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SECTION 9. FIRE

9.1 GENERAL BACKGROUND

This portion of the Commonwealth's plan assesses two types of fire events: urban fires and wildfires (both intermix and interface).

An overview for both types of fire events, urban fire and wildfire is presented in Table 9-1, which summarizes the Massachusetts fire experience from 2005 through 2011. The table summarizes individual fire reports submitted by numerous Massachusetts fire departments and fire districts and published in Massachusetts Division of Fire Safety Annual Reports. Information contained in Table 9-1 includes fire data categorized by type (structure, motor vehicle, and other) and highlights the total number of fires; deaths, injuries, and property damage caused by fires; and the number of arsons reported each year. It is apparent from the table below that statistics based on each category vary from year to year.

9.1.1 Urban Fire

A major urban fire or conflagration is a large destructive, often uncontrollable, fire that spreads substantial destruction. Although fires can start from numerous causes, major fires are often the result of other hazards, such as storms, earthquakes, gas leaks, transportation accidents, hazardous material spills, criminal activity (arson), or terrorism. Small structural fires, which occur more frequently, can result from mundane events such as cooking, smoking, equipment/appliance malfunctions, etc.

Nationally, the leading causes of urban fires are arson, open flames, and cooking. The leading causes of fire deaths are smoking, arson, and heating, with urban fires causing the most fire deaths and injuries. Between 70 and 80 percent of deaths result from residential fires. People under the age of 5 and over the age of 55 have a much higher death rate than the average population, accounting for more than one-third of all deaths nationally.

Over the past several years, structure fires account for the majority of fire deaths, injuries, and property loss within the Commonwealth. In Massachusetts, 83 percent of building fires and 69 percent of fire deaths in 2010 took place in residential occupancies, with more fire deaths occurring in one-and two-family homes than in all other residential occupancies combined. Cooking and heating were the leading cause of fires in one-and two-family homes. Cooking was the leading cause of fires overall in every residential occupancy. Though frequent, cooking fires are not among the most deadly; in 2010, the improper or unsafe disposal of smoking materials was the leading cause (40 percent) of residential fire deaths. In 2011, electrical fires were the leading cause of residential fire deaths. This was the first time since the Massachusetts Division of Fire Safety started keeping records that smoking was not the leading cause of home fire deaths.

9.1.2 Wildfire

A wildfire can be defined as any non-structure fire that occurs in the vegetative wildland, including grass, shrub, leaf litter, and forested tree fuels. In general, wildfires in Massachusetts occurrence can be caused by natural events, human activity or in an intentional controlled manner, as in the case of prescribed fire. Wildfires often begin unnoticed, but spread quickly, igniting brush, trees, and homes.

TABLE 9-1.
MASSACHUSETTS FIRE DATA AND STATISTICS (2005-2011)

Types of Fires	Total Number of Fires	% (+/-) from Previous Year	Deaths (C/FS)[a]	Injuries (C/FS)[a]	Property Damage	Arsons[b]
2011						
Year Overview	29,110	Down 11%	54 C / 2 FS	323 C / 422 FS	$217 M	979
Structure	18,178	Down 3%	42 C / 2 FS	248 C / 390 FS	$195 M	223
Motor Vehicle	2,997	Up 1%	10 C	24 C / 15 FS	$16.3 M	125
Other[c]	7,935	Down 29%	2 C	51 C / 17 FS	$5.6 M	631
2010						
Year Overview	32,680	Up 14%	36 C / 2 FS	366 C / 531 FS	$196 M	1,169
Structure	18,560	Up 4%	28 C / 2 FS	309 C / 491 FS	$177 M	268
Motor Vehicle	2,967	Down 4%	5 C	27 C / 13 FS	$15.5 M	115
Other[c]	11,153	Up 43%	3 C	30 C / 27 FS	$4 M	786
2009						
Year Overview	28,595	Down 5%	36 C	332 C / 460 FS	$183 M	1,184
Structure	17,773	Up 3%	30 C	290 C / 423 FS	$167 M	291
Motor Vehicle	3,069	Down 1%	5 C	14 C / 17 FS	$13.2 M	188
Other[c]	7,753	Down 22%	1 C	28 C / 20 FS	$3 M	705
2008						
Year Overview	30,136	Down 11%	49 C / 1 FS	337 C / 622 FS	$254 M	1,182
Structure	17,198	Up 2%	44 C	273 C / 582 FS	$235 M	280
Motor Vehicle	3,076	Down 8%	5 C / 1 FS	23 C / 16 FS	$14.8 M	150
Other[c]	9,862	Down 28%	None	41 C / 24 FS	$4.6 M	752
2007						
Year Overview	33,522	Up 11%	61 C / 3 FS	394 C / 675 FS	$287 M	1,212
Structure	16,722	Up 7%	47 C / 3 FS	332 C / 564 FS	$268 M	343
Motor Vehicle	3,317	Up 1%	10 C	20 C / 21 FS	$14.7 M	130
Other[c]	13,483	Up 18%	4 C	42 C / 90 FS	$4.1 M	739
2006						
Year Overview	30,198	Up 3%	44 C	386 C / 541 FS	$184 M	1,265
Structure	15,507	Up 4%	34 C	344 C / 488 FS	$165 M	325
Motor Vehicle	3,258	Down 12%	6 C	12 C / 21 FS	$16 M	159
Other[c]	11,433	Up 7%	4 C	30 C / 32 FS	$2.6 M	781
2005						
Year Overview	28,793	Down 3%	52 C	359 C / 523 FS	$222 M	1,219
Structure	14,662	Up 3%	41 C	301 C / 469 FS	$202 M	338
Motor Vehicle	3,666	Down 4%	7 C	27 C / 23 FS	$14.8 M	176
Other[c]	10,465	Up 13%	4 C	31 C / 31 FS	$5 M	705

Sources: Massachusetts Executive Office of Public Safety and Security: Division of Fire Safety, 2012

a. C = Civilian; FS = Fire Services; M = Million

b. For statistical purposes, a fire is considered arson when the cause is listed as intentional and age is not a factor or the person involved was over 18. This definition excludes many "suspicious" and juvenile-set fires.

c. Other includes brush, trash and other outside fires.

There are three classes of wildfires:

- A surface fire is the most common type, burning along the forest floor, moving slowly and killing or damaging trees
- A ground fire, usually induced by drought conditions, burns organic ground fuels below the forest floor;
- Crown fires spread rapidly by the wind, moving quickly by jumping along the treetops.

Because 95 percent of wildfires are started by negligent human behavior, such as smoking in forested areas or improperly extinguishing campfires, most are preventable; in 2011, 631 or approximately 8 percent of the outside and other fires were considered intentionally set. Wildfires often result in the destruction of forests, brush, field crops, grasslands, and personal property. Wildfires may cause secondary impacts on other hazards, such as flooding, the removal of vegetation, and the destruction of watersheds.

The wildfire season in Massachusetts usually begins in late March and typically culminates in early June, corresponding with the driest live fuel moisture periods of the year. April is historically the month in which wildfire danger is the highest. However, wildfires can occur every month of the year. Drought, snow pack, and local weather conditions can expand the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires.

9.1.3 Fire Ecology and Wildfire Behavior

The "wildfire behavior triangle" (see Figure 9-1) illustrates how three primary factors influence wildfire behavior: fuel, topography, and weather. Each point of the triangle represents one of the three factors; the sides represent the interplay between the factors. For example, drier and warmer weather with low relative humidity, combined with dense fuel loads and steeper slopes, can result in dangerous to extreme fire behavior.

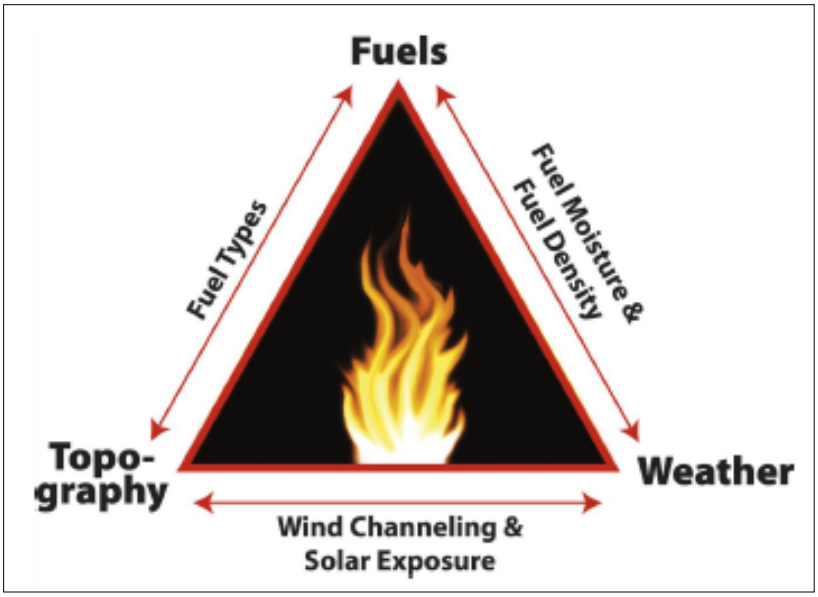

Figure 9-1. The Fire Triangle

A fire needs all three elements in the right combination to start and grow—a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain; included in this section as a potential source of influence is climate change.

