4.3.10 Wildfire

Hazard Profile

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the wildfire hazard in Rockland County.

Hazard Description

According to the New York State Hazard Mitigation Plan (NYS HMP), a wildfire is any fire that is not planned, controlled, or supervised in a natural area such as a forest, grassland, or prairie (MitigateNY 2018). Wildfires that burn or threaten to burn buildings and other structures are referred to as wildland urban interface fires. Wildfires include common terms such as forest fires, brush fires, grass fires, wildland urban interface fires (previously mentioned), range fires or ground fires. Wildfires do not include those fires, either naturally or purposely ignited, that are controlled for a defined purpose of managing vegetation for one or more benefits (MitigateNY 2018). These events often begin unnoticed and spread quickly. A fire needs all of the following three elements in the right combination to start and grow: a heat source, fuel, and oxygen.

Figure 4.3.10-1. Fire Triangle

Source: National Park Service 2020

Figure 4.3.10-2. April 2023 Brushfire in Rockland County

Source: ABC7 2023

The interaction of three conditions determines how a wildfire will grow once ignited: fuel, weather, and topography (MitigateNY 2018). Fuels are anything that will burn and include vegetation and structures. The weather, such as high temperatures, low humidity and high winds increase the likelihood that a wildfire will spread. Topography affects speed at which a wildfire will spread. A fire will move more quickly uphill which causes hot gases to rise in front of it. These gases, in turn, pre-heat and dry vegetation ahead of the wildfire causing it to catch fire more rapidly (MitigateNY 2018).

The National Park Service (NPS) has identified four categories of wildfires that are experienced throughout the US. These categories are defined as follows (NPS 2020):

- **Wildland fires** are fueled almost exclusively by natural vegetation. They typically occur in national forests and parks, where federal agencies are responsible for fire management and suppression.
- **Interface or intermix fires** are urban/wildland fires in which vegetation and the built environment provide fuel.
- **Firestorms** are events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change, or the available fuel is exhausted.

- **Prescribed fires and prescribed natural burns** are fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes.

Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure.

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

Location

While they are not confined to any specific geographic location and can vary greatly in terms of size, location, intensity, and duration, wildfires are most likely to occur in open grasslands. The threat to people and property is greater in the fringe areas where developed areas meet open grasslands (U.S. Forest Service 2020). Many areas in the State, particularly those that are heavily forested or contain large tracts of brush and shrubs, are prone to fires.

Wildfires in Rockland County typically occur in the forested areas in the northern and western portions of the County and in areas parallel to the Hudson River. Many of these areas at risk are popular with hikers and campers. Several major transportation routes (New York State Thruway and Palisades Parkway) traverse these areas, leaving them vulnerable to closure during wildfires due to smoke conditions.

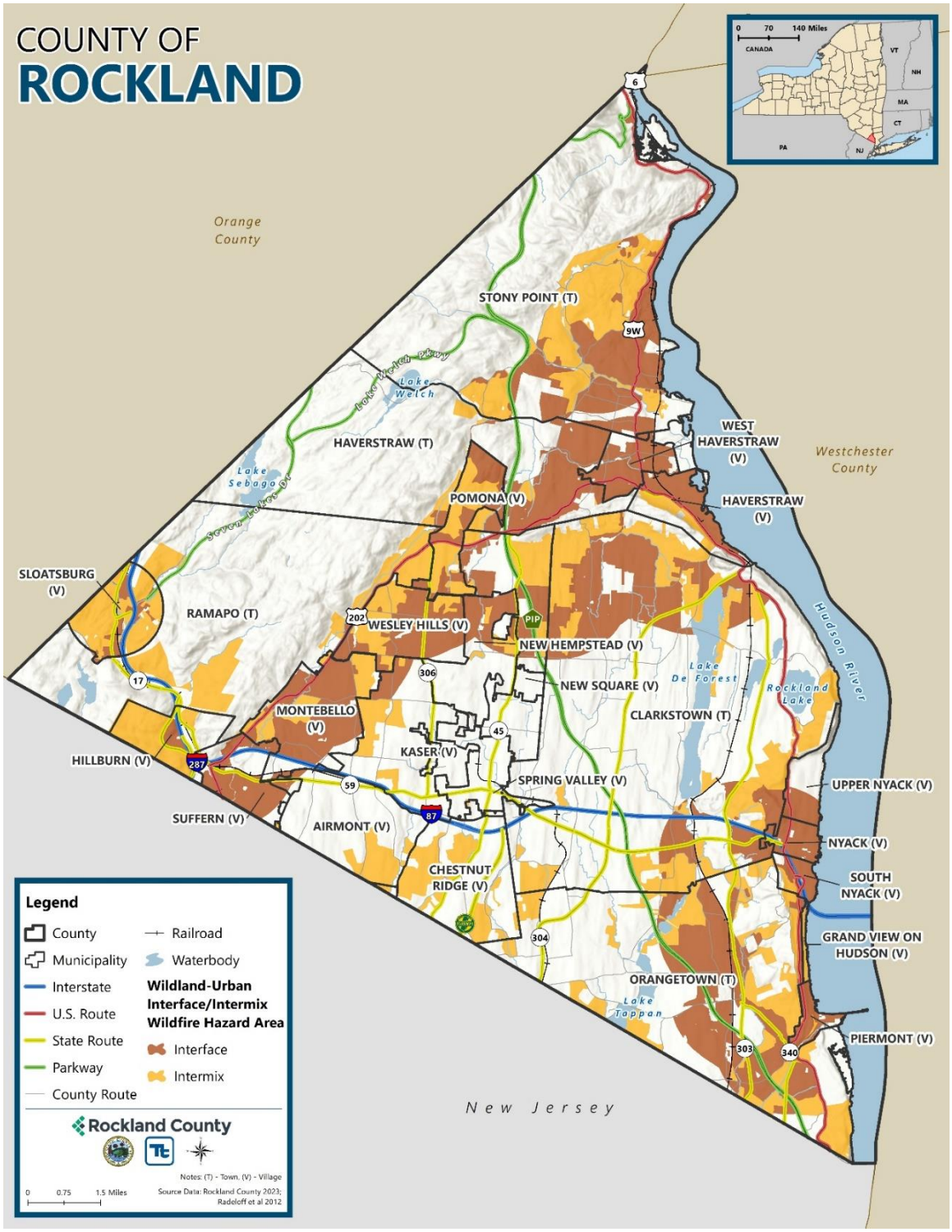
The State of New York is divided into 10 fire danger rating areas (FDRAs). FDRAs are defined by areas of similar vegetation, climate, and topography in conjunction with agency regional boundaries, National Weather Service (NWS) fire weather zones, political boundaries, fire occurrence history, and other influences. The Forest Ranger Division issues daily fire danger warnings when the fire danger rating is at high or above in one or more FDRAs. Rockland County is in the Hudson Valley FDRA. This is discussed further in in the Extent section of this profile.

