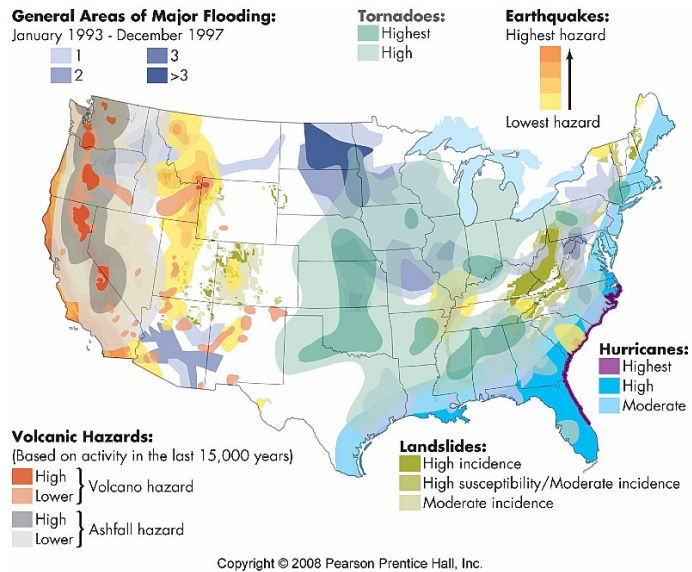


# Chapter 1 - Introduction to Natural Hazards

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## Learning Objectives

Natural processes such as volcanic eruptions, earthquakes, floods, and hurricanes become hazards when they threaten human life and property. As population continues to grow, hazards, disasters, and catastrophes become more common. An understanding of natural processes as hazards requires some basic knowledge of Earth science. Your goals in reading this chapter should be to



- know the difference between a disaster and a catastrophe.
- know the components and processes of the geologic cycle.
- understand the scientific method.
- understand the basics of risk assessment.
- recognize that natural hazards that cause disasters are generally high-energy events, caused by natural Earth processes.
- understand the concept that the magnitude of a hazardous event is inversely related to its frequency.
- understand how natural hazards may be linked to one another and to the physical environment.
- recognize that increasing human population and poor land use changes compound the effects of natural hazards, turning disasters into catastrophes.

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## Chapter Outline

1. Introduction to Natural Hazards
  - 1.1. Why Studying Natural Hazards Is Important
    - 1.1.1. Processes: Internal and External
    - 1.1.2. Hazard, Disaster, or Catastrophe
    - 1.1.3. Death and Damage Caused by Natural Hazards
  - 1.2. Role of History in Understanding Hazards

- 1.3. Geologic Cycle
    - 1.3.1. The Tectonic Cycle
      - 1.3.1.1. Earth's Lithosphere and Crust
      - 1.3.1.2. Type of Plate Boundaries
      - 1.3.1.3. Hot Spots
      - 1.3.1.4. The Tectonic Cycle and Natural Hazards
    - 1.3.2. The Rock Cycle
    - 1.3.3. The Hydrologic Cycle
    - 1.3.4. Biogeochemical Cycles
  - 1.4. Fundamental Concepts for Understanding Natural Processes as Hazards
    - 1.4.1. Science and Natural Hazards
    - 1.4.2. Hazards Are Natural Processes
    - 1.4.3. Forecast, Prediction, and Warning of Hazardous Events
    - 1.4.4. Examples of Disasters In Densely Populated Areas
    - 1.4.5. Human Population Growth
    - 1.4.6. Magnitude and Frequency of Hazardous Events
    - 1.4.7. Case Study: Human Population through History
      - 1.4.7.1. Population Growth and the Future
    - 1.4.8. Case Study: The Magnitude–Frequency Concept
    - 1.4.9. Reactive Response: Impact of and Recovery from Disasters
    - 1.4.10. Anticipatory Response: Avoiding and Adjusting to Hazards
  - 1.5. Many Hazards Provide a Natural Service Function
  - 1.6. Global Climate Change and Hazards
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## **Chapter Summary**

Natural hazards are responsible for causing significant death and damage worldwide each year. Processes that cause hazardous events include those that are internal to Earth, such as volcanic eruptions and earthquakes that result from Earth's internal heat, and those that are external to the Earth, such as hurricanes and global warming, which are driven by energy from the sun.

Natural processes may become hazards, disasters, or catastrophes when they interact with human beings. Central to an understanding of natural hazards is awareness that hazardous events result from natural processes that have been in operation for millions and possibly billions of years before humans experienced them. These processes become hazards when they threaten human life or property and should be recognized and avoided.

Hazards involve repetitive events. Thus a study of the history of these events provides much-needed information for hazard reduction. A better understanding and more accurate prediction of natural processes come by integrating historic and prehistoric information, present conditions, and recent

past events, including land-use changes. Geologic conditions and materials largely govern the type, location, and intensity of natural processes. The geologic cycle creates, maintains, and destroys Earth materials by physical, chemical, and biological processes. Subcycles of the geologic cycle are the tectonic cycle, rock cycle, hydrologic cycle, and various biogeochemical cycles. The tectonic cycle describes large-scale geologic processes that deform Earth's crust, producing landforms such as ocean basins, continents, and mountains. The rock cycle may be considered a worldwide earth-material recycling process driven by Earth's internal heat, which melts the rocks subducted in the tectonic cycle. Driven by solar energy, the hydrologic cycle operates by way of evaporation, precipitation, surface runoff, and subsurface flow. Biogeochemical cycles can most easily be described as the transfer of chemical elements through a series of storage compartments or reservoirs, such as air or vegetation.

Five fundamental concepts establish a philosophical framework for studying natural hazards.

1. Hazards are predictable from scientific evaluation.
2. Risk analysis is an important component in our understanding of the effects of hazardous processes.
3. Linkages exist between various natural hazards as well as between hazards and the physical environment.
4. Hazardous events that previously produced disasters are now producing catastrophes.
5. Consequences of hazards can be minimized.