- Fuel:

  - Lighter fuels such as grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs, and trunks take longer to warm and ignite.
  - Snags and hazard trees—especially those that are diseased, dying, or become receptive to ignition when influenced by environmental factors, such as drought, low humidity, and warm temperatures.
- Weather:
  - Strong winds can exacerbate extreme fire conditions, especially wind events that persist for long periods, or ones with significant sustained wind speeds that quickly promote fire spread through the movement of embers or exposure within tree crowns.
  - Spring and summer drying months, many of which maintain drought-like conditions extending beyond normal season also can increase the normal fire season. Likewise, the passage of a dry, cold front through the region can result in sudden wind speed increases and change in wind direction affecting fire spread.
  - Thunderstorms in Massachusetts are usually accompanied by rainfall; however, during periods of drought, lightning from thunderstorm cells can result in fire ignition. Thunderstorms with little or no rainfall are rare in New England but have occurred.
- Terrain
  - Topography of a region or a local area influences the amount and moisture of fuel.
  - Barriers such as highways and lakes can affect spread of fire.
  - Elevation and slope of landforms—fire spreads more easily uphill compared to downhill.
- Climate Change
  - Without an increase in summer precipitation (greater than any predicted by climate models), future areas burned is very likely to increase.
  - Infestation from insects is also a concern as it may affect forest health. Potential insect populations may increase with warmer temperatures. In addition, infested trees may increase fuel amount.
  - Tree species composition will change as species respond uniquely to a changing climate.
  - Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure.

The wildland-urban interface is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Urban and suburban development in or near wildland vegetation poses a major threat to habitat loss, wildlife populations, and wildfire damage. There are a number of reasons that the wildland-urban interface has an increased risk to wildfire damage. The wildland-urban interface is an area where protection of structures from wildfires is difficult, due to access and fire suppression issues. The wildland-urban interface is also at risk for wildfires due to human-caused fire ignitions, which are very common. In these areas, homes are built among densely wooded areas, so humans are more likely to start a fire that will easily spread to the surrounding forested areas with plentiful vegetative fuels.

Fire is also being used more extensively as a land management tool to replicate natural fire cycles. This practice has been used for both fire dependent ecosystem restoration and hazard fuels mitigation

objectives on federal, state, municipal, and private lands in Massachusetts since the 1980s. Controlled burning as an agricultural tool dates to pre-European settlement. Between 2009 and 2012, over 1,300 acres of state and private partnership lands were treated with prescribed fire in the southeastern Massachusetts pitch pine and scrub oak fuel type in an effort to mitigate high hazard fuel loading in and around wildland-urban interface zones. There may be secondary negative impacts from the wildfire related to air quality, soil erosion resulting in siltation of streams and lakes, or mudslides. However, unless these fires occur in developed areas, they are rarely classified as disasters because they do not affect people or the developed environment. Wildfires, regardless of size, that burn primarily on federally managed lands are only rarely classified as disasters.

In Massachusetts, the DCR Bureau of Forest Fire Control is the state agency responsible for providing aid, assistance, and advice to the Commonwealth's cities and towns with the protection of 3.5 million acres of state, public and private wooded land since 1911. The Bureau is an active participant with all municipal fire departments in protecting forestlands through assistance and cooperation with fire departments, local law enforcement agencies, the Commonwealth's county and statewide civil defense agencies, and mutual aid assistance organizations.

Early detection of wildfires is a key part of the Bureau's overall effort. Early detection is achieved by trained Bureau observers who staff the statewide network of 42 operating fire towers. During periods of high fire danger, the Bureau conducts county-based fire patrols in forested areas. These patrols assist cities and towns in prevention efforts and allow for the quick deployment of mobile equipment for suppression of fires during their initial stage. Figure 9-2 displays the Bureau's 14 fire control districts and fire towers in Massachusetts.

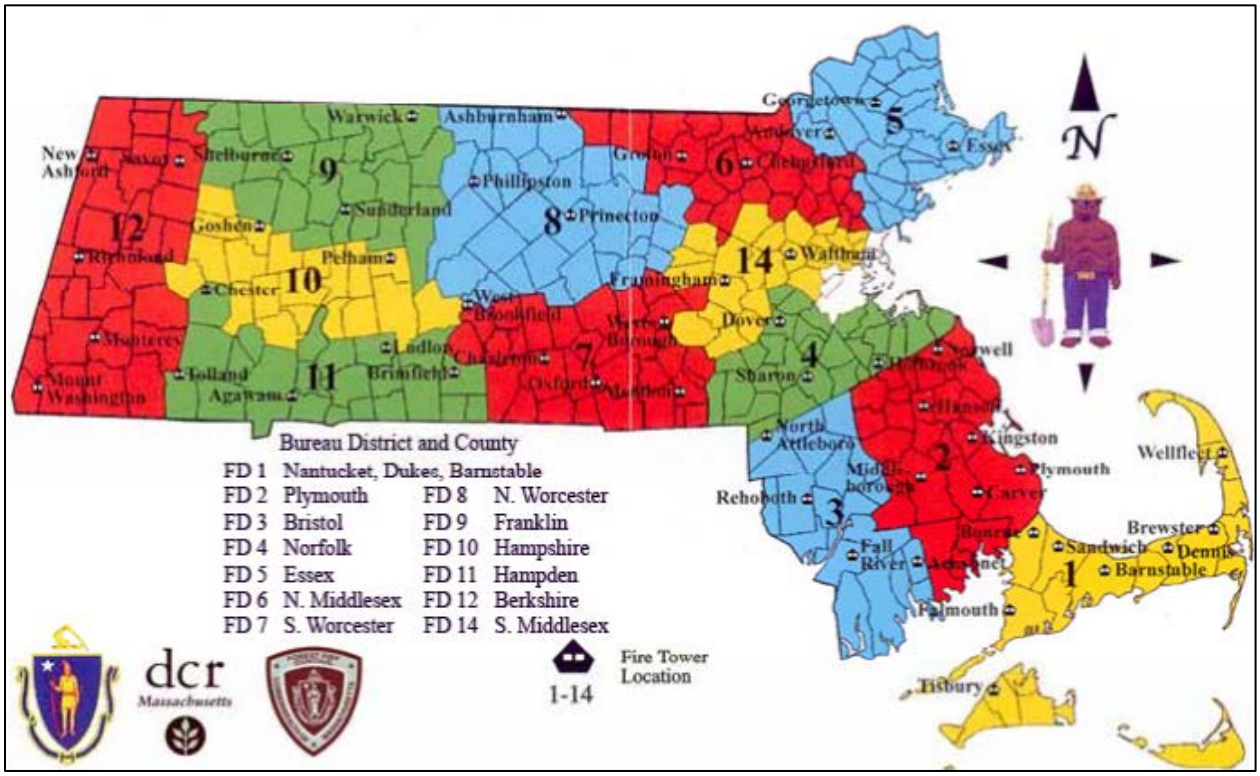

Figure 9-2. Massachusetts Bureau of Forest Fire Control Districts and Tower Network

Bureau units are used at all fires that occur on state-owned forestland and are available to municipal fire departments for mutual assistance. Bureau fire fighters are trained in the use of forestry tools, water pumps, brush breakers, and other motorized equipment, as well as fire behavior and fire safety. Massachusetts also benefits from mutual aid agreements with other state and federal agencies. The

Bureau is a member of the Northeastern Forest Fire Protection Commission, a commission organized in 1949 between the New England states, New York, and four eastern Canadian Provinces to provide resources and assistance in the event of large wildfire activity. Massachusetts DCR also has a long-standing cooperative agreement with the USDA Forest Service for both providing qualified wildfire-fighters for assistance throughout the United States or receiving federal assistance within the Commonwealth.

Based on Bureau records, in 1911, more than 34 acres were burned on average during each wildfire. Since then, that figure has been reduced to 1.17 acres.

Massachusetts had approximately 1,121 wildfires on 1,143 acres in 2009 according to the DCR Bureau of Forest Fire Prevention. When comparing the 2007 season to 2009, there were 1,551 fewer wildfire incidents with 1,762 fewer acres burned. In the last five years, wildfires reported to DCR are trending generally downward.

The fire problem varies from region to region throughout the U.S. This often is a result of climate, poverty, education, demographics, and other causal factors. The national fire death rate in 2009 was 11.0 deaths per million population. In 2009, the fire death rate in Massachusetts was 5.3, which is one of the lowest rates in the U.S.

9.2 HAZARD PROFILE

9.2.1 Location

Urban Fire

The U.S. Fire Administration conducted a study on urban fires that occurred in metropolitan areas. In Massachusetts, the metropolitan area study was the Boston-Worcester-Lawrence Metropolitan Area. The study found that the leading cause of residential structure fires were cooking, heating, and electrical distribution. In non-residential structure fires, the lead causes were incendiary or suspicious origins, cooking, and electrical distribution. The leading causes of home fires that resulted in one or more fatalities were careless smoking, incendiary or suspicious origins, and cooking. The common causes of fires in which one or more injuries were sustained, were cooking, careless smoking, and electrical distribution.

The risk of urban fires exists in all developed areas of Massachusetts. Areas where there are larger concentrations of wood frame construction homes or businesses are more likely to experience large destructive fires. In addition, many former mill communities exist in Massachusetts, which have abandoned or vacant mills and warehouses. These structures are very susceptible to vandalism or accidental fires. Due to environmental impacts such as drought conditions, high winds, or inadequate on-site fire suppression equipment, as in vacant buildings, a fire in a densely developed area can quickly become a major hazard.

Wildfire

The ecosystems that are most susceptible to the hazard are pitch pine, scrub oak, and oak forests. These are the most flammable vegetative fuels. According to a U.S. Forest Service study, Barnstable and Plymouth Counties are more fire prone than southern California due to their sandy soil, drying winds, and fuel types (DCR, 2013, http://www.mass.gov/dc r/stewardship/firecont/facts.htm).

The southeastern part of Massachusetts—Plymouth County to the southern coast of Bristol County, Cape Cod, and Martha's Vineyard—is more susceptible to wildfires due to the availability of fuel, impact from off shore winds, and increasing development within the wildland areas. There are other wildland-urban interface areas scattered in the central and western portions of the Commonwealth; however, the risk is noted to be slightly lesser than the southeast. Figure 9-3 displays the wildland-urban interface throughout Massachusetts by U.S. Census block.

