

## Notes – Natural Disasters PowerPoint

**What are the different natural hazards or disasters that you have heard about in the news or in class?** *Weather related natural disasters include tornadoes, hurricanes, floods, droughts, heat waves, lightning, hail storms, wildfires, ice storms, blizzards, avalanches, sea-level rise and climate change. Geologic natural disasters include earthquakes, tsunamis, volcanic eruptions and mass movement. Asteroid impact is an additional hazard that affects Earth.*

**Of these types of natural disasters, which are the most likely to affect North Texas?** *Tornadoes, floods, hailstorms and lightning are all associated with the frequent thunderstorms that we have in North Texas. Droughts, wildfires, heat waves, and ice storms are other natural hazards that affect North Texas.*

**The following is a brief description of each of the above natural hazards or disasters.**

### Tornadoes

- ◎ **What:** Tornadoes are spinning funnels of wind with rotating wind speeds up to 300 mph. They vary in width from 50 meters to over a kilometer.
- ◎ **Where:** More tornadoes occur in the U.S. than anywhere else on Earth, and the eastern Great Plains, from northeastern Texas to Nebraska, is known as “tornado alley” because it has the highest risk of tornadoes.
- ◎ **Causes:** Tornadoes only occur in thunderstorms. Thunderstorms along a cold front and near a low pressure area and the jet stream have the highest risk of tornadoes.
- ◎ **Effects:** Tornadoes usually cause severe damage or complete destruction of any building that it hits. It can pick up cars and trucks and carry them through the air for long distances. Debris carried in a tornado can cause severe injuries. A single tornado in India caused 10,000 deaths in 1977.
- ◎ **Prevention / Mitigation:** Tornadoes cannot be prevented. Buildings can be constructed to include tornado shelters. The risk of tornadoes during severe thunderstorms can be predicted a few hours in advance, and tornadoes on the ground can be tracked by radar.

### Hurricanes

- ◎ **What:** A hurricane is a large tropical storm that forms over the Atlantic Ocean, with high winds from 74 to over 200 miles per hour. They are called typhoons in the Pacific Ocean and cyclones in the Indian Ocean.
- ◎ **Where:** Hurricanes, typhoons and cyclones form in tropical oceans near the equator, but can travel thousands of kilometers and strike coastlines as far north as New England and Japan. In the U.S., the coastlines of the Gulf of Mexico and southern Atlantic Ocean, from Texas to Florida and North Carolina are most at risk.
- ◎ **Causes:** Evaporation from warm tropical water forms thunderstorms which can develop into intense storms with a counterclockwise rotation. Prevailing winds steer hurricanes westward in the northern hemisphere.
- ◎ **Effects:** Hurricanes are one of the most destructive and deadly type of natural disasters. A single cyclone in Bangladesh in 1970 killed 300,000. In the U.S., hurricanes cause the largest economic losses of all natural disasters, but early warnings limit the death toll. Hurricane Katrina in 2005 destroyed much of New Orleans. In addition to high winds, hurricanes can spin off numerous tornadoes, cause high storm surges and flooding, and build waves up to 20 meters in height.

- ⊙ **Prevention / Mitigation:** Hurricanes cannot be prevented, but early warnings and evacuations of low-lying areas can greatly reduce the death toll. Buildings on high ground can be constructed to survive most hurricanes, but most buildings hit by waves will be destroyed. Governments can limit the use of low-elevation land to limit future destruction.

