5.4.13 Wildfire

This section provides a profile and vulnerability assessment of the wildfire hazard.

5.4.13.1 Hazard Profile

This section provides profile information, including description, location, extent, previous occurrences and losses, and probability of future occurrences.

Description

According to the New York State Hazard Mitigation Plan (NYS HMP), wildfire is defined as an uncontrolled fire spreading through natural or unnatural vegetation that can threaten lives and property if not contained. Wildfires that burn in or threaten to burn buildings and other structures are referred to as wildland urban interface (WUI) fires. Wildfires are commonly termed forest fires, brush fires, grass fires, wildland urban interface fires, range fires, or ground fires. Wildfires do not include fires naturally or purposely ignited to manage vegetation for one or more benefits (NYS Division of Homeland Security and Emergency Services [DHSES] 2014).

Wildfire in Allegany County is assessed by reference to the same scientific and environmental factors applied for that purpose to any wildfire elsewhere. Fuels, weather, and topography are the primary factors in natural spread and destruction of every wildfire. NYS, including Allegany County, has large tracts of diverse forest lands, many of which have resulted from historical destructive wildfires. Although destructive fires do not occur annually, the State's fire history shows a cycle of outbreaks that have caused human death, property loss, forest destruction, and air pollution (NYS DHSES 2014).

Wildfires are grouped within three classes: surface fires, ground fires, and crown fires. Surface fires, the most common, burn along the forest floor, moving slowly and killing or damaging trees. Ground fires are usually started by lightning, and burn on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along tops of trees.

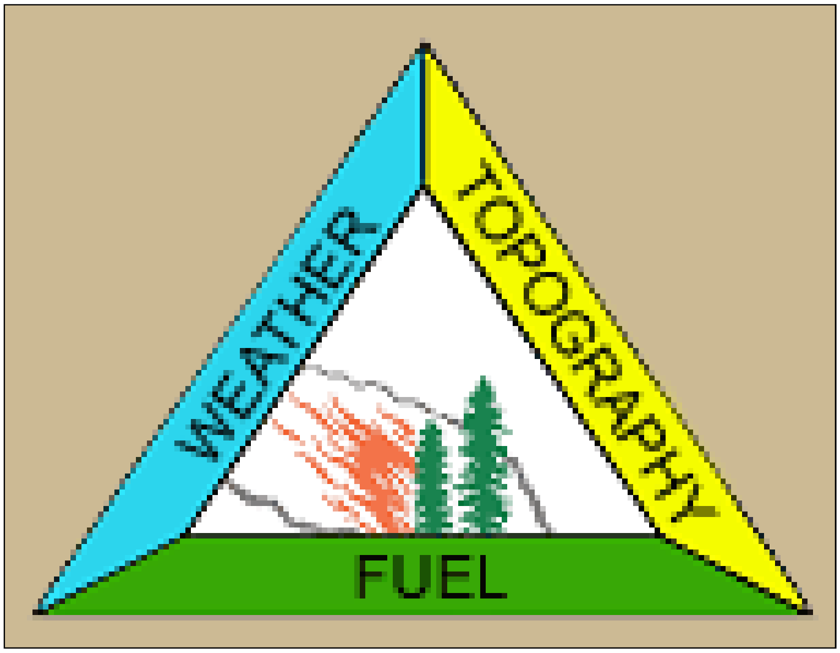
The Federal Emergency Management Agency (FEMA) defines the following four categories of wildfires that occur throughout the United States:

- Wildland fires – fueled almost exclusively by natural vegetation. These fires typically occur in national forests and parks, where federal agencies are responsible for fire management and suppression.
- Interface or Intermix fires – urban/wildland fires where vegetation and the built environment provide fuel.
- Firestorms – events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change or available fuel is exhausted.
- Prescribed fires and prescribed natural burns – fires intentionally set, or selected natural fires that are allowed to burn for beneficial purposes (FEMA 1997).

Fire Ecology and Wildfire Behavior

Fire behavior is one of the most important aspects of wildfires because almost all actions in response to a fire depend on how it behaves. Success in pre-suppression planning and actual suppression of wildfires is directly related to how well fire managers understand and are able to predict fire behavior. Fire behavior is defined as the manner in which fuel ignites, flame develops, and fire spreads, which depend on interactions among fuel, weather, and topography. The wildfire behavior triangle (Figure 5.4.13-1) illustrates how each these factors influences wildfire.

Figure 5.4.1313-1. Wildfire Behavior Triangle



Source: U.S. Department of Agriculture (USDA) U.S. Forest Service (USFS) (No Date [n.d.])

Potential for wildfire and its subsequent development (growth) and severity are controlled by the three principal factors of topography, fuel, and weather, described as follows:

Topography – Topography can powerfully influence wildfire behavior. Movement of air over the terrain tends to direct a fire's course. A gulch or canyon can funnel air and act as a chimney, intensifying fire behavior and inducing faster spread. Saddles on ridgetops tend to offer lower resistance to passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior.

Slope is an important factor. If the percentage of uphill slope doubles, the rate the wildfire spreads will most likely double as well. Fuels on the uphill side of the fire on steep slopes are closer to the source of heat. Radiation preheats and dries the fuel, thus intensifying fire behavior. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of a wildfire's rapid spread (FEMA 1997).

Fuel – Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading can be used to describe the amount of vegetative material available. If this amount doubles, energy released can also double. Each fuel type is given a burn index—an estimate of amount of potential energy that may be released, effort required to ignite a fire in a given fuel, and expected flame length. Different fuels have different burn qualities, and some burn more easily than others. Grass fires release relatively little energy but can sustain very high rates of spread (FEMA 1997). According to the U.S. Forest Service

(USFS), a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels). Fire behavior is strongly influenced by these fuels. Each of these layers provides a different type of fuel source for wildfires.

- Surface fuels consist of grasses, shrubs, litter, and woody material lying on the ground. Surface fires burn low vegetation, woody debris, and litter. Under the right conditions, surface fires reduce likelihood that future wildfires will grow into crown fires.
- Ladder fuels consist of live and dead small trees and shrubs; live and dead lower branches from larger trees, needles, vines, lichens, mosses; and any other combustible biomass between the top of surface fuels and bottom of overstory tree crowns.
- Crown fuels are suspended above the ground in treetops or other vegetation, and consist mostly of live and dead fine material. When historically low-density forests become overcrowded, tree crowns may merge and form a closed canopy. Tree canopies constitute the primary fuel layer in a forest crown fire (USFS 2003).

Weather / Air Mass – Weather is the most important factor in a fire's environment, but it is always changing. Air mass, defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can affect wildfire through climatic factors that include temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and stability of the atmosphere at the time of the fire (NWS 2009). Extreme weather leads to extreme events, and often a subsidence of severe weather marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that radically and suddenly change in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA 1997).

Extent

The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. Several tools are available to estimate fire potential, extent, danger, and growth, including, but not limited to, the following:

Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps, and satellite-derived "greenness" maps. It was developed by the Fire Behavior unit at the Fire Sciences Laboratory in Missoula, Montana, and is currently supported and maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho (USFS, No Date [n.d.]).

Each day during the fire season, national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) are produced by the WFAS (USFS n.d.). The Fire Danger Rating level takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS n.d.). Table 5.4.13-1 lists fire danger ratings and color codes, also used by NYS Department of Environmental Conservation (NYSDEC) to update its fire danger rating maps, identified later in this section.

Table 5.4.133-1. Description of Fire Danger Ratings in New York State

Adjective Rating Class and Color Code	Class Description
Red Flag	A short-term, temporary warning, indicating presence of a dangerous combination of temperature, wind, relative humidity, fuel, or drought conditions that can contribute to new fires or rapid spread of existing fires. A Red Flag Warning can be issued at any Fire Danger level.
Extreme (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high- intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.
Very High (orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
High (yellow)	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly, and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Moderate (blue)	Fires can start from most accidental causes, but except for lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
Low (green)	Fuels do not ignite readily from small firebrands, although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.