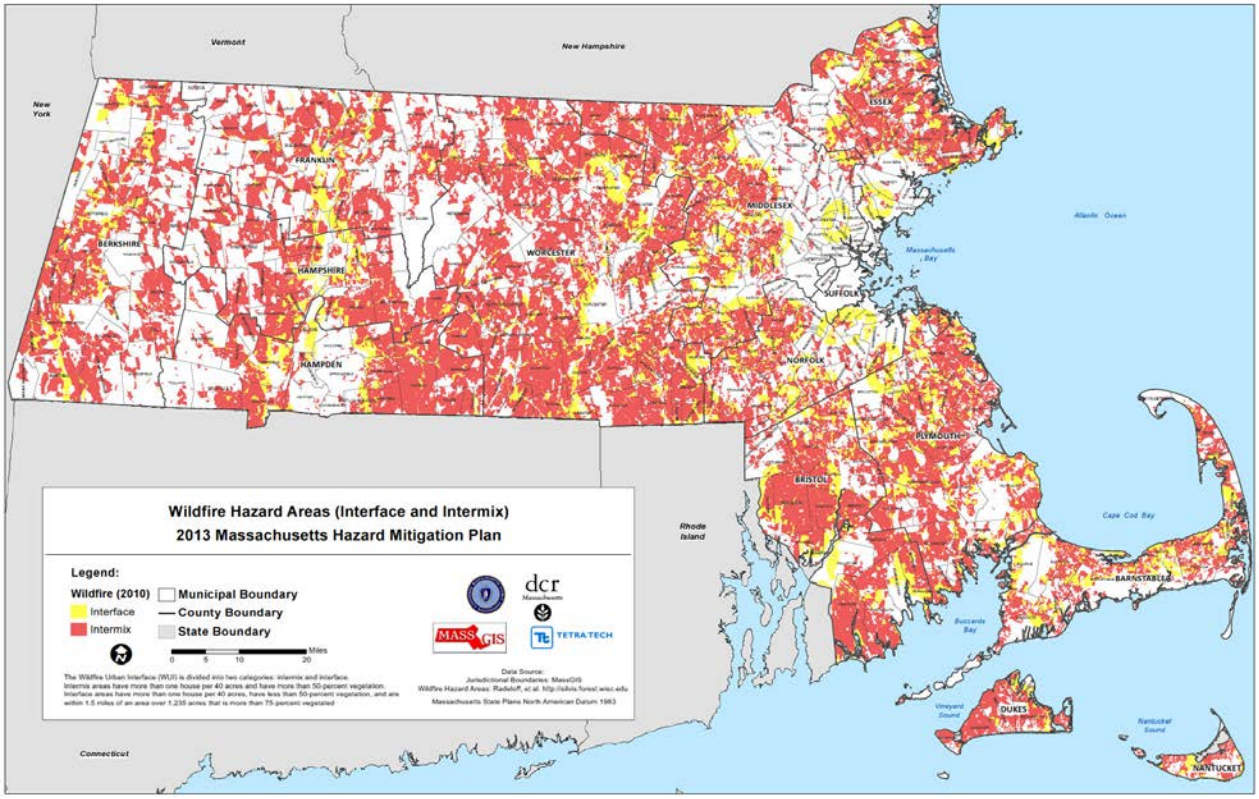

Figure 9-3. Wildland-Urban Interface and Intermix for the Commonwealth of Massachusetts

9.2.2 Previous Occurrences

Urban Fire

The following is a list of notable urban fires in Massachusetts, based on information available as of the drafting of this plan:

- Fall River, 1834
- Great Boston Fire, 1872
- Great Lynn Fire, 1889
- Chelsea Fire, 1903
- Great Salem Fire, 1914
- Hull Conflagration, 1923
- Strand Theater, Brockton, 1941
- Coconut Grove nightclub, Boston, 1942
- Hotel Vendome Fire, Boston, 1972
- Chelsea Fire, October 1973—Resulted in a FEMA disaster declaration (FEMA DR-405)
- Lynn, December 3, 1981—Resulted in a FEMA disaster declaration (FEMA DR-650)
- Worcester Fire, December 1999—Resulted in a FEMA emergency declaration (FEMA EM-3153); total public assistance grants issued by FEMA was $3,101,637.94

- Bernat Mills, Uxbridge, 2007
- Lawrence, February 14, 2008—A fire at a three-unit apartment building killed one person. Damage was estimated at $350,000.
- Northborough, March 25, 2008—A fire at a strip mall was caused by a Molotov cocktail and destroyed five businesses. Damage was estimated at $2.5 million.
- West Springfield, March 27, 2008—A fire at a motor vehicle repair shop was caused by a gas tank, injuring two people. Damage was estimated at $2 million.
- Brockton, April 8, 2008—An electrical fire at a business office injured seven firefighters. Damage was estimated at $1.8 million.
- Framingham, April 11, 2008—A fire at a 72-unit apartment building was caused when the lining of a plumbing chase was set fire. Two civilians and 13 firefighters were injured. Damage was estimated at $3 million.
- Peabody, May 29, 2008—A fire at a 38-unit apartment building was started by a bark mulch fire in the courtyard. Damage was estimated at $6.8 million.
- Lincoln, September 17, 2008—A two-family home was caused by a mechanical failure and damage was estimated at $2.85 million.
- Avon, October 13, 2008—A fire at a refrigerated storage facility had damage estimated at $7.25 million.
- Cambridge, November 25, 2008—A five-alarm fire at a six-unit apartment building killed one person and injured four people. Damage was estimated at $2.26 million.
- Braintree, January 12, 2009—An explosion and a fire at a foundry was reported and damage was estimated at $1 million.
- Worcester, March 5, 2009—A fire at a 10-unit apartment building injured six firefighters and spread to a church next door. The damage at the apartment building was estimated at $1.5 million and the church had damage estimated at $120,000.
- Quincy, March 25, 2009—An electrical fire at a six-unit apartment building killed three people and injured two. Damage was estimated at $200,000.
- Northampton, April 13, 2009—A fire at an eight-unit apartment building injured one civilian and two firefighters. Damage was estimated at $3.75 million.
- Middleborough, May 25, 2009—An electrical fire at a church injured three firefighters and caused an estimated $1.1 million in damage.
- Everett, July 2, 2009—A fire was reported at a steel recycling plant when lightning struck a conveyor belt. Damage was estimated at $4.4 million.
- Greenfield, November 8, 2009—A 16-unit apartment building caught fire, injuring one firefighter. Damage was estimated at $625,000.
- Weston, December 23, 2009—A fire was reported at the Gifford School, started when someone turned on a burner on a stove in a kitchen. Damage was estimated at $3 million.
- Quincy, December 26, 2009—A fire at a 150-unit apartment building killed one person and injured three firefighters. Damage was estimated at $200,000.
- Hadley, February 4, 2010—An electrical fire at a livestock production facility injured one firefighter. It spread to two other buildings and caused approximately $860,000 in damage.

- Lynn, February 13, 2010—A fire in a 99-unit apartment building killed one person. The fire was caused by someone smoking using oxygen.
- Fall River, April 16, 2010—A fire in a three-unit apartment building was caused by cooking liquids becoming ignited on a stovetop. One fatality and one injury were reported. Damage was estimated at $280,100.
- New Bedford, June 6, 2010—A fire at a fisheries facility caused an estimated $1.3 million in damage.
- Peabody, June 20, 2010—A fire at the J.D. Raymond Company mulch yard began in one of the large piles of mulch and spread to equipment that was used to handle the mulch. One firefighter was injured. Damage was estimated at $1.2 million.
- Lenox, December 22, 2010—A fire at a historic inn had damage estimated at $2.25 million.
- Saugus, January 16, 2011—An electrical fire in a four-unit apartment building killed one person and injured two firefighters. Damage was estimated at $105,000.
- Fall River, February 22, 2011—A fire at a six-unit apartment building killed one person and injured one person. Damage was estimated at $320,000.
- Ipswich, February 25, 2011—A fire in an apartment building killed one person and damage was estimated at $250,000.
- Middletown, March 13, 2011—An explosion and fire occurred at the Bostik adhesives manufacturing plant. Flammable gases from the chemicals used were ignited by a piece of equipment. Four injuries resulted from this event. Damage was estimated at $12 million.
- West Springfield, March 23, 2011—An explosion and fire at an auto dealership, killing one person and injuring one person. An employee looked inside a 55-gallon drum with a cigarette lighter and the flame from the lighter ignited the fumes and caused the explosion. Damage was estimated at $150,000.
- Easton, March 25, 2011—A fire at a warehouse injured three firefighters and damage was estimated at $5.9 million.
- West Springfield, April 30, 2011—A 24-unit apartment building caught fire, killing one person and injuring one person. Damage was estimated at $1 million.
- Waltham, April 30, 2011—A fire at a 24-unit apartment building injured three firefighters and damage was estimated at $1.62 million.
- Pittsfield, May 4, 2011—An electrical fire at a 22-unit apartment building. No injuries or deaths were reported. Damage was estimated at $1.4 million.
- Medford, May 13, 2011—A fire in a 175-unit apartment building killed one person and injured one firefighter. Damage was estimated at $200,000.
- Fitchburg, June 13, 2011—A 52-unit apartment building fire injured three firefighters and damage was estimated at $2.3 million.
- Quincy, July 9, 2011—A three-alarm fire was reported at a 24-unit apartment building, injuring one firefighter. Damage was estimated at $8.4 million.
- Saugus, July 23, 2011—A gasoline tanker crash caused a fire along Route 1, causing 14 exposure fires, nine motor vehicle fires, four building fires, and one brush fire. One person was killed and one person was injured. Damage was estimated at $2.94 million.

- Lawrence, October 7, 2011—An arson fire at a 90-unit apartment building killed one person and damage was estimated at $85,000.
- Hyannis, October 31, 2011—A fire at a 110-unit apartment building killed one person and injured five. Damage was estimated at $800,000.
- Worcester, December 8, 2011—A three-floor apartment building fire killing one firefighter and damage was estimated at $250,000.
- Peabody, December 23, 2011—An electrical fire at an eight-unit apartment building, killing one firefighter. Damage was estimated at $240,000.

