leave your animals behind. However, do not let the movement of animals delay your own evacuation and endanger your safety.
- If you are inside a building during a landslide, stay inside and get under a desk, table, or other piece of sturdy furniture.
- If you are outside and cannot get into a sturdy building while scattered rocks and debris tumble toward you, curl into a tight ball and protect your head.
- If you are in a valley, once you hear rumbling from upstream or feel the ground tremble – leave. These may be signs that indicate that a mudflow is coming your way. Do not try to outrun a landslide – instead move at right angles to the direction of flow.

Recovery

Annual economic losses from landslides are estimated at $l to $2 billion. These losses include the replacement and repair of damaged facilities and associated costs such as:

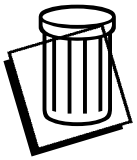
- Lost productivity,
- Disruptions to utility and transportation systems,
- Loss of revenue for affected communities,
- Loss of livestock and horses, and
- Damage to or loss of buildings that house equipment and animals.

Associated dangers include broken electrical, water, gas, and sewage lines. Damaged electrical wires and gas lines may also start fires.

Other long-term dangers from this hazard include the continued threat of landslides due to unstable land. Erosion from the loss of adequate ground cover could be very damaging and lead to flash flooding during periods of heavy rain or following heavy snows.

If a landslide or mudflow has occurred near your home or barn, take the following steps to assure a safe recovery.

- Thoroughly check the foundation, chimney, and surrounding land to be sure no damage has occurred.
- Check for damaged gas, electrical, or water lines. Do not strike a match or attempt to turn on electricity until you are sure it is safe. Report damages to the appropriate utility companies.
- Stabilize new land as quickly as possible to reinforce against secondary slippage. Replanting damaged land will help tremendously in both short- and long-term recovery.



LEARNING CHECK – WHAT HAVE YOU LEARNED ABOUT LANDSLIDES?

This activity is designed to assess your understanding of the information presented in this unit.
Directions: Answer the questions – use the Answer Key in Unit 10 to check your answers.

True or False

1. Instead of trying to outrun a mudflow, you should move at right angles to the direction of the flow.

2. Planting ground cover on slopes will help prevent damage from landslides on your property.

3. It is safe to leave animals behind when evacuating due to a landslide or mudflow, because they will be able to outrun danger.

4. Tilting of trees, poles or walls may give warning of impending landslides.

5. More than one third of all landslides are associated with heavy rains or melting snow.

6. The down slope movement of rock, soil, or other debris characterizes landslides.

7. If you are in a building during a landslide, leave immediately.

8. Erosion following a landslide can lead to flash flooding during heavy rain.

Multiple Choice

9. Which of the following is defined as a flow or river of liquid mud running down a hillside?
   a. Avalanche
   b. Landslide
   c. Mudflow
   d. Flood

10. Which of the following may trigger landslides?
   a. Earthquakes
   b. Drought
   c. Tornadoes
   d. Hurricane winds

Earthquakes

An earthquake is a wave-like movement of the earth's surface. The earth's crust and upper part of the mantle push and move against one another along what are known as fault lines. When rock masses slip along a fault, the energy of an earthquake is released in seismic waves. An earthquake can also be produced by volcanic eruptions.

The damage caused by an earthquake depends on its magnitude and intensity. The most widely known indicator of magnitude, the Richter scale, measures the energy released when large rock masses in the upper earth suddenly shift. A change of one full point in the Richter scale represents a difference by a factor of 30 in energy released. Thus, an earthquake of magnitude 7 is roughly 30 times as powerful, in terms of energy released, as one of magnitude 6. The Modified Mercalli scale, found in Appendix D, indicates intensity.

Earthquake monitoring is conducted by the U.S. Geological Survey, the National Oceanic and Atmospheric Administration (NOAA), and universities throughout the United States. The exact time and place an earthquake will occur still cannot be predicted.

Mitigation

Listed below are several actions that can be taken to mitigate the harmful effects of earthquakes.

- Check your local emergency manager for potential earthquake and fire risks.
- Bolt down or reinforce water heaters and other gas appliances. Use flexible gas line and appliance connections wherever possible. Know where to turn off the gas supplies to your house or barn.
- Place large and heavy objects on lower shelves and securely fasten shelves to walls taller than 5 feet. Brace anchor all tall or top-heavy objects.
- Do not place dog runs or other animal enclosures underneath things that might fall on them during an earthquake, such as a chimney or a heavy retaining wall. Include a pair of bolt cutters in your disaster kit. Gates can sometimes become damaged and unable to be opened.
- Affix tabletop equipment (such as computers or typewriters) with industrial strength Velcro. Overhead lighting fixtures should be anchored solidly in place.

