4.12 WILDFIRE

SECTION 4.12 WILDFIRE

4.12-1 HAZARD OVERVIEW

Hazard Definition

A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, grassland, or prairie. Although, wildfires can start from lightning or other natural causes, most are ignited by human activity, either accidentally or intentionally. Wildfires can damage natural resources, destroy homes, and threaten human lives and safety (FEMA, 2023). New Jersey's high population density has created land use pressures in which more people are moving from urban areas to build homes in rural wildland areas. A potentially explosive combination is created when hazardous wildland fuels interface home development, and an increased risk of human-caused ignition come together under extreme fire weather conditions.

The height of wildland fire season in New Jersey is typically considered the spring (March through May) and typically culminates in early May, corresponding with the driest live fuel moisture periods of the year. Although the spring months are the most severe, the summer and fall months may also experience extensive fires in the State. Drought, snowpack, and local weather conditions can influence the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires while lightning-related fires are more common in the peak season of June through August.

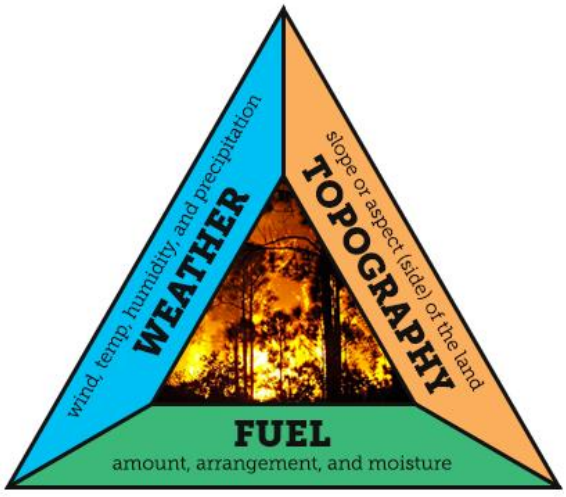
In New Jersey, an average of 1,500 wildfires damage or destroy 7,000 acres of the State's forests each year. Wildfires not only damage woodlands but could threaten homeowners who live within or adjacent to forest environments. In 2022, 1,175 wildfires occurred in New Jersey, burning approximately 12,664 acres. Between January and April 2023, there were 315 wildfires that burned 930 acres (NJ FFS, 2023).

Fire Ecology and Wildfire Behavior

The "wildfire behavior triangle" illustrates how three primary factors influence wildfire behavior: fuel, topography, and weather. For example, drier and warmer weather combined with dense fuel loads and steeper slopes will cause more hazardous fires than light fuels on flat ground.

A fire needs all the following three elements in the right combination to start and grow: a heat source, fuel, and oxygen. The growth of the fire primarily depends on the characteristics of available fuel, weather conditions, and terrain. Climate change is also considered a potential source of influence, which is discussed later in this profile.

Figure 4.12-1 Wildfire Behavior Triangle



Source: WeatherSTEM, 2017

Secondary Hazards

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

4.12-2 LOCATION, EXTENT, AND MAGNITUDE

Location

The ecosystems that are most susceptible to the hazard are pitch pine, scrub oak, and oak forests. These are the vegetative fuels that are the most flammable. The New Jersey Pine Barrens are characterized by low, dense forests of pine and oak, ribbons of cedar and hardwood swamps bordering drainage courses, pitch pine lowlands, and bogs and marshes combined to produce an expansive vegetative mosaic unsurpassed in the northeastern United States. This forest contains many plant species which produce mast (such as acorns, hickory nuts, and beechnuts) that provide important forage for wildlife. The Pine Barrens are a fire-adapted forest ecosystem that depends on wildfire for reproduction and the control of fuel buildup. This forest community is one of the most hazardous wildland fuel types in the nation. Pinelands fires burn extremely hot and spread rapidly.

