5.4.11 WILDFIRE

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

5.4.11.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the wildfire hazard.

Hazard Description

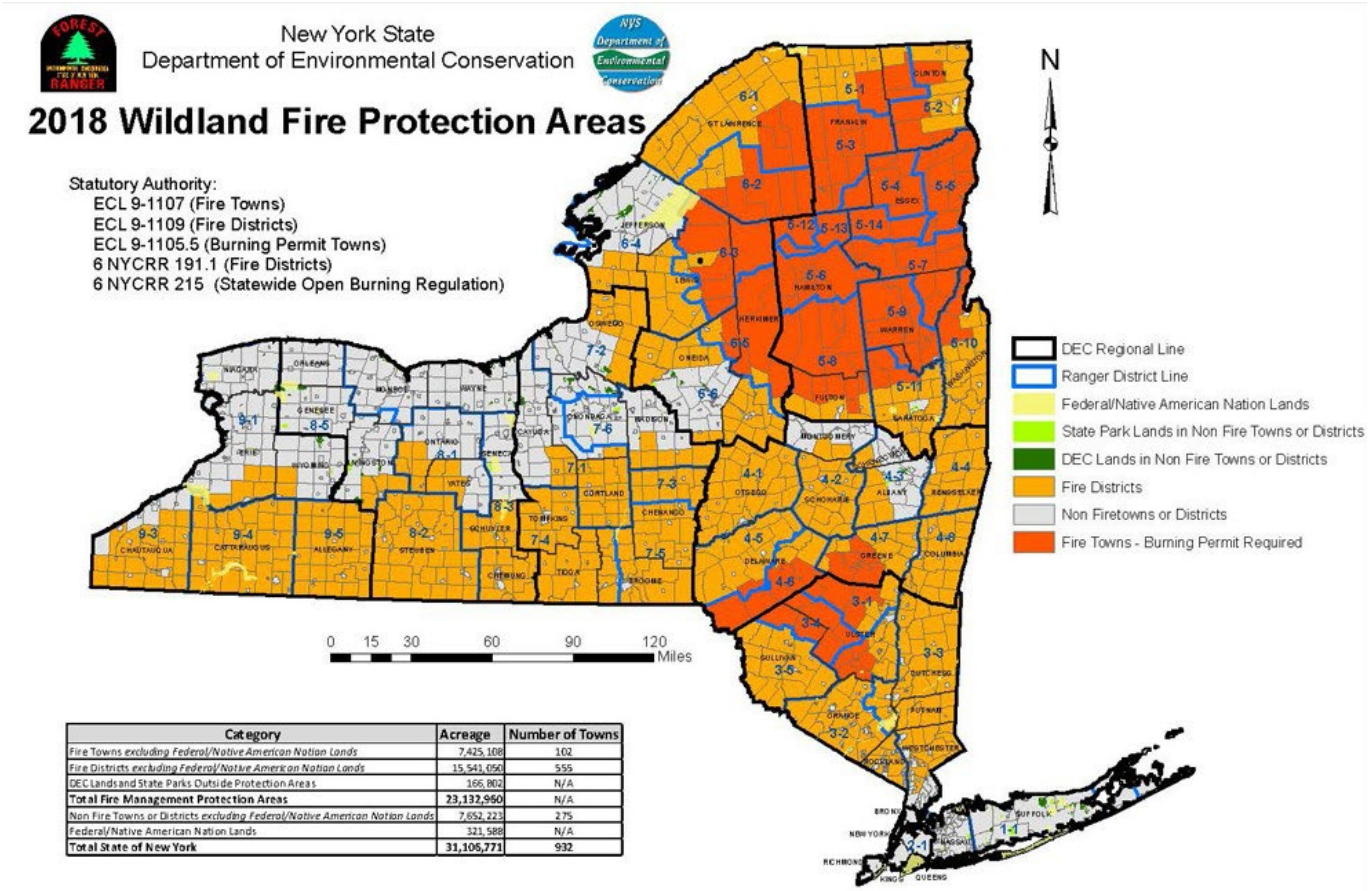
Wildfire is defined as an uncontrolled fire spreading through natural or unnatural vegetation that can threaten lives and property if not contained. Wildfires are commonly termed forest fires, brush fires, grass fires, wildland-urban interface fires, range fires, or ground fires. Wildfires do not include fires naturally or purposely ignited to manage vegetation for one or more benefits (NYS DHSES 2019). 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 2019).

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 Monroe 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 New York State, the 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 a forest fire protection system for 657 of the 932 jurisdictions throughout New York State. This jurisdiction 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 on wildfires in this area are collected from fire department reports to evaluate any need to expand statutory responsibilities. displays the fire protection areas in New York State. Figure 5.4.11-1 indicates that, as of 2018, Monroe County is not part of the wildfire protection area. Figure 5.4.11-2 shows the Forest Ranger Divisions in New York State. Monroe County is part of Forest Ranger Division 8 (NYSDEC 2022).