Source: NYS DHSES 2014

The ***Fire Potential Index (FPI)*** is derived by combining information on daily weather and vegetation condition, and can identify areas most susceptible to fire ignition. The combination of relative greenness and weather information identifies the moisture condition of live and dead vegetation. Weather information also identifies areas of low humidity, high temperature, and no precipitation, allowing identification of areas most susceptible to fire ignition. The FPI enables local and regional fire planners to quantitatively measure fire ignition risk (U.S. Geological Survey [USGS] 2005). FPI maps are provided daily by USFS. The scale ranges from 0 (low) to 100 (high). Calculations used in the NFDRS are not part of the FPI, except for a 10-hour moisture content (Burgan et al. 2000).

Fuel Moisture (FM) content is quantity of water in a fuel particle expressed as a percent of oven-dry weight of the fuel particle. FM content is an expression of cumulative effects of past and present weather events, and must be considered in evaluation of effects of current or future weather on fire potential. FM is computed by dividing weight of "water" in the fuel by oven-dry weight of the fuel and then multiplying by 100 to yield percent of moisture in a fuel (Burgan et al. 2000).

There are two kinds of FM: live and dead. Live fuel moistures are much slower to respond to environmental changes and are most influenced by factors such as a long drought period, natural disease and insect infestation, annuals that cure out early in the season, timber harvesting, and changes in fuel models caused by blowdown from windstorms and ice storms (Burgan et al. 2000). Dead fuel moisture is the moisture in any cured or dead plant part, whether attached to a still-living plant or not. Dead fuels absorb moisture through physical contact with water (such as rain and dew), and absorb water vapor from the atmosphere. Dead fuels are dried by evaporation. These drying and wetting processes of dead fuels are such that moisture content of these fuels is strongly affected by fuel sizes, weather, topography, decay classes, fuel composition, surface coatings, fuel compactness, and arrangement (Schroeder and Buck 1970).

Fuels are classified into four categories that respond to changes in moisture. This response time is referred to as a time lag. A fuel's time lag is proportional to its diameter and is loosely defined as the time it takes a fuel particle to reach two-thirds of its way to equilibrium with its local environment. The four categories include:

- 1-hour fuels: up to ¼-inch diameter – fine, flashy fuels that respond quickly to changes in weather. Computed from observation time, temperature, humidity, and cloudiness.
- 10-hour fuels: ¼- to 1-inch diameter – computed from observation time, temperature, humidity, and cloudiness, or can be an observed value.
- 100-hour fuels: 1- to 3-inch diameter – computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity ranges.
- 1,000-hour fuels: 3- to 8-inch diameter – computed from a 7-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges (National Park Service n.d.).

The ***Keetch-Byram Drought Index (KBDI)*** is designed for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS n.d.). The index increases each day without rain and decreases when it rains. The scale ranges from 0 (no moisture deficit) to 800 (maximum drought possible). The range of the index is determined by assuming presence of eight (8) inches of moisture in a saturated soil readily available to vegetation. Depth of soil required to hold eight (8) inches of moisture varies among different soil types. A prolonged drought influences fire intensity, largely because more fuel is available for combustion. Drying of organic material in soil can lead to increased difficulty in fire suppression (Florida Forest Service n.d.).

The ***Haines Index***, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures potential for existing fires to become large fires. It is named after its developer, Donald Haines, a Forest Service research meteorologist, who did the initial work and published the scale in 1988 (Storm Prediction Center [SPC] n.d.).

The Haines Index can range between 2 and 6. The drier and more unstable the lower atmosphere, the higher the index. It is calculated by combining stability and moisture content of the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point difference. The index, as listed below, has shown to correlate with large growth of initiating and existing fires where surface winds do not dominate fire behavior (USFS n.d.).

- Very Low Potential (2) – moist, stable lower atmosphere
- Very Low Potential (3)
- Low Potential (4)
- Moderate Potential (5)
- High Potential (6) – dry, unstable lower atmosphere.

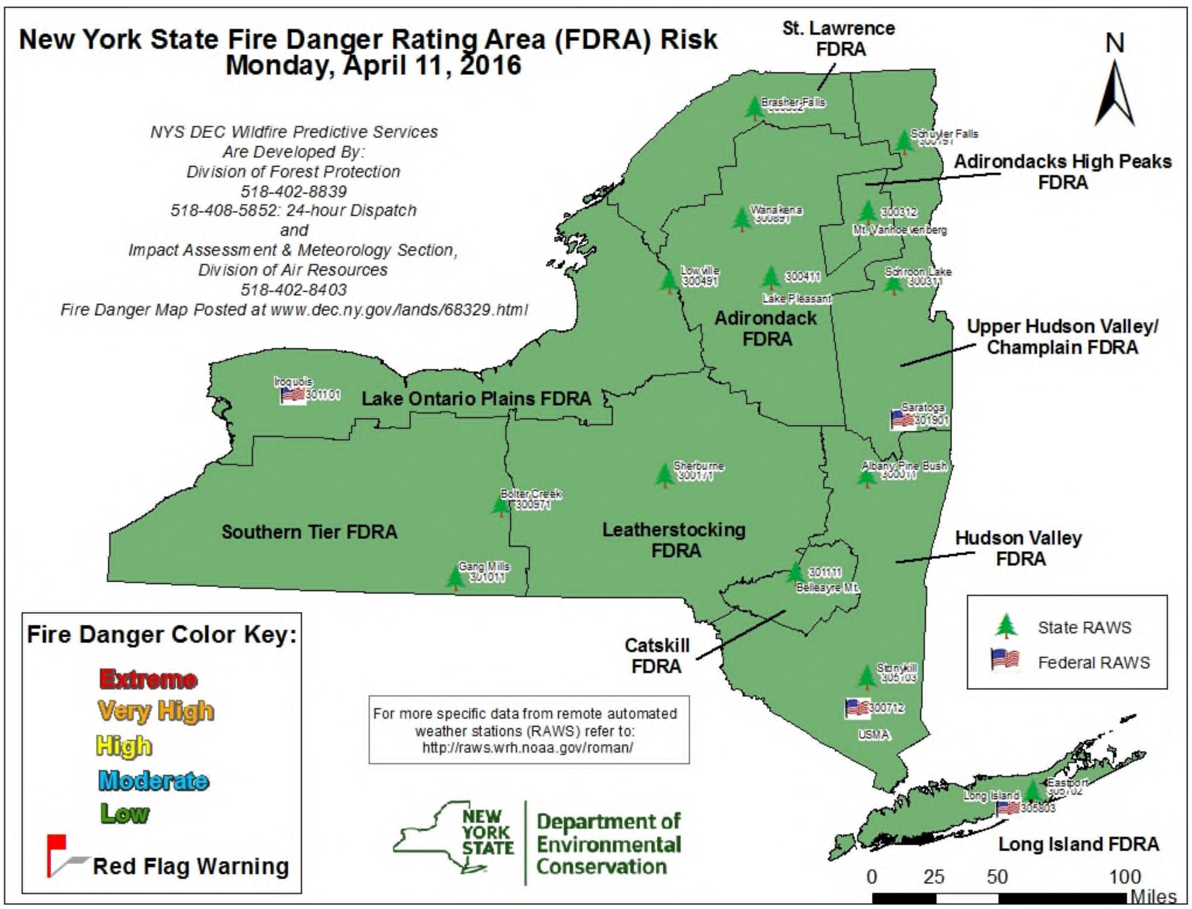
The Haines Index is intended for use all over the United States. It is adaptable for three elevation regimes: low, middle, and high elevations. Low elevation is for fires at or very near sea level. Middle elevation is for fires burning in the 1,000- to 3,000-foot elevation range. High elevation is intended for fires burning above 3,000 feet in elevation (SPC n.d.).