In New Jersey's north, northern hardwood, white pine, eastern hemlock, mixed oak, and a variety of other species including isolated stands of red spruce are part of the forest composition. The oak/hickory-type group is, and has been, the most common-type forest in New Jersey. This group makes up nearly half of New Jersey's forested area. While wildfires in other parts of the State rarely attain the intensity as found in the Pine Barrens, northern New Jersey fires spread rapidly in dry leaf litter and downed, gypsy moth-killed hardwoods. Slope becomes a significant factor in both the spread and the difficulty in suppressing these fires.

In the Outer Coastal Plain, soils tend to be sandier, more drought-prone, and lower in many plant nutrients. Differences in these edaphic factors–especially limitations in available soil moisture—are ultimately responsible for much of the unique vegetation in the region. Even though the Pinelands receives an amount of rainfall which is about average for the State, upland plant communities are all dominated by xerophytic species adapted to establishment, growth, and reproduction in drought-prone sites (NJFFS, 2013).

Extent and Magnitude

The magnitude or severity of wildfires depends on weather, climate conditions, and human activity. NJFFS uses two indices to measure and monitor dryness of forest fuels and the possibility of fire ignitions becoming wildfires. These indices include the National Fire Danger Rating System's Buildup Index, and the Keetch-Byram Drought Index. Both are used for fire preparedness planning, which includes the following: campfire and burning restrictions, fire patrol assignments, staffing of fire lookout towers, and readiness status for both observation and firefighting aircraft.

The *Buildup Index (BUI)* is a number that reflects the combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant. The BUI can represent three to four inches of compacted litter or can represent up to six inches or more of loose litter (North Carolina Forest Service, 2009).

The *Keetch-Byram Drought Index (KBDI)* is a drought index designed for fire potential assessment as defined by the United States Department of Agriculture Forest Service. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. The index increases each day without rain and decreases when it rains. The scale ranges from zero (no moisture deficit) to 800 (maximum drought possible). The Florida Forest Service states that the range of the index is determined by assuming that 8 inches of moisture in

a saturated soil is readily available to the vegetation. For different soil types, the depth of soil required to hold eight inches of moisture varies. A prolonged drought influences fire intensity, largely because more fuel is available for combustion. The drying of organic material in the soil can lead to increased difficulty in fire suppression.

As per the NWS, 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. The USFS indicates that the 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. Table 4.12-1 describes the fire danger ratings and color codes.

Table 4.12-1 Fire Danger Rating and Color Code

Fire Danger Rating and Color Code	Description
Low (L) (Dark 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.
Moderate (M) (Light Green or Blue)	Fires can start from most accidental causes, and 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.
High (H) (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.
Very High (VH) (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.
Extreme (E) (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 (trunks, branches, and treetops) 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.

Source: USFS, 2014

4.12-3 PREVIOUS OCCURRENCES AND LOSSES

FEMA Disaster Declarations

Between 1954 and 2023, Federal Emergency Management Agency (FEMA) made two Fire Management Assistance Declarations (FM) related to wildfires in New Jersey, one in 2002 and one in 2007. Because these disasters generally cover a wide range of the State, each incident may have impacted many counties. However, not all counties were included in the declarations as determined by FEMA (FEMA, 2018). Based on all sources researched, known wildfire events that have affected New Jersey and were declared a FEMA disaster are listed in Table 4.12-2.

Table 4.12-2 FEMA Disaster Declarations

Disaster Number	Declaration Date	Incident Period	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	Impacted Number Of Counties
2411	6/2/2002	Double Trouble Fire															X							1
2695	5/16/2007	Warren Grove Fire			X												X							2

Source: FEMA, 2023

Historical Events Summary

Many sources provided historical information regarding previous occurrences and losses associated with wildfire events throughout New Jersey. With so many sources reviewed for the purpose of this HMP, 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. Table 4.12-3 outlines wildfire since 2010 and includes only events that are considered significant wildfires (burning a total of greater than 1,000 acres).