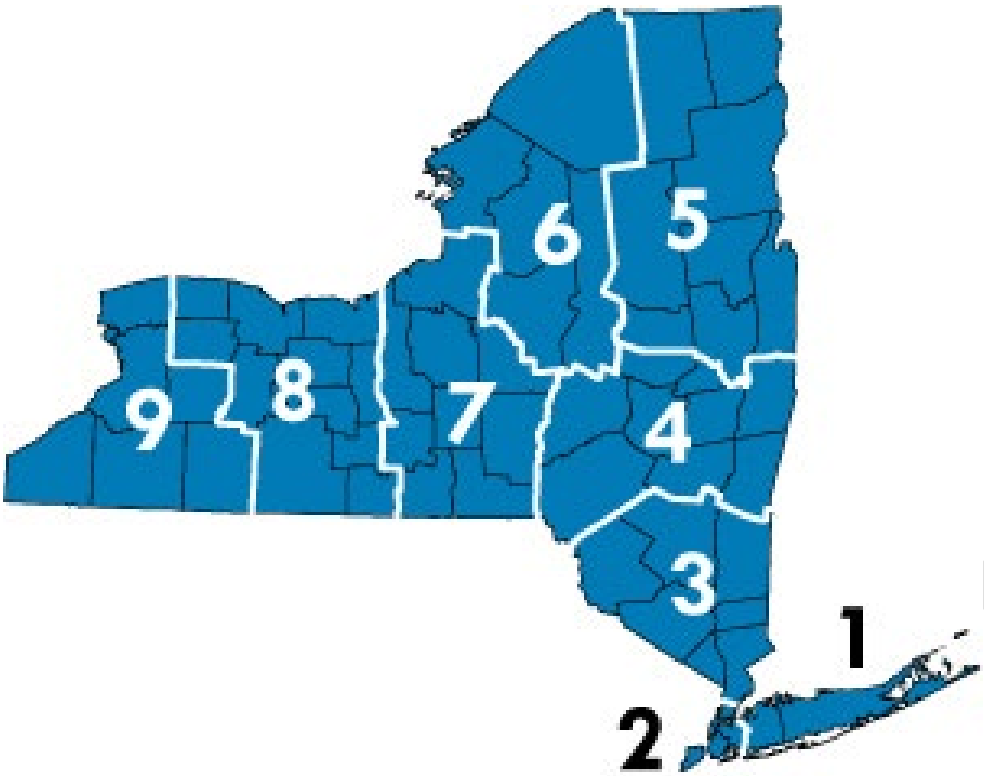
Figure 5.4.11-1. Forest Ranger Division Wildfire Protection Areas



Category	Acreage	Number of Towns
Fire Towns *excluding Federal/Native American Nation Lands*	7,425,108	102
Fire Districts *excluding Federal/Native American Nation Lands*	15,541,050	555
DEC Lands and State Parks Outside Protection Areas	166,802	N/A
Total Fire Management Protection Areas	**23,132,960**	N/A
Non Fire Towns or Districts *excluding Federal/Native American Nation Lands*	7,652,223	275
Federal/Native American Nation Lands	321,588	N/A
Total State of New York	**31,106,771**	932

Source: NYSDEC 2018

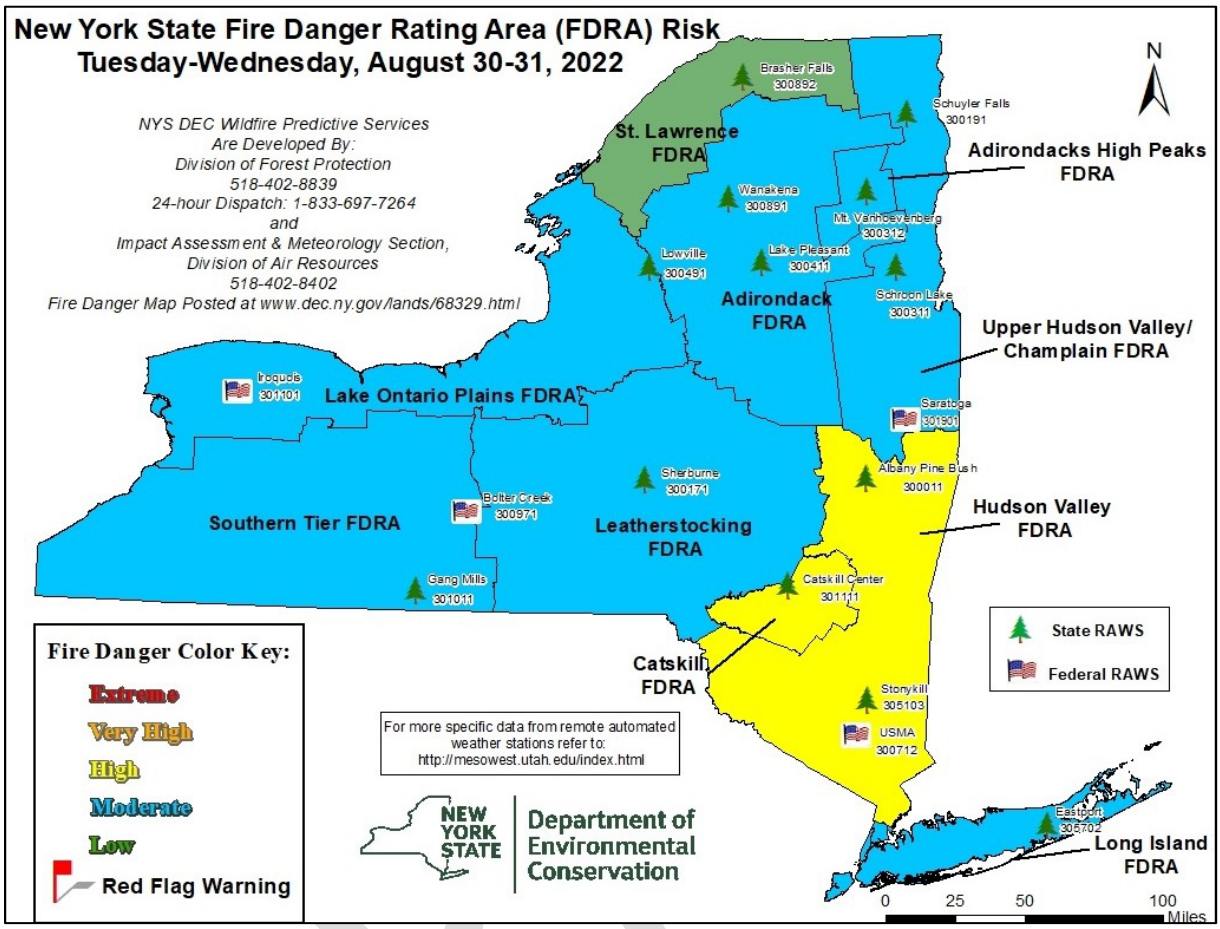
Figure 5.4.11-2. Forest Ranger Divisions in New York State



Source: NYSDEC 2022

New York State is divided into 10 Fire Danger Rating Areas (FDRAs). 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. Monroe County is part of the Lake Ontario Plains FDRA. 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. Figure 5.4.11-3 shows an example of this map.

