1 HAZARDS VS. DISASTERS

Defining Resilient Communities

Starting Point

Go to www.wiley.com/college/Schwab to assess your knowledge of what defines a resilient community.
Determine where to concentrate your effort.

What You'll Learn in This Chapter

- Types of natural and man-made hazards
- How hazards differ from disasters
- Types of costs associated with disasters
- Characteristics of a resilient community
- Phases of the comprehensive emergency management cycle
- Differences between preparedness and mitigation

After Studying This Chapter, You'll Be Able To

- Illustrate how natural hazards relate to the Earth's dynamic equilibrium
- Distinguish between hazards and disasters
- Analyze why there are more and bigger disasters
- Discuss the potential costs of a disaster scenario
- Apply the phases of comprehensive emergency management
- Demonstrate where mitigation and preparedness fit into the emergency management cycle

Goals and Outcomes

- Assess the value of mitigation and preparedness
- Estimate the different types of costs associated with natural hazards, man-made hazards, and disasters
- Evaluate the tools and techniques used to address the costs associated with hazards
- Appraise the basic features of a resilient community
- Collaborate with others to determine mitigation strategies
- Evaluate decision strategies used in community mitigation and preparedness efforts

INTRODUCTION

Imagine you are an emergency manager in a small coastal town along the Atlantic Ocean. The National Hurricane Center in Florida has just predicted that a hurricane will make landfall a few miles south of your town in less than 72 hours. What steps should you take in the time remaining to prepare for this storm? What actions should you have taken weeks, months, and even years ago to make sure your community is safe from hurricanes like the one that is headed your way now? Throughout this book, we will help you find the answers to some of these questions. Chapter 1 gives a brief overview of the hazards that face our communities, both natural and man-made, and how a hazard differs from a disaster. Also covered in this chapter are the many costs—economic, social, environmental, and human—associated with hazards that affect the built environment. The chapter concludes with an examination of ways that emergency managers, planners, residents, and community leaders can use mitigation and preparedness strategies to make a community more resilient to the impacts of hazards.

1.1 Hazards: Part of the Natural Environment

Disasters are not natural. Of course, there are many natural hazards in the world, and there are many man-made hazards as well. But not every hazard becomes a disaster. This section of Chapter 1 introduces the concept of natural hazards and describes how they are naturally occurring phenomena that play a vital role in the earth's dynamic equilibrium. This section also introduces man-made hazards as a potential threat to our communities. Section 1.2 of this chapter discusses what must happen for a disaster to result from a natural or man-made hazard event.

1.1.1 Natural Hazards Are Inevitable and Unstoppable

Natural hazards are part of the world around us, and their occurrence is inevitable. Floods, hurricanes, tornadoes, winter storms, earthquakes, tsunamis, volcanoes, landslides, sinkholes, and other extreme events are natural phenomena we cannot control.

Some natural events can change the ecological environment. Consider these impacts caused by natural hazards:

- ▲ Wildfires burn forests and grasslands.
- ▲ Coastal storms erode beaches, flatten dunes, and create or fill inlets.
- ▲ Flooding inundates wetlands and marshes.
- ▲ Volcanic eruptions cover the landscape with molten rock and lava.

Despite the destruction caused by natural hazards, these occurrences are part of the natural system. Hazards have been happening for billions of years on Earth and will

continue for eons more. The natural environment is amazingly recuperative and resilient. After a hazard event, ecosystems can regenerate, and habitats are restored in time for the next generation of plant and animal life to begin anew.

1.1.2 The Earth's Dynamic Equilibrium

Many of the events we call "hazards" are in fact beneficial for the natural environment and help maintain the delicate balance of nature, the Earth's **dynamic equilibrium.** Under normal, undisturbed conditions, natural systems maintain a balanced state over long periods of time through a series of adjustments. Change in one part of the system will be balanced by change in another part so that the entire system regains equilibrium.[1]

Consider the benefits that result when natural systems absorb the impact of some hazard events and readjust through dynamic equilibrium:

- Wildfires burn off old growth in forests and allow new species of trees to grow.
- Coastal storms change the morphology (shape) of beaches and islands, bringing more sand to some areas and removing sand from others up the coast.
- Flooding brings nutrients and sediment to wetlands and marshes, creating a rich habitat for a variety of plant and animal species.
- Volcanic lava and ash form fertile soils when they weather and break down,[2] stimulating new plant growth.

These examples illustrate ways in which the environment is well equipped to deal with hazards as part of the natural processes on Earth.

1.1.3 Types of Natural Hazards

Natural hazards can be classified by the types of geophysical processes involved in their occurrence. The four types of natural hazards are:

- Meteorological (hurricanes, tropical storms, typhoons, tornadoes, snow and ice storms, thunderstorms, etc.).
- Geological (earthquakes, volcanoes, tsunamis, landslides, subsidence, etc.).
- Hydrological (floods, droughts, wildfire, etc.).
- Extraterrestrial (meteorites impacting the earth's surface)[3].

Physical parameters of natural hazards include intensity and severity, measures that indicate the relative strength of a particular hazard within a class. Hurricanes, for instance, are often categorized using the Saffir-Simpson Scale, which ranks hurricanes from 1 to 5 according to maximum wind speed, storm surge potential, and barometric pressure. See Chapter 2 for a more detailed discussion of the

physical elements of hurricanes and other meteorological and hydrological hazards. Earthquakes are usually described in terms of magnitude using the Richter scale, a unit of measurement that describes the energy release of an earthquake through shock wave amplitude, or the Modified Mercalli scale. See Chapter 3 for a discussion of earthquakes and other geological hazards. Professional meteorologists, hydrologists, seismologists, and other scientists interested in studying and predicting natural hazard events use these systems of hazard measurement. These scales also provide planners, emergency managers, engineers, and decision-makers at all levels with a common terminology to describe, anticipate, plan for, and deal with natural hazards in terms of policy and management.

We will not discuss extraterrestrial hazards further in this book, although the threat of meteorites piercing the Earth's atmosphere and impacting the surface of the planet is considered a natural hazard. Even though catastrophic meteorite impacts have been the grist for Hollywood's mill for years, the scientific community increasingly takes the threat of meteorite impacts seriously. Geologists have documented previous impacts that have left large craters in the Earth's surface. Paleontologists have postulated that one of these catastrophic impacts caused the extinction of the dinosaurs along with vast numbers of species of plant and animal life.[4]

1.1.4 Are Natural Hazards Becoming More Frequent?

There is speculation that natural hazards are becoming more common. Many theories have been posed to explain this increase in hazard occurrence, although scientists and policy makers are not always in full accord on certain points. Some of the reasons that natural hazards may be on the rise include the following:

- Climate changes such as El Niño cause fluctuations in weather patterns.
- Some hazards occur in natural cycles of frequency. (For example, research shows that hurricanes have a cycle of 30 to 40 years; after experiencing a lull since the 1950s, we are now entering a phase in which hurricanes occur in greater numbers.)
- Global warming may cause changes in average worldwide temperatures, creating disturbances in the atmosphere and oceans.
- Deforestation and desertification in parts of the world lead to imbalances in global hydrological cycles.
- Sea level rise due to melting polar ice caps may increase flooding in low-lying coastal areas.

Natural hazards may also appear to be increasing in frequency because of heightened media exposure. Referred to as the "CNN syndrome," intense media coverage of hazard events can increase awareness of hazard losses worldwide as the capability for reporting and documentation of news expands.[5] In past generations,

EXAMPLE

Hazards, Hazards Everywhere

Some natural hazards occur only in certain regions of the United States. Volcanoes are not found in New England, but in Hawaii active volcanoes produce lava, ash, and steam at regular intervals. Other types of hazards are more widely distributed and can be found almost anywhere. Flooding can occur wherever water sources overflow their normal channels. In fact, flash floods can happen even in areas that experience drought most of the year, such as Las Vegas, Nevada. Still other types of hazards occur quite frequently in one part of the country but are also possible in other areas that experience them less often. For example, the risk of earthquakes in California is well documented, but less well known is the large earthquake that struck Charleston, South Carolina, in 1886. The risk of an earthquake occurring there in the near future is quite significant.

when communication systems were not instantaneous as they are today, fewer people knew about natural hazards that took place outside their own communities.