The ***Buildup Index (BUI)*** is a number that reflects combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant. BUI can represent three (3) to four (4) inches of compacted litter or can represent up to six (6) inches or more of loose litter (North Carolina Forest Service 2007).

NYSDEC Fire Danger Rating Map

NYS is divided into 10 Fire Danger Rating Areas (FDRA). FDRAs are defined as areas of similar vegetation, climate, and topography in conjunction with agency regional boundaries, NWS fire weather zones, political boundaries, fire occurrence history, and other influences. The Forest Ranger Division issues daily fire danger warnings when the fire danger rating within one or more FDRAs is at "high" or above. A current fire danger rating map is updated daily on the NYSDEC website. The map is developed by information obtained from the Division of Forest Protection and Division of Air Resources (impact assessment and meteorology section). Figure 5.4.1313-2 shows FDRAs in NYS and the fire danger risk within each area on a specific date.

Figure 5.4.1313-2. New York State Fire Danger Rating Areas



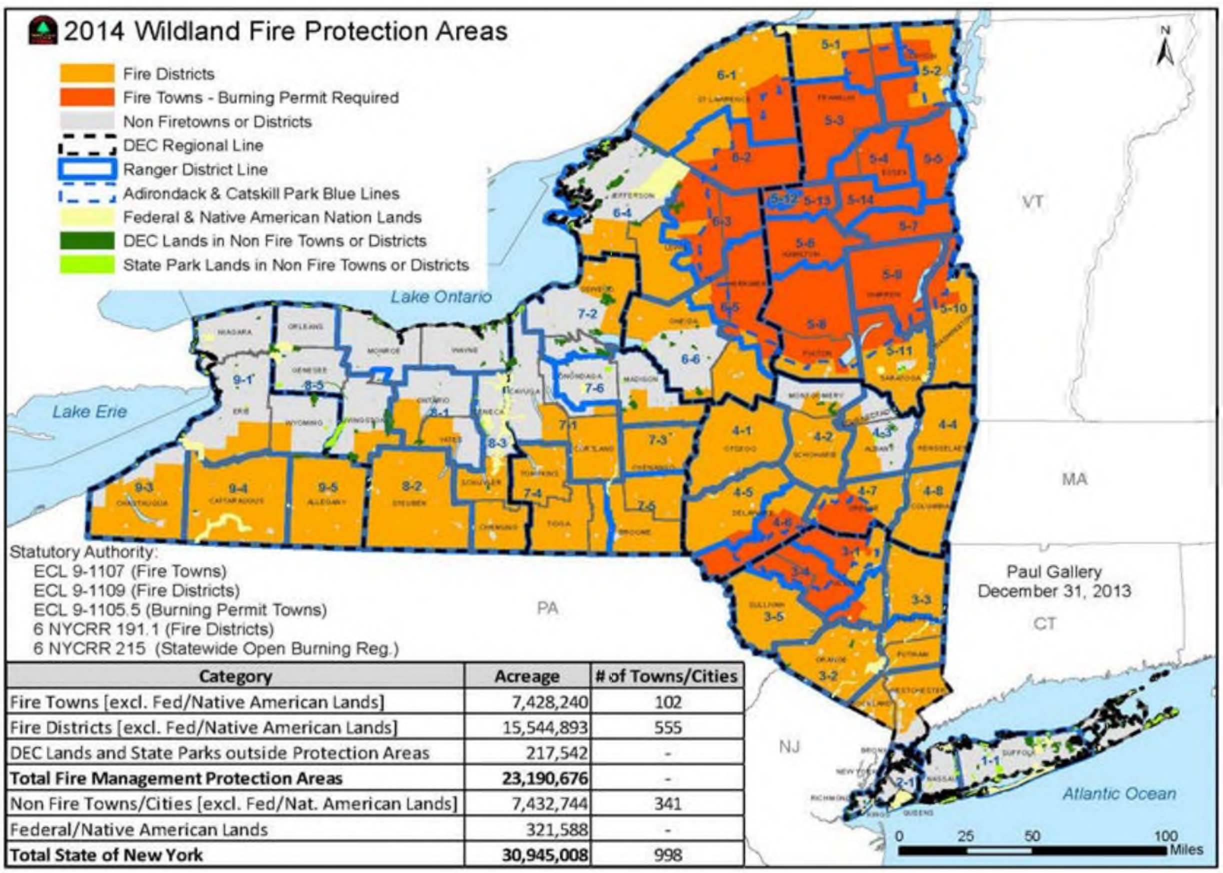
Source: NYSDEC 2015.

Location

According to the U.S. Fire Administration (USFA), the fire problem in the United States varies from region to region. This variation often is a result of climate, poverty, education, demographics, and other causal factors (USFA 2015). Wildfires do occur in Allegany County. Many areas in the County, particularly those that are heavily forested or contain large tracts of brush and shrubs, are prone to fires (NYSDEC 2015).

In NYS, NYSDEC's Division of Forest Protection (Forest Ranger Division) is designated as the State's lead agency for wildfire mitigation. The Forest Ranger Division has a statutory requirement to provide forest fire protection systems for 657 of the 932 jurisdictions throughout NYS. This includes cities and villages, and covers 23.1 million acres of land, including all state-owned land outside of the jurisdictions. The Lake Ontario Plains and New York City-Long Island areas are the general areas not under the statutory requirement. Records of wildfires within these areas are collected from fire department reports to evaluate any need to expand statutory responsibilities. Figure 5.4.1313-3 shows the fire protection areas in NYS. This figure indicates that, as of 2016, Allegany County is in a designated fire district.

Figure 5.4.1313-3. Forest Ranger Division Wildfire Protection Areas



Category	Acreage	# of Towns/Cities
Fire Towns [excl. Fed/Native American Lands]	7,428,240	102
Fire Districts [excl. Fed/Native American Lands]	15,544,893	555
DEC Lands and State Parks outside Protection Areas	217,542	-
Total Fire Management Protection Areas	**23,190,676**	-
Non Fire Towns/Cities [excl. Fed/Nat. American Lands]	7,432,744	341
Federal/Native American Lands	321,588	-
Total State of New York	**30,945,008**	998