Wildfire

Figure 9-4 shows the location of historical wildfires in the Commonwealth from 2001 to 2009, as well as the number of acres burned. The most recent large-scale wildfire occurred in the Town of Russell in Hampden County in September 1995. This wildfire, which initiated the federal Fire Suppression Agreement under a presidential declared disaster (FEMA FSA-2116), was finally controlled after two weeks. The fire's location on extremely steep terrain made access particularly difficult. The fire burned several days because of ready fuel and prolonged regional drought conditions. More than 500 acres were burned and several dwellings and farms were threatened in the Town of Russell.

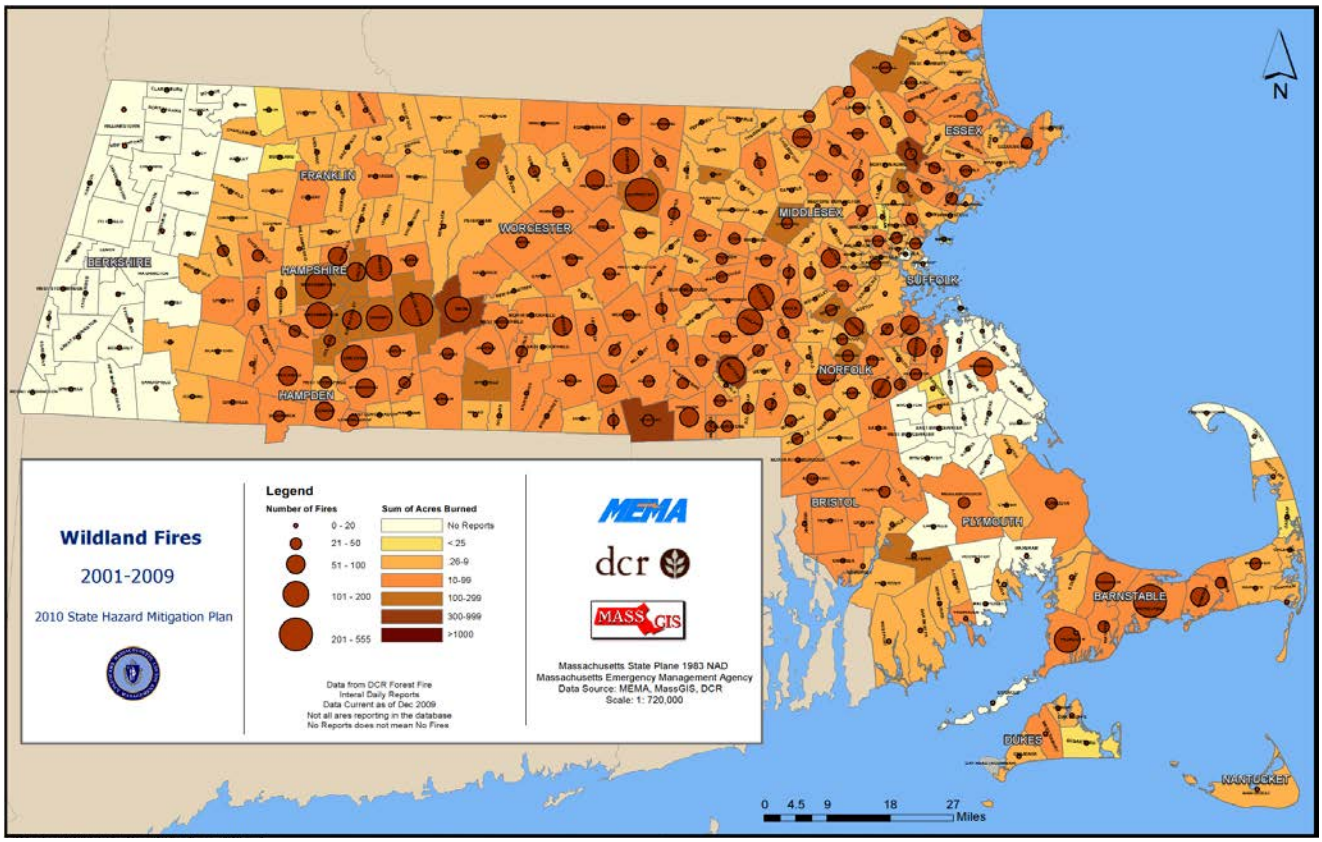

Figure 9-4. Locations of Historical Wildfires and Number of Acres Burned in the Commonwealth of Massachusetts (2001 to 2009)(data from 2001 to 2009 was not available to update this map)

One of the largest wildfires on record was in Plymouth in May 1957. This catastrophic fire burned 15,000 acres and destroyed about 40 structures. Another large fire in the same area in 1964 burned 5,500 acres and destroyed cottages on Charge Pond. The following is a list of wildfire occurrence history in Massachusetts through 2010:

- 1887: Bourne, 25,000 acres
- 1923: Bourne, 25,000 acres, 7 days
- 1927: Townsend State Forest into NH, 16,000 acres.
- 1927: Erving to Wendell, 7,000 acres
- 1927: Montague Plains Fire Destroys Village of Lake Pleasant
- 1937: Bourne, 300 acres, 2 firefighters killed
- 1937: Hyannis, 2000 acres
- 1941: Marshfield, 550 buildings destroyed
- 1957: Plymouth, 15,000 acres, 3000 fought fire, which had a 35 mile perimeter
- 1963: Plymouth, 530 acres
- 1964: Plymouth, 5500 acres, destroyed 26 buildings
- 1965: Sandwich, 5,000 acres
- 1966: Plymouth/Wareham 535 acres
- 1995: Russell, 500 acres, Mt. Tekoa
- 2000: South Hadley, 310 acres, 14 days, Lithia Springs Watershed
- 2000: Erving, 140 acres, 7 days, Hermit Mountain
- 2001: Ware, 400 acres
- 2010: Russell, 320 acres, Mt. Tekoa

According to the Geospatial Multi-Agency Coordinator Group, an internet-based mapping application, there were six wildfires in Massachusetts between 2002 and 2012:

- August 14, 2002, Devens Fire—wildfire located at the Devens Reserve Forces Training Area in Lancaster, MA
- November 16, 2003, 128 Fire—wildfire along Route 128 in Dedham, MA
- April 29, 2004, Bearsden Fire—120 acres burned near Athol Center, MA
- April 16-22, 2005, The Range Fire—wildfire near Leominster, MA
- April 19-26, 2008, Oscar Orange Fire—wildfire near Leominster, MA
- April 19-23, 2008, Widow White Peak Fire—wildfire near Lanesboro, MA
- April 11-15, 2010, Tekoa Mountain Fire—wildfire near Westfield, MA

The NOAA NCDC database lists the following wildfire events in the Commonwealth:

- July 5-7, 2002, Berkshire County—Smoke from wildfires across the Nemiscau region of northern Quebec became trapped under a subsidence inversion and was transported south across western Massachusetts. The fires were started by hot and dry weather conditions over that region of Canada, followed by an unusual amount of thunderstorm activity. The smoke obscured the sky and reduced surface visibility to as low as one mile. Advisories were issued in the Commonwealth, warning people with respiratory issues to remain indoors and all individuals to limit their outside activities.

- April 4-5, 2012, Eastern Hampden County—Dry conditions, combined with wind gusts between 25 and 30 mph, produced ideal conditions for fire spread. A brush fire in Brimfield moved into an area of blown down debris from tornado and became difficult to control. Due to a thunderstorm, firefighters had to stop until the storm passed. This brush fire burned approximately 50 acres. No structures were destroyed; however, many homes were threatened.
- April 19, 2012, Northern Worcester County—Dry conditions, along with gusty winds, caused a fire in the meadowlands to spread in Dedham. The fire burned approximately one acre just off Route 56 on the Leicester-Paxton line. One firefighter was injured.
- April 19-20, 2012, Western Norfolk County—Dry conditions, along with gusty winds, cause a fire to spread near Route 128 on the Dedham-Boston line. Almost 100 acres of meadowlands burned.

9.2.3 Probability of Future Occurrences

For the purpose of this plan, the probability of future occurrences is defined by the number of events over a specified period. The historical record indicates the Commonwealth has experienced four federally declared urban and wildfire events from 1954 to 2012. This figure greatly underestimates how often fires occur and affect the Commonwealth.

9.2.4 Frequency

It is difficult to predict the likelihood of urban fires and wildfires in a probabilistic manner, such as, “there will be a catastrophic wildfire once every X number of years.” This is because a number of variable factors affect the potential for a fire to occur and because some conditions (for example, ongoing land use development patterns, location, fuel sources, construction, etc.) exert increasing pressure on the wildland-urban interface zone. Based on available data, urban fires and wildfires will continue to present a risk.

Given the numerous factors that can impact urban fire and wildfire potential, the likelihood of a fire event starting and sustaining itself should be gauged by professional fire managers on a daily basis using the methods and tools described above.

9.2.5 Severity

The greatest potential for significant damage to life and property from fire exists in areas designated as wildland-urban interface areas. A wildland-urban interface area defines the conditions where highly flammable vegetation is adjacent to developed areas.

Urban Fires

Differences in climate and building stock could play a factor in urban fires. It is likely that home fires related to heating occur more frequently in the northern areas of the U.S. In addition, heating equipment fires are usually one of the leading causes for fires in one-and two-family homes and not in other residential occupancies. This is because other residential occupancies tend to be more regulated by building and fired codes. Electrical distribution fires are likely to be more common in the northeast and south, where the building stocks are older, on average, than in the Midwest and west.

Wildfire

Potential losses from wildfire include human life, structures and other improvements, and natural resources. Given the immediate response times to reported wildfires, the likelihood of injuries and casualties is minimal. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

In addition, wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding due to the impacts of silt in local watersheds.