- Deep plaster cracks in ceilings and foundations should be investigated and repaired by experts, especially if there are signs of structural defects. Be sure the house is firmly anchored to its foundation.
- Purchase earthquake insurance for your home and its contents. Renters can also purchase earthquake insurance for their belongings.
- Support local safe land use and building codes that regulate land use along fault lines. Modern engineering can produce structures that resist earthquake damage; existing buildings can be retrofitted to better withstand tremors. Often there are tax advantages for these types of improvements.

Preparedness

Prepare yourself, your family and your animals for earthquakes by following the guidelines listed below.

- Prepare a family earthquake plan and conduct family earthquake drills. Include animals in these exercises.
- Discuss earthquakes and other possible disasters so that younger members of your family understand how to take action without fear. Instructional videos are available for this.
- Designate an out-of-state contact and be sure that all members of your family know how to reach this person. If possible, include the out-of-state contact number on your animal's identification.
- Know where the safest places are at home, work, or school.
- Teach responsible members of your family how to turn off gas, electricity, and water at main switches and valves. Check with your local utility offices for instructions.
- Learn how to extinguish small fires and to provide emergency first aid.
- Be prepared to survive for 72 hours without any assistance. Remember to include supplies for your animals.
- Test your radio, flashlights and batteries when daylight savings time arrives to ensure your ready response. Keep spare bulbs for flashlights.
- All the members in your household and your horses should have a current tetanus vaccination.

- If you take your dog or cat to a boarding kennel or have a pet sitter come to your home in your absence, make sure they are familiar with your earthquake preparedness plans.
- Keep a collar and an identification tag on your pets at all times.
- You may also learn a lot by helping organize and support earthquake preparedness programs in your community. Your community could hold earthquake drills and public education programs to prepare for earthquakes.
- Earthquakes have the potential to trigger other emergency conditions such as tsunamis, fires, major landslides, dam failures, power plant ruptures, and hazardous materials spills. Be prepared for all of these disasters if you live in an earthquake-prone area.

Response

Earthquakes usually occur without warning. If an earthquake is occurring in your area:

- You will feel a trembling in the ground or floor,
- You may notice hanging lights or planters starting to sway,
- You may even feel slightly dizzy, and
- Many animals will become very nervous and apprehensive – they can bite, kick, or scratch.

The actual movement of the ground is seldom the direct cause of death or injury to humans and animals. The following commonly cause earthquake-related casualties:

- Partial or total building collapse, including toppling chimneys or walls, falling ceiling plaster, light fixtures, and pictures;
- Flying glass from broken windows and skylights (this danger may be greater from windows in high-rise structures);
- Overturned bookcases, fixtures, and other large furniture and appliances falling on people and animals;
- Fires resulting from broken chimneys and broken gas lines;
- Electrocution from fallen power lines; and
- Exertion and fear leading to heart failure.

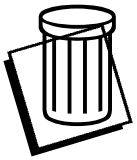
To reduce injury and death to people and animals special precautions should be taken and include the following:

- Broken gas lines often are a major cause of earthquake-related fires. Following an earthquake, turn off any supplies of gas to your home or farm buildings.
- Above all, remain calm. Try to reassure others. Think through the consequences of any action you take.
- If you are indoors stay indoors and remember the safety routine to *drop, cover* and *hold*. Take cover under a sturdy piece of furniture (such as a heavy desk, table, or bed) and hold onto one of the legs. In barns, tools, equipment and other objects on the walls and in the rafters are likely to fall, and can cause serious injury to people and animals. Stay away from objects that can shatter (such as windows, mirrors, or skylights) and chimneys.
- If you are in a high-rise building, a crowded store or mall, do not run for exits. Stairways may be broken or jammed with people. Power for elevators may fail so do not use them. Stay away from store display windows that may break. If you must leave the building, choose your exit as carefully as possible.
- If you are outside, get away from buildings, walls, utility poles, downed wires, and all other objects that could fall.
- If you are in a car, stop as quickly as safety permits but stay in the vehicle until the shaking stops. Avoid bridges, underpasses, and tall buildings.
- Check for injuries and attend to them. Seek medical help if necessary for humans and animals. Check for fires or other hazards.
- Remember that animals can be frightened by an earthquake too. Be alert to any aggressive behavior displayed by an animal. An animal may bite out of fear and stress.