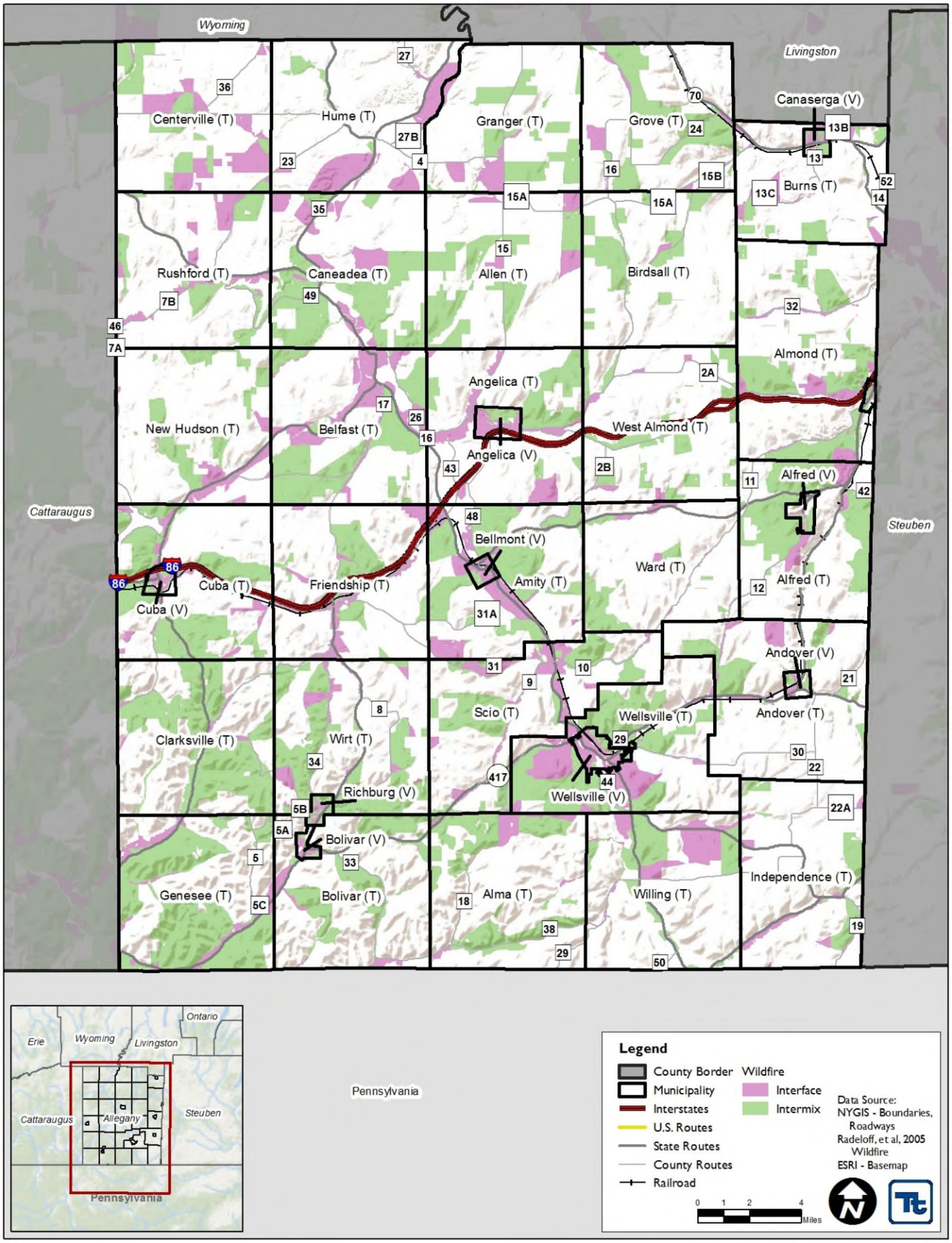
Source: NYSDEC 2015.

Wildfire/Urban Interface in New York State/Allegany County

The NYS HMP indicates that NYS has all three types of WUI interfaces. The Adirondack and Catskill Mountains include large tracts of forests with the mixed, and to a lesser extent, the classic interface occurring throughout. The remainder of the State has classic and mixed interfaces, with some major cities including an occluded interface. Population migration from urban to suburban and rural living will continue, increasing the possibility of loss or damage to structures in the WUI, for a number of reasons. Many property owners are unaware that a threat from a wildfire exists or that their homes are not defensible from it. Water supplies at the scene in the WUI are often inadequate. Access by firefighting equipment is often blocked or hindered by driveways that are narrow, winding, dead-ended, have tight turning radii, or have weight restrictions. Most wildland fire suppression personnel are inadequately prepared for fighting structural fires, and local fire departments are not usually fully trained or equipped for wildfire suppression. Furthermore, the mix of structures, ornamental vegetation, and wildland fuels may cause erratic fire behavior. These factors and others substantially increase risk to life, property, and economic welfare in the WUI. While many interface communities are present throughout NYS and Allegany County, an official list that details location, type of interface, and surrounding fuel makeup does not exist (NYS DHSES 2014).

A detailed WUI (Interface and Intermix) that defines the wildfire hazard area was obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison. The California Fire Alliance determined that 1.5 miles is the approximate maximum distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not within the forest are at risk from wildfire. This buffer distance, along with housing density and vegetation type, were used to define the WUI illustrated on Figure 5.4.13-4 below (Radeloff et al. 2005). Approximately 318.7 square miles or 30.8 percent of the County's land area is within the WUI interface, as shown on Figure 5.4.13-4. Specifically, significant portions of land area in the Towns of Genesee and Wellsville are within the WUI interface, as shown on Figure 5.4.13-4.

Figure 5.4.13-4. WUI in Allegany County



Source: Radeloff et al, 2005.

USGS Geospatial Multi-Agency Coordination (GeoMAC) is an internet-based mapping application designed for fire managers to access on-line maps of current fire locations and perimeters in the United States. This information is publically available via a standard web browser to pinpoint areas affected by fire. According to the USGS GeoMAC, large portions of Allegany County are within the WUI interface (see Figure 5.4.13-5) (USGS GeoMAC 2016).

Figure 5.4.13-5. 2010-2015 Wildfire Information in Allegany County

Source: USGS GeoMAC 2016.

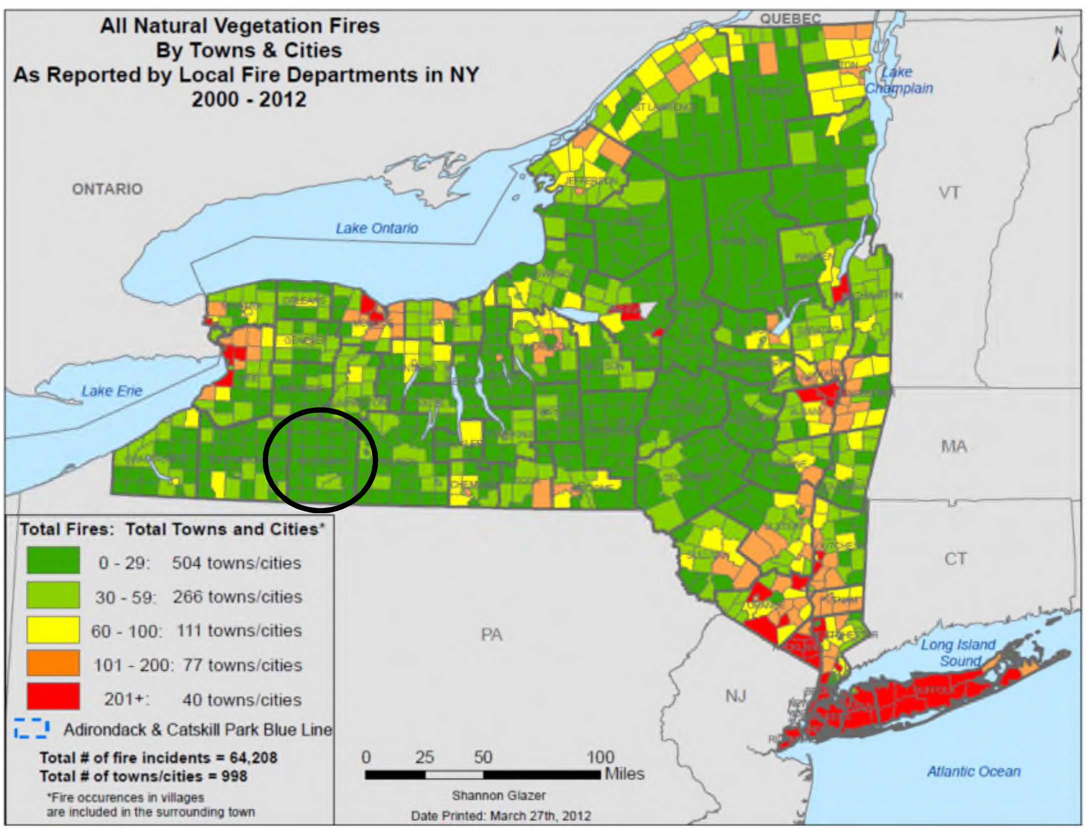
Previous Occurrences and Losses

Short-term effects of wildfires can include destruction of timber, forest, wildlife habitats, scenic vistas, and watersheds. Business and transportation can also be disrupted in the short term. Long-term effects can include reduced access to recreational areas and destruction of community infrastructure and cultural and economic resources (USGS 2006).