Wildfire/Urban Interface (WUI)

Wildland urban interface (WUI) is the area where natural areas and development meet. From 1990 to 2010, the WUI in the United States by 41% in terms of new housing, and by 33% in terms of land area. 97% of this increase in WUI area is due to the construction of new housing, and not related to an increase in wildland vegetation (V. Radeloff, et al. 2018). These homes are at risk of structure loss, injury, and death from a wildfire. All states have at least a small amount of land classified as WUI, and up to 18.8 percent of all US land may be classified as WUI (USGS 2022). The WUI is divided into two categories: intermix and interface. Intermix WUI refers to areas where housing and wildland vegetation intermingle, while interface WUI refers to areas where housing is in the vicinity of a large area of dense wildland vegetation (C. Radeloff, et al. 2020). Intermix areas have more than one house per 40 acres and have more than 50 percent vegetation. Interface areas have more than one house per 40 acres, have less than 50 percent vegetation, and are within 1.5 miles of an area over 1,235 acres that is more than 75 percent vegetated (Stewart, et al. 2006). In the State of New York, 27.2 percent (38,489 square miles) is located in the WUI; with 5.4 percent (7,599 square miles) is located in the WUI interface and 21.9 percent (30,890 square miles) is located in the WUI intermix (C. Radeloff, et al. 2020).

In Rockland County, 30.7 percent (158 square miles) of land is in the WUI; with 17.9 percent (92 square miles) located in the WUI interface and 12.8 percent (66 square miles) is located in the WUI intermix (C. Radeloff, et al. 2020). Refer to Figure 4.3.10-3 for WUI areas in Rockland County.

Figure 4.3.10-3. Wildland-Urban Inface and Intermix Wildfire Hazard Area in Rockland County



Extent

The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. There are several tools available to estimate fire potential, extent, danger, and growth, several of which are described in the following section.

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. 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 (WFAS 2023).

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. Fire Danger Rating level considers current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (WFAS 2023). Table 4.3.10-1 shows the fire danger rating and color code, which is also used by the NYSDEC to update their fire danger rating maps, which is identified later in this section.

Table 4.3.10-1. Description of Fire Danger Ratings in the State of New York

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 which 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: USDA n.d.

The ***Fire Potential Index (FPI)*** is a moisture-based vegetation flammability indicator. The FPI indicates the estimated proportion (percentage) of the vegetation that is dry enough to burn, thus the FPI is highest when dead

fuel moistures and vegetation greenness are low. The FPI is calculated once daily for the continental US at a resolution of 1 square kilometer. Although these maps provide a relative measure of fuel flammability across the nation, they do not indicate the chance that a large fire will occur (USFS 2016) (USGS 2023).

Fuel Moisture (FM) is a measure of the amount of water in a fuel (vegetation) available to a fire and is expressed as a percent of the dry weight of that specific fuel. When fuel moisture content is high, fires do not ignite readily, or at all, because heat energy must be used to evaporate and drive water from the plant before it can burn. When the fuel moisture content is low, fires start easily and will spread rapidly because all the heat energy goes directly into the burning flame itself. When the fuel moisture content is less than 30 percent, that fuel is essentially considered to be dead. Dead fuels respond solely to current environmental conditions and are critical in determining fire potential (NOAA 2023).

Fuels are classified into four categories which respond to changes in moisture. This response time is referred to as a time lag. A fuel's time lag is based upon how long it would take for two-thirds of the dead fuel to respond to atmospheric moisture. Table 4.3.10-2 below outlines these four fuel classifications.

Table 4.3.10-2. Fuel Moisture Classifications

1-hour fuels	10-hour fuels	100-hour fuels	1000-hour fuels
Up to ¼-inch diameter – fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.	¼-inch to one-inch in diameter - computed from observation time, temperature, humidity, and cloudiness or can be an observed value.	One-inch to three-inch in diameter - computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity ranges.	Three-inch to eight-inch in diameter - computed from a seven-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges.

Source: NPS 2023

The ***Keetch-Byram Drought Index (KBDI)*** assesses the risk of fire by representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. The KBDI attempts to measure the amount of precipitation necessary to return the soil to full field capacity. The index ranges from zero, the point of no moisture deficiency, to 800, the maximum drought that is possible, and represents a moisture regime from zero to eight inches of water through the soil layer. At eight inches of water, the KBDI assumes saturation. At any point along the scale, the index number indicates the amount of net rainfall that is required to reduce the index to zero, or saturation (NIDIS 2023).

The ***Haines Index***, also known as the Lower Atmosphere Stability Index, was developed for fire use. It is used to indicate the potential for wildfire growth by measuring the stability and dryness of the air over a fire. It is calculated by combining the 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. This index has been shown to be correlated with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior. The drier and more unstable the lower atmosphere is, the higher the index. See Table 4.3.10-3 below.