Table 4.12-3 Significant Wildland Fire Incidents Since 2010

Date(s) of Event	Counties Affected	Acres Burned	Description
7/1/2010	Ocean	4,000	A wildfire began on the south side of a weapons range at the McGuire-Fort Dix-Lakehurst Joint Military Base approximately 1.5 miles north of New Jersey State Route 70 near the Ocean and Burlington County border on June 28. The wildfire continued to burn until heavy rain fell on July 14. Approximately 4,000 acres were consumed.
2/19/2011	Cape May, Camden, Cumberland, Middlesex, Monmouth, Ocean	Unknown	The combination of the strong west-northwest winds, low humidity levels, and recent dry weather helped cause the rapid spread of wildfires across New Jersey during the day on February 19. In all, 10 wildfires were reported across the State. The largest and most stubborn wildfire started about 5:30 a.m. EST in a mulch pile near the Reliable Wood Products on Broadway Road in South Brunswick Township in Middlesex County. A total of 58 fire fighters from three counties and the New Jersey Forestry Service worked to extinguish the blaze by around 9:30 a.m. EST on February 19. In West Tuckerton (Ocean County), a wildfire consumed 20 acres before it was contained during the late afternoon of the 19th next to the Atlantis Golf Club. In Manalapan (Monmouth County), a brush fire reached 200 yards in length on Smithburg Road before it was contained. In Dennis Township (Cape May County), it took six fire departments 2 hours to contain a wildfire that started near a shed (destroyed it) and spread into nearby brush. Other wildfires were reported in Sayreville and Old Bridge in Monmouth County, Vineland in Cumberland County and Gloucester Township in Camden County.
4/9/2012	Burlington, Mercer, Middlesex, Sussex	1,700	The unseasonably dry weather coupled with strong winds helped quickly spread two wildfires on April 9 in central Burlington County. The South Park fire started just after 12:00 midnight EDT on the 9th in Woodland Township in Burlington County near South Park and Sooy Roads. Most of it occurred on the grounds of the South Park Hunting Club. The strong winds helped spread the fire quickly. Over 250 local and state forestry fire fighters helped battle the blaze. It was expected to consume about 1,000 acres before total containment was reached. A second wildfire occurred on the Fort Dix Military Installation, near the Burlington and Ocean County border on April 9. It was totally contained on April 10. The fire consumed about 300 acres. Other smaller wildfires also occurred in Monroe Township (Middlesex County) on Disbrow Road on the afternoon of April 9 and in West Windsor Township (Mercer County) off Meadow Road. In all, 33 wildfires were reported throughout the State of New Jersey on the April 9.
4/6 to 4/7 2014	Burlington Sussex	1,600	A wildfire consumed approximately 1,600 acres of forest in Wharton State Forest in Washington Township (Burlington County) until it was contained. The wildfire started on the afternoon of the 6th. A wind shift and increase in overall wind speed associated with the passage of a sea breeze front