9.2.6 Warning Time

Urban Fire

Early warning for urban fires is none or minimal at best. Smoke detectors provide early warning of a fire; however, they do not guarantee an escape. Residential sprinklers provide the best opportunity to escape safely from a fire. Federal studies have shown in a typical fire, one has only about 3 minutes to evacuate safely before unsustainable conditions are encountered. Warning signs for electrical problems include the following. Any of these signs may indicate a potential problem.

- Fuses blowing or circuit breakers tripping frequently
- Unusually warm or faulty outlets or switches
- A vague smell of something burning
- A sizzling sound in the wall

Wildfire

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out. Since fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

If a fire breaks out and spreads rapidly, residents may need to evacuate within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

9.3 SECONDARY HAZARDS

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildfires cause the contamination of reservoirs, destroy transmission lines, and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

9.4 CLIMATE CHANGE IMPACTS

Fire is determined by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Historically, drought patterns in the U.S. are related to macro-scale climate patterns in the Pacific and Atlantic oceans. The El Niño–Southern Oscillation in the Pacific varies on a 5- to 7-year cycle, the Pacific Decadal Oscillation varies on a 20- to 30-year cycle, and the Atlantic Multidecadal Oscillation varies on a

65- to 80-year cycle. As these large-scale ocean climate patterns vary in relation to each other, drought conditions in the U.S. shift from region to region.

Climate scenarios project summer temperature increases between 2ºC and 5ºC and precipitation decreases of up to 15 percent. Such conditions would exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases. Forest response to increased atmospheric carbon dioxide—the so-called "fertilization effect"—could also contribute to more tree growth and thus more fuel for fires, but the effects of carbon dioxide on mature forests are still largely unknown.

9.5 EXPOSURE

To understand risk, the assets exposed to the hazard areas are identified. For the wildfire hazard, areas identified as hazard areas include the wildland-urban interface and intermix. The following discusses the Commonwealth of Massachusetts exposure to the wildfire hazard including:

- Population
- State facilities
- Critical facilities and infrastructure
- Economy

The Northeast Wildfire Risk Assessment Geospatial Work Group completed a geospatial analysis of fire risk in the 20-state U.S. Forest Service Northeastern Area. The assessment is comprised of three components: fuels, wildland-urban interface, and topography (slope and aspect) that are combined using a weighted overlay. These three characteristics are combined to identify wildfire-prone areas where hazard mitigation practices would be most effective. Figure 9-5 illustrates these areas as determined for the Commonwealth. This spatial dataset was not made available in time for inclusion in the 2013 plan. However, it is noted as data to be used to enhance the exposure and vulnerability assessment for further plan updates.

Source: Northeast Wildfire Risk Assessment Geospatial Work Group, 2009

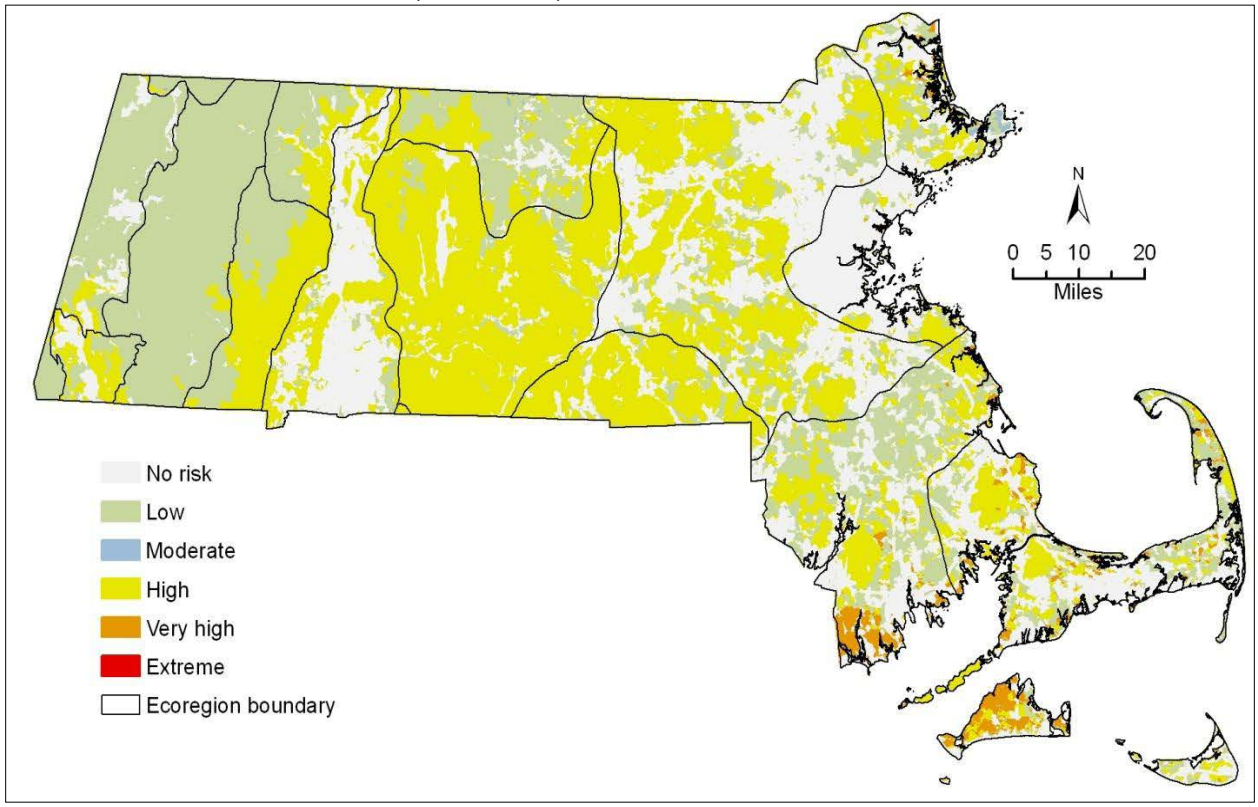

Figure 9-5. Wildfire Risk Areas for the Commonwealth of Massachusetts

For the purposes of this risk assessment, the interface and intermix obtained through the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison defines the wildfire hazard area (Radeloff et al., 2011). The wildfire hazard areas are based on the 2010 Census, 2006 National Land Cover Database, and the Protected Areas Database. For the purposes of this risk assessment, the high-, medium-, and low-density interface areas were combined and used as the 'interface' hazard area and the high-, medium-, and low-density intermix areas were combined and used as the 'intermix' hazard areas. Figure 9-6 and Figure 9-3 display the 2010 wildland-urban interface by 2010 U.S. Census block for the U.S. and the Commonwealth, respectively.

http://silvis.forest.wisc.edu/maps/wui/2010/download

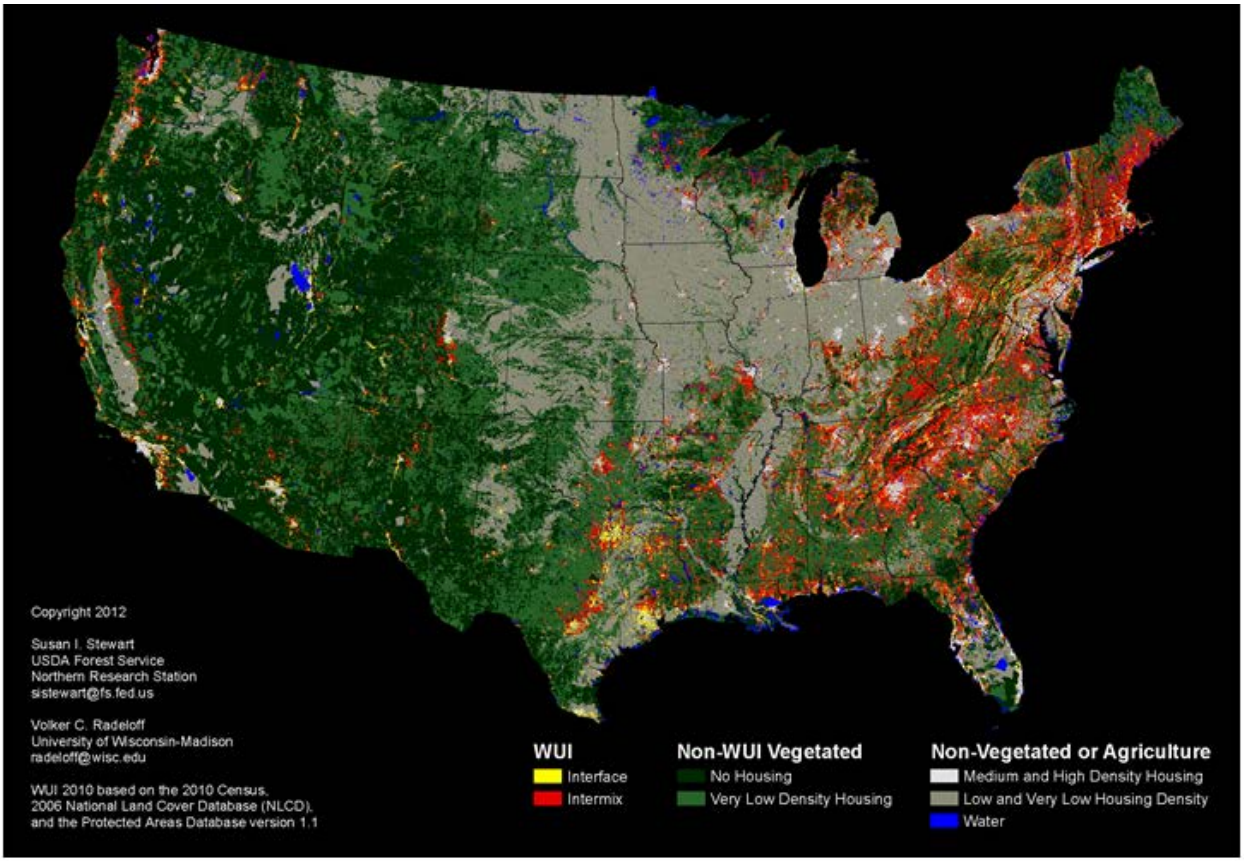

Figure 9-6. 2010 Wildland-Urban Interface for the U.S.