Table 4.3.10-3. Haines Index

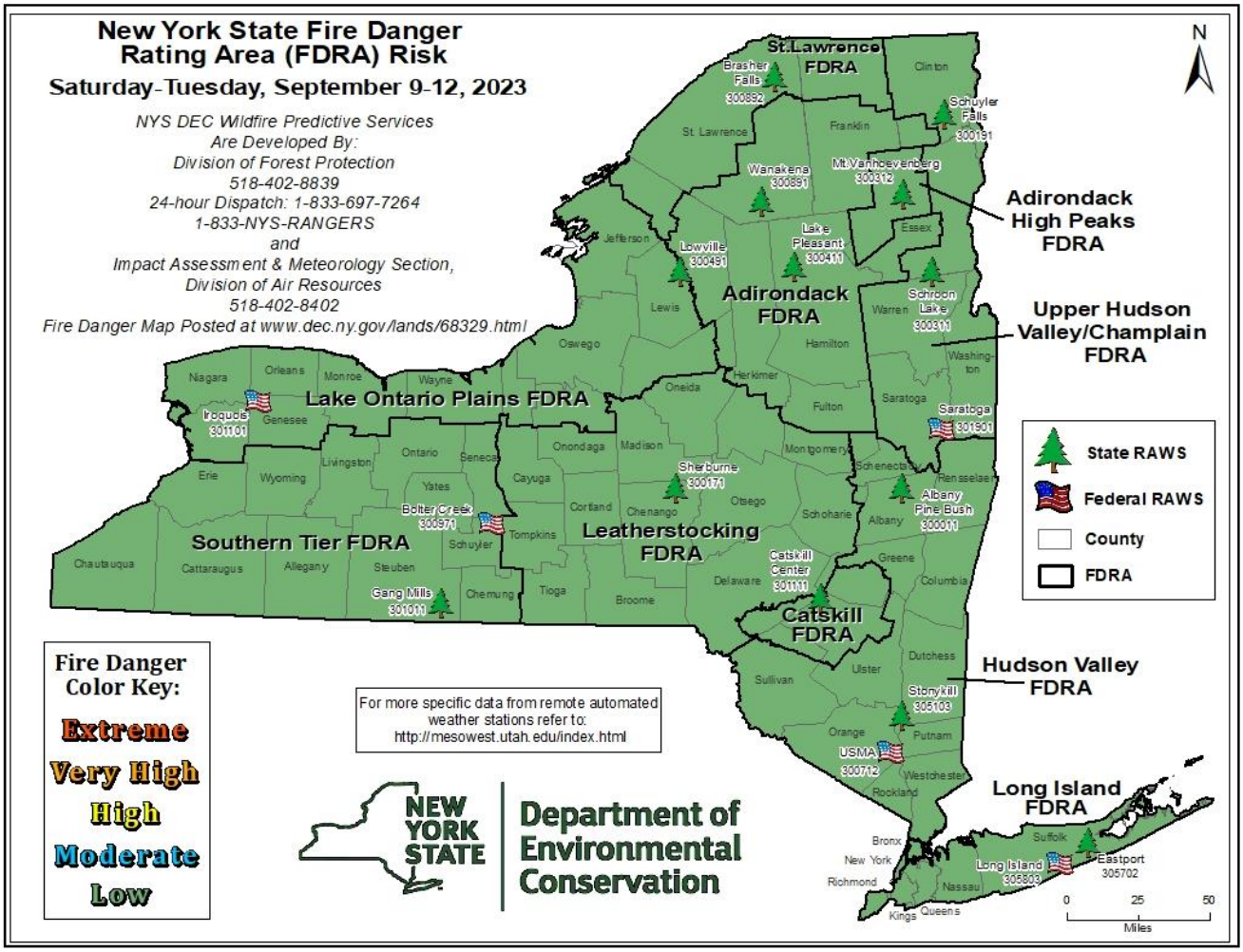
Haines Index	Potential for Large Fire Growth
2 or 3	Very Low
4	Low
5	Moderate
6	High

Source: NOAA n.d.

NYSDEC Fire Danger Rating Map

A current fire danger rating map is updated daily on the NYSDEC website (NYSDEC 2023). The map is developed by information obtained from the Division of Forest Protection and Division of Air Resources (impact assessment and meteorology section). Figure 4.3.10-4 shows the FDRAs in the State of New York and the current (as of September 13, 2023) fire danger risk for each of the areas. The figure is color coded and indicates where there are red flag warning areas. The table following the figure describes the fire danger ratings for the State of New York. The figure is showing Rockland County at low risk, as of September 13, 2023.

Figure 4.3.10-4. the State of New York FDRAs



Source: NYSDEC 2023

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2023, Rockland County was not included in any major disaster (DR) or emergency (EM) declarations for wildfire-related events (FEMA 2023). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

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 2018 and 2023, Rockland County was not included in any wildfire-related agricultural disaster declarations.

Previous Events

For this 2024 HMP update, known hazard events that impacted Rockland County between January 2017 and December 2023 are discussed in Table 4.3.10-4. Many sources provided wildfire information regarding previous occurrences and losses associated with wildfire throughout the State of New York and Rockland County. With so many sources reviewed for the purpose of this HMP Update, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP. For events prior to 2017, refer to the 2018 Rockland County HMP.

Table 4.3.10-4. Hazard Events in Rockland County (2017 to 2023)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Rockland County included in declaration?	Location Impacted	Description
April 14, 2023	Wildfire	N/A	N/A	Stony Point, NY (T); Congers, NY (T)	A large brush fire broke out in the town of Stony Point, NY before moving south along the Hudson River to Congers, NY. A few houses suffered very minor damage (one fence was melted), but no homes or human lives were lost in this incident.
June 2023	Wildfire Smoke from Canadian Wildfires	N/A	N/A	Countywide	As a result from large wildfires in western Canada, smoke from the fires moved eastward and impact air quality in and around Rockland County. NYSDEC issued an air quality health advisory due to the low air quality index throughout the Hudson Valley, including Rockland County.

Sources: NBC 2023; NOAA 2023; Randall 2023

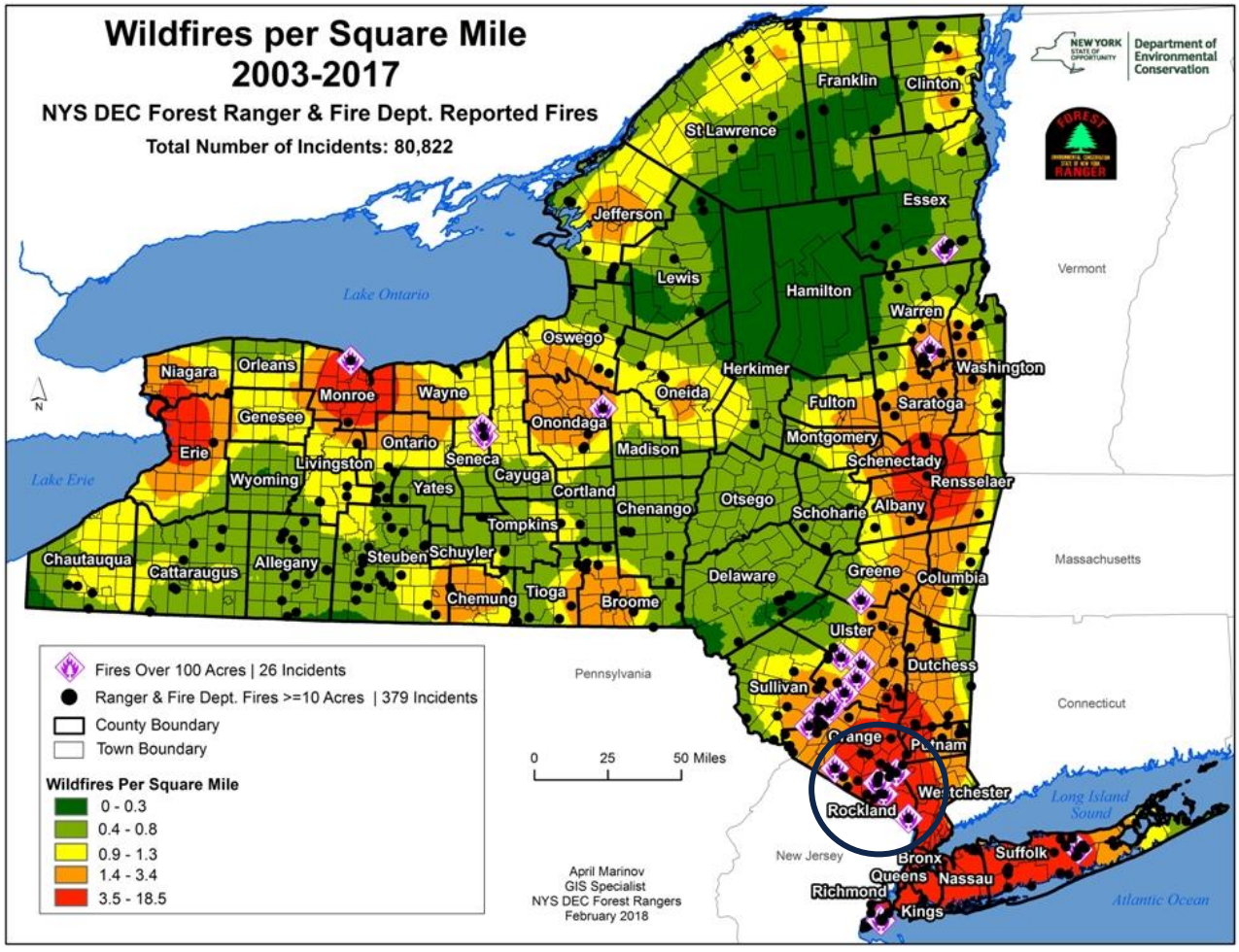
Wildfire occurrence reporting in New York is based on two data sources: State of New York Forest Ranger Division data and National Fire Incident Reporting System (NFIRS) reporting. The State of New York Forest Ranger force has fought fires and retained records since 1891. Between 1993 and 2017, Division records indicate that rangers suppressed 5,423 wildfires that burned a total of 52,580 acres. This averages 217 fires burning 2,103 acres per year; however, the State does not have a consistent wildfire season. The State of New York's fire history indicates periods of time when wildfires are much more numerous and destructive than the 25-year average would indicate. The years 1988, 1989, 1991, 1995, 1998, 1999, 2002, and 2008 were all above average year, including with 11,730