Figure 5.4.11-3. New York State Fire Danger Rating Areas



Source: NYSDEC 2022

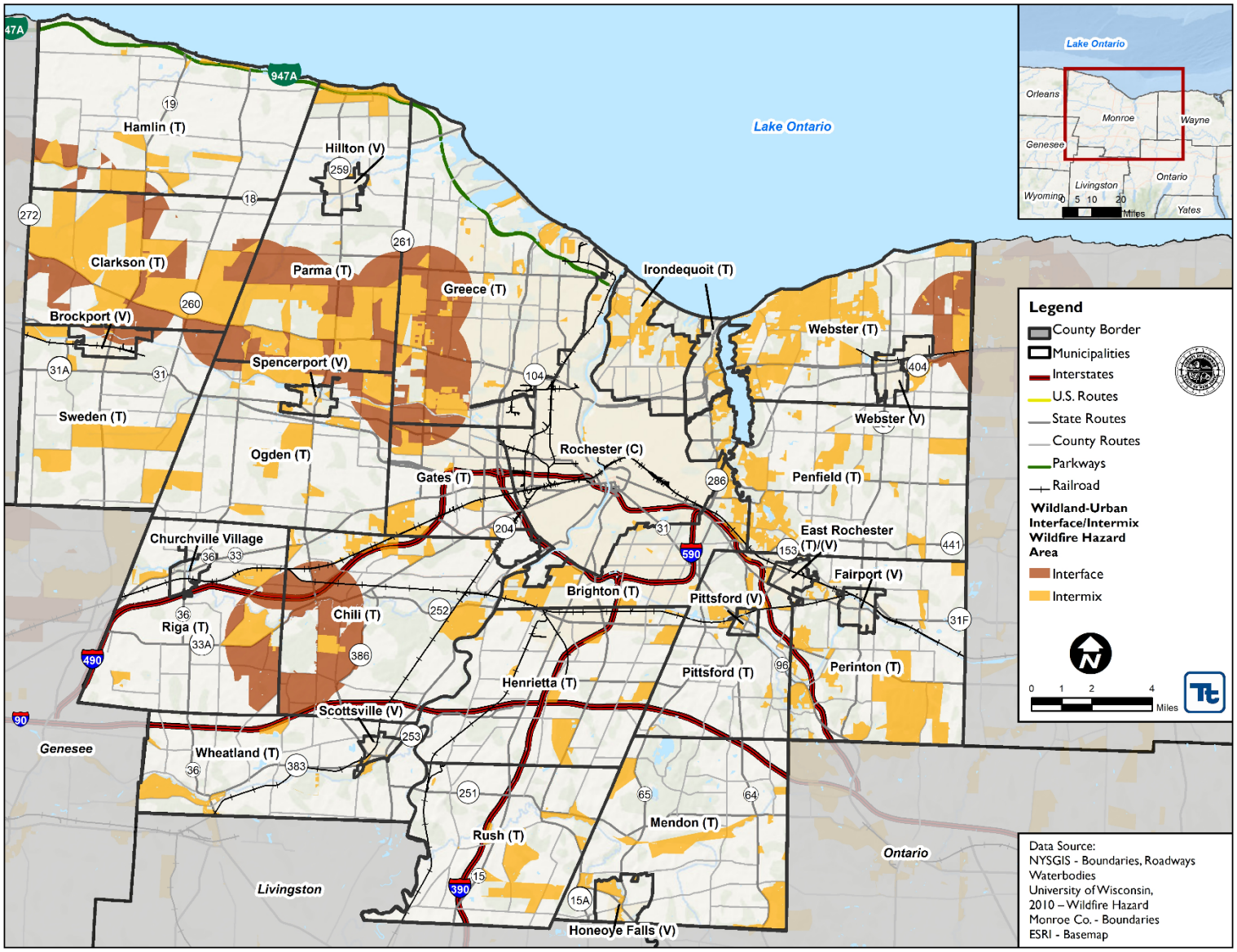
Wildfire/Urban Interface (WUI) in New York State/Monroe County

The wildland/urban interface (WUI) is any location where human structures and woodlands intermingle, allowing a wildland fire to reach beyond trees, brush, and other natural fuels to ignite homes and their immediate surroundings (NYSDEC n.d.). The WUI can also be subdivided into three categories: intermix, interface, and occluded / interior (Sustainable Defensible Space n.d.). The NYS HMP indicates that New York State has all three types of WUI interfaces. The Adirondack and Catskill Mountains contain large tracts of forests with the mixed, and to a lesser extent, the classic interface occurring throughout. The remainder of the state contains classic and mixed interfaces, with some major cities containing 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 New York State and Monroe County, an

official list that details the location, type of interface, and surrounding fuel makeup does not exist (NYS DHSES 2011).

A detailed WUI (interface and intermix) that also 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 areas within 1.5 miles of wildland vegetation are the approximate distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not located 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 5.4.11-4 below (Radeloff 2018). Specifically, significant portions of land area in the Towns of Clarkson, Parma, Greece, Webster, Chili, and Riga are within the WUI interface/intermix, as shown in Figure 5.4.11-4.

Figure 5.4.11-4. WUI in Monroe County



Extent

Wildfire events can range in size and intensity. A wildfire's intensity depends significantly on both meteorological conditions and human activity.

