

GLG 110 - CHAPTER 5 - INTRO TO NATURAL HAZARDS

Learning Objectives for this Chapter:

- ✓ Understand why increasing population and changing land use increase the threat of loss of life and property from a natural disaster to the level of a catastrophe
- ✓ Know the conditions that make some natural Earth processes hazardous to people
- ✓ Understand how a natural process that gives rise to disasters may also be beneficial to people
- ✓ Understand the various natural processes that constitute hazards to people and property
- ✓ Know why history, linkages between processes, prediction, and risk assessment are important in determining the threat from natural hazards
- ✓ Know how people perceive and adjust to potential natural hazards
- ✓ Know the stages of recovery following natural disasters and catastrophes

Nevado del Ruiz Catastrophe

- Volcanic eruption produced mudflow that killed 21,000 of the 23,000 people living in town of Armero, Colombia, on November 13, 1985
 - Flat lands and rich soil of area (resulting from an 1845 mudflow that killed about 1,000) lured growing population to the area
 - A year of precursor activity preceded the Nov. 13 eruption
 - Hazards map completed in October 1985, and warnings and attempts to warn the town and evacuate it were made, but were largely ignored
 - This tragedy (loss of life, not the mudflow itself) was preventable!
- **Natural Hazards:** naturally occurring processes that may be dangerous to human life and structures, such as:
 - Volcanic eruptions
 - Earthquakes
 - Floods
 - Hurricanes
 - Landslides
- Annual worldwide loss of life from such hazards worldwide averages about 150,000
 - Earthquakes and floods are major culprits worldwide
 - About 550-600 deaths/year in U.S., with windstorms/tornadoes being the most deadly (about 340 deaths/year combined)
- Annual financial losses now exceed \$50 billion
- Natural processes become natural *hazards*, when people live or work in areas where they occur

- Natural processes can also become hazards when land uses affect the processes
 - Deforestation or draining of wetlands can lead to extra erosion and/or flooding hazards being increased, especially if these areas are then used for housing or workplaces
 - Environmental geologist's role is to identify these hazards so that land use planning can be performed in ways that are consistent with minimizing risk to human life and property
- **Impact** of a natural disaster is a result of both its **magnitude** (amount of energy involved) and its **frequency** (how often it occurs), as well as:
 - Climate
 - Geology
 - Vegetation
 - Population
 - Land use
- Magnitude and frequency are typically inversely related

Benefits of Natural Hazards include:

- Delivery of nutrient-rich sediments (useful for agriculture) to floodplains, delivery of sand to beaches, and flushing of contaminants from coastal estuaries and wetlands via **flooding**
 - **Estuary** – the widened mouth of a river “drowned” by the sea
- **Landslide** dammed rivers produce new lakes
- **Volcanic eruptions** can produce new land along coastlines and weathered volcanic ash can add beneficial nutrients to soils
- **Earthquakes** can produce pulverized rock “dams” that collect groundwater
- Hazards are predictable from scientific evaluation
 - Events and processes can be monitored and mapped
 - Future activity can be predicted based on past events, patterns, and precursor events
- Risk analysis allows understanding of impacts of hazardous processes
 - Analysis based on probability of event occurring and the consequences of that event
- Hazards are linked/occur together
 - Earthquakes can also produce landslides and tsunamis
 - Hurricanes produce coastal flooding and erosion
- Hazardous events that were previously disasters are now catastrophes due to increased human population and poor land use practices

- Consequences of hazards can be minimized via scientific understanding, land use planning (both locational regulation and building codes), and pro-active preparedness (such as evacuation drills, etc.)
- Total *risk* associated with an event is product of event's **probability** and the likely **consequences** should it actually occur
- Impacts of a disaster on a population include direct effects:
 - People killed, injured, or displaced
 - Property damage or destruction
 - Infrastructure damage/loss of communication, utility services, and transportation systems

And indirect effects:

- Emotional distress
- Donation of money, goods, and labor
- Paying taxes to finance recovery
- Societal *perception* of hazards is critically important
 - More aware of hazards that occur often (once per decade or more)
 - Often choose to just bear consequences of infrequent (once every few decades to a century or more), without significant preparations
- Adjustments made by society in response to disasters include:
 - land-use planning (don't build in danger zones)
 - building codes (reinforced buildings)
 - insurance (required and/or unavailable in maximum hazard areas, legally precluding building there)
 - evacuation
 - disaster preparedness training/drills (tsunami and/or eruption drills)
 - artificial control of natural processes (sea walls, levees, etc.)
- All adjustments involve significant costs in time, manpower, and money
- Balance between preparation costs and the costs of clean-up/recovery afterward
- Population increase and increased use of marginal or hazardous lands necessitates increased land-use planning and disaster preparedness or natural catastrophes become increasingly common
- Increase in human population is forcing many people to live in areas where natural hazards are more likely, producing catastrophes where formerly "only" disasters would have occurred
- Living in hazardous areas, such as floodplains, is not a sustainable practice because loss of life and property will continue to occur

- Earth systems and processes such as the atmosphere, hydrosphere and lithosphere produced processes that are harmful to people, with changes in one system sometimes affecting another
- Study of hazardous processes has greatly increased our knowledge and ability to mitigate losses when they occur. People's values, coupled with this knowledge, will be reflected in choices made that can increase or decrease the likelihood of their being adversely affected by natural hazards in the future