acres burned in 1989 alone. In 2015, a 2,759-acre wildfire burned from Roosa Gap, Sullivan County to Cragsmoor, Ulster County, threatening 50 residences before being contained. In 2016, the Sam's Point Fire in Ulster County burned 2,028 acres, threatening a radio communication tower complex that serves the Lower Hudson Valley and southern Catskill Mountains.

According to the Ranger Division wildfire occurrence data from 1993 through 2017, 95 percent of wildfires in the State were caused by humans, while lightning was responsible for 5 percent of wildfires. Of the wildfires in the State of New York during this period, debris burning accounts for 33 percent, incendiary fires account for 16 percent, campfires cause 16 percent, children are responsible for 4 percent, and smoking, equipment, railroads, and other miscellaneous causes contribute to the remaining 25 percent of wildfires (NYSDEC 2017).

Between 2015 and 2019, the State of New York reported 338,139 fires to NFIRS. Rockland County reported 4,056 fires to NFIRS, with approximately 25 percent of these events being classified as “outside fires”. Alongside these reported fires, over 78 percent of residential building fires in Rockland County were caused by cooking accidents (FEMA 2021).

Figure 4.3.10-5. Wildfires per Square Mile in the State of New York, 2003-2017



Source: NYSDEC 2017
Note: The black circle indicates the location of Rockland County.

Between 1954 and 2023, Rockland County was not included in any Fire Management Assistance (FMA) Declarations or Fire Suppression Authorizations as issued by the Federal Emergency Management Agency (FEMA).

Probability of Future Occurrences

The State's large size, diverse topography, and variety of climates require the State be divided into distinct units for describing wildfire potential and risk. See the Location section of this profile for information regarding the risk areas. Wildfire experts say there are four reasons why wildfire risks are increasing (CSSR 2017):

- Increased fuel availability driven by antecedent moisture
- Increased fuel flammability due to warmer, drier conditions
- Increasingly hot, dry weather in the US
- Changing weather patterns across the country
- More homes built in the areas called the Wildland/Urban Interface, meaning homes are built closer to wildland areas where wildfires can occur

It is likely that the State of New York will experience small wildfires throughout the state on a yearly basis (as the State has regularly experienced in the past). However, advanced methods of wildfire management and control and a better understanding of the fire ecosystems should help in reducing the number of devastating fires in the future.

Estimating the approximate number of wildfires to occur in Rockland County is difficult to predict in a probabilistic manner. This is due to several factors impacting the potential for a fire to occur and because some conditions (for example, ongoing land use development patterns, location, fuel sources, and construction sites) exert increasing pressure on the WUI zone. Based on available data, wildfires will continue to present a risk to Rockland County. Given the numerous factors that can impact urban fire and wildfire potential, the likelihood of a fire event starting and sustaining itself should be gauged by professional fire managers on a continuous basis.

For the 2024 HMP update, best available data was used to collect hazard event details. These details were used to calculate the probability of future occurrence of hazard events in the County. Information from the 2019 State of New York HMP, the 2018 Rockland County HMP, NBC, NOAA, and FEMA were used to identify the number of events that occurred between 2008 and 2023. Table 4.3.10-5 provides the calculated probability of future wildfire events in Rockland County.

Table 4.3.10-5. Probability of Future Wildfire Events in Rockland County

Hazard Type	Number of Occurrences Between 2008 and 2023	Percent Chance of Occurring in Any Given Year
Wildfire	14	81.2 percent

Sources: FEMA 2023; NBC 2023; NOAA 2023; NYSDEC 2023

Notes: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected wildfire events since 1968. Due to limitations in data, not all wildfire events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for Rockland County were ranted. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Partnership, the probability of occurrence for wildfire in the County is considered 'occasional'.

Climate Change Projections

Climate change make forests more susceptible to severe fires due to changing precipitation patterns. However, not every area will be affected in the same way. For example, forests of the Midwest and Northeast face an uncertain future as the climate continues to change. Forests vary widely across the region, and vulnerabilities are strongly influenced by regional differences in climate impacts and adaptive capacity (MitigateNY 2018).

Wildfire likelihood and extent is determined by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Temperatures in the State of New York 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 the State of New York 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). Summer droughts are also projected to increase, affecting water supply, agriculture, ecosystems, and energy projects (NYSERDA 2014). Hot dry spells create the highest fire risk. With the increase in temperatures, heat waves will become more frequent and intense, posing new challenges to the energy system, air quality and agriculture, and potentially increasing the risk of wildfire.

