

INSTRUCTOR'S MANUAL FOR
**HAZARD
MITIGATION AND
PREPAREDNESS**
Second Edition

_____ by _____

Anna K. Schwab,
Dylan Sandler, and
David J. Brower

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CRC Press is an imprint of the
Taylor & Francis Group, an informa business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

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Printed on acid-free paper
Version Date: 20160303

International Standard Book Number-13: 978-1-4987-7292-1 (Ancillary)

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Chapter 1

HAZARDS VS. DISASTERS

Learning Objectives

Upon Reading This Chapter, Students Should Be Able To:

- Evaluate the types of hazards and how they relate to Earth's dynamic equilibrium
- Assess the differences between hazards and disasters
- Critique various reasons why disasters are increasing in number and intensity
- Estimate the different costs associated with natural hazards, human-made hazards, and disasters
- Understand the relationship between climate change and natural hazards

Chapter Summary

Every community faces potential exposure to hazards, both natural and human-made. Only when people are injured or killed and property is damaged by a hazard does a disaster occur. Due to patterns of population growth and development in the United States, disasters now occur more frequently than ever before. The impacts of climate change will only exacerbate the hazards we experience. Because we all pay for these disasters, directly or indirectly, it is in our best interests to prepare for disasters with responsible emergency management plans. Mitigation and preparedness strategies are critical ways of making a community more resilient against the impacts of hazards.

Key Terms

Climate Change	A statistically identifiable change in the means and/or variability of the climate that persists for decades or longer.
Disaster	The result when a natural hazard takes place where humans have situated themselves.
Dynamic equilibrium	The process through which Earth's natural systems maintain a balanced state over long periods of time by way of a series of adjustments.
Human-made hazards	Intentional or accidental occurrences caused by human activity; examples include oil spills and acts of terrorism such as bombings.

Natural hazards

Inevitable and uncontrollable occurrences such as floods, hurricanes, winter storms, and earthquakes.

Lecture Notes

1. Ask students to describe what they view as the difference between hazards and disasters. Be sure to have the class provide examples of what they consider hazards and what they consider disasters.
2. Have students relate their personal experiences with disasters. Ask students to describe some of the costs associated with the disasters that they experienced. Next, have the students classify these costs as direct, long-term, environmental, societal, and so on.
3. Ask students to discuss how climate is different from weather. Encourage students to think about the connection between long-term changes in climate and short-term hazards and disasters.

Suggestions for Learning Activities

1. Ask students to write a 1–2 page paper describing, in their own words, the various kinds of costs associated with disasters, including direct losses, environmental harm, and societal costs.
2. Ask each student to prepare for class by researching a specific disaster that has occurred anywhere in the world, and come prepared to talk about the characteristics of the natural event and the primary impacts experienced by the community or city where it occurred.
3. Invite a local emergency manager into the classroom. Ask this person to speak about some of the hazards facing the community and what mitigation and preparedness activities have been undertaken in relation to these hazards. Also ask the emergency manager to describe the response to some of the disasters that have impacted the community in the past, as well as the costs of these disasters and their related responses.

Suggestions for Additional Resources

1. For additional information on FEMA, visit the agency's website at <http://www.fema.gov/>.
2. A record of and statistics about major weather and climate disasters can be accessed through the National Climatic Data Center: <https://www.ncdc.noaa.gov/billions/>
3. Access the National Climate Assessment, a current overview of climate change impacts in the United States at: <http://nca2014.globalchange.gov>

Answers to Self-Check Questions

Answers to Self-Check Questions immediately following section 1.1

1. **Define natural hazards and dynamic equilibrium.** Natural hazards are inevitable and uncontrollable occurrences such as floods, hurricanes, winter storms, earthquakes, and other extreme events caused by natural phenomena. Dynamic equilibrium is the process through which Earth's natural systems maintain a balanced state over long periods of time by way of a series of adjustments. Many of the events we call "natural hazards" are in fact beneficial for the natural environment in that they help maintain dynamic equilibrium.
2. **Discuss the beneficial functions of three natural hazards.** Answers will vary based on the hazards students opt to describe. For example, students might note that wildfires help burn off old growth in forests and allow new species of trees to grow; coastal storms change the morphology of beaches and islands, bringing more sand to some areas and removing sand from others; and flooding brings nutrients and sediment to wetlands and marshes, creating a rich habitat for a variety of plant and animal species.
3. **Describe the differences between technological hazards and terrorism.** Technological hazards are usually caused by accident—either through incompetence, poor planning, faulty equipment, bad weather, or some other mishap. No one intends for these hazards to occur. Terrorism, on the other hand, infers an intentional act; that is, some individual or group means to cause harm in order to further a political agenda or a social, economic, or religious mission. A person may also commit terrorism because he or she is delusional or misguided in some way.