Wildfire Behavior and Fire Ecology

Fire behavior is defined as the way fuel ignites, flame develops, and fire spreads, which depend on interactions among fuel, weather, and topography. 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. The extent to which fire manages can understand and predict fire behavior relies on success in pre-suppression planning and actual suppression of wildfires.

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. 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 is 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):

- 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 influencing fire behavior, 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).

Several tools are available to estimate fire potential, extent, danger, and growth, including, but not limited to, the following:

- The 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 (USFS n.d.).
- 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 (Burgan, Klaver and Klaver 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 and is an expression of cumulative effects of past and present weather events, to help evaluate the effects of current or future weather on fire potential (Burgan, Klaver and Klaver 2000).
- The Keetch-Byram Drought Index (KBDI) is designed for fire potential assessment and 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 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 (USFS 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 (North Carolina Forest Service 2009).

The Fire Danger Rating in New York is established using information from the National Fire Danger Rating System (NFDRS) and 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.) in each of the ten regions of New York State. Figure 5.4.11-3 shows an example of a Fire Danger Rating Areas (FDRA) in NYS and the fire danger risk within each area on a specific date. Monroe County is part of the Lake Ontario Plains FDRA. On this particular day, the Lake Ontario Plains Fire Danger Rating was low, however some parts of the state were experiencing moderate fire danger. Table 5.4.11-1 lists fire danger ratings and color codes, also used by NYSDEC to update its fire danger rating maps, identified earlier in Figure 5.4.11-3.

Table 5.4.11-1. 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 the 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.

Adjective Rating Class and Color Code	Class Description
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, with the exception of 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 2022

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with wildfires throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

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 (USDA n.d.).

According to Ranger Division wildfire occurrence data from 1993 through 2017, 95 percent of wildfires in the state were human-caused; the remaining 5 percent are the result of lightning. With regards to human-caused fires, debris burning accounted for 33 percent; arson accounted for 16 percent; campfires accounted for 16 percent; children accounted for 4 percent; and smoking, equipment, and railroads accounted for 25 percent (NYSDEC 2022). Figure 5.4.11-5 illustrates occurrences of natural vegetation wildfires in New York State between 2003 and 2017. This figure reveals occurrences of between 0 and 18.5 wildfires per square mile within Monroe County municipalities with the highest number focused on the center and eastern two thirds of the County.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State was included in two FEMA declared wildfire specific disasters (DR) or emergency declarations (EM). Monroe County was not included in either of these declarations (FEMA 2022).

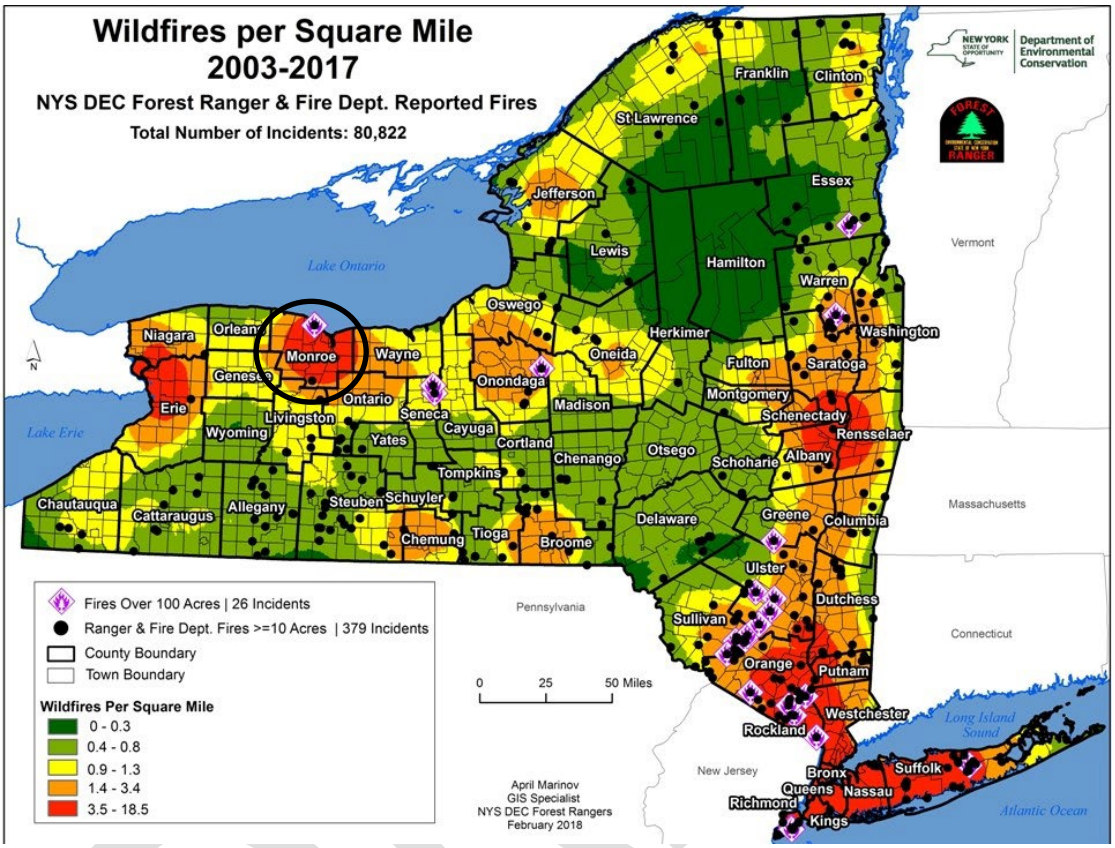
USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that noted wildfire was a contributing factor:

- S4023 - 2016 Drought
- S4031 - 2016 Drought
- S4052 - 2016 Drought (USDA 2022)

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County did not have crop losses specifically attributed to wildfire.