One of the most serious climate change concerns around wildfires is that climate change could lead to an increase in the conditions that lead to larger wildfires. This is especially important to the State because a majority of area burned in the Eastern US results from a limited number of exceptionally large wildfires. Very large fires (VLFs) are wildfire events associated with significant economic, human health, and environmental risk unique from other conventional wildfires (Podschwit, et al. 2018). Recent studies have found that the factors and conditions associated with VLFs are closely related to factors that drive climate change. This research also showed that the probability of VLF conditioned by fire occurrence increases when long-term drought, depleted fuel moisture and elevated fire weather align (MitigateNY 2018).

The region encompassing Rockland County, which includes the Catskill Mountains and West Hudson River Valley, is expected to experience temperature increases of 3.1°F to 6.9°F by the 2050s and 4.0°F to 10.7°F by the 2080s (baseline of 50.0°F). Precipitation totals will increase between one and 14 percent by the 2050s and two to 18 percent by the 2080s (baseline of 46.0 inches). Table 4.3.10-6 displays the projected seasonal precipitation change for the Catskill Mountains and West Hudson River Valley Region (NYSERDA 2014).

Table 4.3.10-6. Projected Seasonal Precipitation Change in Region the Catskill Mountains and West Hudson River Valley, 2050s (% Change)

Winter	Spring	Summer	Fall
0 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSERDA 2014

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entirety of Rockland County is exposed and vulnerable to the wildfire hazard; however, assets located within the WUI areas (population, structures, critical facilities, and lifelines), as described in Section 3 (County Profile), are potentially more vulnerable to a wildfire event. The following text evaluates and estimates the potential impact of the wildfire hazard in the County.

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. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Table 4.3.10-7 summarizes the estimated population exposed to the wildfire hazard by municipality. Based on the analysis, an estimated 29,295 residents, or 8.7 percent of the County's population, are in the wildfire intermix hazard area. Overall, the Town of Clarkstown has the greatest number of individuals located in the wildfire intermix hazard area (5,381 persons). Similarly, an estimated 116,124 residents, or 34.5 percent of the County's population, are in the wildfire interface hazard area. Overall, the Town of Clarkstown has the greatest number of individuals located in the wildfire interface hazard area (14,575 persons).

Table 4.3.10-7. Estimated Population Located Within the Wildfire Threat Hazard Areas

Jurisdiction	Total Population	Estimated Population Located Within the Wildfire Threat Hazard Areas			
		Intermix Threat Hazard Area	Percent of Total	Interface Threat Hazard Area	Percent of Total
Airmont, Village of	9,964	902	9.1%	95	1.0%
Chestnut Ridge, Village of	10,211	2,501	24.5%	0	0.0%
Clarkstown, Town of	81,385	5,381	6.6%	14,575	17.9%
Grand View on Hudson, Village of	241	189	78.4%	50	20.7%
Haverstraw, Town of	14,028	1,109	7.9%	12,702	90.5%
Haverstraw, Village of	12,292	962	7.8%	11,284	91.8%
Hillburn, Village of	1,110	367	33.1%	742	66.8%
Kaser, Village of	5,433	0	0.0%	0	0.0%
Montebello, Village of	4,665	1,010	21.7%	3,400	72.9%
New Hempstead, Village of	5,440	419	7.7%	1,143	21.0%
New Square, Village of	9,433	0	0.0%	0	0.0%
Nyack, Village of	7,303	0	0.0%	7,263	99.5%
Orangetown, Town of	36,127	3,704	10.3%	13,679	37.9%
Piermont, Village of	2,525	35	1.4%	2,486	98.5%

Jurisdiction	Total Population	Estimated Population Located Within the Wildfire Threat Hazard Areas			
		Intermix Threat Hazard Area	Percent of Total	Interface Threat Hazard Area	Percent of Total
Pomona, Village of	3,306	1,593	48.2%	1,712	51.8%
Ramapo, Town of	48,846	4,826	9.9%	5,739	11.7%
Sloatsburg, Village of	3,043	1,529	50.2%	1,480	48.6%
South Nyack, Village of	2,803	155	5.5%	2,647	94.4%
Spring Valley, Village of	32,953	43	0.1%	0	0.0%
Stony Point, Town of	14,876	3,013	20.3%	10,544	70.9%
Suffern, Village of	11,376	0	0.0%	10,484	92.2%
Upper Nyack, Village of	2,355	0	0.0%	1,484	63.0%
Wesley Hills, Village of	6,105	1,557	25.5%	4,098	67.1%
West Haverstraw, Village of	10,665	0	0.0%	10,517	98.6%
Rockland County (Total)	**336,485**	**29,295**	**8.7%**	**116,124**	**34.5%**

Source: U.S. Census Bureau, American Community Survey 5-year estimates 2017-2021; Radeloff et al. 2012
Notes: Values are Rounded Down

Socially Vulnerable Population

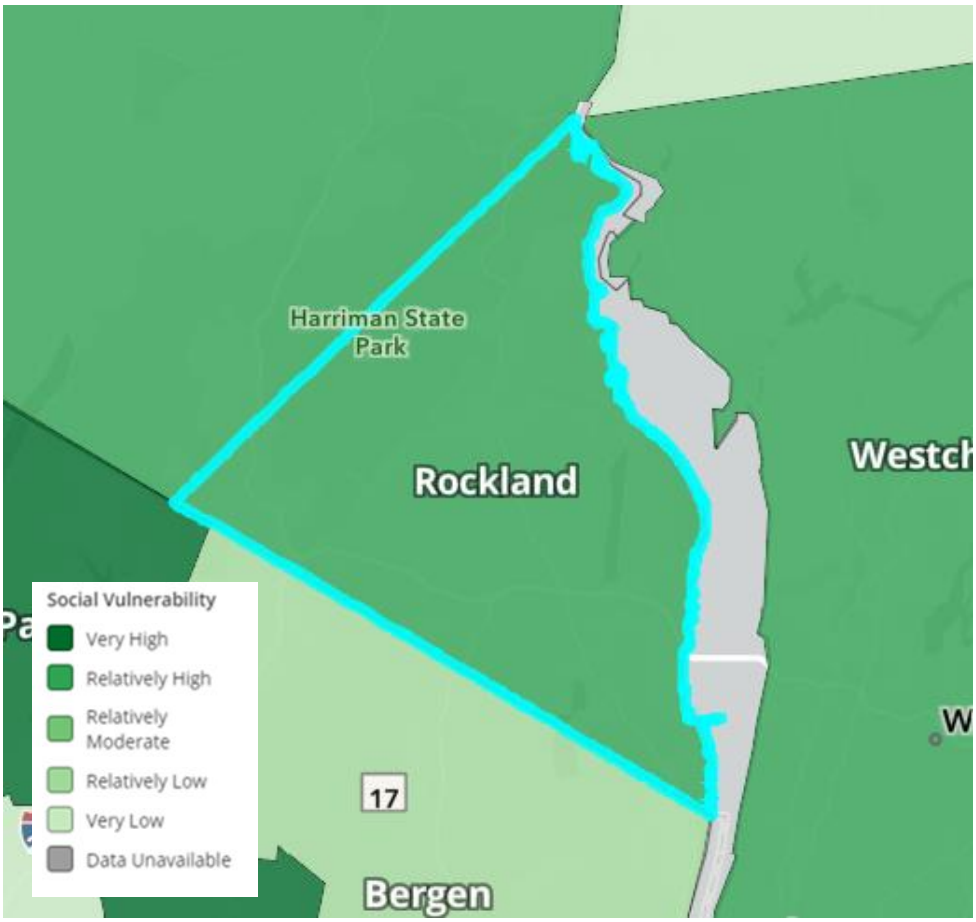
Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