Recovery

Earthquakes can cause damage to buildings, utility lines, bridges, or dams. Water supplies can become contaminated by seepage around broken water mains. Damage to roadways and to other means of transportation may create food and other resource shortages for people and animals if transportation is interrupted. Use the following guidelines to aid in safe recovery from earthquakes.

- If you are unsure of a building's safety, do not enter until it has been inspected by a qualified person. Aftershocks may cause additional damage to buildings.
- Check to make sure that fences used to confine animals are intact. If animals have escaped, they will often return to their regular feeding site at mealtime and may be recaptured.
- Keep animals safely confined until debris is removed.
- Check utilities. If you smell gas, open windows and shut off the main gas valve. Shut off electrical power if there is damage to your house wiring. Leave the building and report damage to the appropriate utility companies. Do not use matches, lighters, or open-flame appliances until you are sure there are no gas leaks. Do not operate electrical switches on appliances if gas leaks are suspected, i.e., if lights are on, leave them on. If they are off leave them off.
- Do not eat or drink from open containers near shattered glass and do not offer these to animals either. Remove any contaminated sources of food or water so that animals can not get to them. If there is a boil water order in effect, do not drink or give animals tap water until the officials announce that it is safe to do so. Let water from pipes run several minutes once the boil water order is lifted.
- Open closet and cupboard doors carefully, watching for falling objects. Immediately clean spilled medicines and potentially harmful materials. Wear gloves when you do this.
- Check to be sure that sewage lines are intact before flushing toilets. On farms, check to see that the waste-handling facilities have not been disrupted and manure is not leaking into the environment or groundwater.
- Be prepared for additional aftershocks. While the aftershocks are usually smaller than the main shock, some may be large enough to cause additional damage.
- Do not use your telephone except for emergency calls. Listen to your radio for damage reports and information.
- Do not go sightseeing. Stay away from beach and waterfront areas where seismic sea waves (tsunamis) may strike.
- When it comes time to repair your house and farm buildings, ensure that the repairs will increase the structure's ability to withstand future quakes.



LEARNING CHECK – WHAT HAVE YOU LEARNED ABOUT EARTHQUAKES?

This activity is designed to assess your understanding of the information presented in this unit.
Directions: Answer the questions – use the Answer Key in Unit 10 to check your answers.

True or False

1. Geologists can predict exactly when and where earthquakes will occur.

2. If you are in your car during an earthquake, stop immediately and get out.

3. Fires can be a major problem following earthquakes.

4. The best thing to do if you are in a building during an earthquake is to get out of the building.

5. Animals always sense earthquakes before they occur and will usually bite, kick, or scratch you.

6. If animals escape during an earthquake, they may return at mealtime.

7. The beach is a safe place to stay until earthquake aftershocks have passed.

8. It is safe to give animals tap water to drink following an earthquake.

Multiple Choice

9. Which one of the following is a danger commonly associated with earthquakes?
   a. Avalanches
   b. Flash flooding
   c. Hazardous materials spills
   d. Wildfires

10. Which one of the following can help cause an earthquake?
   a. Landslides
   b. Floods
   c. Volcanic eruption
   d. Drought

Tsunamis

A tsunami (pronounced “soo na’mee”) is a series of giant ocean waves produced by a major underwater or coastline disturbance such as an earthquake or volcanic eruption. A series of waves sometimes lasts several hours, with 20 or 30 minutes between waves. Tsunamis can occur in all oceans, but they are most common in the Pacific. In this century, more than 200 tsunamis have been recorded in the Pacific.

Areas thousands of miles from an earthquake can be struck by a resulting tsunami. The waves appear to be normal ocean waves until they approach the coastline, where a gigantic wall of water can build on the ocean surface. Tsunamis reaching heights of more than 100 feet have been recorded.

Mitigation

The most effective mitigation measure to avoid property damage is not to build or live in buildings within several hundred feet of the coastline. Even the strongest buildings can be damaged or undermined by a powerful tsunami.

Preparedness

Tsunamis can be detected before they strike land and local warning systems are in place. Approaching tsunamis usually are preceded by a pronounced rise or fall of coastal water. This action is nature’s tsunami warning and should be heeded. Many people have been trapped while exploring the newly uncovered sea bottom for marine life as the sea retreats before the giant wave strikes. Follow these general guidelines to prepare for tsunamis.