Figure 5.4.11-5. Wildfire Occurrences in New York State, 2003-2017



Source: NYSDEC 2022
Note: The black oval indicates the location of Monroe County.

Previous Events

Table 5.4.11-2 identifies the known wildfire events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.11-2. Wildfire Events between 2015 and 2022

Date(s) of Event	Event Type	FEMA Declaration Number	Location / County Designated?	Losses / Impacts
May 26, 2015	Wildfire	N/A	No	A wildfire detected in the Town of Hamlin

Sources: NASA FIRMS 2015; Monroe County Fire Wire 2015
Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or after the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.
FEMA Federal Emergency Management Agency N/A Not applicable

Climate Change Impacts

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 the highest fire risk. With temperatures increasing in New York State, wildfire danger may intensify with warming and drying of vegetation. When climate alters fuel loads and fuel moisture, the susceptibility of the 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.

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25 °F per decade. Average annual temperatures are projected to increase across New York State by 2 °F to 3.4 °F by the 2020s, 4.1 °F to 6.8 °F by the 2050s, and 5.3 °F to 10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State (NYSERDA 2014). The total number of hot days in New York State is expected to increase as this century progresses. The frequency and duration of heat waves, defined as three or more consecutive days with maximum temperatures at or above 90 ˚F, are also expected to increase. In contrast, extreme cold events, defined both as the number of days per year with minimum temperature at or below 32 ˚F and those at or below 0 ˚F, are expected to decrease as average temperatures rise (NYSERDA 2011).

Each region within NYS, as defined by the Integrated Assessment for Effective Climate Change in New York State (ClimAID), contains attributes that climate change will affect. Monroe County is part of ClimAID Region 1: The Great Lake Plains. In ClimAID Region 1, temperatures are estimated to increase between 3.7 to 7.3 ºF by the 2050s and 4.2 to 12 ºF by the 2080s (baseline of 47.7 ºF) (NYSERDA 2014). Extreme heat events and heat waves are also projected to increase, as listed in Table 5.4.11-3 below. 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).

In Region 1, it is estimated that temperatures will increase by 4.3ºF to 6.3ºF by the 2050s and 5.7ºF to 9.6ºF by the 2080s (baseline of 47.7ºF) (NYSERDA 2014). Extreme events are also projected to increase, as illustrated in Table 5.4.11-3 below.

Table 5.4.11-3. Extreme Event Projections for Region 1

Event Type (2020s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 °F (8 days)	12	14-17	19
# of Heat Waves (0.7 heat waves)	2	2	2
Duration of Heat Waves (4 days)	4	4	4
Days below 32 °F (133 days)	99	103 to 111	116

Source: NYSERDA 2014

A gradual change in temperatures will alter the growing environment of many tree species throughout the United States and New York, reducing the growth of some trees and increasing the growth of others. Tree growth and regeneration may be affected more by extreme weather events and climatic conditions than by gradual changes in temperature or precipitation. Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for wildfires, insects, and invasive species. Increased temperature and change in precipitation

will also affect fuel moisture during wildfire season and the length of time wildfires can burn in a given year (USDA 2011).

Climate change may also increase the frequency of lightning strikes. A warmer atmosphere holds more moisture, which is one of the key items for triggering a lightning strike. Lightning strikes cause approximately half of the wildfires in the United States. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases (Lee 2014). Wildfire incidents are predicted to increase throughout the United States because of climate change, causing at least a doubling of areas burned within the next century (USDA 2011).

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 the frequency and severity of many forest disturbances, such as infestations, invasive species, wildfires, and storm events. As temperatures increase, the suitability of a habitat for specific types of trees changes. There is also evidence that prolonged heat waves are likely to lead to a greater number of wildfires. Stronger winds from larger storms may lead to more fallen branches for wildfires to consume. An increase in rain and snow events primes forests for fire by supporting growth of more fuel. Drought and warmer temperatures lead to drier forest fuels (NYS DHSES 2014).

Probability of Future Occurrences

According to the New York State Forest Ranger Division, wildfire occurrence data from 1993 to 2017 have shown that New York State, including Monroe County, is susceptible to wildfires. Beginning in 2010, New York State 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 analysis of wildfire occurrence (NYS DHSES 2014).

Fire probability depends on local weather conditions, outdoor activities (such as camping, debris burning, and construction) and the degree of public cooperation with fire prevention measures. Dry weather, such as drought, can increase the likelihood of wildfire events. Lightning can also trigger wildfire and urban fire events. Other natural disasters can increase the 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 (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 has the potential to "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 New York State (as the state has regularly undergone in the past). However, advanced methods of wildfire management and control and a better understanding of the fire ecosystems should reduce the number of devastating fires in the future (NYS DHSES 2011).

The hazards of concern identified for Monroe 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 Planning Committee, the probability of occurrence of wildfire within the County is considered "occasional" (between 10 and 100 percent annual probability of a hazard event occurring).

5.4.11.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable within the hazard area identified. The following discusses Monroe County's vulnerability to the wildfire hazard.

Impact on Life, Health and Safety

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, 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. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. Table 5.4.11-4 summarizes the estimated population exposed to the wildfire hazard by jurisdiction.

Based on the analysis, an estimated 43,218 residents (5.7 percent of the County population) are located in the WUI interface hazard area and 59,539 residents (7.9 percent of the County's population) are located in the WUI intermix hazard areas. Overall, the Town of Greece has the greatest number of individuals located in the wildfire hazard areas (i.e., 19,164 persons in the WUI interface and 4,981 in the WUI intermix).

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Monroe County contains approximately 127,588 people over the age of 65 and 100,484 people below the poverty level (US Census 2020). Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating. 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, and nitrogen oxides), and toxics (formaldehyde and 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.