All persons exposed to the wildfire hazard are potentially vulnerable to wildfire impacts. 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. In addition, wildfire may threaten the health and safety of those fighting the fires. First responders are exposed to dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

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.

According to the 2021 ACS, there are 49,451 total persons living below the poverty level, 52,060 persons over the age of 65 years, 27,605 persons under the age of five years, 26,990 non-English speakers, 29,008 persons with a disability, 49,451 living in poverty, and 109,704 living below ALICE in Rockland County. Figure 4.3.10-6 displays the FEMA National Risk Index Inventory's Social Vulnerability Index for Rockland County, which is identified as 'relatively high'.

Figure 4.3.10-6. FEMA Social Vulnerability Index for Natural Hazards



Source: FEMA n.d.

As shown in Table 4.3.10-7, there are 29,295 persons located in the wildfire intermix hazard area. Table 4.3.10-8 presents the estimated socially vulnerable populations located in the wildfire intermix hazard area. Of the 29,295 persons located in the wildfire intermix hazard area, there are 4,762 persons over the age of 65 years, 2,300 persons under the age of five years, 1,146 non-English speakers, 2,634 persons with a disability, 3,419 living in poverty, and 8,646 living below ALICE.

As shown in Table 4.3.10-7, there are 116,124 persons located in the wildfire interface hazard area. Table 4.3.10-9 presents the estimated socially vulnerable populations located in the wildfire interface hazard area. Of the 116,124 persons located in the wildfire interface hazard area, there are 19,933 persons over the age of 65 years, 7,309 persons under the age of five years, 7,415 non-English speakers, 11,190 persons with a disability, 10,055 living in poverty, and 40,927 living below ALICE.

Table 4.3.10-8. Estimated Vulnerable Persons Located Within the Wildfire Intermix Hazard Area

Jurisdiction	Estimated Vulnerable Persons Located Within the Wildfire Intermix Hazard Area											
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total	Living Below ALICE	Percent of Total
Airmont, Village of	134	9.0%	59	8.9%	32	9.0%	65	8.9%	96	9.0%	236	9.0%
Chestnut Ridge, Village of	388	24.4%	335	24.5%	151	24.5%	281	24.5%	477	24.5%	479	24.5%
Clarkstown, Town of	1,108	6.6%	246	6.6%	281	6.6%	532	6.6%	234	6.6%	1,503	6.6%
Grand View on Hudson, Village of	50	78.1%	10	76.9%	0	0.0%	12	75.0%	10	76.9%	25	77.4%
Haverstraw, Town of	199	7.9%	86	7.9%	78	7.8%	97	7.9%	111	7.9%	397	7.9%
Haverstraw, Village of	127	7.8%	69	7.8%	160	7.8%	117	7.8%	140	7.8%	365	7.8%
Hillburn, Village of	53	32.9%	37	32.5%	15	31.3%	48	33.1%	50	32.5%	119	32.9%
Kaser, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Montebello, Village of	121	21.5%	41	21.2%	35	21.2%	65	21.5%	111	21.5%	127	21.6%
New Hempstead, Village of	62	7.6%	19	7.3%	5	7.7%	29	7.6%	9	7.4%	33	7.5%
New Square, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Nyack, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Orangetown, Town of	708	10.2%	184	10.2%	108	10.2%	362	10.2%	166	10.2%	1,292	10.3%
Piermont, Village of	7	1.3%	1	0.7%	2	1.4%	2	1.1%	0	0.0%	17	1.4%
Pomona, Village of	295	48.1%	118	48.0%	55	47.4%	141	48.1%	53	47.7%	250	48.1%
Ramapo, Town of	464	9.9%	709	9.9%	124	9.8%	239	9.9%	1,600	9.9%	1,868	9.9%
Sloatsburg, Village of	257	50.1%	100	50.0%	34	50.0%	191	50.3%	83	50.0%	722	50.2%
South Nyack, Village of	29	5.4%	3	5.1%	1	3.1%	20	5.4%	4	5.5%	50	5.5%
Spring Valley, Village of	4	0.1%	4	0.1%	12	0.1%	3	0.1%	10	0.1%	17	0.1%
Stony Point, Town of	537	20.2%	120	20.2%	53	20.0%	327	20.2%	135	20.2%	889	20.2%
Suffern, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Upper Nyack, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wesley Hills, Village of	219	25.4%	159	25.4%	0	0.0%	103	25.4%	130	25.3%	257	25.5%
West Haverstraw, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Rockland County (Total)	**4,762**	**9.1%**	**2,300**	**8.3%**	**1,146**	**4.2%**	**2,634**	**9.1%**	**3,419**	**6.9%**	**8,646**	**7.9%**

Source: U.S. Census Bureau, American Community Survey 5-year estimates 2017-2021; ALICE 2021; Radeloff et al. 2012
Notes: Values are rounded down.

Table 4.3.10-9. Estimated Vulnerable Persons Located Within the Wildfire Interface Hazard Area