Determinations of wildfire occurrences in NYS are based on two data sources: the New York State Forest Ranger force, and the New York State Office of Fire Prevention and Control (NYS OFP&C). The NYS Forest Ranger force is a division of NYSDEC. It has fought fires and retained records for more than 125 years. The most recent data available on the NYSDEC website—in Ranger Division records accumulated over a period of 25 years (1988-2012)—indicate that rangers suppressed 6,971 wildfires which burned a total of 67,273 acres. In 2014, fire departments and rangers responded to 1,269 wildfires that burned a total of 1,541 acres (NYSDEC 2015).

According to Ranger Division wildfire occurrence data from 1988 through 2012, 95 percent of wildfires in the State were human-caused; the remaining five (5) percent resulted from lightning. Regarding human-caused fires, debris burning accounted for 35 percent, arson accounted for 17 percent, campfires accounted for 13 percent, children accounted for five (5) percent, and smoking, equipment, and railroads accounted for 30 percent (NYSDEC 2013). Figure 5.4.1313-6 illustrates occurrences of natural vegetation wildfires in NYS between 2000 and 2012. This figure reveals occurrences of between 0 and more than 59 wildfires (indicated as 30-59 on the map) from 2000 to 2012 within Allegany County municipalities. The Towns of Wellsville and Scio had the highest occurrences—between 30 and 59 events from 2000-2012.

Figure 5.4.1313-6. Wildfire Occurrences in New York State, 2000-2012

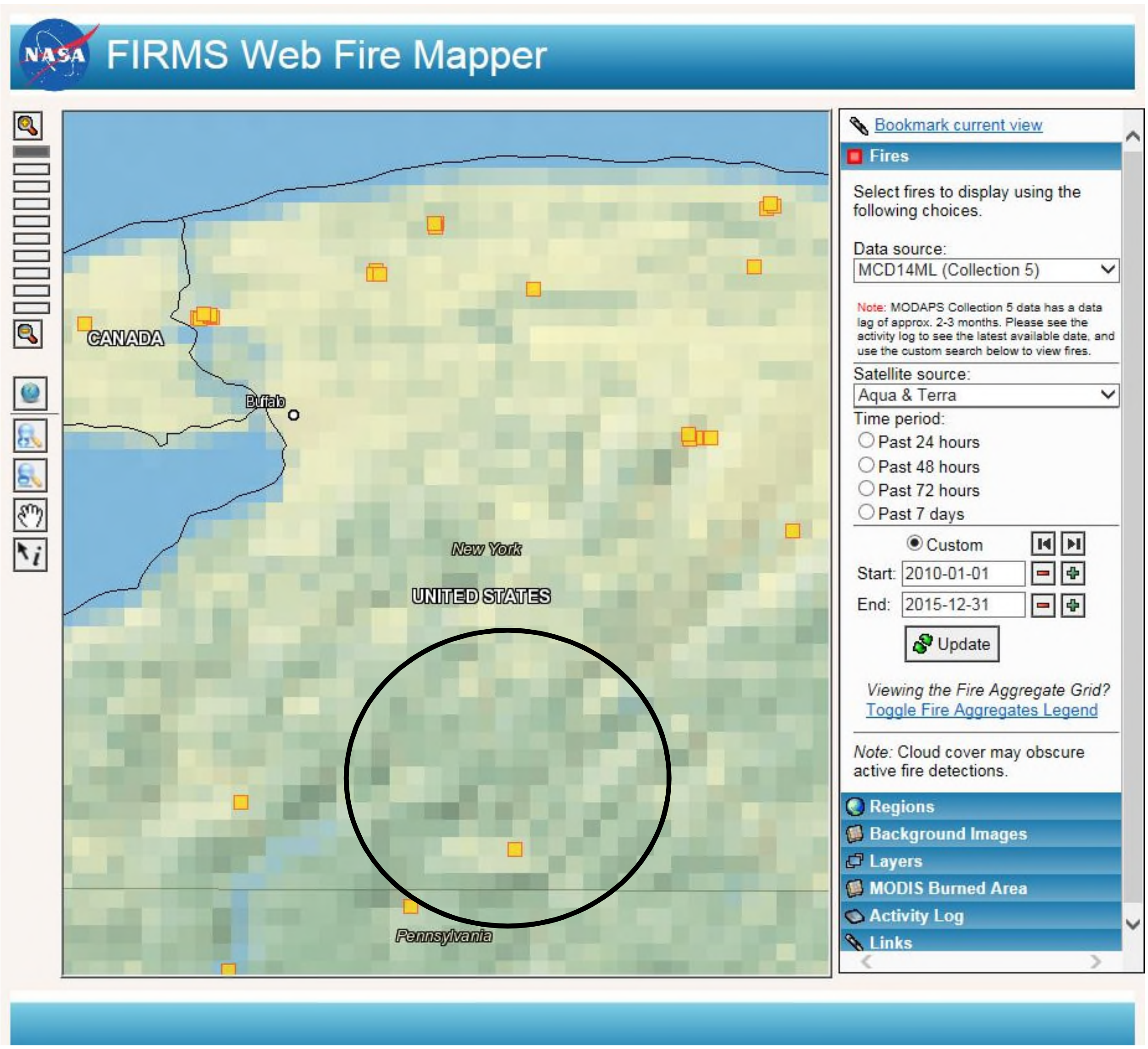


Source: NYSDEC 2013.

Note: The black oval indicates the location of Allegany County.

In 2014, NYSDEC reported 836 acres burned by 131 wildfire events (NYSDEC 2015). The NASA Fire Information for Resource Management System (FIRMS) distributes real-time and archived data extracted from the standard MCD14ML fire product produced at NASA's MODerate Resolution Imaging Spectroradiometer (MODIS) Fire Science Computing Facility (SCF) at the University of Maryland. The MODIS instrument, on board NASA's Earth Observing System (EOS) Terra (EOS AM) and Aqua (EOS PM) satellites, develops an active fire detection out of images that represent the center of a 1-kilometer (km) (approximately) pixel flagged as containing one or more actively burning hotspots or fires. Resulting MODIS fire locations are good for identifying locations of active fires, providing information on spatial and temporal distribution of fires, and comparing annual data. Figure 5.4.1313-7 illustrates occurrences of wildfires in Allegany County between 2010 and 2015, as detected by the MODIS instrument.

Figure 5.4.1313-7. Wildfire Occurrences in Allegany County, 2010-2015



Source: NASA FIRMS 2015.

Note: The black oval indicates the location of Allegany County.

Allegany County Office of Emergency Management and Fire has no records of wildfires in the County since the 1960s, because any that have occurred were relatively minor. Between 1954 and 2015, NYS was not included in any wildfire-related major disaster (DR) or emergency (EM) declarations (FEMA 2015).

Probability of Future Events

According to the NYS Forest Ranger Division, wildfire occurrence data from 1988 to 2012 have shown that NYS, including Allegany County, will always be susceptible to wildfires. Ninety-five percent of wildfires in NYS are caused by humans, while lightning is responsible for only five (5) percent. Forty-seven percent of all fire department-response to wildfires occur from March 15 through May 15. Beginning in 2010, NYS enacted revised open burning regulations that ban brush burning statewide during this time period. Forest ranger data indicate that this new statewide ban resulted in 74 percent fewer wildfires caused by debris burning in upstate New York from 2010 to 2012. Forest ranger and fire department historical fire occurrence data recorded after the new burn ban regulations were enacted in 2010 will serve as a benchmark for analyses of wildfire occurrence (NYS DHSES 2014).

The State's large size, diverse topography, and variety of climates require division of the State into distinct units for describing wildfire potential and risk. See the Location section of this profile for information regarding these risk areas (NYS DHSES 2014).