Inventoried assets (population, building stock, and critical facilities) were evaluated to determine exposure and potential impacts associated with this hazard. To determine what assets are exposed to wildfire, available and appropriate GIS data were overlaid on the hazard area. The limitations of this analysis are recognized, so the analysis is used only to provide a general estimate.

9.5.1 Population

As demonstrated by historical wildfire events, potential losses include human health and life of residents and responders. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment.

To estimate the population vulnerable to the wildfire hazard, the interface and intermix hazard areas were overlaid upon the 2010 Census population data (U.S. Census, 2010). The Census blocks identified as interface or intermix were used to calculate the estimated population exposed to the wildfire hazard. In total, there are an estimated 2.5 Million people in the wildland interface and intermix hazard areas (or nearly 40-percent of the Commonwealth's total population). Table 9-2 summarizes the estimated population within the defined hazard areas by County.

TABLE 9-2.
U.S. 2010 POPULATION IN THE WILDFIRE HAZARD AREAS

County	Total Population	Interface	% Total	Intermix	% Total
Barnstable	215,888	62,190	28.8	48,289	22.4

Berkshire	131,219	55,486	42.3	39,171	29.9
Bristol	548,285	150,890	27.5	116,462	21.2
Dukes	16,535	6,007	36.3	7,453	45.1
Essex	743,159	174,121	23.4	84,446	11.4
Franklin	71,372	31,267	43.8	27,093	38.0
Hampden	463,490	76,147	16.4	61,462	13.3
Hampshire	158,080	59,161	37.4	52,177	33.0
Middlesex	1,503,085	314,100	20.9	132,353	8.8
Nantucket	10,172	6,161	60.6	2,552	25.1
Norfolk	670,850	164,684	24.5	73,965	11.0
Plymouth	494,919	145,314	29.4	130,761	26.4
Suffolk	722,023	16,035	2.2	211	0.0
Worcester	798,552	294,657	36.9	233,872	29.3
Total	**6,547,629**	**1,556,220**	**23.8**	**1,010,267**	**15.4**

9.5.2 State Facilities

To assess the exposure of the state-owned and state-leased facilities provided by DCAMM and the Office of Leasing, an analysis was conducted with the wildfire interface and intermix hazard areas. Using ArcMap GIS software, the wildfire interface and intermix data were overlaid with the state facility data to determine which facilities are within the defined hazard areas. Table 9-3 and Table 9-4 summarize the number of state-owned and state-leased buildings in the wildfire hazard area by County and agency, respectively. Figure 9-7 illustrates the state-owned and leased buildings in the wildfire hazard areas.

TABLE 9-3.
STATE-OWNED AND LEASED BUILDINGS IN THE WILDFIRE HAZARD AREA BY COUNTY

County	Interface	Intermix	Total
Barnstable	38	104	**142**
Berkshire	103	85	**188**
Bristol	156	87	**243**
Dukes	2	2	**4**
Essex	56	123	**179**
Franklin	38	39	**77**
Hampden	54	125	**179**
Hampshire	73	107	**180**
Middlesex	118	66	**184**
Nantucket	3		**3**
Norfolk	65		**65**
Plymouth	93	63	**156**
Suffolk	16	93	**109**
Worcester	232	118	**350**
Total	**1,047**	**1,012**	**2,059**

TABLE 9-4.
STATE-OWNED AND LEASED BUILDINGS IN WILDFIRE HAZARD AREA BY STATE AGENCY

Agency Name	Interface	Intermix
Berkshire Community College	1	—
Bridgewater State University	28	—
Bristol Community College	12	—
Committee For Public Counsel Services	1	1
Department of Children and Families	5	2
Department of Conservation and Recreation	216	453
Department of Corrections	52	6
Department of Developmental Services	107	116
Department of Environmental Protection	2	—
Department of Fish and Game	32	53
Department of Fire Services	—	5
Department of Industrial Accidents	1	—
Department of Mental Health	14	10
Department of Public Health	2	1
Department of State Police	22	16
Department of Transitional Assistance	1	3
Department of Transportation	217	217
Department of Veterans Services	—	9

TABLE 9-4.
STATE-OWNED AND LEASED BUILDINGS IN WILDFIRE HAZARD AREA BY STATE AGENCY

Agency Name	Interface	Intermix
Department of Workforce Development	1	—
Division of Banks	1	—
Division of Capital Asset Management	9	36
Exec. Office of Energy & Environmental Affairs	1	2
Fitchburg State University	57	1
Greenfield Community College	1	—
Holyoke Community College	12	—
Massachusetts Department of Revenue	2	—
Massachusetts State Lottery Commission	1	3
Massachusetts College of Liberal Arts	16	2
Massachusetts Maritime Academy	1	—
Massachusetts National Guard	1	—
Massachusetts Rehabilitation Commission	4	2
Massasoit Community College	2	—
Military Division	25	2
Mount Wachusett Community College	13	—
Municipal Police Training Committee	1	—
Northern Essex Community College	—	12
Office of the Chief Medical Examiner	1	—
Office of the District Attorney Cape & Island	1	—
Office of the District Attorney Northern	2	—
Office of the District Attorney Northwestern	1	—
Office of the State Auditor	1	—
Quinsigamond Community College	1	—
Sheriff's Department Berkshire	3	—
Sheriff's Department Bristol	—	1
Sheriff's Department Essex	1	1
Sheriff's Department Franklin	4	—
Sheriff's Department Hampden	23	—
Sheriff's Department Hampshire	—	6
Sheriff's Department Worcester	1	—
State Reclamation and Mosquito Control B	—	2
Trial Court	16	6
University of Massachusetts at Amherst	75	44
University of Massachusetts at Dartmouth	33	—
Westfield State University	2	—
Worcester State University	21	—
Total	**1,047**	**1,012**

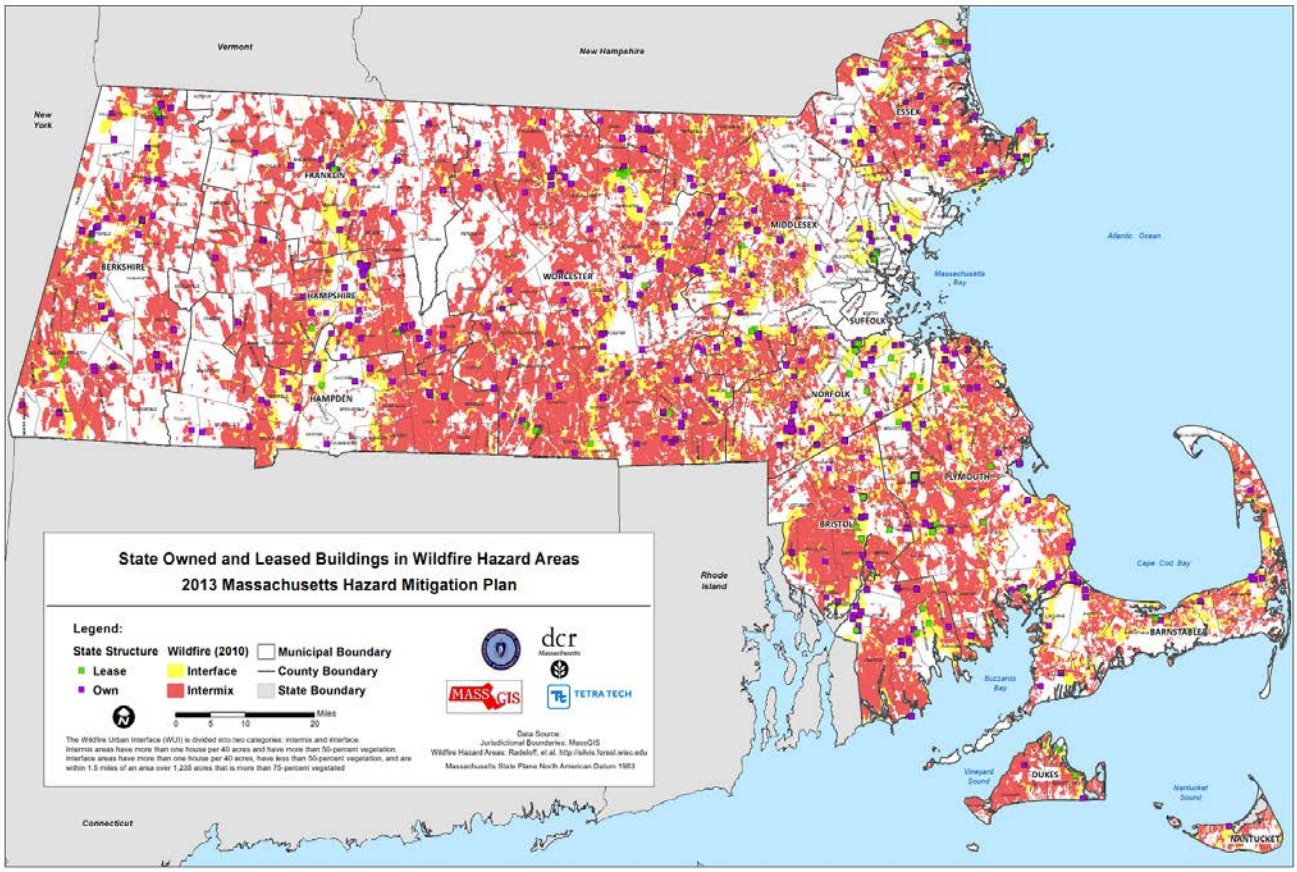

Figure 9-7. State Owned and Leased Buildings in Wildfire Hazard Areas

9.5.3 Critical Facilities

For the purposes of this planning effort, the critical facilities located in the wildland interface and intermix areas are exposed to the wildfire hazard. The number of critical facilities exposed to the wildfire hazard in the Commonwealth is summarized by county in Table 9-5 through Table 9-10.

