Hazard Mitigation and Preparedness An Introductory Text for Emergency Management and Planning Professionals 2nd edition Schwab Solutions Manual

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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

hazards. Climate change mitigation are efforts to reduce greenhouse gas emissions that causing climate change. Climate change adaptation are actions to address the effects of climate change. In cases where climate change is influencing the likelihood or severity of natural hazards, hazard mitigation actions may also be a form of climate change adaptation.

2. **Explain why climate change adaptation is important even if steps are taken to reduce greenhouse gas emissions.** Even if emissions of greenhouse gases were to stop immediately, the climate would continue changing for several decades or longer based on emissions from the past. Therefore, it is important that steps are taken to both reduce the cause of climate change – mitigation – for lessen the future impacts, as well as reduce the effects of climate change, some of which are inevitable because of the concentration of carbon already in the atmosphere.

Answers to Self-Check Questions immediately following section 2.3

1. **List four major categories of hazard mitigation strategies that can also be used for climate change adaptation.** Four categories of mitigation and adaptation strategies include: infrastructure, land use, natural resource, and education.

2. **Describe how risk assessment and mapping help inform the mitigation strategy process.** When a community conducts a risk assessment, it determines what assets and populations are vulnerable to the hazards that have been identified, including analysis of land use patterns, growth potential, and development trends to evaluate what may be at risk in the future. Mapping is an important element in this assessment, because maps can be used to illustrate where hazards intersect with the built environment in a graphic and visual way. The analysis and maps produced during a risk assessment can help a community make important mitigation decisions about how to best protect local assets and vulnerable populations against likely hazards.

3. **How can land use planning contribute to a community's overall risk reduction strategy?** Land use planning and regulation are incredibly powerful tools to steer development away from hazardous locations, such as floodplains, seismic risk areas, landslide-prone sites, and wildfire areas. In the long-term, steps to grow communities in areas that are known to be safer is often a core component of a community's risk reduction strategy.

Answers to Self-Check Questions immediately following section 2.5

1. **List four benefits of preparedness and mitigation.** Benefits of preparedness and mitigation include reductions in losses of life and property; reductions in vulnerability to future hazards; monetary savings; faster response and recovery; and a demonstrated commitment to community health and safety.

2. **Explain how hazard mitigation and preparedness are connected to sustainable development.** Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. A core component of sustainability is that communities take sufficient steps in the present to reduce the likelihood that hazards will have catastrophic impacts in the future. This includes both preparedness actions to respond effectively in the event of an event, and mitigation to lessen the impacts.

Answers to Summary Questions

1. Hazard mitigation can only be carried out during or after a disaster takes place. **False**
2. Exercises and drills are a valuable component of disaster preparedness. **True**
3. Which of the following websites is not part of FEMA's public engagement and awareness campaign? **Ready.gov/homeowners**
4. Because residents want to recover from disasters as quickly as possible, planners and emergency managers should always make speed their only recovery goal. **False**
5. Installing air conditioning to better cope with heat waves is a form of climate change mitigation. **False**
6. Some climate change adaptation strategies may have immediate benefits and cost savings. **True**
7. A resilient community is a community that prevents hazards from happening. **False**
8. Preparedness involves anticipating what might happen during different types of hazard events. **True**
9. Which of the following is an example of preparedness measures? **b. conserving floodplains**
10. The period following a disaster is a valuable time for implementing mitigation measures. **True**
11. Mitigation is a way to save communities money. **True**

Answers to Review Questions

1. **What stages of the emergency management cycle do resilient communities use to try to limit the long-term impact of a disaster?** Resilient communities rely on the preparedness and mitigation stages of the emergency management cycle to help ensure that a disaster does not occur.

2. **Citing examples, explain the difference between preparedness and hazard mitigation.** Preparedness involves activities that improve the ability to respond quickly in the immediate aftermath of a disaster; examples of preparedness activities include installing warning systems and engaging in evacuation planning. Mitigation involves activities that prevent a disaster, reduce the chances of a disaster, or lessen the potential damage caused by a disaster;

examples of mitigation measures include building dams and levees, engaging in land-use planning, and conducting public education programs.

3. **A comprehensive emergency management system follows four stages. Name the stages.** The four phases in a comprehensive emergency management system are preparedness, response, recovery, and mitigation.

4. **Hazard mitigation should be considered a wise investment for a community. Explain why.** Mitigation can be thought of as a wise investment because current dollars invested in mitigation will significantly reduce the demand for future dollars by reducing the amount needed for emergency response, recovery, repair, and reconstruction following a disaster. By protecting its investment in infrastructure and capital assets, a community will enjoy cost savings over the long term.