- If you live near a coastal area and have experienced or heard of a recent earthquake or volcano, listen to your radio for a tsunami warning.
- If you hear of a tsunami warning, do not go down to the beach to look for the tsunami. If you can see it, you will be too close to escape it.
- Adequately identify all animals so that if they are separated from you, they can be traced and returned.

Response

There are several ways that you may be warned of an approaching tsunami:

- Your community may be warned by radio or television announcements.

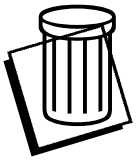
- Local police, fire, or emergency officials may go door-to-door in threatened areas.
- Outdoor sirens may sound to warn of the dangers.

To respond safely to the threat of a tsunami, use the following guidelines.

- Learn the warning signs and signals and heed them. This includes staying off the beach during unusual tidal action.
- Plan several escape routes to high ground. Your primary escape route might be damaged or destroyed if a local earthquake strikes.
- Be prepared to evacuate low-lying coastal areas immediately. Evacuate all animals that you can.
- If you must leave animals behind, do not confine them.
- Keep a collar and an identification tag on dogs and cats at all times in case they get lost.
- Since a tsunami is not a single wave but a series of waves, stay out of dangerous areas until an all clear is issued.
- After the tsunami, check for injuries and seek medical help if necessary for humans and animals.

Recovery

Risks associated with tsunamis include broken sewage lines, polluted water supplies, damaged gas lines, and downed power lines and fences. If your home, apartment, business or farm has been damaged, document the damage with photos and videos and call your insurance agent, who will advise you what to do next. Follow the same instructions regarding water, food, and building safety as in other sections of this course, such as for floods and earthquakes.



LEARNING CHECK – WHAT HAVE YOU LEARNED ABOUT TSUNAMIS?

This activity is designed to assess your understanding of the information presented in this unit.
Directions: Answer the questions – use the Answer Key in Unit 10 to check your answers.

True or False

1. A tsunami is a series of giant ocean waves produced by a major underwater or coastline disturbance.

2. Tsunami waves are usually visible before they approach the coastline.

3. Two events that may trigger tsunamis are earthquakes and hurricanes.

4. Tsunami waves usually arrive within a few moments of each other and the entire event lasts about an hour in length.

5. A pronounced rise or fall of coastal water usually precedes approaching tsunamis.

6. Tsunamis cannot be detected before they strike land.

7. It is important to plan several escape routes in the event a tsunami should occur.

Multiple Choice

8. Not building a home within several hundred feet of the coastline to avoid damage from tsunamis is an effective example of which of the four phases of emergency management?
   a. Mitigation
   b. Preparedness
   c. Response
   d. Recovery

9. Tsunamis most commonly occur in which of the following oceans?
   a. Atlantic
   b. Arctic
   c. Indian
   d. Pacific

10. Which of the following is one of the first steps you should take when recovering from tsunamis?
    a. Check for injuries and seek medical advice
    b. Document damage with photos and videos and call your insurance agent
    c. Call the Federal Emergency Management Agency for assistance
    d. Call the Small Business Administration to seek a loan

Volcanoes

Volcanoes form where weak spots or breaks in the earth's crust allow the magma to push toward the surface. When the pressure of gas and magma becomes too great, the volcano erupts. Magma may pour through the vent opening in lava flows or shoot into the air as dense clouds of gas and dust (ash) fall. Volcanic eruptions can generate mild to moderate earthquakes, mudflows, flash floods, tsunamis and huge ash clouds that can create intense lightning storms.

In the United States, the chance of eruptions that could damage populated areas is greatest in the active volcano range of the Pacific Rim. The danger area around a volcano can extend hundreds of miles.

In 1980, the violent eruption of Mount St. Helen's resulted in 60 deaths and caused approximately $1.5 billion in damages. The eruption spread thick layers of ash over thousands of square miles and caused massive flooding and mudflows in the immediate area. The Mount St. Helens eruption renewed interest in the possibility of future eruptions in the Cascade Range.

Mitigation

Because areas far from the volcano may be affected, you should listen for advisories as to whether your area will be impacted. Warnings include information about the approximate time, place, and extent of the effects as well as the uncertainties involved in making the prediction. Evacuation routes for yourself and your animals should be determined in advance for use if needed.