Jurisdiction	Estimated Vulnerable Persons Located Within the Wildfire Interface Hazard Area											
	Over 65	Percent of Total	Under 5	Percent of Total	Non-English Speaking	Percent of Total	Disability	Percent of Total	Poverty Level	Percent of Total	Living Below ALICE	Percent of Total
Airmont, Village of	14	0.9%	6	0.9%	3	0.8%	6	0.8%	10	0.9%	25	1.0%
Chestnut Ridge, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Clarkstown, Town of	3,001	17.9%	667	17.9%	761	17.9%	1,442	17.9%	635	17.9%	4,071	17.9%
Grand View on Hudson, Village of	13	20.3%	2	15.4%	0	0.0%	3	18.8%	2	15.4%	6	18.6%
Haverstraw, Town of	2,284	90.5%	989	90.5%	901	90.5%	1,111	90.5%	1,280	90.5%	4,548	90.5%
Haverstraw, Village of	1,490	91.7%	809	91.7%	1,877	91.8%	1,377	91.8%	1,648	91.8%	4,288	91.8%
Hillburn, Village of	107	66.5%	76	66.7%	32	66.7%	96	66.2%	103	66.9%	242	66.9%
Kaser, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Montebello, Village of	410	72.8%	140	72.5%	120	72.7%	220	72.6%	376	72.9%	428	72.8%
New Hempstead, Village of	171	21.0%	54	20.8%	13	20.0%	80	20.9%	25	20.7%	92	20.9%
New Square, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Nyack, Village of	1,512	99.4%	345	99.4%	263	99.2%	857	99.4%	284	99.3%	3,633	99.4%
Orangetown, Town of	2,617	37.9%	683	37.9%	399	37.8%	1,340	37.9%	615	37.8%	4,772	37.9%
Piermont, Village of	530	98.3%	138	97.9%	139	97.9%	178	98.3%	47	97.9%	1,195	98.4%
Pomona, Village of	317	51.7%	127	51.6%	60	51.7%	151	51.5%	57	51.4%	269	51.7%
Ramapo, Town of	552	11.7%	844	11.7%	148	11.7%	284	11.7%	1,902	11.7%	2,222	11.7%
Sloatsburg, Village of	249	48.5%	97	48.5%	33	48.5%	184	48.4%	80	48.2%	699	48.6%
South Nyack, Village of	505	94.4%	55	93.2%	30	93.8%	350	94.3%	68	93.2%	860	94.4%
Spring Valley, Village of	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Stony Point, Town of	1,880	70.9%	421	70.9%	187	70.6%	1,147	70.8%	472	70.8%	3,113	70.9%
Suffern, Village of	2,134	92.1%	451	92.0%	798	92.1%	1,014	92.1%	650	92.1%	5,021	92.1%
Upper Nyack, Village of	301	62.8%	55	62.5%	11	57.9%	101	62.7%	107	62.9%	339	62.8%
Wesley Hills, Village of	578	67.1%	420	67.1%	0	0.0%	272	67.0%	344	67.1%	676	67.1%
West Haverstraw, Village of	1,268	98.6%	930	98.5%	1,640	98.6%	977	98.6%	1,350	98.6%	4,428	98.6%
Rockland County (Total)	**19,933**	**38.3%**	**7,309**	**26.5%**	**7,415**	**27.5%**	**11,190**	**38.6%**	**10,055**	**20.3%**	**40,927**	**37.3%**

Source: U.S. Census Bureau, American Community Survey 5-year estimates 2017-2021; ALICE 2021; Radeloff et al. 2012

Notes: Values are rounded down.

Impact on General Building Stock

Buildings located within the wildfire intermix and interface hazard areas are exposed and considered vulnerable to the wildfire hazard. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete.

The potential damage is the modeled loss that could occur to the exposed inventory measured by the structural and content replacement cost value. There are an estimated 12,132 buildings in the wildfire intermix hazard area, representing approximately 8.5 percent of the County's total general building stock inventory replacement cost value. The Town of Clarkstown has the greatest number of its buildings located in the wildfire intermix hazard area (2,261 buildings or 6.6 percent of its total building stock). There are an estimated 42,216 buildings in the wildfire interface hazard area, representing approximately 31.9 percent of the County's total general building stock inventory replacement cost value. The Town of Orangetown has the greatest number of its buildings located in the wildfire interface hazard area (6,853 buildings or 37.2 percent of its total building stock). Refer to Table 4.3.10-10 for the estimated exposure of the wildfire hazard areas by jurisdiction.

Table 4.3.10-10. Estimated Number and Total Replacement Cost Value (RCV) of Structures Located in the Wildfire Threat Hazard Areas

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Number and Total Replacement Cost Value of Structures Located in the Wildfire Threat Hazard Areas							
			Number of Buildings in the Wildfire Intermix Threat Hazard Area	Percent of Total	Total RCV of Buildings Located in the Wildfire Intermix Threat Hazard Area	Percent of Total	Number of Buildings in the Wildfire Interface Threat Hazard Area	Percent of Total	Total RCV of Buildings Located in the Wildfire Interface Threat Hazard Area	Percent of Total
Airmont, Village of	4,324	$2,712,726,498	404	9.3%	$221,608,936	8.2%	48	1.1%	$36,174,451	1.3%
Chestnut Ridge, Village of	3,996	$2,590,102,202	1,011	25.3%	$597,551,271	23.1%	0	0.0%	$0	0.0%
Clarkstown, Town of	34,094	$22,578,694,610	2,261	6.6%	$1,477,695,363	6.5%	5,996	17.6%	$3,586,039,879	15.9%
Grand View on Hudson, Village of	219	$123,746,894	172	78.5%	$98,564,822	79.7%	46	21.0%	$24,789,840	20.0%
Haverstraw, Town of	5,157	$14,687,792,118	388	7.5%	$253,603,171	1.7%	4,282	83.0%	$2,369,258,359	16.1%
Haverstraw, Village of	2,232	$1,373,775,543	171	7.7%	$124,552,918	9.1%	2,030	90.9%	$1,234,173,648	89.8%
Hillburn, Village of	499	$340,797,550	165	33.1%	$85,373,031	25.1%	317	63.5%	$146,182,041	42.9%
Kaser, Village of	197	$434,976,786	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Montebello, Village of	2,002	$1,957,771,278	424	21.2%	$260,901,208	13.3%	1,454	72.6%	$1,199,190,800	61.3%
New Hempstead, Village of	2,074	$1,416,579,766	153	7.4%	$120,991,753	8.5%	492	23.7%	$387,985,114	27.4%
New Square, Village of	455	$640,979,013	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Nyack, Village of	1,830	$1,930,474,072	0	0.0%	$0	0.0%	1,811	99.0%	$1,106,537,916	57.3%
Orangetown, Town of	18,439	$19,240,363,073	1,921	10.4%	$1,609,842,798	8.4%	6,853	37.2%	$9,846,684,751	51.2%
Piermont, Village of	841	$520,681,014	11	1.3%	$6,126,465	1.2%	827	98.3%	$509,103,331	97.8%
Pomona, Village of	1,437	$947,429,629	689	47.9%	$504,345,135	53.2%	748	52.1%	$443,084,494	46.8%
Ramapo, Town of	9,783	$7,401,302,608	1,055	10.8%	$943,437,747	12.7%	1,136	11.6%	$750,366,559	10.1%
Sloatsburg, Village of	1,776	$780,218,848	893	50.3%	$390,508,718	50.1%	856	48.2%	$341,159,650	43.7%
South Nyack, Village of	1,009	$628,994,780	62	6.1%	$42,188,569	6.7%	929	92.1%	$439,722,923	69.9%
Spring Valley, Village of	3,468	$2,977,580,954	4	0.1%	$1,670,234	0.1%	0	0.0%	$0	0.0%
Stony Point, Town of	8,819	$4,492,546,145	1,727	19.6%	$852,319,411	19.0%	6,118	69.4%	$2,855,592,828	63.6%
Suffern, Village of	3,110	$2,011,976,760	0	0.0%	$0	0.0%	2,831	91.0%	$1,672,407,940	83.1%
Upper Nyack, Village of	1,121	$714,087,836	0	0.0%	$0	0.0%	710	63.3%	$427,534,423	59.9%
Wesley Hills, Village of	2,432	$1,597,464,375	621	25.5%	$381,446,016	23.9%	1,631	67.1%	$1,106,331,979	69.3%
West Haverstraw, Village of	3,171	$1,575,031,545	0	0.0%	$0	0.0%	3,101	97.8%	$1,402,736,864	89.1%
Rockland County (Total)	**112,485**	**$93,676,093,896**	**12,132**	**10.8%**	**$7,972,727,565**	**8.5%**	**42,216**	**37.5%**	**$29,885,057,792**	**31.9%**