Answers to Self-Check Questions immediately following section 1.2

1. **Characterize the federal government's definition of disaster.** The official definition of a disaster laid out in the Robert T. Stafford Act is any catastrophe of such magnitude and severity that the ability of states and local governments to cope is overwhelmed. The threshold for determining what constitutes a disaster depends on the resources and capabilities of states and local governments, as well as other organizations such as the American Red Cross.
2. **Explain why disasters are increasing in frequency.** We are experiencing more disasters than ever before in our nation's history because more infrastructure and more people are in harm's way than ever before. Part of the reason for this is because the population of the United States is growing very quickly. As cities and towns expand to accommodate more people, they sprawl out into areas that are potentially hazardous. This is particularly true along our nation's shorelines, where perhaps the most dramatic increase in population growth and development is occurring.

3. **Discuss how the conditions of a disaster differ from those of a natural hazard.** Natural hazards occur as part of the balance of nature, and natural environments and ecosystems can usually recover and restore themselves after a hazard event. A disaster is different, however, in that it results when a natural hazard takes place where humans are located. In other words, it is only when people are injured and property is damaged by a hazard that we experience a disaster.

Answers to Self-Check Questions immediately following section 1.3

1. **List five categories of costs associated with disaster.** Five categories of costs associated with disaster include direct financial costs, long-term economic costs, environmental costs, societal costs, and human lives lost.
2. **Discuss how the environment can suffer from a disaster.** The natural environment can suffer severe damage during a disaster. Environmental damage can be the result of a man-made hazard that affects habitats and ecosystems directly, such as a chemical accident or an oil spill. The environment can also be damaged when a natural hazard causes a secondary hazard to occur, such as an earthquake that causes a gas line to rupture or a tornado that uproots a hazardous waste facility.
3. **Cite five examples of social costs.** Possible social costs of a disaster include disruption of social networks; widespread abandonment of vibrant communities; displacement of residents; disruptions in school and home life for children; loss of congregations by places of worship; dismantling of community centers; increases in incidents of domestic violence and substance abuse; increased stress and tension and a related reduction in people's coping skills; and disproportionately damaging effects on those residents who were only marginally able to provide for themselves before the disaster occurred.
4. **What are some of the factors that contribute to social vulnerability?** Poor and marginalized communities are often at much higher risk when disasters strike. Other factors that may increase social vulnerability include: disability, literacy, language barriers, mental illness, drug abuse, and homelessness.

Answers to Summary Questions

1. Natural hazards are not the same as disasters. **True**
2. Which of the following is an example of a natural hazard? **c. winter storm**
3. The frequency of hazards is increasing. **False**
4. Disasters are a beneficial part of the balance of nature. **False**
5. A disaster occurs only when human life and property suffer from damage. **True**
6. Disasters occur most often in unpopulated areas. **False**
7. Examples of technological hazards include: **a. bridge collapse.**
8. Costs associated with disasters include: **d. all of the above.**

9. Contamination of water supplies is a possible environmental cost associated with a flood. **True**

Answers to Review Questions

1. **Natural hazards may differ from one geographic area to the next. Discuss a natural hazard for California that is unlikely to affect New Jersey, and vice versa.** Answers will vary based on the hazards students opt to describe. For example, students might note that an earthquake is likely to affect California but not New Jersey, while a nor'easter is likely to affect New Jersey but not California.
2. **Hazards help maintain the Earth's dynamic equilibrium. Explain the role of a nor'easter on the coast of Long Island.** Coastal storms, such as a nor'easter on the coast of Long Island, can change the shape of beaches, bringing more sand to some areas and removing sand from others up the coast, thus preserving the equilibrium of the beaches over an extended period of time.
3. **Give three possible explanations for why it appears that natural hazards are becoming more frequent.** Possible answers include that climate changes such as El Niño are causing fluctuations in weather patterns; that hazards occur in natural cycles of frequency and Earth is entering a phase of increased hazards; that global warming is creating disturbances in the atmosphere and oceans; that deforestation and desertification in parts of the world are leading to imbalances in global hydrological cycles; and that sea levels are rising due to melting polar ice caps and increasing flooding in low-lying coastal areas.
4. **How does a natural hazard differ from a disaster?** Natural hazards occur as part of the balance of nature, and natural environments and ecosystems can usually recover and restore themselves after a hazard event. A disaster, however, results when a natural hazard takes place where humans are located. In other words, it is only when people are injured and property is damaged by a hazard that we experience a disaster.
5. **Disasters are increasing in frequency. Explain why.** Disasters are increasing in frequency because more and more areas of hazard-prone land areas are being developed and settled. This is in large part due to the rapid growth of the population of the United States. Climate change is also increasing the frequency or intensity of some hazards.
6. **Human-made hazards are another consideration for community planning. Name two types of man-made hazards.** There are two major classifications of man-made hazards: technological hazards and terrorism. Technological hazards are usually caused by accident. Terrorism, on the other hand, infers an intentional act.