1.1.5 Man-Made Hazards

In general terms, there are two major classifications of **man-made hazards**: 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 intended the hazard 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; a social, economic or religious mission; or because they are delusional or misguided in some way. See Chapter 4 for further discussion of man-made hazards and their effects.

Intentional man-made hazards (such as a bombing) almost always have humans as their ultimate targets. Unintentional or accidental hazards (such as an oil spill or a train derailment) are more like natural hazards because they do not occur as a result of a malicious plot or an organized activity that is designed to cause damage or injury. Either way, it is very difficult to predict where or when man-made hazards will occur, and our ability to completely prevent either terrorism or technological hazards is limited.

Although the root of the problem for most man-made disasters is different from that for natural processes, there are many factors in common in terms of the impact the two types of events might have on a community. There are also many common ways to prevent damage and to prepare for both natural and human-made hazards. Therefore, during the rest of this chapter, and throughout much of the remainder of this book, we will treat natural and man-made hazards in a similar way.

SELF-CHECK

- Define **natural hazards** and **dynamic equilibrium.**
- Discuss the beneficial functions of three natural hazards.
- Describe the differences between technological hazards and terrorism.

1.2 Hazards and Disasters: Not the Same

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 something different. A **disaster** results when a natural hazard takes place where humans are located. To some degree, this distinction is also true for man-made hazards, particularly those caused by accident.

1.2.1 The Official Definition of Disaster

The Robert T. Stafford Disaster Relief and Emergency Assistance Act is the primary legislation authorizing the federal government to provide disaster assistance to states, local governments, Native American tribes, and individuals and families. The Stafford Act defines a disaster as

> *Any natural catastrophe (including hurricane, tornado, storm, high water, wind driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm or drought), or, regardless of cause, any fire, flood or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of States, local governments, and disaster relief organizations, in alleviating the damage, loss, hardship, or suffering caused thereby.*

As this definition indicates, a disaster, whatever its cause, is a "catastrophe" of such magnitude and severity that the capacities of states and local governments are overwhelmed. The threshold for determining what constitutes a disaster depends upon the resources and capabilities of states and local communities, as supplemented by relief organizations such as the American Red Cross. The patchwork of policies and regulations that makes up our system of governance has direct bearing on these resources and capabilities. Chapter 5 elaborates on the hazards management framework that exists in our federalist system of government, and Chapters 6, 7, and 8 give more detailed information about how the federal, state, and local governments carry out their responsibilities for disaster management. It is important to note that the federal government is responsible for providing

assistance only after other resources have been depleted. How strictly this policy is actually carried out is discussed in later chapters as well. The "politics of extreme natural events"[6] can significantly affect the way in which disaster declarations are made and how disaster funds are disbursed from the national treasury.

1.2.2 The Intersection of the Human Environment and a Natural Hazard

The human environment—made up of homes, offices, farms, schools, roads, sewage treatment plants and other types of buildings and infrastructure—is not nearly as resilient as the natural one. The occurrence of a natural hazard can debilitate an entire community for many years following the event, and some communities never recover fully from a particularly severe disaster.

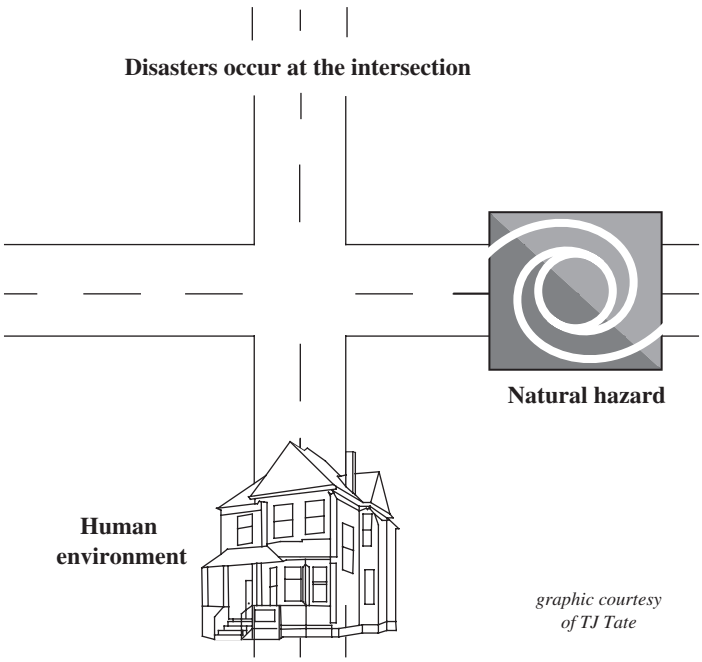
The formula for a natural disaster is

Natural hazard + Human environment = Disaster

In other words, it is only when people are injured and property is damaged by a hazard that we experience a disaster.

Figure 1-1 illustrates what happens when the human environment collides with a natural hazard. At the intersection we have a disaster.

Figure 1-1



Disaster occurs at the intersection.

EXAMPLE

A Hurricane at Sea Is Not a Disaster

A hurricane is a natural hazard, but if it happens far out to sea, it cannot harm anyone. In the middle of the ocean there are no buildings to be damaged and no people to be injured or killed. Even when a hurricane reaches land, if it makes landfall in an unpopulated area, then no disaster occurs.

1.2.3 Why Are There More and Bigger Natural Disasters?

We mentioned earlier in the chapter that hazard events are possibly occurring more frequently around the world today. Scientists have proposed various theories as to why this may be true. But whether or not *natural hazards* are increasing in frequency, it is very clear that *disasters* are occurring more and more often. It is also certain that disasters are becoming more *costly*. Why is this so?

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. The rate of disasters in this country is rising at an alarming rate, because more people have chosen to live in areas exposed to coastal storms, repeated flooding, seismic activity, and other types of natural hazards, often with little or no attention to the need to protect themselves and their property. As a result, the risk of disasters occurring in the wake of natural hazards has grown exponentially over the past few decades.

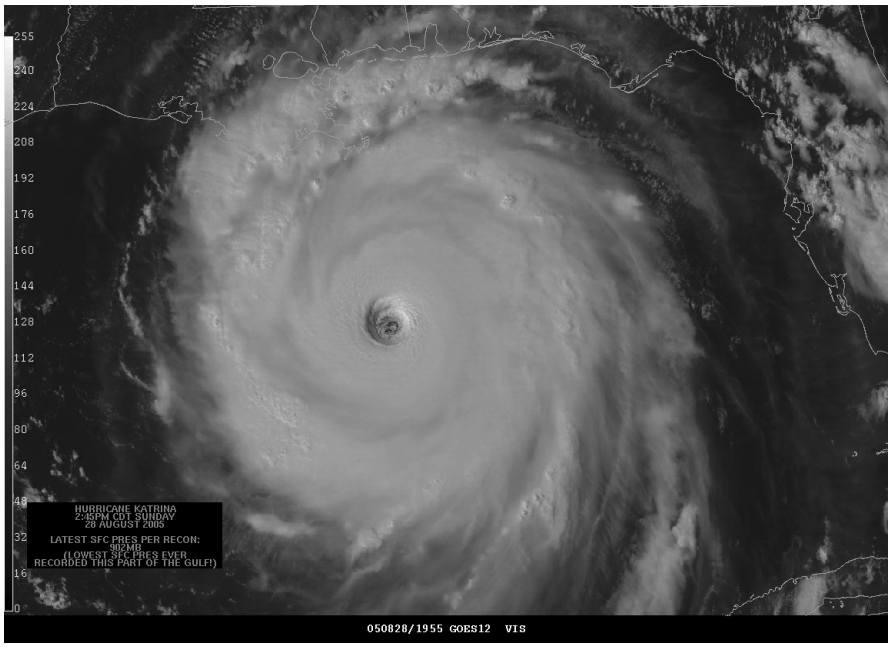
Why is this happening? Part of the answer is that the population of the United States is growing very quickly. As cities and towns expand to accommodate more people, they sprawl out into areas that are potentially hazardous. For instance, the cities of Los Angeles and San Francisco are growing by leaps and bounds, despite the well-known risk of earthquakes in California. Other communities are building new shopping centers and subdivisions in the floodplain, even though these areas are flooded on a regular basis. Still others are building on steep slopes where the potential for landslides is high, and others insist on encroaching on the urban-wildland interface despite the likelihood of wildfires. Perhaps the most dramatic increase in population growth and development is occurring on our nation's shorelines. The coastal environment is extremely hazardous due to hurricanes, nor'easters, flooding, storm surge, wind, erosion, inlet migration, and other coastal hazards, yet the shoreline continues to be the most desirable real estate in the country. As long as development and population growth keep expanding into hazardous areas, we can expect more and bigger disasters in the future.