Preparedness

Contact your local emergency management office to learn about methods of protecting your family, animals, and home from ash fall. The U.S. Geological Survey assesses all information related to the development of impending geological disasters and informs the public. To prepare for an eventual volcanic eruption, take the following preparedness steps.

- Keep a collar and an identification tag on your dogs and cats at all times, so that if they should get lost you have a greater chance of finding them.
- Have emergency, battery-operated lighting and heating supplies available in case of a power failure. Test the power of the batteries monthly.

Response

The degree of hazard to human and animal life and property resulting from a volcano depends on the type and distance from the eruption. Hazards include lava flows, rock falls, ash falls, earthquakes, mudflows, and flash floods. Take the following actions when responding to a volcanic eruption.

- Heed official warnings of imminent volcanic eruption.
- If told to evacuate, do so immediately.
- Following an eruption, flash floods resulting from glacier outbursts can cause overflow from dams and reservoirs. Avoid stream beds and valleys in the vicinity of a volcano. If caught in a low area, run uphill to avoid injury from flash floods or mudflows.
- During ash fall, close all windows, doors, and dampers in your home and where your animals are housed. Put all machinery inside a garage or barn. Bring animals into closed shelters. Stay indoors until the ash has settled.
- Do not attempt to drive in heavy ash fall, it will stir up more ash and clog and stall your vehicle.
- If caught in a small rock fall (not a landslide), roll into a ball and protect your head. If caught outside during ash fall, keep your mouth and nose covered to avoid inhalation of ash. Cover your eyes and keep your skin covered to avoid irritation or burns. Do the same for animals where possible and practical. Respiratory diseases can develop in any persons or animals that are exposed to the fumes and fine ash suspended in the air.

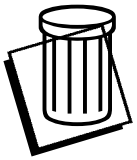
Recovery

Hazards within the immediate vicinity of the volcano come from heavy ash fall, which can darken the sky as if it were nightfall. The increased demand for lighting could result in power failures. Ash may be carried by winds for thousands of miles and affect distant areas long after the eruption. Secondary eruptions and lava flows can occur in the days, weeks, or months after a volcanic eruption.

The ash is actually pulverized rock. A one-inch layer weighs ten pounds per square foot. Ash can clog waterways, reservoirs, and machinery and its weight can cause roofs to collapse.

If you have to work in an environment where there is volcanic ash be sure to take the following actions.

- Wear an approved respirator.
- Clear roofs of ash fall as soon as possible to avoid collapse.
- Remove ash from any areas where animals will be confined. With ash covering the ground livestock cannot graze.
- Throw away any food or water, for both humans or animals, that have been contaminated by the ash. Ash is commonly contaminated with heavy metals that are toxic to humans and animals. In addition, pyroclastic material contains glass-like particles that can cut or irritate lungs and intestines.



LEARNING CHECK – WHAT HAVE YOU LEARNED ABOUT VOLCANOES?

This activity is designed to assess your understanding of the information presented in this unit.
Directions: Answer the questions – use the Answer Key in Unit 10 to check your answers.

True or False

1. Volcanic ash is often contaminated with heavy metals that can be toxic to humans and animals.

2. If you are indoors during actual ash fall, open all doors and windows to increase ventilation.

3. Volcanic ash and lava is usually slow moving, so there is ample time to evacuate.

4. The danger area around volcanoes can extend several hundred miles.

5. The eruption of Mount St. Helens spread thick layers of ash over thousands of square miles.

6. Volcano warning information includes the exact time, place and extent of effects.

7. Power failures are common following a volcanic eruption.

Multiple Choice

8. Which of the following is NOT a hazard following a volcanic eruption?
   a. Mudflow
   b. Flash flood
   c. Tsunami
   d. Tornado

9. Which of the following agencies assesses information related to the development of impending geological disasters?
   a. Department of Energy
   b. Environmental Protection Agency
   c. State highway patrol
   d. U.S. Geological Survey

10. People and animals that are exposed to ashfall are most susceptible to which of the following?
    a. Bacterial infection
    b. Respiratory disease
    c. Dehydration
    d. Viral infection

Summary

In this unit you learned how the four phases of emergency management – mitigation, preparedness, response and recovery – can be applied to the emergency management and response to natural geological hazards. At each level you were given practical advice to protect yourself and your animals from the dangers that these hazards cause.

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