5. **How does mitigation affect a community's decisions regarding growth and development?** Mitigation forces a community to make wise development choices. For example, a mitigation-minded community might choose to prevent development in a flood-prone area or to require all new buildings to meet certain construction and zoning requirements in order to help prevent the damaging effects of future disasters.

6. **Describe the results of research analyzing the overall return on investment for money spent on hazard mitigation**. A study of the overall benefit-cost ratio for FEMA mitigation grants showed a 4:1 return on investment, meaning that, on average, every dollar invested in mitigation saves four dollars in avoided losses in the future.

7. **Explain the difference between climate change mitigation and climate change adaptation.** Climate change mitigation refers to actions taken to reduce the causes of climate change, typically reducing emissions of greenhouse gases such as carbon dioxide. Climate change adaptation refers to efforts to better cope with the effects of climate change, such as altering coastal development to accommodate sea level rise.

Answers to Applying This Chapter Questions

1. **Compare how a town in northern Minnesota would prepare for hazards versus a town in Arizona. Which measures are consistent?** Answers will vary but should reflect the specific types of hazards each town would face. The town in Minnesota, for example, would have to prepare for severe winter weather, whereas the town in Arizona would not. However, the town in Arizona would have a much greater need to prepare for drought. Despite this difference, both towns would need to have emergency plans reflecting their specific hazards in place.

2. **As the chief emergency manager in your town, you must present a proposal to the local governing board about a new federal program that requires local governments to engage in hazard mitigation activities. How will you describe what a resilient community is? What will you include in your presentation about the benefits of mitigation? How will you convince the board to authorize spending local resources to reduce the impacts of hazards?** Answers will vary. However, all students should describe a resilient community as one that has been developed or redeveloped to minimize the human, environmental, and property losses and social and economic disruption caused by disasters. Students should also point out that 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. Much of the evidence students present in favor of mitigation should focus on the long-term economic benefits of current dollars invested in mitigation. In addition, students should also mention the prevention of environmental losses, societal losses, and loss of life that mitigation can bring about.

3. **Explain how hazard mitigation and climate change adaptation are similar.** Hazard mitigation is aimed at reducing long-term risk to people and property from hazards and their effects. Similarly, climate change adaptation focuses on addressing the effects of climate change, many of which are natural hazards. However, climate change adaptation takes a longer time frame to address how hazards are likely to change in the future and address impacts of climate change that may not be considered natural hazards, such as changes in biodiversity.

Courtesy of CRC Press/Taylor & Francis Group

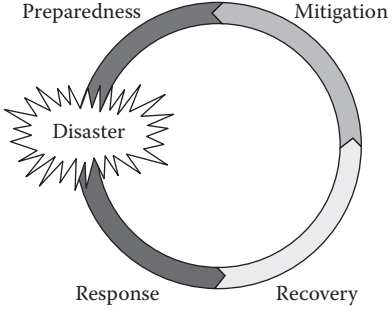

FIGURE 2.1 The emergency management cycle consists of preparedness, response, recovery, and mitigation. While these are distinct phases in the diagram, the reality is that these phases often run together, and actions taken in one phase may significantly affect other phases of the emergency management cycle.

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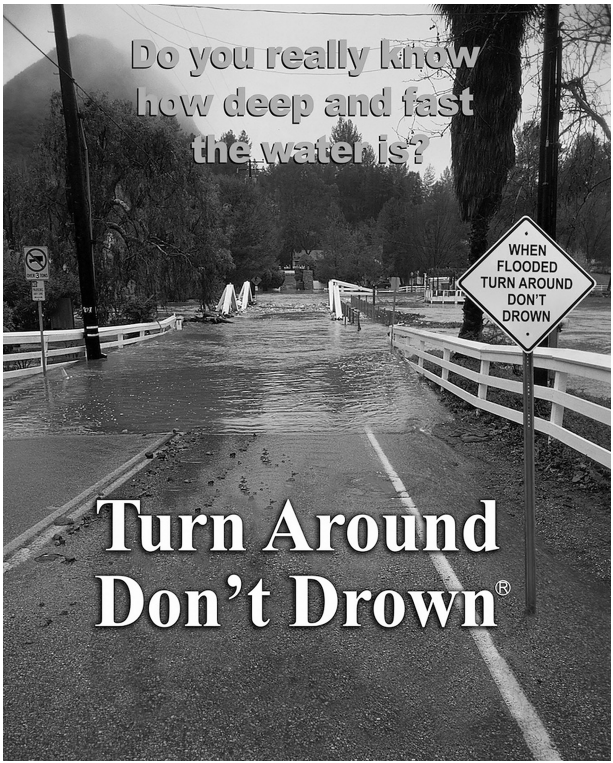

FIGURE 2.2 **"Turn Around Don't Drown" is a National Weather Service campaign which promotes preparedness by warning people of the hazards of walking or driving through flood waters.**