Fire probability depends on local weather conditions, outdoor activities (such as camping, debris burning, and construction), and degree of public cooperation with fire prevention measures. Dry weather, such as drought, can increase likelihood of wildfire events. Lightning can also trigger wildfire and urban fire events. Other natural disasters can increase probability of wildfires by producing fuel in both urban and rural areas. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities (Northern Virginia Regional Commission [NVRC] 2006).

Wildfire experts point to four reasons why wildfire risks are increasing:

- Fuel, in the form of fallen leaves, branches, and plant growth, has accumulated over time on the forest floor. Now this fuel can "feed" a wildfire.
- Increasingly hot, dry weather has occurred and will occur within the United States.
- Weather patterns across the country are changing.
- More homes are built within areas of WUI, meaning that homes are built closer to wildland areas where wildfires can occur (NYS DHSES 2011).

Annual small wildfires likely will occur throughout NYS (as the State has regularly undergone in the past). However, advanced methods of wildfire management and control and better understanding of fire ecosystems should reduce the number of devastating fires in the future (NYS DHSES 2011).

Hazards of concern identified for Allegany County were ranked in Section 5.3. Probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Hazard Mitigation Team, probability of occurrence of wildfire within the County is considered "Occasional" (event is likely to occur within 100 years, as presented in Table 5.3-3).

Climate Change Impacts

Climate change directly and indirectly affects growth and productivity of forests: directly as a result of changes in atmospheric carbon dioxide and climate, and indirectly through complex interactions within forest ecosystems. Climate also affects frequency and severity of many forest disturbances, such as infestations, invasive species, wildfires, and storm events. As temperatures increase, suitability of a habitat for specific types of trees changes. As well is evidence that prolonged heat waves are likely to generate a greater number of wildfires. Stronger winds from larger storms may lead to more fallen branches for wildfires to consume. Increases in rain and snow events prime forests for fire by supporting growth of more fuel. Drought and warmer temperatures lead to drier forest fuels (NYS DHSES 2014).

Climate change is beginning to affect both people and resources in NYS, and continued increase of these impacts is expected. Effects related to increasing temperatures and sea level rise are already evident within the State. The Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State's vulnerability to climate change, and to facilitate development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011).

Each region within NYS, as defined by ClimAID, has attributes that climate change will affect. Allegany County is part of Region 3, the Southern Tier. Some issues in this region that may be affected by climate change include challenges regarding water supply and wastewater treatment, increase in heat-related deaths, increase in illnesses related to air quality, and higher summer energy demand that will stress the energy system (NYSERDA 2011).

Temperatures in NYS are warming, with an average rate of warming over the past century of 0.25 degrees Fahrenheit (°F) per decade. Average annual temperatures are projected to increase across NYS by two (2) to 3.4°F by the 2020s, 4.1 to 6.8°F by the 2050s, and 5.3 to 10.1°F by the 2080s. The lower ends of these ranges assume lower greenhouse gas emissions scenarios, and the higher ends of these ranges assume higher greenhouse gas emission scenarios.

In Region 3, estimated temperature increases are 4.4 to 6.3ºF by the 2050s and 5.7 to 9.9ºF by the 2080s (baseline of 47.5 ºF) (NYSERDA 2014). Extreme events are also projected to increase, as listed in Table 5.4.13-2 below:

Table 5.4.13-2. Extreme Event Projections for Region 3

Event Type (2020s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 degrees Fahrenheit (°F) (8 days)	15	17-21	23
# of Heat Waves (0.7 heat waves)	2	2 to 3	3
Duration of Heat Waves (4 days)	4	4 to 5	5
Days below 32°F (133 days)	119	122 to 130	134

Source: NYSERDA 2014.

Heat waves will become more frequent and intense with increasing temperatures and increasing heat-related illness and death, and will pose new challenges to the energy system, air quality, and agriculture. Summer droughts are projected to increase, affecting water supply, agriculture, ecosystems, and energy projects (NYSERDA 2011).

Fire potential depends on climate variability, local topography, and human intervention. Climate change can affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create highest fire risk. With temperatures increasing in NYS, wildfire danger may intensify with warming and drying of vegetation. When climate alters fuel loads and fuel moisture, susceptibility of forest 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.

5.4.13.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and potentially vulnerable to the hazard. The following factors are addressed in subsequent text that evaluates and estimates potential impacts of the wildfire hazard on Allegany County:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on (1) life, health, and safety of residents; (2) general building stock; (3) critical facilities; (4) economy; and (5) future growth and development
- Change of vulnerability as compared to that presented in the 2011 Allegany County HMP
- Further data acquisitions that will increase understanding of this hazard over time.

Overview of Vulnerability

Wildfire hazards can affect significant areas of land, as evidenced by wildfires throughout the State and the United States over the past several years. Fire in urban areas can inflict great damage on infrastructure, cause loss of life, and strain lifelines and emergency responders because of the high density of population and structures that can be damaged within these areas. Wildfire can spread quickly, become a huge fire complex over thousands of acres, and present greater challenges for allocating resources, defending isolated structures, and coordinating multi-jurisdictional response. If a wildfire occurs at a WUI, it can also cause an urban fire, increasing potential for great damage to infrastructure, loss of life, and strain on lifelines and emergency responders because of the high density of population and structures in these areas.

Potential losses from wildfire include human life, structures and other improvements, and natural resources. Given the very short response times following reports of wildfires, likelihood of injuries and casualties is minimal. But 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 health and safety of those fighting the fire. 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 caused by impacts of silt in local watersheds.

Data and Methodology

The WUI (Interface and Intermix) obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison, was referenced to delineate wildfire hazard areas. The University of Wisconsin – Madison wildland fire hazard areas are based on the 2010 Census and 2006 National Land Cover Dataset and the Protected Areas Database. For 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 5.4.13-4 shown above displays the WUI and Intermix areas within Allegany County.

Asset data (population, building stock, and critical facilities) presented in the County Profile (Section 4) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to wildfire, available and appropriate Geographic Information System (GIS) data were overlaid on the hazard area. Limitations of this analysis are recognized, and as such, the analysis is used only to provide a general estimate.

Impact on Life, Health, and Safety

As demonstrated by historical wildfire events in NYS and other parts of the country, potential losses include those of human health and life of residents and responders, structures, infrastructure, and natural resources. In addition, wildfires can significantly impact a community because of initial loss of structures and subsequent loss of revenue from destroyed business and decrease in tourism. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment.

Wildfires can cost thousands of taxpayer dollars for suppression and control, and can involve hundreds of operating hours on fire apparatus and thousands of volunteer hours from volunteer firefighters. In addition, many direct and indirect costs burden local businesses that excuse volunteers from work to fight these fires.

As a way to estimate the county's population vulnerable to the wildfire hazard, the population located within the WUI was overlaid on the 2010 Census population data (U.S. Census 2010). Census blocks with centers within the hazard area were used to calculate estimated populations exposed to the wildfire hazard. Table 5.4.13-3 summarizes estimated populations exposed by municipality.

Based on the analysis, 14,054 individuals, or 28.7 percent of the County's population, are within the Intermix wildfire hazard area; 20,480 individuals, or 41.8 percent of the County's population, are within the Interface wildfire hazard area. Overall, the Village of Wellsville has the greatest number of individuals within the defined wildfire hazard area (4,640 people). Notably, some municipalities' total populations are within the hazard area (i.e., Village of Belmont, Village of Richburg).