HURRICANE KATRINA: AN IMPRESSIVE NATURAL HAZARD AND A CATASTROPHIC HUMAN DISASTER

Hurricane Katrina is an example of both an extreme natural hazard and a horrifying disaster (see Figure 1-2). This storm was not only extraordinarily powerful, but it also caused a catastrophic amount of damage and a tragic number of human deaths. As a natural hazard, Katrina had a life span in hurricane form of almost four days. During that time, Katrina made landfall twice, first as a Category 1 Hurricane in Florida and then again as a Category 3 Hurricane in Louisiana. It was one of the largest, most intense hurricanes on record in the Atlantic when it reached Category 5 status over the Gulf of Mexico. The storm produced high winds, storm surge, flooding, and tornadoes in parts of Cuba, Florida, Georgia, Alabama, Mississippi, and Louisiana and continued to produce heavy rains and flooding as it dissipated through the Mississippi Basin and Tennessee Valley.

If there had been no people or property in the path of Hurricane Katrina to experience her wrath, or if the hurricane had taken place on open ocean waters,the hurricane would have been counted as one of the strongest storms on record. But the implications of the storm would have been of

Figure 1-2



Satellite image of Hurricane Katrina over the central Gulf of Mexico on August 28, 2005, near the time of peak intensity.

NOAA

interest merely to professional meteorologists and amateur storm watchers. Unfortunately, the history of Hurricane Katrina tells a very different tale. Thousands of people and structures were within direct reach of Katrina's intense rain bands and swirling winds, resulting in one of the deadliest, as well as the single costliest, hurricane to hit the United States. Katrina struck an area that is particularly vulnerable to storm surge and flooding, resulting in widespread destruction of homes, businesses, schools, farms, infrastructure, and entire ecosystems. The economic ramifications are deep and long-lasting, and the storm will continue to impact the oil and gas industry, fisheries and shellfishery, transportation networks along the Mississippi River system, and the tourism and hospitality industries for years to come. Insured losses caused by Katrina are estimated by the American Insurance Services Group (AISG) to be around $75 billion, about twice the adjusted costs of the next costliest hurricane in US history, Hurricane Andrew.[7] The total number of fatalities directly or indirectly related to Katrina may never be known. At the time of this writing, approximately 1,090 deaths were reported in Louisiana, 228 in Mississippi, 14 in Florida, 2 in Alabama and 2 in Georgia, for a total of 1,336 human lives lost, including hundreds of children and elderly people.[8] Of those that survived, many are displaced in temporary shelters (such as hotels, mobile homes or travel trailers) scattered throughout the country. Some survivors may never return to their homes or communities.

The full impacts of the Hurricane Katrina disaster are still being compiled and are beyond the scope of this book or any single text written at this time. It is indeed a sad and compelling chapter in our nation's modern history. There are short scenarios regarding Hurricane Katrina in each chapter that illustrates some of the mitigation and preparedness concepts discussed in that chapter. These examples hopefully will bring to life some of the obstacles as well as some of the opportunities that confront practitioners in the emergency management field today. If we can learn from studying how this particular disaster happened in the wealthiest and most powerful country on Earth, perhaps we can prevent such a tragedy from occurring again.

SELF-CHECK

- Recite the federal government's definition of **disaster**.
- Explain why disasters are increasing in frequency.
- Discuss how the conditions of a disaster differ from those of a natural hazard.

1.3 The Many Costs of Disasters

There are many different types of costs associated with a disaster. Some costs are obvious, such as the expense of repairing damaged structures. Other costs are less direct and cannot be fully calculated until years after the disaster has passed. Still other costs are not financial in nature, and no monetary value can be placed on them.

1.3.1 Direct Financial Costs

Disasters are very expensive, whether they are caused by a natural hazard or by a human agent. When people are in danger, they must be rescued quickly and safely, then sheltered and fed. When community security is compromised, law enforcement must beef up patrols to protect people and property from looting and vandalism (see Figure 1-3). When power goes out, electricity and telephone lines must be repaired. When buildings and infrastructure are damaged, they must be rebuilt.

It costs millions, sometimes even billions of dollars to remove debris, repair infrastructure, rebuild homes, and reestablish commerce and industry when a community has been hit by a disaster. Local governments are often burdened with much of the cost to reconstruct schools, utilities, fire stations, roads, bridges, and other local facilities that are damaged during a disaster. If the local and state governments cannot afford to pay for it all, the federal government covers much of the cost of recovery and reconstruction following a large disaster, as well the costs of short-term assistance to people who lose their homes and jobs. Federal disaster assistance programs are discussed in more detail in Chapter 6.

Who pays for these costs? Taxpayers finance all the activities of local, state, and federal governments before, during, and after a disaster. Property owners who have purchased insurance coverage (homeowners, flood, earthquake, etc.) often receive reimbursement for some of the costs of repairing their homes and businesses following a disaster. But when thousands of people make insurance claims all at once after a large-scale disaster, premiums for everyone, not just for those directly affected, can go up. Churches and other charities and volunteer organizations also contribute generously for disaster recovery, but the funds that they provide to disaster victims could have been directed elsewhere, such as helping the homeless, donating to arts and education, protecting animals, or otherwise serving the original mission of the organization. In other words, *we all pay for disasters*, even if we don't live in the area directly affected.

1.3.2 Long-Term Economic Costs

In addition to the direct financial costs of repair and reconstruction, other costs are often associated with disasters. Long-term economic costs can keep a community from recovering fully after a disaster occurs, even if the direct financial costs of repair and reconstruction are met.

Figure 1-3

East Grand Forks, MN, April 8, 1997: Law enforcement officers patrol the Sherlock Park area of East Grand Forks. Photo by Dave Saville/FEMA News Photo

Following a large-scale disaster that affects a major portion of a community, local businesses may close permanently, either because their capital assets (warehouses, manufacturing plants, equipment, inventory, offices, etc.) are damaged beyond repair and cannot be replaced, or because the company has lost employees displaced by the disaster. Often employees must move out of the area, either because they have lost their own homes or because they no longer have a place to work. Disruptions in the flow of goods and services can also impact local businesses for a long time as well as industries located out of the disaster region. Long-term economic losses are particularly hard for small business owners and farmers, who may not have adequate savings or insurance to cover expenses and who cannot recoup their losses quickly enough to stay financially solvent.

The loss of jobs that occurs when major employers close because of a disaster can have a ripple effect throughout the community (see Figure 1-4). If the job loss is severe enough, the entire economic structure of the locality can be changed permanently. Many smaller communities are dependent upon just one or two industries for their economic base, and when these are destroyed, there is no source of employment for residents. Towns and villages that serve primarily as tourist destinations, for example, can be devastated when a natural

hazard obliterates the accommodations and attractions that bring visitors to the area. In turn, the local government loses its main sources of revenue from property, occupancy, and sales taxes, and no longer has means of providing services needed to support the community.

Problems arising from changes to the economic structure and employment base are compounded when municipal services are interrupted and cannot be restored quickly and efficiently. The longer utilities, schools, transportation systems, communications, and other local facilities are off-line, the more difficult it becomes for residents and businesses to return to work and commerce.

A lack of housing is often one of the most serious limitations to the full recovery of a community over the long-term. When housing stocks are depleted because of an earthquake, hurricane, or other major disaster, the cost of available housing goes up, further adding to the economic burden of community residents. Building costs typically rise dramatically following a disaster owing to a scarcity of materials, rising prices of material and labor, and a corresponding increase in demand. These high prices further limit the housing choices of new and returning residents.