During a wildfire event, hazardous materials at containment sites in wildfire risk zones could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils and seeping into surface waters, and have a disastrous effect on the environment.

In the event of wildfire, there would likely be little damage to the majority of infrastructure. Most road and railroads would be without damage except in the worst scenarios. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Power lines are the most at risk to wildfire because most poles are made of wood and susceptible to burning. In the event of a wildfire, pipelines could provide a source of fuel and lead to a catastrophic explosion.

TABLE 9-5.
POLICE STATIONS EXPOSED TO THE WILDLAND INTERFACE AND INTERMIX

County	Total Number of Police Stations	Interface	Intermix
Barnstable	20	3	4
Berkshire	33	14	10
Bristol	27	7	6
Dukes	10	3	4
Essex	39	14	4
Franklin	26	8	12
Hampden	28	7	7
Hampshire	23	6	7
Middlesex	64	14	13
Nantucket	3	2	—
Norfolk	32	6	5
Plymouth	31	5	11
Suffolk	34	2	—
Worcester	67	29	21
Total	**437**	**120**	**104**

TABLE 9-6.
FIRE STATIONS EXPOSED TO THE WILDLAND INTERFACE AND INTERMIX

County	Total Number of Fire Stations	Interface	Intermix
Barnstable	37	6	13
Berkshire	46	19	18
Bristol	63	15	17
Dukes	8	2	5
Essex	82	29	10
Franklin	31	7	14
Hampden	51	12	9
Hampshire	28	8	13
Middlesex	164	32	26
Nantucket	1	1	—
Norfolk	59	14	7
Plymouth	67	22	18
Suffolk	47	2	—
Worcester	105	49	24
Total	**789**	**218**	**174**

TABLE 9-7.
EMERGENCY OPERATIONS CENTERS EXPOSED TO THE WILDLAND INTERFACE AND INTERMIX

County	Total Number of Emergency Operations Center	Interface	Intermix
Barnstable	—	—	—
Berkshire	—	—	—
Bristol	—	—	—
Dukes	—	—	—
Essex	—	—	—
Franklin	—	—	—
Hampden	1	—	—
Hampshire	—	—	—
Middlesex	1	—	—
Nantucket	—	—	—
Norfolk	—	—	—
Plymouth	—	—	—
Suffolk	—	—	—
Worcester	—	—	—
Total	**2**	**0**	**0**

TABLE 9-8.
HOSPITALS EXPOSED TO THE WILDLAND INTERFACE AND INTERMIX

County	Total Number of Hospitals	Interface	Intermix
Barnstable	2	—	—
Berkshire	4	1	1
Bristol	5	1	—
Dukes	1	—	—
Essex	10	2	—
Franklin	1	—	—
Hampden	6	2	—
Hampshire	2	1	—
Middlesex	16	2	—
Nantucket	1	1	—
Norfolk	5	3	—
Plymouth	4	1	—
Suffolk	15	—	—
Worcester	10	3	—
Total	**82**	**17**	**1**

TABLE 9-9.
SCHOOLS EXPOSED TO THE WILDLAND INTERFACE AND INTERMIX

County	Total Number of Schools	Interface	Intermix
Barnstable	82	18	19
Berkshire	76	22	27
Bristol	243	60	40
Dukes	10	2	5
Essex	309	65	49
Franklin	53	22	15
Hampden	217	25	26
Hampshire	113	35	18
Middlesex	576	125	47
Nantucket	4	3	1
Norfolk	286	70	35
Plymouth	197	41	54
Suffolk	244	5	—
Worcester	357	123	93
Total	**2,767**	**616**	**429**

TABLE 9-10.
COLLEGES EXPOSED TO THE WILDLAND INTERFACE AND INTERMIX

County	Total Number of Colleges	Interface	Intermix
Barnstable	6	1	1
Berkshire	6	3	1
Bristol	12	2	2
Dukes	—	—	—
Essex	13	—	2
Franklin	3	—	1
Hampden	16	1	—
Hampshire	5	1	—
Middlesex	47	2	2
Nantucket	1	—	1
Norfolk	21	2	1
Plymouth	6	1	—
Suffolk	48	1	—
Worcester	21	4	2
Total	**205**	**18**	**13**

The wildfire hazard typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. The default Hazus-MH highway bridge inventory developed from the 2001 National Bridge Inventory database was used for this analysis. Table 9-11 identifies the number of highway bridges in the Hazus-MH default highway bridge inventory exposed to the wildland interface and intermix areas. The exposure analysis indicated 1,601 highway bridges located within the hazard areas or 33-percent of the total inventory in Hazus-MH (4,832 bridges).

9.5.4 Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and involve hundreds of operating hours on fire apparatus and thousands of volunteer man-hours from the volunteer firefighters. There are 852.3 square miles (or 10 percent) of land in the Commonwealth in the interface hazard area, and 3,563.3 square miles (or 44 percent) of land in the intermix hazard area. There are also many direct and indirect costs to local businesses that excuse volunteers from work to fight these fires.

TABLE 9-11.
HIGHWAY BRIDGES LOCATED IN THE WILDFIRE HAZARD AREAS BY COUNTY

County	Total Number Exposed	Federal			State			Local		
		Interface	Intermix	**Total**	Interface	Intermix	**Total**	Interface	Intermix	**Total**
Barnstable	24	—	1	**1**	9	7	**16**	—	7	**7**
Berkshire	232	—	—	**—**	44	51	**95**	61	76	**137**
Bristol	98	—	—	**—**	29	35	**64**	10	24	**34**
Dukes	—	—	—	**—**	—	—	**—**	—	—	**—**
Essex	79	—	—	**—**	26	29	**55**	10	14	**24**
Franklin	153	—	1	**1**	31	36	**67**	26	59	**85**
Hampden	149	—	1	**1**	38	46	**84**	20	44	**64**
Hampshire	134	—	1	**1**	20	21	**41**	23	69	**92**
Middlesex	134	—	—	**—**	55	37	**92**	23	19	**42**
Nantucket	—	—	—	**—**	—	—	**—**	—	—	**—**
Norfolk	68	—	—	**—**	29	26	**55**	7	6	**13**
Plymouth	115	—	—	**—**	23	50	**73**	17	25	**42**
Suffolk	8	—	—	**—**	5	—	**5**	3	—	**3**
Worcester	407	1	3	**4**	111	127	**238**	60	105	**165**
Total	**1,601**	**1**	**7**	**8**	**420**	**465**	**885**	**260**	**448**	**708**

Source: Hazus-MH v. 2.1 default highway bridge inventory; Radeloff et.al, 2011
Note: The following owners are listed in the Hazus-MH default highway bridge inventory (total number of bridges for each category in parentheses): Federal (22)—National Park Service, Corps of Engineers; State (3,344)—State Highway Agency, State Park Reservation Agency, Bureau of Fish & Wildlife, Other State Agencies; Local (1,466)—Town Highway Agency, City Highway Agency, Local Park Reservation Agency, Local Toll Authority

9.6 VULNERABILITY

9.6.1 Population

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

9.6.2 State Facilities

The vulnerability of state facilities to fire-related hazards, especially wildfires, is currently difficult to determine based on the current, best available data. There is a lack of consistent data on previous wildfire and man-made fire occurrences.

To estimate the potential losses to state-owned and leased structures, the exposure analysis methodology was used. As discussed, there are 6,765 state-owned/leased structures in the Commonwealth. Table 9-12 identifies a total risk exposure of nearly $12 billion for state-owned and leased buildings located in the wildfire interface and intermix defined areas. This figure assumes 100-percent loss to each structure and its contents. This estimate is considered high because structure and content losses generally do not occur to the entire inventory exposed; wildfire events are generally centered within one region. Table 9-13 shows the data by state agency.

TABLE 9-12.
STATE-OWNED AND LEASED BUILDING TOTAL REPLACEMENT COST VALUE IN THE WILDLAND INTERFACE AND INTERMIX HAZARD AREAS BY COUNTY

	Interface			Intermix			
County	Total	Lease	Own	Total	Lease	Own	**Total**
Barnstable	$44,637,882	$1,595,866	$43,042,016	$95,343,083	$491,878	$94,851,205	**$139,980,965**
Berkshire	$530,375,094	$13,284,214	$517,090,880	$127,765,291	—	$127,765,291	**$658,140,384**
Bristol	$1,534,740,918	$18,277,046	$1,516,463,872	$304,402,166	$26,656,280	$277,745,886	**$1,839,143,084**
Dukes	$464,164	$258,630	$205,534	$5,616,788	$5,600,628	$16,160	**$6,080,952**
Essex	$708,204,263	$4,049,738	$704,154,525	$527,884,186	$2,287,220	$525,596,966	**$1,236,088,449**
Franklin	$301,871,994	$6,694,462	$295,177,532	$51,106,274	$7,039,124	$44,067,150	**$352,978,268**
Hampden	$1,049,482,689	$365,236	$1,049,117,453	$1,218,620,128	—	$1,218,620,128	**$2,268,102,817**
Hampshire	$267,112,756	$2,511,492	$264,601,264	$403,629,950	$6,998,780	$396,631,170	**$670,742,706**
Middlesex	$583,738,604	$24,356,128	$559,382,476	$140,315,439	$35,195,000	$105,120,439	**$724,054,043**
Nantucket	$30,440,058	—	$30,440,058	—	—	—	**$30,440,058**
Norfolk	$165,630,179	$18,544,430	$147,085,749	$154,357,257	$34,979,740	$119,377,517	**$319,987,436**
Plymouth	$383,496,267	$29,754,132	$353,742,135	$88,823,186	$4,697,826	$84,125,360	**$472,319,452**
Suffolk	$59,166,953	$34,990,160	$24,176,793	—	—	—	**$59,166,953**
Worcester	$1,941,733,753	$66,047,410	$1,875,686,343	$1,275,536,057	$4,978,096	$1,270,557,961	**$3,217,269,810**
Total	**$7,601,095,574**	**$220,728,944**	**$7,380,366,630**	**$4,393,399,804**	**$128,924,572**	**$4,264,475,232**	**$11,994,495,378**