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Courtesy of CRC Press/Taylor & Francis Group

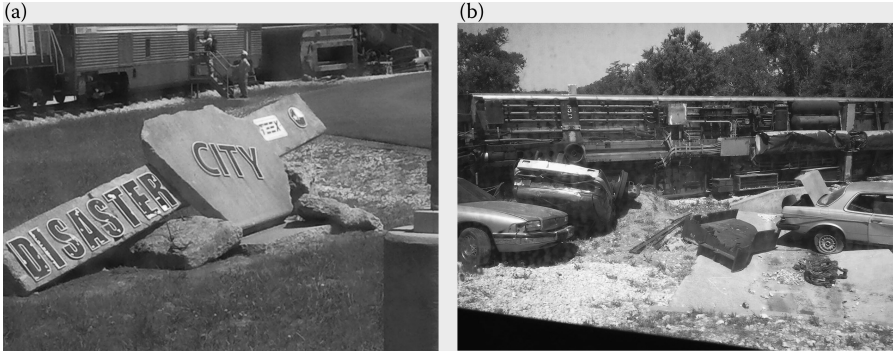

FIGURE 2.3 (a) Each year, thousands of first responders from around the globe receive intensive hands-one scenario-based training at the "Disaster City" training ground at Texas A&M University. (b) A simulated train wreck is used to teach emergency workers how to respond quickly and effectively in potentially dangerous conditions. (Courtesy of Anna Schwab.)

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Courtesy of CRC Press/Taylor & Francis Group

FIGURE 2.4 Following Hurricane Sandy, several businesses along the Jersey Shore were open for business in time for the busy summer season. Many more, however, will take much longer to recover, if in fact they are rebuilt at all. (Official White House photo by Sonya Herbert.)

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Courtesy of CRC Press/Taylor & Francis Group

FIGURE 2.5 Green roofs, like this one on City Hall in Chicago, are good examples of multiobjective building techniques, by serving both natural hazard mitigation as well as climate change mitigation purposes. The vegetation captures excess rainwater while also cooling the building, thereby reducing the building's energy consumption.

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Courtesy of CRC Press/Taylor & Francis Group

FIGURE 2.6 Sea Bright, New Jersey: Construction crews are elevating this house damaged during Hurricane Sandy. Elevation, or raising the base floor above expected flood heights, is one way to mitigate flooding for a home situated in a flood zone.

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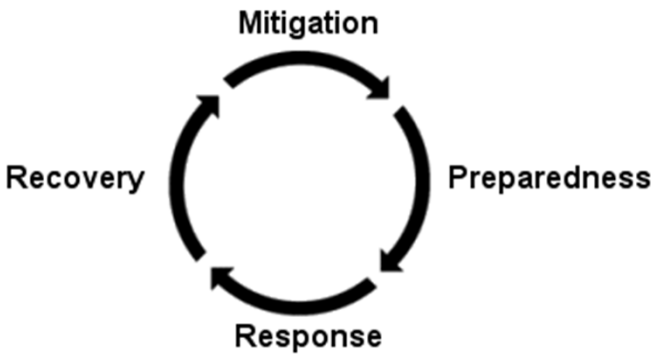
Chapter 2: Preparedness, Hazard Mitigation and Climate Change Adaptation: An Overview

Comprehensive Emergency Management

- Comprehensive Emergency Management is a widely used approach to deal with hazards
- The disaster life cycle system describes the process through which emergency managers:
  - **prepare** for disasters
  - **respond** to them
  - help people and institutions **recover** from them
  - **mitigate** their effects, and
  - (in some cases) **prevent** disasters from occurring



Preparedness

Preparedness ensures that if a disaster occurs, people are ready to get through it safely, and respond to it effectively. It involves:

- Anticipating what might happen during different types of hazard events
- Developing plans to deal with those possibilities
- Carrying out exercises, evaluating plans for shortfalls, and training and education

Preparedness Strategies

- Emergency Operations Planning
- Training emergency managers, first responders, and public officials
- Exercises & drills
- Emergency awareness and education for the general public
- Warning and alert systems

Mitigation

The ultimate purpose of mitigation is to:

- avoid placing people and property in harm's way
- make structures safer and stronger when avoidance is impossible or impractical

Mitigation involves planning, strategizing, and implementing actions in advance of a hazard event.

Mitigation Strategies

There is a wide variety of tools and techniques to reduce the impacts of hazards on people and property, ranging from:

- Land use planning to prevent development in hazardous areas
- Strong buildings codes to protect structures
- Acquiring and relocating damaged structures
- Preserving the natural environment to serve as a buffer
- Insurance to protect homeowners and business owners
- Engineering solutions to lessen impacts or protect investments

Ecosystem Services

Preserving and restoring floodplains, wetlands, dunes, and other natural features allows these areas to serve as buffers and reduce storm damage.