### Floods

- ⊙ **What:** A flood occurs when rising water in rivers or other bodies of water leaves the normal banks and fills surrounding areas with water.
- ⊙ **Where:** Floods can occur on low-elevation land along any river, water body or seacoast. Most rivers have flood plains which are flooded on a regular basis.
- ⊙ **Causes:** Hurricanes cause massive coastal flooding when they come ashore, due to storm surges and wind-driven waves. Heavy rainfall from thunderstorms or slow moving fronts can cause river flooding. Rapid melting of snow and ice can cause spring floods.
- ⊙ **Effects:** Floods cause damage to buildings and farm crops, and can displace large populations. In poor countries, starvation and outbreaks of disease often follow floods. Water supplies are often contaminated by floods. Floods can destroy bridges and roads. In flash floods, numerous deaths may occur.
- ⊙ **Prevention / Mitigation:** Flooding can be prevented or limited by the use of levees and flood control structures such as dams and channels. Regulations limiting the use of flood plain land can minimize flood damage. Flood warnings and evacuations can limit deaths.

### Droughts

- ⊙ **What:** A drought is a prolonged period with less than average rainfall amounts. A drought can either be temporary, or signal a long-term climate change with less rainfall.
- ⊙ **Where:** Droughts can occur almost anywhere on Earth. At present, the western and southeastern U.S. are experiencing extreme droughts.
- ⊙ **Causes:** Droughts are caused by changing weather patterns which shift rainstorms from one area to another. A drought in one area may be offset with floods in other areas. Drought can either be caused by natural cycles like El Niño or human-created climate change.
- ⊙ **Effects:** Droughts can cause the failure of crops, loss of livestock, and shortages of drinking water. In poor parts of the world, drought can lead to starvation and disease outbreaks, and loss of wildlife populations. Wildfires generally accompany droughts.
- ⊙ **Prevention / Mitigation:** Natural weather cycles cannot be controlled or prevented. The effects of droughts can be limited through the use of dams for water storage during short droughts, and conservation efforts to stretch water supplies. Ocean water can be desalinated for drinking, and groundwater can be tapped.

### Heat Waves

- ⊙ **What:** A heat wave is an unusual period of hot weather in areas not prepared for such conditions.
- ⊙ **Where:** Most heat waves occur in high latitudes not used to high temperatures. In recent years, much of the U.S. has experienced heat waves. Most of the warmest years on record have occurred since 1990.
- ⊙ **Causes:** In the U.S., heat waves occur when the jet stream moves north into Canada, allowing warm air from the southern states to reach far northward. Such climate shifts can be part of the El Niño / La Niña cycle, or part of a general global warming trend.
- ⊙ **Effects:** A recent heat wave in Europe caused thousands of deaths. Heat waves may be accompanied by droughts, leading to crop failures and wildfires. Power failures caused by high electricity demand often occur in heat waves.

- ⦿ **Prevention / Mitigation:** Weather and climate cannot be controlled. Buildings can be designed to be more comfortable in hot temperatures, with better ventilation and cooling systems.

### Lightning

- ⦿ **What:** Lightning, an electrical discharge between the Earth's surface and a thunderstorm cloud, is a natural hazard in thunderstorms.
- ⦿ **Where:** Lightning can occur anywhere that has thunderstorms. Lightning strikes the Earth thousands of times a day, but is most common at high points such as mountain peaks and trees.
- ⦿ **Causes:** Thunderstorms form when warm, moist air rises to form clouds. Thunderstorms occur almost every day in the mountains and in areas near a sea coast. Lines of thunderstorms often form along cold fronts and in low pressure areas.
- ⦿ **Effects:** Lightning kills hundreds of people in the U.S. each year, but usually in individual events when people are caught outside and do not take shelter. Lightning can start wildfires, especially when drought conditions are present, and can also cause building fires.
- ⦿ **Prevention / Mitigation:** People should stay inside during thunderstorms to avoid being struck. Tall buildings should have lightning rods. There is little that can be done to prevent lightning started wildfires in natural areas.