TABLE 9-12.
STATE-OWNED AND LEASED BUILDING TOTAL REPLACEMENT COST VALUE IN THE WILDLAND INTERFACE AND INTERMIX HAZARD AREAS BY COUNTY

Source: DCAMM, 2011; Radeloff et.al, 2011

TABLE 9-13.
STATE OWNED AND LEASED BUILDING TOTAL REPLACEMENT COST VALUE IN THE WILDFIRE INTERFACE AND INTERMIX HAZARD AREAS BY STATE AGENCY

Agency	Interface	% of Total	Intermix	% of Total	Grand Total
Berkshire Community College	$3,947,460	100%	—	—	$3,947,460
Bridgewater State University	$288,921,896	100%	—	—	$288,921,896
Bristol Community College	$374,953,386	100%	—	—	$374,953,386
Committee for Public Counsel Services	$1,328,686	73.0%	$491,878	27%	$1,820,564
Department of Children and Families	$18,519,580	66.7%	$9,253,244	33.3%	$27,772,824
Department of Conservation and Recreation	$423,153,212	39.0%	$661,499,872	61%	$1,084,653,084
Department of Corrections	$368,610,042	98.2%	$6,637,074	1.8%	$375,247,116
Department of Developmental Services	$419,033,633	30.3%	$962,115,024	69.7%	$1,381,148,657
Department of Environmental Protection	$36,697,708	100%	—	—	$36,697,708
Department of Fire Services	—	—	$24,773,903	100%	$24,773,903
Department of Fish and Game	$31,466,488	63.1%	$18,391,109	36.9%	$49,857,596
Department of Industrial Accidents	$2,608,746	100%	—	—	$2,608,746
Department of Mental Health	$224,884,797	61.9%	$138,475,854	38.1%	$363,360,651
Department of Public Health	$8,286,054	67.5%	$3,991,418	32.5%	$12,277,472
Department of State Police	$69,095,545	43.8%	$88,772,282	56.2%	$157,867,827
Department of Transitional Assistance	$1,916,482	16.3%	$9,862,148	83.7%	$11,778,630
Department of Transportation	$413,272,472	64.6%	$226,603,261	35.4%	$639,875,733
Department of Veterans Services	—	—	$12,463,486	100%	$12,463,486
Department of Workforce Development	$1,068,720	100%	—	—	$1,068,720
Division of Banks	$720,050	100%	—	—	$720,050
Division of Capital Asset Management	$21,089,904	5.9%	$336,162,314	94.1%	$357,252,218
Executive Office of Energy & Environmental Affairs	$391,418	100%	—	—	$391,418
Executive Office of Health & Human Services	—	—	$9,542,868	100%	$9,542,868
Fitchburg State University	$656,814,401	99.8%	$1,237,534	0.2%	$658,051,935
Greenfield Community College	$187,325	100%	—	—	$187,325
Holyoke Community College	$403,189,126	100%	—	—	$403,189,126
Massachusetts Department of Revenue	$9,430,654	100%	—	—	$9,430,654
Massachusetts State Lottery Commission	$1,238,380	3%	$39,520,196	97%	$40,758,576
Massachusetts College of Liberal Arts	$149,977,109	81.6%	$33,748,500	18.4%	$183,725,609
Massachusetts Maritime Academy	$82,214	100%	—	—	$82,214
Massachusetts National Guard	$383,440	100%	—	—	$383,440
Massachusetts Rehabilitation Commission	$3,935,294	60.6%	$2,561,454	39.4%	$6,496,748
Massasoit Community College	$4,381,321	100%	—	—	$4,381,321
Military Division	$149,669,355	98.2%	$2,816,978	1.8%	$152,486,333

TABLE 9-13.
STATE OWNED AND LEASED BUILDING TOTAL REPLACEMENT COST VALUE IN THE WILDFIRE INTERFACE AND INTERMIX HAZARD AREAS BY STATE AGENCY

Agency	Interface	% of Total	Intermix	% of Total	Grand Total
Mount Wachusett Community College	$465,331,139	100%	—	—	$465,331,139
Municipal Police Training Committee	$1,469,490	100%	—	—	$1,469,490
Northern Essex Community College	—	—	$236,707,604	100%	$236,707,604
Office of the Chief Medical Examiner	$365,236	100%	—	—	$365,236
Office of the D.A. Cape & Island	$1,595,866	100%	—	—	$1,595,866
Office of the D.A. Northern	$2,229,082	100%	—	—	$2,229,082
Office of the D.A. Northwestern	$3,067,760	100%	—	—	$3,067,760
Office of the State Auditor	$3,071,502	100%	—	—	$3,071,502
Quinsigamond Community College	$2,986,432	100%	—	—	$2,986,432
Sheriff's Department Berkshire	$171,337,298	100%	—	—	$171,337,298
Sheriff's Department Bristol	—	—	$59,784,324	100%	$59,784,324
Sheriff's Department Essex	$2,764,602	54.7%	$2,287,220	45.3%	$5,051,822
Sheriff's Department Franklin	$102,865,098	100%	—	—	$102,865,098
Sheriff's Department Hampden	$607,535,874	100%	—	—	$607,535,874
Sheriff's Department Hampshire	—	—	$94,653,804	100%	$94,653,804
Sheriff's Department Worcester	$2,156,850	100%	—	—	$2,156,850
State Reclamation and Mosquito Control Board	—	—	$2,624,508	100%	$2,624,508
Trial Court	$718,553,239	37.9%	$1,174,986,206	62.1%	$1,893,539,445
University of Massachusetts at Amherst	$266,570,526	53.3%	$233,435,740	46.7%	$500,006,266
University of Massachusetts at Dartmouth	$735,332,160	100%	—	—	$735,332,160
Westfield State University	$33,913,930	100%	—	—	$33,913,930
Worcester State University	$390,694,594	100%	—	—	$390,694,594
Total	**$7,601,095,574**	**63.4%**	**$4,393,399,804**	**36.6%**	**$11,994,495,378**

Source: DCAMM, 2011; Radeloff et.al, 2011

Given the limitations of this methodology, the mitigation strategy identifies activities to advance the accuracy of the wildfire potential loss estimates. This includes the state agency review and validation of the owned and leased structure data in terms of location, replacement cost value of structure and contents, and all relevant attributes for analysis.

9.6.3 Critical Facilities

Similar to the state facilities, to estimate potential losses to critical facilities and infrastructure, the exposure analysis methodology was used. The replacement cost values for critical facilities were not available for this planning effort. A total risk exposure would equal to the full replacement value of each critical facility exposed. As these data become available, the Commonwealth will update this section of the plan with new information. In terms of highway bridges, the Hazus-MH v. 2.1 default replacement cost value for the bridges in the wildfire hazard areas is $10.9 Billion (of the greater than $68 Billion total).

9.6.4 Economy

As stated earlier, wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism.

According to the wildland hazard areas from Radeloff, et al., based on the 2010 Census, the intermix hazard area contains 476,934 housing units (or approximately 17-percent of the total housing units in the Commonwealth).The interface hazard area contains 715,209 housing units (or approximately 26-percent of the total housing units in the Commonwealth).

To estimate the total potential loss of buildings in the Commonwealth, the wildfire hazard areas were overlaid upon the default general building stock in Hazus-MH based on the U.S. Census 2000 data. Table 9-14 summarizes the estimated replacement cost value of the general building stock in the Commonwealth located in the interface and intermix hazard areas, summarized by County.

TABLE 9-14
ESTIMATED POTENTIAL BUILDING LOSS (STRUCTURE AND CONTENT)
IN THE WILDLAND INTERFACE AND INTERMIX

	Replacement Cost Value				
County	Total	Interface	% of Total	Intermix	% of Total
Barnstable	$47,450,250,000	$21,304,885,000	44.9	$24,558,487,000	51.8
Berkshire	$20,566,219,000	$15,329,205,000	74.5	$12,350,966,000	60.1
Bristol	$74,946,506,000	$36,068,531,000	48.1	$30,293,572,000	40.4
Dukes	$4,894,499,000	$3,100,639,000	63.3	$3,219,756,000	65.8
Essex	$100,099,771,000	$38,480,980,000	38.4	$28,948,292,000	28.9
Franklin	$10,130,548,000	$8,464,330,000	83.6	$7,054,574,000	69.6
Hampden	$67,212,508,000	$19,614,174,000	29.2	$18,883,677,000	28.1
Hampshire	$20,961,384,000	$15,678,408,000	74.8	$11,679,123,000	55.7
Middlesex	$244,161,008,000	$79,306,788,000	32.5	$57,977,573,000	23.7
Nantucket	$3,610,072,000	$3,364,579,000	93.2	$1,627,659,000	45.1
Norfolk	$111,344,832,000	$42,949,345,000	38.6	$34,254,477,000	30.8
Plymouth	$70,614,087,000	$40,612,784,000	57.5	$40,616,831,000	57.5
Suffolk	$115,439,212,000	$2,307,078,000	2.0	$519,563,000	0.5
Worcester	$112,858,251,000	$69,937,235,000	62.0	$55,933,034,000	49.6
Total	**$1,004,289,147,000**	**396,518,961,000**	**39.5**	**327,917,584,000**	**32.7**

Source: Hazus-MH v. 2.1; Radeloff et.al, 2011