Figure 1-4

The owner of this small business in New Hope, Pennsylvania spent weeks cleaning up after flooding on the Delaware River. He suffered $100,000 in inventory losses and spent $200,000 in cleaning fees. This business may or may not remain viable after this disaster.

1.3.3 Environmental Costs

Economic losses are not the only costs associated with hazard events. 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.

Flooding very often causes severe environmental damage when hazardous materials are released into the floodwaters. As floodwaters recede, contaminants may be carried along to surface waters (rivers, lakes, and streams) or seep into the groundwater and eventually may make their way into drinking water supplies. For example, propane, gas, chemicals, solvents, pesticides, and other harmful agents can be released if tanks, barrels, and storage containers are breached during a flooding event. Junkyards, livestock pens, meat and poultry processing plants, sewage treatment facilities, and other sources of contamination can also increase the environmental costs of a flooding disaster. For example, during Hurricane Floyd in 1999, many hog farms in eastern North Carolina were flooded when rivers and streams overflowed their banks following days of heavy rainfall. Tons of raw animal waste spilled over containment lagoons and entered the waterways of the region. Water quality declined precipitously, endangering the health of people, livestock, wildlife, and aquatic animals and fish for a considerable length of time after the event.

Often, with proper cleanup and handling procedures, the damage to ecosystems and habitats can be minimized, but in other cases, wildlife and vegetation are severely impacted for many years following a disaster.

1.3.4 Societal Costs

One of the most insidious effects of a disaster is the impact it can have on society. When a disaster destroys whole neighborhoods and large sections of the community, the social fabric of the community may be ripped to shreds. Consider these possible consequences of a catastrophic event:

- Social networks that were in place to support residents are disjointed.
- A vibrant neighborhood may suddenly become a ghost town.
- Residents are often displaced and forced to live in unfamiliar locations far from family and friends.
- Children are suddenly without teachers, friends, and classmates, and the routines of school and home life are disrupted.
- Places of worship may lose their congregations, and community centers that once provided assistance to residents may be dismantled.
- Incidents of domestic violence and substance abuse often increase following a traumatic event.

EXAMPLE

Many Katrina Victims Are Poor African Americans

The impact of Hurricane Katrina in New Orleans and elsewhere on the Gulf Coast in 2005 highlighted some of the many problems associated with poverty, race, and class in areas affected by a natural disaster of that scale. The hardest-hit regions in the Gulf states were already drowning in extreme poverty: Mississippi is the poorest state in the nation, with Louisiana just behind it. Before the storm, New Orleans had a poverty rate of 23%, ranking 7th out of 290 large US cities. In 2000, the city of New Orleans was more than 67% black. Although the national average for elders with disabilities is 39.6%, New Orleans hovers near 57%. Nearly one in four New Orleans citizens did not have access to a car. These pre-Katrina statistics have direct bearing on the conditions in the city following the hurricane, when hundreds of people were stranded without adequate resources to evacuate or to cope with the conditions created by flooding, loss of power, breakdowns in security, and other disaster impacts.[9]

- As parents and families frantically try to find food, shelter, clothing, diapers, and other necessities of life, tensions can rise, and stress can cause changes in behavior and reduce coping skills.
- Residents who were only marginally able to provide for themselves before the disaster are often disproportionately affected. These individuals with special needs include lower-income, non-English speaking, minority, elderly, disabled, homeless, or otherwise disadvantaged people, and those in single parent households.

All of these impacts put together can cause some communities to lose their sense of place. What was once a source of pride and identity is now lost, and the characteristics that held the society together may never be regained. The social costs of a disaster should never be underestimated, because these costs may never be fully compensated for.

1.3.5 Human Lives Lost

The death of one human being as a result of a natural or man-made hazard is one death too many. Tragically, over a thousand lives were lost during Hurricane Katrina in 2005. Buildings, infrastructure, personal possessions, and other material goods can be restored given enough time and money, but a human life can never be replaced. Our first priority for creating resilient communities must be to reduce the likelihood that people may be killed or injured during a disaster. The loss of any life is an unacceptable cost of disaster and should always be the focus of our mitigation and preparedness efforts.

Table 1-1: Top Ten Natural Disasters in the United States (Ranked by Relief Costs of FEMA)

Event	*Year*	*FEMA Funding*
Hurricane Katrina (AL, LA, MS)	2005	$7.2 billion*
Northridge Earthquake (CA)	1994	$6.961 billion
Hurricane Georges (AL, FL, LA, MS, PR, VI)	1998	$2.251 billion
Hurricane Ivan (AL, FL, GA, LA, MS, NC, NJ, NY, PA, TN, WVA)	2004	$1.947 billion**
Hurricane Andrew (FL, LA)	1992	$1.813 billion
Hurricane Charley (FL, SC)	2004	$1.559 billion**
Hurricane Frances (FL, GA, NC, NY, OH, PA, SC)	2004	$1.425 billion**
Hurricane Jeanne (DE, FL, PR, VI, VA)	2004	$1.407 billion**
Tropical Storm Allison (FL, LA, MS, PA, TX)	2001	$1.387 billion
Hurricane Hugo (NC, SC, PR, VI)	1989	$1.307 billion

www.fema.gov/hazard/topten.shtm Last Modified: Wednesday, 05-Apr-2006 12:35:00 EDT

Amount obligated from the President's Disaster Relief Fund for FEMA's assistance programs, hazard mitigation grants, federal mission assignments, contractual services and administrative costs as of March 31, 2006. Figures do not include funding provided by other participating federal agencies, such as the disaster loan programs of the Small Business Administration and the Agriculture Department's Farm Service Agency.* ***Note:* *Funding amounts are stated in nominal dollars, unadjusted for inflation.*

Amount obligated from the President's Disaster Relief Fund for FEMA's assistance programs, hazard mitigation grants, federal mission assignments, contractual services and administrative costs as of May 31, 2005. Figures do not include funding provided by other participating federal agencies, such as the disaster loan programs of the Small Business Administration and the Agriculture Department's Farm Service Agency.* ***Note: *Funding amounts are stated in nominal dollars, unadjusted for inflation.*

1.3.6 Top Ten Natural Disasters in the United States

The United States has a long history of expensive disasters. Table 1-1 lists the top ten natural disasters in the United States as compiled by the Federal Emergency Management Agency (FEMA). These figures represent only the costs paid or obligated by FEMA for disaster assistance and do not include the amounts paid by other federal agencies, state and local governments, charities and relief organizations, or insurance payouts. Nor do these figures account for the social, environmental, or long-term indirect costs due to these hazards. Also note also that fatalities are not listed in this chart.

SELF-CHECK

- List the five categories of costs associated with disaster.
- Discuss how the environment can suffer from a disaster.
- Cite five examples of social costs.

1.4 Mitigation and Preparedness for Resilient Communities

We cannot stop natural hazards from happening, nor can we prevent many man-made hazards, but we *can* take action to reduce the impacts of these hazards so that the damage is less extensive and so that recovery can take place quickly. Actions taken to lower disaster risk can also help reduce losses and their associated costs.

1.4.1 Taking Action to Prevent Disasters

Resilient communities are towns, cities, counties, and states that take action prior to a hazard event so that a disaster does not result. Resilient communities do this in two stages:

1. Preparedness
2. Mitigation

A **disaster resilient community** is 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.[10]

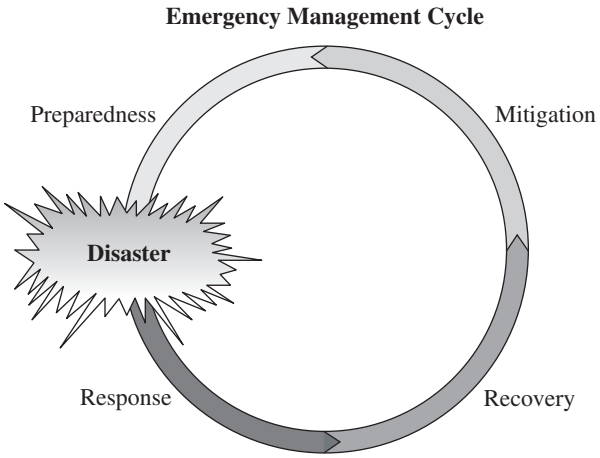
1.4.2 The Emergency Management System

Comprehensive emergency management is a widely used approach at the local, state, and federal levels to deal with the inevitability of natural hazards and the possibility of man-made hazards and their potential to cause disasters in a community. The four phases of a Comprehensive emergency management system are: **Preparedness**, **Response, Recovery**, and **Mitigation**.