### Hail Storms

- ⦿ **What:** Hail is a type of ice precipitation which may fall in thunderstorms. Hail stones can be as large as softballs, and thus may be a natural hazard.
- ⦿ **Where:** Hail can occur anywhere large violent thunderstorms occur. Texas frequently has large hail in spring thunderstorms.
- ⦿ **Causes:** Hail can only occur in very large thunderstorms with strong updrafts which keep the hail recirculating through the cloud, building up layers of ice until the stone is too heavy to stay aloft.
- ⦿ **Effects:** Hail can cause severe damage to cars, windows and building roofs. Injuries and deaths to humans are rare but can occur. Crops can be destroyed by hail.
- ⦿ **Prevention / Mitigation:** When the threat of severe thunderstorms is forecast, people should take shelter, and move cars into covered areas if possible. Roofing materials that can resist hail damage can be used on buildings.

### Wildfires

- ⦿ **What:** Wildfires are fires in forests and grasslands that cannot easily be controlled or extinguished.
- ⦿ **Where:** Wildfires can occur anywhere where drought and weather conditions create dry grass and wood. In recent years, the majority of wildfires have occurred in the west and southeast, because of droughts in those areas.
- ⦿ **Causes:** Wildfires usually occur only when drought conditions, high temperatures and high winds make them possible. The fire can either be started by dry lightning strikes (lightning without rain) or by human carelessness.
- ⦿ **Effects:** Wildfires destroy millions of acres of forests and grasslands each year in the U.S., as well as many homes. They add carbon dioxide to the atmosphere and add further to global warming through deforestation.
- ⦿ **Prevention / Mitigation:** The size of forest wildfires can be limited by thinning underbrush and dead wood through controlled burns in wet months. Humans can take steps to avoid accidental setting of forest fires.

## Ice Storms

- ⊙ **What:** Ice storms are winter storms in which the precipitation is freezing rain--rain which falls as a liquid but freezes when it hits trees, power lines and roads.
- ⊙ **Where:** In the U.S., ice storms usually occur in the central or southern states, from Oklahoma and Texas, through North Carolina and Georgia.
- ⊙ **Causes:** Ice storms occur along the southern edge of winter storms, where the air is not cold enough aloft to produce snow, but is below freezing at the surface.
- ⊙ **Effects:** Ice storms can cause massive power outages, as power lines and tree limbs collapse under the weight of the ice. The ice can completely stop travel when roads become impassible. Last winter, much of Oklahoma and southwest Missouri was without power for over a week because of an ice storm.
- ⊙ **Prevention / Mitigation:** While weather events cannot be prevented, tree limbs overhanging power lines can be trimmed, and alternate heat and power supplies can be secured for use when power failures occur.

## Blizzards

- ⊙ **What:** Blizzards are snowstorms with high winds, low visibility and deep, drifting snow.
- ⊙ **Where:** In the U.S., blizzards are common in the northern and western states during the winter months. Occasionally, blizzards occur in the southeastern U.S. and up the east coast.
- ⊙ **Causes:** Blizzards are caused by cold air from the arctic and warm, moist air from the Gulf of Mexico mixing in a low pressure storm system.
- ⊙ **Effects:** Power outages, and shutdown of roads, business and services can occur during blizzards. Deaths can occur when cars become stranded in deep snow and are not found for many days. If a rapid warming occurs after a blizzard, floods may result.
- ⊙ **Prevention / Mitigation:** Damage and loss of life from blizzards can be minimized by watching weather forecasts and warnings, and limiting travel during blizzards. Preparation for blizzards includes stockpiling of food and alternate heat and power supplies.

## Avalanches

- ⊙ **What:** An avalanche is a landslide of snow that travels at very high speeds down a steep slope.
- ⊙ **Where:** Avalanches only occur in high elevation mountain areas that receive heavy snow in short periods of time. Avalanches often occur close to ski areas and at mountain passes in winter.
- ⊙ **Causes:** Avalanches occur after a heavy snowfall that does not have the chance to settle and melt together, on steep slopes with few trees and other vegetation to hold the snow in place.
- ⊙ **Effects:** Avalanches can kill skiers and people traveling on mountain highways, when the wall of snow moving at over 100 mph knocks them down and buries them.
- ⊙ **Prevention / Mitigation:** Along mountain highways and in ski areas, workers regularly check the snow depth and conditions and set off explosive charges to trigger controlled avalanches when they will not harm anyone. During snow storms, skiers should be careful when traveling across steep slopes, and not ski in closed areas. Cars should avoid mountain pass highways during blizzards until the roads are plowed.