7. **How are natural hazards and man-made hazards alike? How are they different?** Technological man-made hazards are like natural hazards in that they do not occur as a result of a malicious plot or an organized activity. Terrorism, however, differs from natural hazards in that it is intentional and meant to cause harm. One similarity between natural hazards and both types of man-made hazards is that they can be hard to predict, and our ability to prevent them is limited. In addition, both natural hazards and man-made hazards can have similar effects on a community.
8. **We all pay for the cost of disasters. Explain three ways we do so.** One way in which we all pay for disasters is through our tax dollars, because taxpayers finance all activities of local, state, and federal governments before, during, and after a disaster. Similarly, the higher insurance premiums that are often put in place after a disaster affect all people, not just those who sustained damage from the disaster. Finally, because charitable monies are often directed toward recovery and not elsewhere following a disaster, those of us who are not affected by the disaster may not be able to benefit from the activities of many charitable organizations.
9. **Some costs associated with disasters are not financial. Discuss how this is possible.** Disasters can bring about many costs beyond direct and long-term financial costs. For example, they often cause environmental costs, societal costs, and loss of human life.

Answers to Applying This Chapter Questions

1. **Natural hazards are uncontrollable events. List three examples of hazards particular to where you live.** Answers will vary based on the area in which a student lives. For example, a student who lives near Los Angeles might cite hazards including earthquakes, wildfires, and mudslides, whereas a student who lives in Florida might list hurricanes, flooding, and tornadoes.
2. **Compare the disaster potential of Missoula, Montana, versus Miami, Florida.** Missoula has a population of approximately 57,000, while Miami's population is nearly 400,000. Thus, if a disaster strikes Miami, many more people will be affected. The types of hazards that Miami might encounter also differ significantly from those faced by Missoula. For example, Miami runs a relatively high risk of hurricanes, whereas Missoula does not.
3. **Discuss the direct and indirect costs of an oil spill in a coastal Oregon tourist town.** Answers will vary. Direct costs of the oil spill might include those associated with beach closure and cleanup efforts. Indirect costs would likely include those related to a loss of tourism, including a slump in the motel business and the possible closure of local restaurants and other businesses. This might in turn lead to a rise in local unemployment rates.

4. **As a resident of a rural farming region of the Midwest, you've suffered through three tornadoes this year. You've faced the obvious costs of damaged crops, buildings, and equipment; outline some of the social costs your small community will face.** Answers will vary. For example, in this situation, you might face social costs such as many farmers selling their land and moving away from the community. This might cause further loss of income by many local businesses and residents who are already experiencing financial difficulties directly related to the disaster. In turn, as a result of these events, the area's feeling of community may disintegrate over time.

5. **Which members of your community should be considered for extra protection during a disaster? How will you identify this vulnerable population?** Some members of the community who should be considered for extra protection include the elderly, those who are sick and/or disabled, and those who lack money for transportation. These people may be unable to evacuate or handle the trauma of evacuation if necessary. You can help define and locate this vulnerable population by engaging in hazard identification efforts, such as mapping areas of the community in which certain hazards are more likely to occur and then pinpointing certain neighborhoods and facilities (such as hospitals and nursing homes) that are likely to contain high numbers of vulnerable individuals.

Chapter 2

PREPAREDNESS, HAZARD MITIGATION AND CLIMATE CHANGE ADAPTATION

Learning Objectives

Upon Reading This Chapter, Students Should Be Able To:

- Understand the phases of the comprehensive emergency management cycle
- Assess the value of hazard mitigation and preparedness
- Identify hazard mitigation and adaptation strategies
- Explore the links between climate change and hazard mitigation
- Describe the timing of hazard mitigation and preparedness relative to disasters
- Understand the connection between hazard mitigation, resilience and sustainability

Chapter Summary

Hazard mitigation and preparedness activities help communities become more resilient to the impacts of hazards, and climate change adaptation gives communities a running start to deal with the impacts of natural hazards in the future. Disaster costs continue to escalate in the United States, and we must increase our efforts to keep property out of vulnerable locations through implementation of long-lasting and forward-thinking mitigation strategies such as natural resource protection and land use regulations to keep development out of hazard areas, and building codes to strengthen homes and businesses against hazard impacts. We have much to do in terms of preparedness as well. The loss of life and property during Hurricanes Sandy and Katrina, and other recent catastrophic events, highlights the need for vast improvements in our ability to evacuate, shelter, and administer emergency aid to disaster victims. These areas of improvement should serve as a catalyst for further research and study into the most effective means of preventing disasters so that community resilience becomes reality.

Key Terms

Adaptation

The process of adjustment to the actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities.

Comprehensive emergency management

Approach used to deal with natural hazards and human-caused hazards and their potential to cause disasters in a community.