Table 1-2: Phases of Comprehensive Emergency Management

Phases of Comprehensive Emergency Management	
Preparedness	• Activities to improve the ability to respond quickly in the immediate aftermath of an incident. • Includes development of response procedures, design and installation of warning systems, evacuation planning, exercises to test emergency operations, and training of emergency personnel.
Response	• Activities during or immediately following a disaster to meet the urgent needs of disaster victims. • Involves mobilizing and positioning emergency quipment and personnel; includes time-sensitive operations such as search and rescue, evacuation, emergency medical care. food and shelter programs, and bringing damaged services and systems back online.
Recovery	• Actions that begin after the disaster, when urgent needs have been met. Recovery actions are designed to put the community back together • Include repairs to roads, bridges, and other public facilities, restoration of power, water and other municipal services, and other activities to help restore normal operations to a community.
Mitigation	• Activities that prevent a disaster, reduce the chance of a disaster happening, or lessen the damaging effects of unavoidable disasters and emergencies. • Includes engineering solutions such as dams and levees; land-use planning to prevent development in hazardous areas; protecting structures through sound building practices and retrofitting; acquiring and relocating damaged structures; preserving the natural environment to serve as a buffer against hazard impacts; and educating the public about hazards and ways to reduce risk.

Figure 1-5



Emergency Management Cycle.

The four phases of comprehensive emergency management are often illustrated in a circular pattern, signifying its cyclical nature (see Figure 1-5). We prepare for disasters before they occur. When a disaster happens, a community must first respond to that particular event and soon thereafter begin recovery. But even while the community is still recovering from one disaster, it must begin the process of mitigating the impacts of the next disaster.

Also known as the **disaster life cycle**, this system describes the process through which emergency managers prepare for emergencies and disasters, respond to them when they occur, help people and institutions recover from them, mitigate their effects, reduce the risk of loss, and prevent secondary disasters such as fires from occurring.[11]

We are always preparing for and mitigating the impacts of disasters. These two phases indicate the future orientation of emergency management and are the building blocks for resilient communities. Ironically, the period of recovery following a hazard event often provides a unique opportunity to rebuild in a way that incorporates mitigation concepts into the redevelopment of a damaged community. In fact, the availability of government funding to carry out mitigation plans and projects has historically been highest during the recovery phase of the disaster life cycle. New emphasis is being placed on predisaster mitigation activity, but the postdisaster environment continues to be one of significant increases in fiscal and technical capability.

1.4.4 Preparedness

Preparedness ensures that if a disaster occurs, people are ready to get through it safely and respond to it effectively. Preparedness can be characterized as a state of readiness to respond to any emergency or disaster. It involves anticipating

Table 1-3: Preparedness Activities Are Any Actions Taken Prior to the Emergency That Facilitate the Implementation of a Coordinated Response.

Preparedness Activities	*Description*
Planning	All 56 U.S. states and territories prepare Emergency Operations Plans (EOPs). The EOP establishes a chain of command, designates responsible parties, provides for continuity of government functions, establishes an Emergency Operations Center (EOC), and provides a road map for decision making during emergencies. Evacuation and emergency sheltering are also an important planning function of the preparedness phase.
Training	Emergency managers, first responders, and public officials take classes in emergency planning, disaster management, hazardous materials response, fire service management, and so on.
Exercises & Drills	From "tabletop" discussions of a specific problem to full scale exercises that involve detailed disaster scenarios that unfold over several days, exercise events bring together every agency and volunteer organization that would respond in a real disaster.
Emergency Awareness and Education	Educational messages include teaching children how to make a 911 call, reminding parents to keep emergency supplies on hand, showing homeowners how to make their homes more hazard proof, distributing disaster-specific messages to areas at risk, and so forth.
Warning	Warning activities include development of warning systems, emergency alert systems, and coordination of sirens and other emergency notification methods. Regular testing of warning and notification devices is also involved.

EXAMPLE

Turn Around Don't Drown

People are at risk even in shallow flooding. According to the National Weather Service (NWS), almost half of all flood fatalities occur in vehicles. The next highest percentage of flood-related deaths is due to walking into or near flood waters. Local storms can quickly fill underpasses and cover bridges, and even two feet of water can float most vehicles, including large ones. If the water is moving, vehicles can be swept away. Driving at night during a local flood can be especially hazardous. To increase awareness of the dangers of shallow flooding, the NWS has initiated the "Turn Around Don't Drown" program to help communities educate residents about the dangers of walking or driving in floodwaters (see Figure 1-6).

Figure 1-6

The Federal Highway Administration has approved the Flooding Ahead Don't Drown sign as an official Incident Road Sign.; weather.gov/os/water/tadd/pdfs/TADDroad_sign.pdf.

what might happen during different sorts of hazard events and developing plans to deal with those possibilities. Preparedness also involves carrying out exercises, evaluating plans for shortfalls, and training and education. Although emergency managers must remain flexible and able to adapt their plans to meet immediate needs as the situation warrants, a plan or established protocol for dealing with disasters and emergencies of all sorts is crucial to a successful response. See Chapter 11 for a more detailed discussion of preparedness.

1.4.4 Mitigation

Mitigation is defined as "any sustained action to reduce or eliminate long-term risk to people and property from hazards and their effects".[12] This definition highlights the long-term benefits that effective mitigation can have. This definition also emphasizes that mitigation is an ongoing effort that communities must make on a continuous basis. Mitigation involves planning, strategizing, and implementing action ideas in advance of a hazard event. The ultimate purpose of mitigation plans, strategies, and actions is to avoid placing people and property in harm's way and to make structures safer and stronger when avoidance is impossible or impractical. We elaborate on various approaches to mitigation in the next section.

1.4.5 The Difference 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. During preparedness, we gather our supplies and make our plans for what to do when the disaster hits.

Preparedness can be visualized as the phase in which we pose a series of "what if" questions, and seek to find the answers before they become reality. For instance, an emergency manager may consider various worst-case scenarios, such as:

- What if the power goes out? Do we have generators and a supply of fuel? What about telecommunications, water, and sewer service?
- What if the roads are blocked? How will we deliver needed supplies and medical services to impacted populations?
- What if our food supplies are cut off? Do we have access to water, ice, Meals-Ready-to-Eat? Where are these supplies stored, and how quickly can they become available?
- What if there are multiple injuries? Who are our medical contacts? Will they need transportation, supplies, a power source, blood?
- What if residents have to leave their homes quickly? Is an evacuation plan in place? Does it account for fluctuations in populations, such as the tourist season in a resort community? What about people who are not independently mobile Those who are ill, old, young, illiterate?

- Are community buildings ready to serve as shelters? Are their locations clearly identified and accessible? Who opens the shelters? Are pets provided for as well?
- Are first responders ready to carry out search and rescue missions? Have they been trained to serve in disaster conditions? How will they communicate with one another?

These are the types of issues that the preparedness phase attempts to address before emergency conditions render the situation impossible.

Mitigation, in contrast, is the ongoing effort to lessen the impacts of disasters on people and property through predisaster 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. Mitigation involves a different thought process and a different skill set, one that is oriented toward long-range policy and decision-making processes.

One of the primary differences between mitigation and preparedness is the visibility of the respective results. The benefits of mitigation often are not realized for some time, and success is measured by what does *not* occur. Avoidance and prevention are the outcomes of mitigation done well, outcomes that can be difficult to quantify. In the past, some emergency managers have been hesitant to embrace mitigation activities with enthusiasm equal to that for preparedness, perhaps thinking "I won't lose my job for failing to mitigate, but I might lose my job if a botch a response." The emphasis therefore has been on highly visible, results-oriented action in preparation for the immediacy of an emergency situation rather than the slower, process-oriented strategy of mitigation.