## Sea Level Rise

- ⊙ **What:** Ocean levels are rising and will flood many low-lying areas by the end of this century.
- ⊙ **Where:** Sea coasts around the world will be affected by rising sea levels. A number of island countries will disappear completely, and countries such as Holland and Bangladesh will shrink.

- ⊙ **Causes:** The Earth's climate has been undergoing a gradual warming trend since the end of the last ice age, but increased carbon dioxide levels since the start of the industrial revolution has speeded the warming trend, causing glaciers and polar ice caps to melt.
- ⊙ **Effects:** Much of the world's population lives in large cities near the ocean. Many of these cities will be partially or completely drowned if ocean levels continue to rise. These populations will be pushed inland.
- ⊙ **Prevention / Mitigation:** The natural causes of global warming cannot be controlled, but humans can limit the future creation of greenhouse gases in an attempt to eventually stop rising sea levels. However, even if greenhouse gas emissions stopped completely today, ocean levels would continue to rise for at least the next century.

### Climate Change

- ⊙ **What:** Climate change and global warming are terms used to describe the warming of the Earth's climate during the last 200 years.
- ⊙ **Where:** The increase in average temperatures has been the greatest in the high latitudes (that is, closer to the poles) and least in tropical areas, but local effects are likely worldwide.
- ⊙ **Causes:** Climate change is caused in part by short and long term natural cycles such as the cycle of ice ages and interglacial periods. The burning of fossil fuels and deforestation by humans also contributes to climate change.
- ⊙ **Effects:** To date, the most significant effect of global warming is the rapid melting of glaciers and polar ice, which has resulted in changes in weather patterns and rising ocean levels. The future effects of global warming climate change are not easily predicted, but may include larger increases in ocean levels, coastal flooding, stronger storms and increased flooding, more pronounced droughts and an increase of desert areas, and the extinction of some wildlife species. At worst, runaway global warming could lead to mass extinctions and catastrophic loss of human life.
- ⊙ **Prevention / Mitigation:** The natural cycles that contribute to climate change cannot be controlled by humans. The only things that humans can do to affect climate change is to reduce the creation of "greenhouse gases" such as carbon dioxide, and to stop the destruction of forests. Warming during the next century is already locked in by present carbon dioxide levels, so humans must prepare for the negative effects of climate change, such as rising sea levels and droughts, as much as possible.

### Earthquakes

- ⊙ **What:** Earthquakes are a violent shaking and movement of the Earth's crust.
- ⊙ **Where:** The highest earthquake risk areas of the U.S. are in California, Oregon, Washington, Alaska and Hawaii, but there are a number of other places in the U.S. where earthquakes have occurred. Two of the largest earthquakes in the U.S. occurred near Memphis, Tennessee in 1811 and Charleston, S.C in 1886.
- ⊙ **Causes:** Earthquakes are caused by movement of tectonic plates building up stress (elastic potential energy) in crustal rock.
- ⊙ **Effects:** Earthquakes can cause the destruction of buildings, bridges and elevated highways, and trigger landslides and tsunamis. Fires and loss of utility service often follows an earthquake. In areas with poor building construction, deaths can number in the hundreds of thousands.
- ⊙ **Prevention / Mitigation:** Earthquakes cannot be prevented. At present, scientists cannot predict when earthquakes will occur, but can give the general risk of an earthquake occurring in certain areas, based on past earthquakes.