Table 5.4.13-3. Estimated Population within the WUI in Allegany County

Municipality	U.S. Census 2010 Population	Estimated Population Exposed			Percent of Total Exposed
		Intermix	Interface	Total	
Alfred (T)	1,063	574	247	821	77.2
Alfred (V)	4,174	1,041	728	1,769	42.4
Allen (T)	448	123	81	204	45.5
Alma (T)	842	387	220	607	72.1
Almond (T)	1,218	562	292	854	70.1
Almond (V)	415	183	230	413	99.5
Amity (T)	1,339	426	584	1,010	75.4
Andover (T)	788	199	117	316	40.1
Andover (V)	1,042	329	643	972	93.3
Angelica (T)	534	21	184	205	38.4
Angelica (V)	869	275	588	863	99.3
Belfast (T)	1,663	328	1,112	1,440	86.6
Belmont (V)	969	111	858	969	100.0
Birdsall (T)	221	100	7	107	48.
Bolivar (T)	998	369	191	560	56.1
Bolivar (V)	1,047	115	877	992	94.7
Burns (T)	630	86	112	198	31.4
Canaseraga (V)	550	138	408	546	99.3

Municipality	U.S. Census 2010 Population	Estimated Population Exposed			Percent of Total Exposed
		Intermix	Interface	Total	
Caneadea (T)	2,542	534	830	1,364	53.7
Centerville (T)	822	188	279	467	56.8
Clarksville (T)	1,161	678	215	893	76.9
Cuba (T)	1,669	663	422	1,085	65.0
Cuba (V)	1,575	276	1,297	1,573	99.9
Friendship (T)	2,004	437	1,182	1,619	80.8
Genesee (T)	1,693	954	450	1,404	82.9
Granger (T)	538	130	130	260	48.3
Grove (T)	548	229	65	294	53.6
Hume (T)	2,071	65	393	458	22.1
Independence (T)	1,167	211	324	535	45.8
New Hudson (T)	781	140	245	385	49.3
Richburg (V)	450	259	191	450	100.0
Rushford (T)	1,150	186	558	744	64.7
Scio (T)	1,833	686	725	1,411	77.0
Ward (T)	368	79	63	142	38.6
Wellsville (T)	2,718	1,207	1,222	2,429	89.4
Wellsville (V)	4,679	889	3,751	4,640	99.2
West Almond (T)	334	107	26	133	39.8
Willing (T)	1,228	371	455	826	67.3
Wirt (T)	805	398	178	576	71.6
Allegany County (Total)	**48,946**	**14,054**	**20,480**	**34,534**	**70.6**

Sources: U.S. Census 2010, Radeloff et al. 2005.

Impact on General Building Stock

Structures must vulnerable to wildfire events are those within WUI areas. Buildings constructed of wood or vinyl siding are generally more likely to be damaged by fire than buildings constructed of brick or concrete. Wildfire hazard areas were overlaid on the county building inventory (Census block) to estimate numbers and replacement costs of buildings exposed to the wildfire hazard. Replacement cost values (RCV) of structures with centers within the hazard area were totaled. Table 5.4.13-4 lists estimated building stock RCVs within the WUI in Allegany County, and Table 5.4.13-5 lists estimated numbers of buildings within the WUI in Allegany County; both table listings are by municipality. Limitations of this analysis are recognized, and as such the analysis is used only to provide general estimates. Approximately 28.1 percent ($4.1 billion) of the County's building RCV is within the WUI Intermix hazard area, and approximately 47.6 percent ($6.9 billion) of the County's RCV is within the WUI Interface hazard area. The Village of Wellsville has the greatest number of buildings and RCV within wildfire hazard areas (total Intermix and Interface).

Table 5.4.13-4. Building Stock Replacement Cost Value within the WUI in Allegany County

Municipality	Total RCV (Structure and Contents)	Building RCV Exposed			Percent of Total Exposed
		Intermix	Interface	Total	
Alfred (T)	$371,214,531	$177,923,877	$91,643,682	$269,567,559	72.6
Alfred (V)	$550,636,847	$206,105,386	$333,234,692	$539,340,078	97.9
Allen (T)	$162,300,474	$58,063,779	$15,225,840	$73,289,619	45.2
Alma (T)	$256,374,017	$110,263,476	$51,016,551	$161,280,027	62.9

Municipality	Total RCV (Structure and Contents)	Building RCV Exposed			Percent of Total Exposed
		Intermix	Interface	Total	
Almond (T)	$312,231,916	$160,207,507	$67,781,577	$227,989,084	73.0
Almond (V)	$135,692,850	$52,761,070	$78,892,428	$131,653,498	97.0
Amity (T)	$334,307,982	$134,056,791	$113,812,125	$247,868,916	74.1
Andover (T)	$230,686,817	$51,080,525	$27,390,240	$78,470,765	34.0
Andover (V)	$338,015,430	$73,637,458	$231,244,238	$304,881,696	90.2
Angelica (T)	$194,212,919	$32,731,410	$54,841,164	$87,572,574	45.1
Angelica (V)	$284,974,634	$102,109,540	$180,121,547	$282,231,087	99.0
Belfast (T)	$531,601,630	$109,060,132	$328,721,790	$437,781,922	82.4
Belmont (V)	$396,945,690	$29,656,086	$356,049,049	$385,705,135	97.2
Birdsall (T)	$115,899,500	$49,328,485	$2,100,721	$51,429,206	44.4
Bolivar (T)	$258,709,425	$86,969,390	$59,494,835	$146,464,225	56.6
Bolivar (V)	$409,452,702	$39,955,766	$358,554,835	$398,510,601	97.3
Burns (T)	$176,932,773	$29,216,940	$30,285,316	$59,502,256	33.6
Canaseraga (V)	$200,008,440	$40,879,114	$156,432,302	$197,311,416	98.7
Caneadea (T)	$506,452,673	$210,426,677	$206,884,652	$417,311,329	82.4
Centerville (T)	$220,631,685	$60,173,188	$70,555,412	$130,728,600	59.3
Clarksville (T)	$289,246,885	$180,585,240	$39,989,256	$220,574,496	76.3
Cuba (T)	$465,992,122	$164,953,274	$127,810,301	$292,763,575	62.8
Cuba (V)	$602,554,836	$90,031,402	$505,008,068	$595,039,470	98.8
Friendship (T)	$649,189,751	$119,551,329	$402,925,719	$522,477,048	80.5
Genesee (T)	$366,042,711	$208,940,439	$78,490,489	$287,430,928	78.5
Granger (T)	$182,924,910	$53,545,243	$28,111,006	$81,656,249	44.6
Grove (T)	$203,653,283	$84,667,910	$21,349,603	$106,017,513	52.1
Hume (T)	$595,483,501	$33,307,950	$67,925,262	$101,233,212	17.0
Independence (T)	$317,936,823	$44,044,915	$97,891,493	$141,936,408	44.6
New Hudson (T)	$250,742,307	$61,142,744	$62,602,701	$123,745,445	49.4
Richburg (V)	$115,588,317	$66,832,539	$48,026,010	$114,858,549	99.4
Rushford (T)	$676,861,880	$195,742,197	$304,921,763	$500,663,960	74.0
Scio (T)	$431,175,535	$133,081,981	$197,485,546	$330,567,527	76.7
Ward (T)	$115,902,946	$31,129,208	$13,086,960	$44,216,168	38.1
Wellsville (T)	$720,536,730	$293,832,249	$347,345,533	$641,177,782	89.0
Wellsville (V)	$1,930,580,062	$263,995,071	$1,633,900,704	$1,897,895,775	98.3
West Almond (T)	$146,702,356	$61,734,456	$16,783,781	$78,518,237	53.5
Willing (T)	$322,582,548	$101,213,593	$106,627,985	$207,841,578	64.4
Wirt (T)	$219,156,819	$89,530,179	$32,701,592	$122,231,771	55.8
Allegany County (Total)	**14,590,137,257**	**$4,092,468,515**	**$6,947,266,766**	**$11,039,735,281**	**75.7**

Sources: Allegany County, Radeloff et al. 2005.