Unfortunately, mitigation is often neglected until after a disaster actually occurs. In the case of natural disasters, history is filled with examples of communities which rebuild in the same places, in the same manner as previously, only to suffer the same perils when the hazard event recurs. Mitigation seeks to break the cycle of unnecessary destruction and reconstruction by adapting human settlement patterns and construction techniques to reflect the threat posed by potential hazards.[13]

SELF-CHECK

- Define **disaster resilient communities, comprehensive emergency management, preparedness, response, recovery,** and **mitigation.**
- List the four stages of comprehensive emergency management cycle.
- Discuss the differences between preparedness and mitigation.

1.5 Mitigation Strategies

Because it is so important, we will restate the definition of mitigation here:

Mitigation is any sustained action to reduce or eliminate long-term risk to people and property from hazards and their effects.

1.5.1 A Mitigation Toolbox

There is a wide variety of tools and techniques that a community can use to reduce the impacts of hazards on people and property. These range from keeping people and property out of harm's way through incentives and acquisition to imposing regulatory standards on all construction in hazard areas.

- Building standards specify how buildings are constructed. In addition to traditional building codes, building standards can include flood-proofing requirements, such as elevating structures above expected flood heights; seismic design standards; and wind-bracing and anchoring requirements for new construction and similar requirements for retrofitting existing buildings.
- Development Regulations, which may include zoning and subdivision ordinances, regulate the location, type, and intensity of new development. Development regulations can include flood-zone regulations; setbacks from faults, steep slopes, and coastal erosion areas; and overlay zoning districts that apply additional development standards for sensitive lands such as wetlands, dunes, and hillsides.
- **Capital improvement programs** can be an effective way to implement mitigation throughout a community. Local public polices supporting hazard mitigation should be incorporated into these programs. Locating schools, fire stations, and other public buildings, streets, storm sewers, and other utilities outside of high hazard areas provides direct mitigation benefits. When siting public facilities in hazardous locations cannot be avoided, communities can incorporate hazard reduction measures into the design or require retrofits. Public facility siting is a key determinant of the location of new privately financed growth in a community. As such, facilities, particularly roads and utilities, should not be provided where they have the potential to encourage growth in high hazard areas.
- **Land and property acquisition** means purchasing properties in hazard-prone areas with public funds and restricting development to uses that are less vulnerable to disaster-related damages. This can be accomplished through acquisition of undeveloped lands, acquisition of development rights, transfer of development rights to lower-risk areas, relocation of buildings, and acquisition of damaged buildings.
- **Taxation and fiscal policies** can be used to distribute the public costs of private development onto owners of such properties. Employing

impact fees to cover the public costs of development in areas of high hazards or providing tax breaks for reducing land use intensities in hazardous areas are two options.

- **Public awareness** through information dissemination on natural hazards and providing educational materials to the construction industry, homeowners, tenants, and businesses is also important. Included in this category are hazard disclosure requirements for the real estate industry and public information campaigns to increase awareness in all sectors of the community.[14]

Each of these types of strategies seeks to reduce the vulnerability of the built environment to the impacts of hazards (see Figure 1-7). Many communities use a combination of strategies to meet their mitigation needs. See Chapter 12 for a more detailed discussion of hazard mitigation tools and techniques.

1.5.2 Strategies to Mitigate Man-Made Hazards

Many of the strategies used to reduce the effects of natural hazards are also effective for mitigating the impacts of man-made hazards. For instance, construction

Figure 1-7

Baldwin County, Alabama: This house has been elevated above the expected flood height. Elevation is one way to mitigate flooding for a home situated in a river's floodplain. Photo by Mark Wolfe/FEMA

techniques that strengthen buildings to withstand hurricane-force winds may also provide some protection against the force of an explosive device. Following the terrorist attacks of September 11, 2001, greater attention has been paid to prevention and mitigation of terrorism and other intentional hazards, but because these types of incidents are difficult to predict and analyze, this field is still under development. There is some possibility that increased intelligence, surveillance, and security operations can minimize the threats posed by these hazards, but much remains to be done to solidify our approach to dealing with terrorist events while also protecting our civil liberties.

We have had more experience in this country with mitigating other technological hazards. For instance, following the Three Mile Island nuclear accident, the U.S. Nuclear Regulatory Commission implemented several improvements for operations, including increased oversight, more frequent inspections, more comprehensive training and exercises for personnel, and upgrades in equipment at all nuclear reactors in the United States. These improvements significantly decreased the risk of a similar nuclear accident in this country.

1.5.3 Risk Assessment and Mapping

Before a community can implement any of its mitigation strategies, it must have a clear picture of the types of hazards that pose a threat to it and how those hazards may impact people and property. Hazard identification is the necessary first step to reducing vulnerability; it involves a process of culling information about the community's hazard history, profiling various hazard events, and making predictions about the possibility of future hazards. The community must also determine 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*. Maps are an important component of a community **risk assessment**, as they 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 decisions about how to protect local assets and vulnerable populations against likely hazards. See Chapter 10 for a more in-depth discussion about community risk assessment.

Many communities in the United States have an official Flood Insurance Rate Map, or FIRM, that shows the location of flood-prone areas throughout the jurisdiction. These maps indicate the likelihood that a particular home, street or businesses could be flooded during the next 100-year flood (a flood that has a 1% chance of occurring during a given year). These maps also contain visual information about the frequencies of other flooding events. These maps are used as the basis for developing ordinances that regulate the types of structures that are allowed in the community's floodplain and specify how structures must be protected to mitigate the impacts of various levels of flooding.

1.5.4 Managing Community Growth and Development

One of the most effective approaches to mitigation involves managing community growth and development through land use regulations and planning and controlling the quality of structures that are built through building standards and code requirements. Local governments can place hazardous locations such as floodplains, seismic risk areas, landslide-prone sites, wildfire areas, and other places vulnerable to natural hazards off-limits through zoning and subdivision ordinances. Local governments can also install infrastructure such as roads, utility lines, water and sewage treatment facilities, and other public services to avoid hazardous areas. By making hazardous areas less attractive for development by withholding capital improvements, communities can discourage building on inappropriate sites.

The choices we make regarding where and how we build determine our level of vulnerability to many natural and man-made hazards. Mitigation should not be seen as an impediment to growth and development of a community. On the contrary, incorporating hazard mitigation into decisions related to a community's growth can result in a safer, more resilient community and one that is more attractive to new families and businesses.

1.5.5 Protecting the Environment

Damage to natural ecosystems and resources during and after a hurricane, earthquake, or other major hazard is inevitable. Given time, the natural environment will recuperate and adjust. However, communities, public agencies, and individuals can help reduce the vulnerability of natural ecosystems and resources by preventing releases of hazardous waste through proper handling, storage, and contingency planning. Sound planning and siting of development and infrastructure consistent with realistic disaster scenarios is also an important environmental protection. Preserving and restoring floodplains and wetlands allow these areas to serve as storm and erosion buffers and as temporary storage for floodwaters. Protection of beaches, dunes, floodplains and native vegetation, and appropriate construction regulations that take into consideration natural processes, may help to minimize damage to critical habitats and bolster protection of the built environment.[15]

1.5.6 Tying It All Together with Mitigation Planning

Hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage that can happen as a result of hazards. An **all-hazards approach** to mitigation planning involves consideration of all hazards with the potential for causing harm, including natural hazards (earthquakes, snowstorms, flooding, hurricanes and the like) as well as man-made hazards such as technological accidents and terrorism. The end product of the process is a hazard mitigation plan, a document that presents policies and strategies that will reduce vulnerability to hazards when those policies and strategies are put into

EXAMPLE

Eastern Band of Cherokee Indians Is First Native American Tribe in the Southeast to Plan to Reduce Damages from Future Disasters

The Eastern Band of Cherokee Indians (EBCI) in North Carolina was the first American Indian tribe in the eight southeastern states to receive approval of their hazard mitigation plan from FEMA. The EBCI reservation, incorporated under the laws of North Carolina in 1889, is located in the southern Appalachian Mountains of western North Carolina. The Multi-Hazard Mitigation Plan submitted by the Cherokee Tribal Council (the legislative branch of the EBCI) addresses ways to mitigate the ravages of natural and man-made disasters. The plan was developed to help the Cherokee Tribal Council make decisions on how best to minimize damage resulting from natural hazards, including floods, landslides and erosion, wildfires, high winds, earthquakes, droughts and extreme heat, severe winter weather, and selective man-made hazards on the EBCI Reservation.