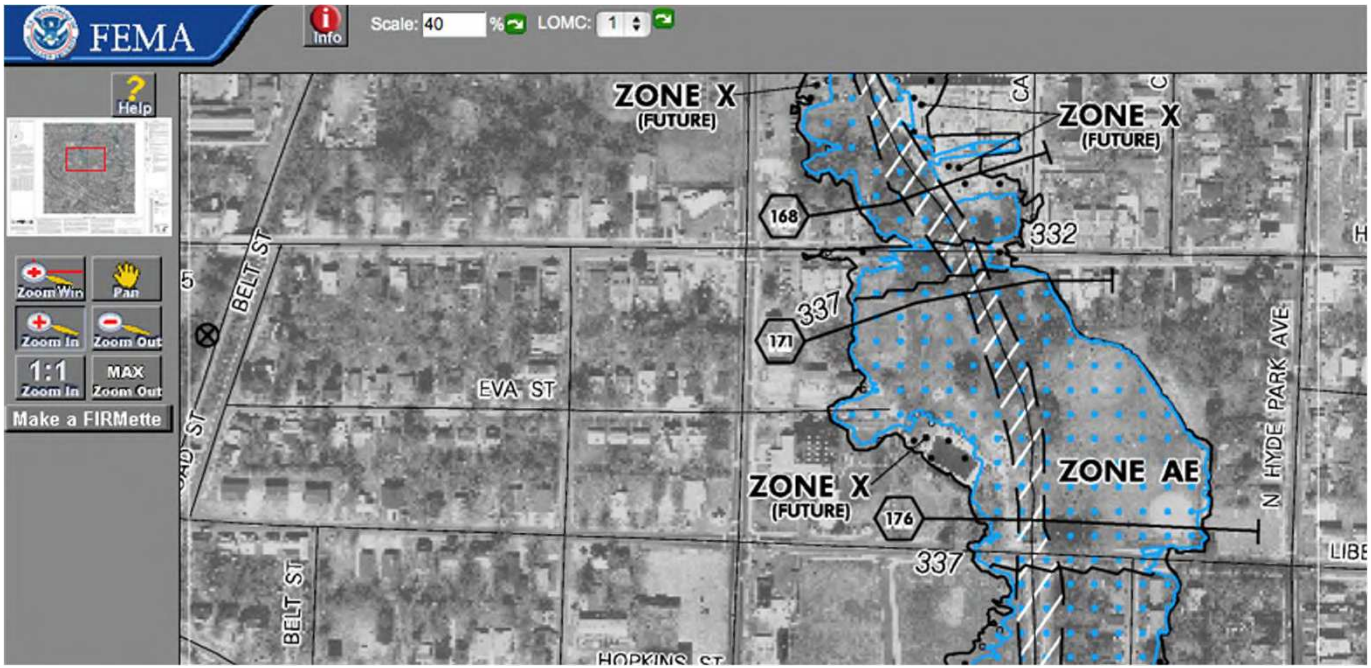
Example:
This one-acre stormwater wetland was constructed in Philadelphia to treat stormwater runoff in an effort to improve drinking water quality while minimizing the impacts of storm-related flows on natural ecosystems.

All-Hazards Approach

- An *all-hazards approach* to mitigation planning involves consideration of all the hazards with the potential for causing harm
- Many of the strategies used to reduce the effects of natural hazards are also effective for mitigating the impacts of human-made hazards.

Hazard Identification

- Before implementing mitigation or preparedness strategies, communities need a clear picture of the types of hazards that pose a threat to the community, and how those hazards may impact people and property.
- **Risk Assessment** and **mapping** allow us to understand assets and populations that are particular vulnerable and make strategic decisions to reduce risk.



Mitigation & Preparedness Value

Mitigation can contribute to the community's long-term sustainability, supporting economic vitality, environmental health, and quality of life.

Current dollars invested in mitigation will significantly reduce the demand for future dollars.

$1 spent in mitigation saves
$4 in avoided losses!

Build Back Smarter

The aftermath of a disaster presents a unique window of opportunity for a community to figure out what went wrong, and to implement strategies to prevent the same kind of damage in the future.

Climate Change Adaptation

Adjust our natural or human systems in response to climate change impacts to reduce harm or exploit beneficial opportunities.

Examples:

- Ensuring that coastal development accounts for future sea level
- Build stormwater systems to cope with rainfall estimates decades in the future
- Adjust crops and agricultural practices to ensure that production is not reduced by changes in climate

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.

Key Terms

- All-hazards approach
- Comprehensive emergency management
- Disaster
- Disaster resilient community
- Human-made hazards
- Mitigation
- Natural hazards
- Preparedness
- Recovery