Disaster life cycle	The cycle of the four phases of the comprehensive emergency management system as it interacts with a disaster event.
Disaster resilient community	A community or region developed or redeveloped to minimize the human, environmental, and property losses and the social and economic disruption caused by disasters. A resilient community understands natural systems and realizes that appropriate siting, design, and construction of the built environment are essential to advances in disaster prevention.
Hazard Mitigation	Any sustained action to reduce or eliminate long-term risk to people and property from hazards and their effects.
Natural hazards	Inevitable and uncontrollable occurrences such as floods, hurricanes, winter storms, and earthquakes.
National Preparedness Directorate	Within FEMA, the National Preparedness Directorate provides strategy, policy and planning guidance to build prevention, protection, response and recovery capabilities for states and local governments nationwide. You can find out more about the Directorate at www.fema.gov/national-preparedness-directorate .
Preparedness	A state of readiness to respond to any emergency or disaster.
Ready.gov	FEMA's public outreach and education program that helps communities, businesses, families and individuals learn about steps they can take to be prepared for any emergency.
Recovery	Phase in the emergency management cycle that involves actions that begin after a disaster, after emergency needs have been

met; examples include road and bridge repairs and restoration of power.

Response

Phase in the emergency management cycle that involves activities to meet the urgent needs of victims during or immediately following a disaster; examples include evacuation as well as search and rescue.

Risk assessment

The process or methodology used to evaluate risk. Risk assessment typically includes five preliminary steps: (1) identify hazards; (2) profile hazard events; (3) inventory assets and populations; (4) estimate losses; and (5) determine future development and population trends. A sixth step, determining an acceptable level of risk, is often included in a risk assessment to decide whether further action is warranted.

Sustainable development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Lecture Notes

1. Have students divide into groups representing different components of the community: business owners, mayor and city council, homeowners, social services and homeless shelter staff, teachers, police and emergency services, and others. Have each group come up with preparedness strategies that they would pursue for a specific disaster (e.g., ice storm, wildfire, large chemical spill). Report back and discuss as a class.
2. Ask students to identify examples of mitigation activities and preparedness activities that are being used within their own communities.
3. Despite the fact that spending on hazard mitigation has a 4:1 return on investment (in terms of disaster losses avoided), the United States continues to spend much more on disaster response and recovery each year as opposed to mitigation. Discuss reasons for this with the class and how being more proactive may reduce the costs of disasters.

Suggestions for Learning Activities

1. Ask each student to research a recent disaster that has occurred internationally. Have them work backwards to think about actions that could have been taken to prevent or reduce the impact of the disaster.

2. Have the students type of natural or human-made hazard (e.g., tornado, flood, chemical leak) and write 2 examples of preparedness measures that could be taken and 2 examples of mitigation measures.
3. Using FEMA's Flood Map Service Center (<https://msc.fema.gov/portal>), have the students find a floodplain in their community and discuss how this information could be used to reduce flood risks.

Suggestions for Additional Resources

1. FEMA has compiled a list of mitigation best practices and related case studies that can be accessed at <https://www.fema.gov/mitigation-best-practices-portfolio>
2. American Red Cross, Plan and Prepare webpage links to a wealth of information about individual and organizational preparedness: <http://www.redcross.org/prepare>
3. The Natural Hazard Mitigation Association report "Planning and Building Livable, Safe and Sustainability Communities" can be accessed at <http://nhma.info/uploads/PatchWork/THE%20PATCHWORK%20QUILT.pdf>

Answers to Self-Check Questions

Answers to Self-Check Questions immediately following section 2.1

1. **List the four stages of the comprehensive emergency management cycle.** The four stages of the comprehensive emergency management cycle are preparedness, response, recovery, and mitigation. Occasionally, prevention is added to the list, especially with regard to human-made hazards.
2. **Discuss the differences between preparedness and mitigation.** Preparedness involves the functional, logistical, and operational elements of emergency management. Although preparedness activities are carried out in advance of a hazard event, they are directed to the response and, to a lesser degree, the recovery phases of the emergency management cycle. Mitigation, in contrast, is the ongoing effort to lessen the impacts of disasters on people and property through pre-disaster activities. Mitigation can take place months, years, and even decades before a hazard event and continues after a disaster occurs with an eye to the future. Mitigation differs from the other phases of emergency management in that it looks for long-term solutions to reduce hazards.
3. **Describe the primary preparedness tasks that Ready.gov encourages citizens to carry out.** Ready.gov urges individuals to: 1) Build an emergency supply kit, 2) Make a family emergency plan, and 3) Be informed about the different types of emergency that can occur and their appropriate response.

Answers to Self-Check Questions immediately following section 2.2

1. **Describe the relationship between hazard mitigation, climate mitigation, and adaptation.** Hazard mitigation focuses on reducing vulnerability to natural