The plan also calls for reducing the vulnerability of existing infrastructure, providing the basis for grant funding and loans to homeowners and small businesses for the purpose of implementing mitigation measures, capitalizing on federal funding that may become available before or after a disaster strikes, and ensuring the tribe maintains eligibility for the full range of future federal disaster relief. The EBCI also has an EOP that focuses primarily on response and recovery and heavily on assignment of responsibilities by emergency services personnel in the event of a disaster.[16]

action. These policies and action strategies should be based on a sound and thorough assessment of the hazards present in the community and an analysis of what is at risk from those hazards. The planning process helps pull together these important analyses and uses them as background support for changes that will contribute to the resiliency and overall sustainability of the community. See Chapter 13 for further discussion of the hazard mitigation planning process.

SELF-CHECK

- List six categories of mitigation strategies.
- Describe how risk assessment and mapping help inform the mitigation strategy process.
- Discuss the benefits of preparing a hazard mitigation plan.

1.6 The Value of Mitigation and Preparedness

Mitigation, also known as prevention, encourages long-term reduction of hazard vulnerability. The goal of mitigation is to save lives and reduce property damage. Mitigation can accomplish this through cost-effective and environmentally sound actions. This, in turn, can reduce the enormous cost of disasters to property owners, businesses, and all levels of government. In addition, mitigation can protect critical community facilities, reduce exposure to liability, and minimize community disruption. Preparedness saves lives and property and facilitates response operations through predisaster plans and training. Through mitigation and preparedness, individuals and communities can recover more rapidly from

Table 1-4: Benefits of Mitigation and Preparedness

Mitigation and Preparedness Benefit	*Details*
Reduces losses of life and property	Communities can save lives and reduce property damage from hazards through mitigation actions, such as moving families and their homes out of harm's way. Mitigation and preparedness also reduce the risk to emergency workers who must rescue people and pets during a disaster.
Reduces vulnerability to future hazards	By having mitigation and preparedness plans in place, a community is able to take steps to permanently reduce the risk of future losses.
Saves money	A community will experience cost savings by not having to provide emergency services, rescue operations, or recovery efforts. Communities also avoid costly repairs or replacement of buildings and infrastructure.
Speeds response and recovery	By considering mitigation and preparation in advance, a community can identify postdisaster opportunities before a disaster occurs. A strategy that is thought out prior to a disaster allows the community to react quickly when the time comes.
Demonstrates commitment to community health and safety	A mitigation and preparedness strategy demonstrates the community's commitment to safeguarding its citizens and protecting its economic, social, and environmental well-being.

disasters, lessening the financial burden of disasters on families, the Treasury, state, local, and tribal communities.[17]

1.6.1 Mitigation Contributes to Sustainable Communities

As mitigation serves to protect the environment and reduce disaster-related costs, it can contribute to the community's long-term sustainability, supporting economic vitality, environmental health, and quality of life for the community as a whole. Sustainability is attained when decisions made by the present generation do not reduce the options of future generations; **Sustainable development** is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."[18] Resilience to disasters is an essential characteristic of a sustainable community. [19]

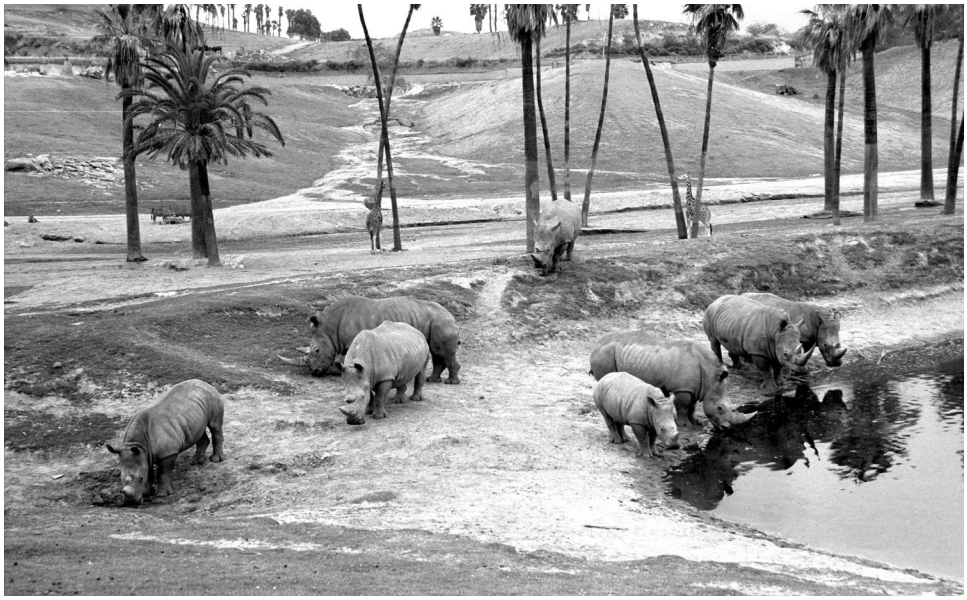
Sustainability is a concept that can help communities of all sizes and in all locations make decisions that will lead to a better quality of life for all of its members. The principles of sustainability also apply to communities that find they must recover and rebuild in the aftermath of a disaster. The goal of sustainable development and redevelopment is to create and maintain safe, lasting communities through the protection of life, property, the natural environment, and the economy. Resilience, created thorough hazard mitigation and preparedness activities, is a very important part of any effort to become more sustainable.

The guiding principles of sustainable development are intended to provide a sense of direction to decision makers for ensuring the quality of development and redevelopment without necessarily limiting the quantity of development. Sustainability recognizes that the economy and the environment are not in conflict, but are intricately intertwined. These principles are not an impediment to growth; instead, sustainable development fosters quality growth. See Chapter 14 for further discussion of the role of mitigation and preparedness in building community sustainability.

1.6.2 Mitigation Pays

A fundamental premise of mitigation is that 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. Mitigation, therefore, is a fiscally responsible activity for a community to pursue (see Figure 1-8). The benefits of mitigation and preparedness accrue equally to business, industry, and other members of the private sector. By reducing risk to hazard losses, companies can protect their employees, their income stream, and company assets, and they are better equipped to maintain fiscal solvency and economic viability even after a disaster. See Chapter*[c11]* 9 for a discussion of private sector mitigation and preparedness activities.

Figure 1-8



Heeding warnings of El Niño rains, the San Diego Zoo Wild Animal Park invested heavily in preventive measures to protect zoo assets and inhabitants, including silt damming, re-grassing, and drainage improvements.

1.6.3 Mitigation Calls for Environmental Integrity

Mitigation calls for conservation of natural and ecologically sensitive areas (such as floodplains, wetlands, and dunes), which allows the environment to absorb some of the impact of hazard events. This open space preservation technique also serves to protect the habitats of many species, enhances water quality, and provides recreational and aesthetic opportunities for the community. In this way, mitigation programs can contribute to a community's environmental integrity.

Preserving the natural function of the floodplain is a particularly effective way to mitigate flood risks and also enhance environmental quality. River floodplains are the flat lands along a river that are naturally subject to periodic inundation by the river. When floodplains accept water from a flooding river, they diminish the force of water flow on the river's main stem and prevent damage downstream. Water on floodplains has little or no flow, so it causes minimal damage to trees, which are adapted to survive occasional flooding, nor erodes soil unless it is carrying chunks of ice. Also, because the water in a floodplain is not moving, it will deposit much of its sediment between larger gravel and naturally smooth rocks or "cobble" on the riverbed instead of carrying it downstream. This is important for fish, which use the spaces between cobblestones to lay eggs, and to aquatic insects, which hide and forage in these spaces.

1.6.4 Window of Opportunity

Although any time is the right time to engage in mitigation activities, the aftermath of a disaster presents a unique window of opportunity for a community to figure out what went wrong and to develop and implement strategies to prevent the same kind of damage from occurring in the future.