Table 5.4.11-4. Estimated Population within the WUI in Monroe County

Jurisdiction	Total Population (2020 Decennial Census)	Estimated Population Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Hazard Areas			
		Number of People in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of People in the WUI Intermix Wildfire Hazard Area	Percent of Total
Brighton (T)	37,137	0	0.0%	4,397	11.8%
Brockport (V)	7,104	4,174	58.8%	106	1.5%
Chili (T)	29,123	4,680	16.1%	2,615	9.0%
Churchville (V)	2,091	0	0.0%	0	0.0%
Clarkson (T)	6,904	3,147	45.6%	2,384	34.5%

Jurisdiction	Total Population (2020 Decennial Census)	Estimated Population Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Hazard Areas			
		Number of People in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of People in the WUI Intermix Wildfire Hazard Area	Percent of Total
East Rochester (T/V)	6,334	0	0.0%	91	1.4%
Fairport (V)	5,501	0	0.0%	0	0.0%
Gates (T)	29,167	4,151	14.2%	1,868	6.4%
Greece (T)	96,926	19,164	19.8%	4,981	5.1%
Hamlin (T)	8,725	606	6.9%	1,021	11.7%
Henrietta (T)	47,096	0	0.0%	2,360	5.0%
Hilton (V)	6,027	0	0.0%	54	0.9%
Honeoye Falls (V)	2,706	0	0.0%	496	18.3%
Irondequoit (T)	51,043	0	0.0%	7,114	13.9%
Mendon (T)	6,389	0	0.0%	667	10.4%
Ogden (T)	16,585	2,302	13.9%	1,894	11.4%
Parma (T)	10,190	2,083	20.4%	3,095	30.4%
Penfield (T)	39,438	0	0.0%	4,679	11.9%
Perinton (T)	39,128	0	0.0%	4,831	12.3%
Pittsford (T)	25,714	0	0.0%	1,923	7.5%
Pittsford (V)	1,419	0	0.0%	181	12.7%
Riga (T)	3,495	799	22.9%	353	10.1%
Rochester (C)	211,328	0	0.0%	589	0.3%
Rush (T)	3,490	0	0.0%	561	16.1%
Scottsville (V)	2,009	0	0.0%	55	2.8%
Spencerport (V)	3,685	0	0.0%	531	14.4%
Sweden (T)	6,140	235	3.8%	611	10.0%
Webster (T)	39,676	1,877	4.7%	11,357	28.6%
Webster (V)	5,651	0	0.0%	399	7.1%
Wheatland (T)	2,888	0	0.0%	326	11.3%
Monroe County (Total)	**753,109**	**43,218**	**5.7%**	**59,539**	**7.9%**

Sources: U.S. Census 2020; University of Wisconsin 2010
Notes: (C) = City, (T) = Town, (V) = Village

Impact on General Building Stock

The most vulnerable structures to wildfire events are those located within the WUI areas. If a wildfire occurs at a WUI, it can also cause an urban fire and in this case has the potential for great damage to infrastructure, because of the high density of population and structures in these areas. Buildings constructed of wood or vinyl siding are generally more likely to be damaged by the fire hazard than buildings constructed of brick or concrete. The hazard areas were overlaid on the building inventory in the County (Census block) to estimate the buildings exposed to the wildfire hazard. The replacement cost value of the structures with their center in the hazard area were totaled. Table 5.4.11-5 summarizes the number of buildings exposed by municipality. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate. Approximately 5.5 percent of the County's buildings are located in the WUI interface hazard area, and approximately 0.1 percent of the County's buildings are located in the WUI intermix hazard area.

Table 5.4.11-5. Building Stock within the WUI in Monroe County

Jurisdiction	Total Number of Buildings	Estimated Number of Structures Located in the Wildfire Hazard Areas			
		Number of Buildings in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of Buildings in the WUI Intermix Wildfire Hazard Area	Percent of Total
Brighton (T)	11,693	0	0.0%	1,442	12.3%
Brockport (V)	2,224	1,270	57.1%	32	1.4%
Chili (T)	11,534	1,918	16.6%	1,047	9.1%
Churchville (V)	1,112	0	0.0%	0	0.0%
Clarkson (T)	3,411	1,405	41.2%	1,271	37.3%
East Rochester (T/V)	2,924	0	0.0%	35	1.2%
Fairport (V)	2,394	0	0.0%	0	0.0%
Gates (T)	11,801	1,564	13.3%	796	6.7%
Greece (T)	36,414	6,984	19.2%	1,953	5.4%
Hamlin (T)	5,539	336	6.1%	683	12.3%
Henrietta (T)	15,982	0	0.0%	765	4.8%
Hilton (V)	2,143	0	0.0%	17	0.8%
Honeoye Falls (V)	1,155	0	0.0%	218	18.9%
Irondequoit (T)	21,885	0	0.0%	2,928	13.4%
Mendon (T)	3,835	0	0.0%	374	9.8%
Ogden (T)	7,407	961	13.0%	880	11.9%
Parma (T)	5,509	1,193	21.7%	1,663	30.2%
Penfield (T)	15,882	0	0.0%	1,885	11.9%
Perinton (T)	16,817	0	0.0%	2,159	12.8%
Pittsford (T)	10,590	0	0.0%	789	7.5%
Pittsford (V)	804	0	0.0%	111	13.8%
Riga (T)	2,356	440	18.7%	203	8.6%
Rochester (C)	89,392	0	0.0%	229	0.3%
Rush (T)	2,808	0	0.0%	447	15.9%
Scottsville (V)	1,069	0	0.0%	28	0.0%
Spencerport (V)	1,654	0	0.0%	212	0.1%
Sweden (T)	3,465	131	3.8%	420	0.1%
Webster (T)	16,660	1,050	6.3%	4,688	0.3%
Webster (V)	1,633	0	0.0%	98	0.1%
Wheatland (T)	1,926	0	0.0%	178	0.1%
Monroe County (Total)	**312,018**	**17,252**	**5.5%**	**25,551**	**0.1%**