Note: RCV Replacement cost value

Table 5.4.13-5. Number of Buildings Within the WUI in Allegany County

Municipality	Total Number of Building	Buildings Exposed			Percent of Total Exposed
		Intermix	Interface	Total	
Alfred (T)	588	296	121	417	70.9
Alfred (V)	546	236	303	539	98.7
Allen (T)	399	165	36	201	50.4

Municipality	Total Number of Building	Buildings Exposed			Percent of Total Exposed
		Intermix	Interface	Total	
Alma (T)	602	247	110	357	59.3
Almond (T)	634	342	135	477	75.2
Almond (V)	189	79	104	183	96.8
Amity (T)	676	278	211	489	72.3
Andover (T)	445	101	50	151	33.9
Andover (V)	485	128	302	430	88.7
Angelica (T)	391	75	98	173	44.2
Angelica (V)	402	132	266	398	99.0
Belfast (T)	961	275	501	776	80.7
Belmont (V)	473	48	416	464	98.1
Birdsall (T)	310	144	6	150	48.4
Bolivar (T)	596	203	132	335	56.2
Bolivar (V)	572	67	490	557	97.4
Burns (T)	352	71	60	131	37.2
Canaseraga (V)	280	73	203	276	98.6
Caneadea (T)	1,010	515	335	850	84.2
Centerville (T)	436	135	130	265	60.8
Clarksville (T)	853	570	90	660	77.4
Cuba (T)	971	415	240	655	67.5
Cuba (V)	733	130	595	725	98.9
Friendship (T)	1,067	198	582	780	73.1
Genesee (T)	857	482	180	662	77.2
Granger (T)	431	130	54	184	42.7
Grove (T)	513	217	56	273	53.2
Hume (T)	928	48	122	170	18.3
Independence (T)	554	83	145	228	41.2
New Hudson (T)	517	157	104	261	50.
Richburg (V)	199	118	80	198	99.5
Rushford (T)	1,429	507	573	1,080	75.6
Scio (T)	907	311	367	678	74.8
Ward (T)	286	95	40	135	47.2
Wellsville (T)	1,344	597	576	1,173	87.3
Wellsville (V)	2,565	439	2,090	2,529	98.6
West Almond (T)	324	145	35	180	55.6
Willing (T)	708	214	255	469	66.2
Wirt (T)	598	286	84	370	61.9
Allegany County (Total)	**26,131**	**8,752**	**10,277**	**19,029**	**72.8**

Sources: Allegany County, Radeloff et al. 2005

Impact on Critical Facilities

A number of critical facilities are within the wildfire hazard area, and potentially vulnerable to the threat of wildfire. Many of these facilities are locations of vulnerable populations (schools and senior facilities) and agencies that respond to wildfire events (fire and police). Table 5.4.13-6 lists numbers of critical facilities within the wildfire hazard area by jurisdiction.

Table 5.4.13-6. Facilities within the WUI (Intermix or Interface) in Allegany County

Municipality	Facility Types											
	Air	Communication	Correctional	Emergency Medical Services	Fire Station	Historic Register	Library	Medical	Nursing Care	Police Station	School	Substation
Alfred (T)	0	0	0	0	1	0	1	0	0	0	0	0
Alfred (V)	0	0	0	0	1	2	1	3	0	1	1	0
Allen (T)	0	0	0	0	0	0	0	0	0	0	0	0
Alma (T)	0	0	0	0	1	0	0	0	0	0	0	0
Almond (T)	0	0	0	0	0	0	0	0	0	0	1	0
Almond (V)	0	0	0	0	1	1	1	0	0	0	0	0
Amity (T)	0	2	0	1	0	1	0	0	0	2	1	0
Andover (T)	0	0	0	0	0	0	0	0	0	0	0	0
Andover (V)	0	0	0	0	1	0	1	1	0	1	0	0
Angelica (T)	0	0	0	0	0	2	0	0	0	0	0	0
Angelica (V)	0	0	0	0	1	1	1	0	0	1	0	0
Belfast (T)	0	0	0	0	1	2	1	0	0	0	1	0
Belmont (V)	0	1	1	0	0	5	1	0	0	1	0	0
Birdsall (T)	0	0	0	0	0	0	0	0	0	0	0	0
Bolivar (T)	0	0	0	0	0	0	0	0	0	0	0	0
Bolivar (V)	0	0	0	0	1	1	1	1	0	1	2	0
Burns (T)	0	0	0	0	0	0	0	0	0	0	0	0
Canaseraga (V)	0	0	0	0	1	1	1	0	0	0	1	1
Caneadea (T)	0	0	0	0	2	1	1	2	1	0	0	0
Centerville (T)	0	0	0	0	1	1	0	0	0	0	0	0
Clarksville (T)	0	0	0	0	1	0	0	0	0	0	0	0
Cuba (T)	0	0	0	0	0	0	0	0	0	0	0	0
Cuba (V)	0	0	0	0	1	0	1	4	1	1	1	0
Friendship (T)	0	0	0	0	1	4	0	0	0	0	0	2
Genesee (T)	0	0	0	0	0	1	1	0	0	0	0	0
Granger (T)	0	0	0	0	1	0	0	0	0	0	0	0
Grove (T)	0	0	0	0	0	0	0	0	0	0	0	0
Hume (T)	0	0	0	0	1	0	0	0	0	0	0	0
Independence (T)	0	0	0	0	1	0	1	0	0	1	0	0
New Hudson (T)	0	0	0	0	1	0	0	0	0	0	0	0
Richburg (V)	0	0	0	0	1	0	1	0	0	0	0	1
Rushford (T)	0	0	0	0	1	0	1	0	0	0	0	0

Municipality	Facility Types											
	Air	Communication	Correctional	Emergency Medical Services	Fire Station	Historic Register	Library	Medical	Nursing Care	Police Station	School	Substation
Scio (T)	0	0	0	0	1	0	1	0	0	0	1	0
Ward (T)	0	0	0	0	0	0	0	0	0	0	0	0
Wellsville (T)	1	0	0	0	0	0	0	0	1	0	0	0
Wellsville (V)	0	0	0	1	3	4	1	9	1	1	2	1
West Almond (T)	0	0	0	0	0	2	0	0	0	0	0	0
Willing (T)	0	0	0	0	1	0	0	0	0	1	0	0
Wirt (T)	0	0	0	0	0	0	0	0	0	0	0	0
Allegany County (Total)	**1**	**3**	**1**	**2**	**26**	**29**	**17**	**20**	**4**	**11**	**11**	**5**

Sources: Allegany County, Radeloff *et al. 2005.*

Impact on the Economy

Wildfires jeopardize homes and businesses within the WUI. As noted earlier, these fires may cost thousands of taxpayer dollars for suppression and control and may involve hundreds of operating hours on fire apparatus and hundreds of volunteer hours from volunteer firefighters. Many direct and indirect costs also burden local businesses that excuse volunteers from work to fight these fires. A number of critical facilities and transportation and utility assets are within the WUI and may be vulnerable to the threat of wildfire.

Change of Vulnerability

The WUI (Interface and Intermix) obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison, was not used for the 2011 HMP vulnerability assessment. The previous HMP described the County's forested land in relation to a qualitative discussion of its risk. The County's population, building stock, and critical facilities were evaluated in relation to the hazard area for the HMP update. Overall, Allegany County remains vulnerable to the wildfire hazard.

Future Growth and Development

Areas targeted for potential future growth and development within the next five (5) years have been identified across Allegany County at the jurisdictional level. Refer to the jurisdictional annexes in Volume II of this HMP. Any new development and new residents within the WUI are expected to be exposed to the wildfire hazard. Refer to the jurisdictional annexes in Volume II of this HMP.

Additional Data and Next Steps

The custom building inventory developed for this HMP update may be further enhanced to include updated data regarding construction of structures: roofing material, fire detection equipment, and structure age. As stated earlier, buildings constructed of wood or vinyl siding are generally more likely to be damaged by fire than are buildings constructed of brick or concrete. Proximities of these building types to the WUI should be identified for further evaluation. Development and availability of such data would permit a more detailed estimate of potential vulnerabilities, including loss of life and potential structural damages.