During the recovery and reconstruction that take place following a disaster, streets, water systems, schools, and other public facilities can be constructed in safer locations away from hazardous areas in the community. If there are no safer alternatives for locating structures and facilities that were damaged or

EXAMPLE

Reduce, Reuse, Recycle After a Disaster

Following Hurricane Floyd, many residential structures in the Charlotte-Mecklenburg metropolitan area in North Carolina were severely flooded. The City-County participated in the Hazard Mitigation Grant Program (HMGP) buyout of many of the damaged homes. But the community went beyond mere acquisition and demolition to mitigate flood hazards and extended its program to include the use of two creative alternatives to immediate demolition: stripping of salvageable materials and public safety training. Partnering with Habitat for Humanity of Charlotte, the community identified opportunities to remove and reuse undamaged interior materials such as hardwood floors, ceiling fans, light fixtures, interior doors, kitchen appliances, counter tops, cabinets, sinks, door moldings, mantelpieces, basins, and vanities. Several homes also had furnaces and hot water heaters located in the attic, protecting them from past floodwaters. Volunteers from Habitat Charlotte carried out the work of removing the items and taking them off-site for storage and distribution through Habitat's ReStore.

By salvaging and recycling materials from acquisition/demolition projects, communities can reduce the amount of debris in their landfills, minimize demolition and landfill costs, and even offer opportunities for job training and welfare-to-work programs. Mecklenburg County Soil & Water Conservation District led an effort to rescue plants that would have otherwise been leveled during demolition. Ornamental plants like azalea bushes and flowers were saved and replanted at a local nature preserve, a senior citizens' center, and several nearby schools.

Before the demolition was carried out, Charlotte-Mecklenburg made many of the damaged structures available to local public safety personnel for training purposes. The abandoned homes were used by firefighters, law enforcement (including K-9 training for drug searches and S.W.A.T. team training), rescue workers, and other public safety officers.[20]

destroyed, then new homes, businesses, and other buildings can be built according to building techniques that make them stronger and more capable of withstanding hazard impacts. A resilient community builds back better, smarter, and stronger after a disaster, so that the next hazard might not result in another disaster.

In addition to incorporating principles of resilience into the rebuilding process, the postdisaster period of recovery is also a time of opportunity to rebuild in a more sustainable way. Communities may wish to encourage local residents and business owners to include "green" building techniques in terms of energy efficiency and alternative energy sources (for example, installing solar panels as damaged roofs are repaired) and to use recycled building materials. The community may also use this chance to provide affordable housing, create walkable neighborhoods, implement water use reduction measures, and protect the environment.

1.6.5 There's More to Be Done

Mitigation and preparedness help communities become more resilient to the impacts of hazards. Although mitigation and preparedness for man-made hazards are still evolving, we have a comprehensive set of tools for reducing the risk of loss from natural hazards. This does not mean that our job is done. Disaster costs continue to escalate, and we must increase our efforts to keep property out of vulnerable locations thorough implementation of long-lasting and forward-thinking mitigation strategies such as acquisition of at-risk structures, 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 during Hurricane Katrina 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 resiliency becomes reality.

SELF-CHECK

- Define **sustainable development.**
- Discuss the role of community growth in a resilient community's mitigation plan.
- List four benefits of preparedness and mitigation.

SUMMARY

Every community faces the potential for exposure to hazards, both natural and man-made. Only when people are injured 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. 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

All-hazards approach — Consideration of all the hazards with the potential for causing harm in a community, including natural hazards and man-made hazards, such as technological accidents and terrorism.

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

Disaster — The result when a natural hazard takes place where humans have situated themselves.

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 .

Dynamic equilibrium — The Earth's natural systems maintain a balanced state over long periods of time through a series of adjustments.

Hazard Mitigation Plan — A document that presents policies and strategies to reduce vulnerability to hazards when those policies and strategies are put into action. These policies and action strategies are based on a sound and thorough risk and vulnerability assessment.

Man-made hazards	Intentional or accidental occurrences caused by human activity; examples include oil spills and acts of terrorism such as bombings.
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.
Preparedness	A state of readiness to respond to any emergency or disaster.
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; (5) determine future development and population trends. A sixth step, (6) determine 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.

ASSESS YOUR UNDERSTANDING

Go to www.wiley.com/college/Schwab to evaluate your knowledge of how to define resilient communities.
Measure your learning by comparing pre-test and post-test results.

Summary Questions

1. Natural hazards are not the same as disasters. True or False?
2. Which of the following is an example of a natural hazard?
   (a) warehouse fire
   (b) sewage overflow
   (c) winter storm
   (d) soil spill
3. The frequency of hazards is increasing. True or False?
4. Disasters are a beneficial part of the balance of nature. True or False?
5. A disaster occurs only when human life and property suffer from damage. True or False?
6. Disasters occur most often in unpopulated areas. True or False?
7. Examples of technological hazards include
   (a) bridge collapse.
   (b) flood.
   (c) bombing.
   (d) tornado.
8. Costs associated with disasters include
   (a) infrastructure repair.
   (b) rise in domestic violence.
   (c) job loss.
   (d) all of the above.
9. Loss of power is a possible environmental cost associated with a flood. True or False?
10. A resilient community is a community that prevents hazards from happening. True or False?
11. Preparedness involves anticipating what might happen during different types of hazard events. True or False?
12. Which of the following is an example of preparedness measures?
    (a) rebuilding water-supply systems
    (b) conserving floodplains
    (c) training those involved in emergency situations
    (d) road repairs

13. The period following a disaster is a valuable time for implementing mitigation measures. True or False?
14. Mitigation is a way to save communities money. True or False?

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.
2. Hazards help maintain the Earth's dynamic equilibrium. Explain the role of a Nor'easter on the coast of Long Island.
3. Give three possible explanations for why it appears that natural hazards are becoming more frequent.
4. How does a natural hazard differ from a disaster?
5. Disasters are increasing in frequency. Explain why.
6. Man-made hazards are another consideration for community planning. Name two types of man-made hazards.
7. How are natural hazards and man-made hazards alike? How are they different?
8. We all pay for the cost of disasters. Explain three ways we do so.
9. Some costs associated with disasters are not financial. Discuss how this is possible.
10. What two stages of the emergency management cycle do resilient communities use to ensure that a disaster does not occur?
11. Citing examples, explain the difference between preparedness and mitigation.
12. A comprehensive emergency management system follows four phases. Name the stages.
13. Mitigation should be considered a wise investment for a community. Explain why.
14. How does mitigation affect a community's decision regarding growth?

Applying This Chapter

1. Natural hazards are uncontrollable events. List three examples of hazards particular to where you live.
2. Compare the disaster potential of Missoula, Montana, versus Miami, Florida.
3. Discuss the direct and indirect costs of an oil spill in a coastal Oregon tourist town.
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.

5. Which members of your community should be considered for extra protection during a disaster? How will you identify this vulnerable population?
6. Compare how a town in northern Minnesota would prepare for hazards versus a town in Arizona. Which measures are consistent?
7. 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?

YOU TRY IT

Find Your Local Hazard

What natural hazards take place in your community on a regular basis? Are there hazards that haven't happened in a long time, yet residents can still remember "the big one" that occurred years ago? You can visit the NWS website to find warnings, watches, and advisories for all sorts of natural hazards for all states and territories in the United States. The website is updated about every two minutes around the clock. Go to www.weather.gov to find what the forecast is for your state.

Disasters at Home

Think about your own community or neighborhood. If a major disaster occurred where you live, what buildings and facilities could be damaged or destroyed? Who are the major employers in your city or town? What would happen if these industries and companies suddenly shut down? Could people you know find jobs nearby, or would they be forced to transfer to other areas?

Tracking a Hurricane

As an official with your local government, you have a responsibility to ensure the safety of those who live in your town. You haven't experienced a serious hurricane in decades, but one changed its track last year and narrowly missed affecting your area. Assume that hurricane season is approaching, and outline a public announcement that will update residents about what your town has done to prepare for this year's season. The federal (NOAA) hurricane tracking website (www.nhc.noaa.gov) is an excellent resource.

Judging Resiliency

Assume you are an emergency manager in a flood-prone community. What factors will you look at to determine how resilient your community is to this hazard? How can you determine whether your community will experience a natural hazard event, so that damage is minimal and people are safe, or whether your community will suffer a disaster?