Sources: Monroe County GIS 2022; University of Wisconsin 2010
Notes: (C) = City, (T) = Town, (V) = Village

Impact on Critical Facilities

A number of critical facilities are within the wildfire hazard area, and are also 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 5.4.11-6 summarizes the number of critical facilities and lifelines within the WUI Intermix and Interface hazard areas by jurisdiction. Overall, 124 critical facilities (120 of which are considered lifelines) are located in the wildland-urban intermix hazard area and 82 critical facilities (72 of which are considered lifelines) are located in the wildland-urban interface hazard area. The Town of Greece has the greatest number of critical facilities built in the wildland-urban interface (i.e., 21 critical facilities) and the Town of Chili and Town of Greece have the greatest number of critical facilities built in the wildland-urban intermix hazard areas (i.e., 14 critical facilities each). Critical facilities are further broken out by type

within the WUI Interface and Intermix hazard areas, as summarized in Table 5.4.11-6. Lifeline types located in the wildfire hazard areas are identified in Table 5.4.11-7.

Table 5.4.11-6. Facilities within the WUI (Intermix or Interface) in Monroe County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Intermix Wildfire Hazard Area				Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Intermix Wildfire Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brighton (T)	69	65	5	7.2%	5	7.7%	5	7.2%	5	7.7%
Brockport (V)	29	28	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Chili (T)	111	102	14	12.6%	14	13.7%	14	12.6%	14	13.7%
Churchville (V)	24	23	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Clarkson (T)	14	10	2	14.3%	2	20.0%	2	14.3%	2	20.0%
East Rochester (T/V)	31	29	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Fairport (V)	17	16	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Gates (T)	58	54	4	6.9%	4	7.4%	4	6.9%	4	7.4%
Greece (T)	165	158	14	8.5%	14	8.9%	14	8.5%	14	8.9%
Hamlin (T)	23	22	8	34.8%	8	36.4%	8	34.8%	8	36.4%
Henrietta (T)	111	103	5	4.5%	5	4.9%	5	4.5%	5	4.9%
Hilton (V)	21	20	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Honeoye Falls (V)	17	16	8	47.1%	7	43.8%	8	47.1%	7	43.8%
Irondequoit (T)	103	100	3	2.9%	3	3.0%	3	2.9%	3	3.0%
Mendon (T)	21	20	4	19.0%	4	20.0%	4	19.0%	4	20.0%
Ogden (T)	42	38	6	14.3%	5	13.2%	6	14.3%	5	13.2%
Parma (T)	18	16	6	33.3%	6	37.5%	6	33.3%	6	37.5%
Penfield (T)	73	68	7	9.6%	7	10.3%	7	9.6%	7	10.3%
Perinton (T)	64	57	8	12.5%	7	12.3%	8	12.5%	7	12.3%
Pittsford (T)	45	39	4	8.9%	3	7.7%	4	8.9%	3	7.7%
Pittsford (V)	14	13	4	28.6%	4	30.8%	4	28.6%	4	30.8%
Riga (T)	20	18	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Rochester (C)	639	605	1	0.2%	1	0.2%	1	0.2%	1	0.2%
Rush (T)	29	26	6	20.7%	6	23.1%	6	20.7%	6	23.1%
Scottsville (V)	14	13	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Spencerport (V)	13	13	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sweden (T)	11	11	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Webster (T)	55	53	13	23.6%	13	24.5%	13	23.6%	13	24.5%
Webster (V)	16	15	1	6.3%	1	6.7%	1	6.3%	1	6.7%
Wheatland (T)	23	21	1	4.3%	1	4.8%	1	4.3%	1	4.8%
Monroe County (Total)	**1,890**	**1,773**	**124**	**6.6%**	**120**	**6.8%**	**124**	**6.6%**	**120**	**6.8%**

Source: Monroe County 2022; University of Wisconsin 2010
Notes: (C) = City, (T) = Town, (V) = Village

Table 5.4.11-7. Lifeline Facilities within the WUI (Intermix or Interface) in Monroe County

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Wildland-Urban Interface Wildfire Hazard Area	Number of Lifelines Located in the Wildland-Urban Intermix Wildfire Hazard Area
Communications	68	5	8
Energy	14	0	0
Food, Water, Shelter	286	18	25
Hazardous Material	1	0	0
Health and Medical	93	1	10
Safety and Security	1,274	47	77
Transportation	36	1	0
Monroe County (Total)	**1,772**	**72**	**120**

Source: Monroe County 2022; University of Wisconsin 2010

Impact on 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 businesses and decreases in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and can involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that provide employees with time off to volunteer to fight these fires.

Table 5.4.11-8 summarizes the estimated building stock inventory exposed by municipality. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate. Approximately 3.9 percent ($12.2 billion) of the County's replacement cost value is located in the WUI interface hazard area, and approximately 5.2 percent ($16.4 billion) of the County's replacement cost value is located in the WUI intermix hazard area.