Source: Rockland County, NYS Office of Information Technology Services Geospatial Services and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS) 2022; Center for International Earth Science Information Network, New York State Energy Research and Development Authority 2022; U.S. Army Corps of Engineers, National Structure Inventory 2022; RS Means 2022; Radeloff et al. 2012

Impact on Critical Facilities and Community Lifelines

Wildfires can have an impact on the water supplies throughout the County because of residual pollutants like char or debris landing in water resources which can clog wastewater pipes, culverts, etc. Wildfires may also impact transportation routes, blocking residents and commuters from getting in and out of the County during a wildfire event because of char and debris polluting the air making it difficult to drive, or the flames having proximity to the roadways making the route an unsafe passageway. In general, roads and bridges surrounding the areas of fire risk are important because they provide ingress and egress to large areas and, in some cases, to isolated neighborhoods. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. If a wildfire reached the following critical facilities, their vulnerability could complicate response and recovery efforts during and following an event:

- **Hazardous Materials and Fuel Storage**—During a wildfire event, these materials could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils, and seeping into surface waters, and have a disastrous effect on the environment.
- **Communication Facilities**—If these facilities are damaged and become inoperable, it would exacerbate already difficult communication in the planning area.
- **Fire Stations**—If fire stations were compromised during a wildfire event, it would make fire suppression and support services even more challenging.

Table 4.3.10-11 summarizes the number of community lifelines exposed to the wildfire hazard areas. Of the 123 community lifelines located in the wildfire intermix hazard area, Water Systems has the majority of facilities (44). Of the 306 community lifelines located in the wildfire interface hazard area, Safety and Security has the majority of facilities (137). Refer to Section 3 (County Profile) for more information about the critical facilities and lifelines in Rockland County.

Table 4.3.10-11. Number of Lifelines Located in the Wildfire Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Wildfire Intermix Threat Hazard Area	Number of Lifelines Located in the Wildfire Interface Threat Hazard Area
Communications	154	24	40
Energy	0	0	0
Food, Water, Shelter	71	2	30
Hazardous Material	56	9	10
Health and Medical	195	14	43
Safety and Security	349	30	137
Transportation	8	0	2
Water Systems	148	44	44
Rockland County (Total)	**981**	**123**	**306**

Impact on the Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business. These events may cost thousands of taxpayer dollars to suppress and control; hundreds of operating hours on fire apparatus; and thousands of volunteer man hours from the volunteer firefighters.

Impact on the Environment

Wildfires are a necessary part of ecosystem health, but intense wildfires severely damage the environment, including burning and killing of plant and animal life. Intense fires can also heat narrow and shallow waterways, resulting in damage to aquatic systems.

According to the USGS, post-fire runoff polluted with debris and contaminates can be extremely harmful to terrestrial ecosystems and aquatic life (USGS 2023). Studies show that urban fires are more harmful to the environment compared to forest fires (Harvard University 2022). The age and density of infrastructure within Rockland County can exacerbate consequences of fires on the environment because of the increased amount of chemicals and contaminates that would be released from burning infrastructure. These chemicals, such as iron lead, and zinc, may leach into the stormwater, contaminate nearby streams, and impair aquatic life.

Intense wildfire events that destroy existing ecosystems can result in an increase in invasive species that may be able to move into an area with a lack of natural competitors (U.S. Department of the Interior 2012).

Cascading Impacts on Other Hazards

Following wildfires, cascading hazards such as debris flow, landslides, and flooding may occur due to loss of stabilizing vegetation, resulting in potentially catastrophic sequences. When wildfire hits in drought-stricken areas, watersheds and reservoirs can be further impacted by ash and debris flows, water treatment facilities may shut down with damage or loss of power, crops can be destroyed, and smoke can affect animal and human health (NIDIS 2023).

Flooding after a wildfire is often more severe, as debris and ash left from the fire can form mudflows. During and after a rain event, as water moves across charred and denuded ground, it can also pick up soil and sediment and carry it in a stream of floodwaters. These mudflows have the potential to cause significant damage to impacted areas. Areas directly affected by fires and those located below or downstream of burn areas are most at risk for flooding (FEMA 2020). For detailed information regarding flooding, see Section 4.3.6 (Flood).

As previously mentioned, intense wildfire events that destroy existing ecosystems can result in an increase in invasive species that may be able to move into an area with a lack of natural competitors (U.S. Department of the Interior 2012).

Future Changes That May Impact Vulnerability

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. 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

Potential or Projected Development

As discussed, and illustrated in Section 3 (County Profile), areas targeted for future growth and development have been identified across the County. Any changes in development can impact the County's risk to the wildfire hazard of concern, especially new development occurring in WUI areas.

Projected Changes in Population

Rockland County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately 8.5 percent between 2010 and 2020 (County of Rockland 2021). Cornell University's Program on Applied Demographics project Rockland County will have a population of 356,758 by 2030 and 372,432 by 2040 (Cornell University 2018).

Any increase in population density can impact the number of persons exposed to the wildfire hazard. Fire suppression capabilities are high at the State and local levels. However, new development and changes in population with a mix of additional structures, ornamental vegetation, and wildland fuels will require continued assessment of the hazard and mitigation risk.

Other Identified Conditions

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 (United Nations 2021). Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain and are more likely to expand into residential neighborhoods.

Change of Vulnerability Since 2018 HMP

The 2024 HMP has been updated to reflect the 2020 Decennial Census and the 2021 ACS 5-Year Estimates for population changes. The building stock inventory was updated using data from Rockland County. Further, the building stock inventory replacement cost values were updated using RS Means 2022 values providing an overall update to the assets assessed in this risk assessment.