## Tsunamis

- ⊙ **What:** Tsunamis are large, fast moving ocean waves that can reach 30 meters or more in height.
- ⊙ **Where:** The coastlines of the Pacific and Indian Oceans have the highest risk of tsunamis. This includes Hawaii and the California, Oregon and Washington coasts. There is also a lesser risk of tsunamis on the Atlantic Ocean coast.
- ⊙ **Causes:** Large underwater earthquakes, especially at subduction zones, underwater landslides, asteroid impacts and volcanic eruptions on islands.
- ⊙ **Effects:** Tsunamis only cause damage at coastlines, where they build into breaking waves up to 30 meters (100 feet) in height moving at very fast speeds. They can wash inland for many kilometers, and then carry the victims back out to sea. The December 26, 2004 Indian Ocean tsunami killed over 300,000 people.
- ⊙ **Prevention / Mitigation:** Tsunamis cannot be prevented. Scientists can sometimes give a few hours warning of a possible tsunami, and evacuation routes can be planned in advance.

## Volcanic Eruptions

- ⊙ **What:** Eruption of molten rock, hot gases and ash from beneath the Earth's surface. Eruptions can be highly explosive.
- ⊙ **Where:** In the U.S., recent volcanic eruptions have occurred in Hawaii, Alaska, Northern California, Oregon and Washington. Presently extinct volcanoes are also located in Arizona, New Mexico, Wyoming and Idaho.
- ⊙ **Causes:** Volcanoes are either located near tectonic plate boundaries, such as around the Pacific Ocean or at "hot spots" in the Earth's crust.
- ⊙ **Effects:** There are two main types of volcanic eruptions: explosive and non-explosive. In the non-explosive eruptions such as in Hawaii, slow moving lava flows cover large land areas, and may destroy some buildings, but only rarely cause deaths. In explosive eruptions, entire mountains can be blasted into pyroclastic flows of molten rock, hot ash and gases that can kill all life in large areas. These explosive eruptions can also cause lahars that can kill thousands many miles from the volcano.
- ⊙ **Prevention / Mitigation:** Volcanic eruptions cannot be prevented. The most that science can presently do is to predict imminent eruptions (based on the earthquakes created by rising magma) and to assess the risk of building in areas near volcanoes and lahar paths. Volcanic eruptions can occur without warning in areas near tectonic plate boundaries.

## Mass Movement

- ⊙ **What:** Mass movement includes landslides, mudflows, lahars (volcanic debris flows), slump and creep.
- ⊙ **Where:** Mass movement usually occurs in steep or mountainous areas, especially where there are earthquakes, flood events and volcanic eruptions. In the U.S., California, Oregon and Washington are most at risk.
- ⊙ **Causes:** Steep slopes with weathered rocks and clay, combined with heavy rain, earthquakes and volcanic eruptions.
- ⊙ **Effects:** Small events may damage or destroy roads and buildings. Large events such as lahars can cause the destruction of entire towns, with thousands of deaths.
- ⊙ **Prevention / Mitigation:** Mass movement cannot be prevented. Instead, scientists can predict areas where mass movement risks are high, and recommend that these areas not be developed. Lahar (debris flow) detectors near active volcanoes can give evacuation warnings.

## Asteroid Impact

- ◎ **What:** Asteroids are large rocks from 10 meters to many kilometers in size that orbit the Sun. They periodically hit Earth.
- ◎ **Where:** Thousands of asteroids have orbits that cross the Earth's orbit. Within the next few years, several will come very close to Earth. Eventually, another asteroid will hit Earth.
- ◎ **Causes:** Collisions between asteroids in the asteroid belt between the orbits of Mars and Jupiter regularly send asteroids towards Earth.
- ◎ **Effects:** A collision with a small asteroid could wipe out a large city or cause a tsunami. A collision with a large asteroid could cause a mass extinction event, in which most life on Earth, and the entire populations of many species, would die.
- ◎ **Prevention / Mitigation:** Scientists are trying to identify all asteroids that could hit Earth, and plot their orbits. If an asteroid appears likely to hit Earth, an attempt would be made to deflect it.