Table 5.4.11-8. Building Stock Replacement Cost Value within the WUI in Monroe County

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Total Replacement Cost Value of Structures Located in the Wildfire Hazard Areas			
		Total RCV of Buildings Located in the WUI Interface Wildfire Hazard Area	Percent of Total	Total RCV of Buildings Located in the WUI Intermix Wildfire Hazard Area	Percent of Total
Brighton (T)	$14,443,886,002	$0	0.0%	$1,186,836,024	8.2%
Brockport (V)	$5,158,789,593	$2,472,603,273	47.9%	$9,532,926	0.2%
Chili (T)	$9,206,843,885	$1,305,889,268	14.2%	$622,171,237	6.8%
Churchville (V)	$938,164,078	$0	0.0%	$0	0.0%
Clarkson (T)	$1,887,392,030	$668,022,331	35.4%	$828,501,014	43.9%
East Rochester (T/V)	$3,440,171,127	$0	0.0%	$13,844,475	0.4%
Fairport (V)	$2,281,456,075	$0	0.0%	$0	0.0%
Gates (T)	$12,220,599,285	$545,862,128	4.5%	$821,130,034	6.7%
Greece (T)	$26,954,378,684	$4,164,052,659	15.4%	$1,468,468,649	5.4%
Hamlin (T)	$2,318,778,027	$116,872,394	5.0%	$342,147,263	14.8%
Henrietta (T)	$23,460,566,322	$0	0.0%	$578,353,234	2.5%
Hilton (V)	$2,120,287,988	$0	0.0%	$5,656,507	0.3%
Honeoye Falls (V)	$1,813,180,690	$0	0.0%	$219,371,913	12.1%
Irondequoit (T)	$13,427,006,840	$0	0.0%	$1,169,893,590	8.7%
Mendon (T)	$2,852,155,915	$0	0.0%	$221,664,720	7.8%
Ogden (T)	$5,558,087,440	$648,996,610	11.7%	$655,119,709	11.8%
Parma (T)	$3,373,412,574	$940,465,375	27.9%	$991,289,442	29.4%
Penfield (T)	$11,119,233,991	$0	0.0%	$1,263,191,307	11.4%
Perinton (T)	$13,125,415,407	$0	0.0%	$1,461,139,537	11.1%
Pittsford (T)	$10,686,774,000	$0	0.0%	$477,211,403	4.5%
Pittsford (V)	$1,776,834,511	$0	0.0%	$195,408,082	11.0%
Riga (T)	$1,539,492,845	$186,597,276	12.1%	$178,658,659	11.6%
Rochester (C)	$119,943,371,056	$0	0.0%	$78,776,290	0.1%
Rush (T)	$1,816,445,354	$0	0.0%	$214,448,885	11.8%
Scottsville (V)	$908,716,753	$0	0.0%	$75,724,774	8.3%
Spencerport (V)	$1,580,844,696	$0	0.0%	$118,792,132	7.5%
Sweden (T)	$3,402,258,236	$73,724,593	2.2%	$226,661,211	6.7%
Webster (T)	$11,510,191,170	$1,081,442,876	9.4%	$2,706,113,413	23.5%
Webster (V)	$3,634,066,282	$0	0.0%	$76,383,368	2.1%
Wheatland (T)	$2,509,077,040	$0	0.0%	$234,376,260	9.3%

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Total Replacement Cost Value of Structures Located in the Wildfire Hazard Areas			
		Total RCV of Buildings Located in the WUI Interface Wildfire Hazard Area	Percent of Total	Total RCV of Buildings Located in the WUI Intermix Wildfire Hazard Area	Percent of Total
Monroe County (Total)	**$315,007,877,896**	**$12,204,528,782**	**3.9%**	**$16,440,866,055**	**5.2%**

Sources: Monroe County GIS 2022; University of Wisconsin 2010
Notes: (C) = City, (T) = Town, (V) = Village

Impact on the Environment

Wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding caused by the impacts of silt in local watersheds. According to the USGS, post-fire runoff polluted with debris and contaminants can be extremely harmful to ecosystem and aquatic life. Studies show that urban fires in particular are more harmful to the environment compared to forest fires (USGS 2018). The age and density of infrastructure within Monroe County can exacerbate consequences of fires on the environment because of the increased amount of chemicals and contaminants that would be released from burning infrastructure. These chemicals, such as iron lead, and zinc, may leach into the storm water, contaminate nearby streams, and impair aquatic life.

Cascading Impacts On Other Hazards

Wildfires result in the uncontrolled destruction of forests, brush, field crops, grasslands, real estate, and personal property, and have secondary impacts on other hazards such as flooding, by removing vegetation and destroying watersheds. Additionally, wildfires can increase because of rising temperatures and increased droughts. More information about extreme temperature and drought hazards of concern is provided in Section 5.4.4 and Section 5.4.2, respectively.

Severe wildfires can result in a loss of vegetation that causes slope instability. This can contribute to an increase in landslide events. For more information on landslides, refer to Section 5.4.8. Vegetation loss can also increase the amount of runoff during rainfall events, increasingly the likelihood for flash flooding. For more information on the flood hazard, refer to Section 5.4.5.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Areas targeted for potential future growth and development within the next 5 years have been identified across Monroe County at the jurisdiction 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 for maps which include new development project areas and their proximity to the wildland-urban interface/intermix hazard areas.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of population, particularly in the WUI, can impact the number of persons exposed to the wildfire hazard. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

According to the USDA Forest Service, climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, impact carbon cycling, forest structure, and species composition (US EPA 2020). Climate change associated with warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conductive to large, severe fires. Under a changing climate, wildfires exceeding 50,000 acres have increased over the past 30 years (USDA 2012a). Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species, and an increasing WUI.

As discussed earlier, average temperatures are anticipated to increase in New York; therefore, the suitability of habitats for specific types of trees will potentially change, altering the fire regime and resulting in more frequent fire events and changes in intensity. Prolonged and more frequent heat waves have the potential to increase the likelihood of a wildfire. The increased potential combined with stronger winds may make it harder to contain fires and thus will increase the County's vulnerability to this hazard.

Change of Vulnerability Since 2017 HMP

Monroe County continues to be vulnerable to the wildfire hazard. However, there are several differences between the exposure estimates of this plan update and the results reported in the 2017 HMP. Population statistics have been updated using the 2020 US Census. The building stock inventory was updated using data from Monroe County. Additionally, the critical facility inventory list was updated by Monroe County.