Date(s) of Event	Counties Affected	Acres Burned	Description
			around 5 p.m. EDT that afternoon helped spread the fire faster
4/24 to 4/26/2014	Gloucester, Ocean	1,535	The combination of strong gusty northwest winds, the lack of significant rain in over a week and low relative humidity levels helped several major wildfires spread quickly across the southern half of New Jersey on the 23rd and 24th. Containment was not reached until the 26th. Residents were evacuated in one of the wildfires in Berkeley Township (Ocean County), but property damage was minimal and no serious injuries were reported. T
4/26 to 4/28/2014	Camden, Cumberland	1,000	A wildfire charred nearly 1,000 acres of brush in Wharton State Forest in Waterford Township in Camden County on the 26th through the 28th. The wildfire started during the evening on the 26th and occurred west of U.S. Route 206, south of Atsion Road and north of Chew Road near the Camden and Burlington County line in Waterford Township. Gusty west to northwest winds (Peak wind gust of 30 mph at the Atlantic City International Airport) on the 27th pushed the smoke plume through Atlantic County and passed it over Atlantic City.
9/7 to 9/9/2015	Burlington, Ocean	1,012	A wildfire consumed 1,012 acres of woodland along the Burlington and Ocean County borders from September 7th through the 9th. The wildfire coincided with the last run of 90 degree weather in the state for the year. The Woodmansie Wildfire started in that section of Woodland Township shortly after Noon EDT on the 7th and then spread eastward into Manchester Township in Ocean County. About ninety percent of the acreage that was burned was within this township. The wildfire was contained at Noon EDT on the 9th.
3/30 to 3/31/2019	Burlington	10,000	Dry conditions and wind helped spread a 10,000 acre wildfire in Penn State Forest, forcing the closure of Rt. 72. The fire started in the afternoon of Saturday the 30th, growing throughout the night and reaching 10,000 acres on Sunday the 31st. No property damage or injuries were reported.
6/19 to 6/21/2022	Burlington Gloucester Atlantic	15,000	An illegal campfire in Wharton State Forest led to a significant wildfire that burned 15,000 acres at its peak, spreading across three counties. Around 50 park visitors were evacuated and no injuries were reported. It was reported that at least 18 structures were at risk, but no reports of damages were found.
4/11 to 4/13/2023	Ocean	3,859	The fire broke out along Rt. 539 and grew to exhibit “extreme fire behavior”, including a wall of fire, 200-foot flames, and raining fire embers. 170 buildings in the area were evacuated in Manchester and Lakehurst Townships. No injuries were reported.

The New Jersey Pinelands is one of the most hazardous wildland fuel types in the nation. A review of the historic record indicates a majority of the wildfire events in the State have occurred in the Pinelands located in Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Ocean Counties. Table 4.12-4 summarizes the number of wildfire events since 2000 by County according to NOAA’s National Centers for Environmental Information.

Table 4.12-4 Number of Wildfire Events by County Since 2000

County	Number	Injuries	Property Damage ($)
Atlantic	8	7	$0
Bergen	0	0	$0
Burlington	29	2	$1,000.00
Camden	11	0	$0
Cape May	4	0	$10,000.00
Cumberland	9	0	$0
Essex	0	0	$0
Gloucester	8	0	$50,000.00
Hudson	1	0	$0
Hunterdon	6	2	$55,000.00
Mercer	6	0	$0

County	Number	Injuries	Property Damage ($)
Middlesex	18	0	$5,000.00
Monmouth	10	0	$5,000.00
Morris	6	1	$0
Ocean	24	3	$1,250,000.00
Passaic	0	0	$0
Salem	4	0	$0
Somerset	3	0	$0
Sussex	12	2	$200,000.00
Union	0	0	$0
Warren	7	0	$0
Total	**168**	**16**	**$ 1,576,000.00**

Source: NOAA-NCEI, 2023

4.12-4 PROBABILITY OF FUTURE OCCURRENCES

The likelihood of urban fires and wildfires is difficult to predict in a probabilistic manner. Estimating the approximate number of catastrophic wildfires to occur in New Jersey every year is next to impossible because a number of variable factors impact 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, urban fires and wildfires continue to present a risk. The probability exists that New Jersey will continue to face an average of three fires greater than 100-acres each year, with the potential for more.

The Northeast-Midwest State Foresters Alliance (NMSFA) estimated burn probability for New Jersey. According to NMSFA, burn probability is the annual probability of wildfire burning in a specific location. It is not predictive and does not reflect any currently forecasted weather or fire danger conditions; it is simply a probability that any specific location (pixel) may experience wildfire in any given year. Table 4.12-5 summarizes the number and percent of acres in each burn probability category statewide. Approximately 35% of land statewide does not have any burn probability. No land in the state has a greater than one-in-ten chance of experiencing wildfire in a given year (NMSFA, 2023).

Figure 4.12-2 shows the wildfire burn probability across counties. As shown, the counties with the greatest concentration of high burn probability are in south Jersey, particularly Atlantic, Cape May, Cumberland, Ocean, and Salem counties. The highest burn probabilities statewide are found along the Delaware Bayshore from Salem to Cape May counties and along the back bays of the Atlantic Coast from Ocean to Cape May counties (NMSFA, 2023).

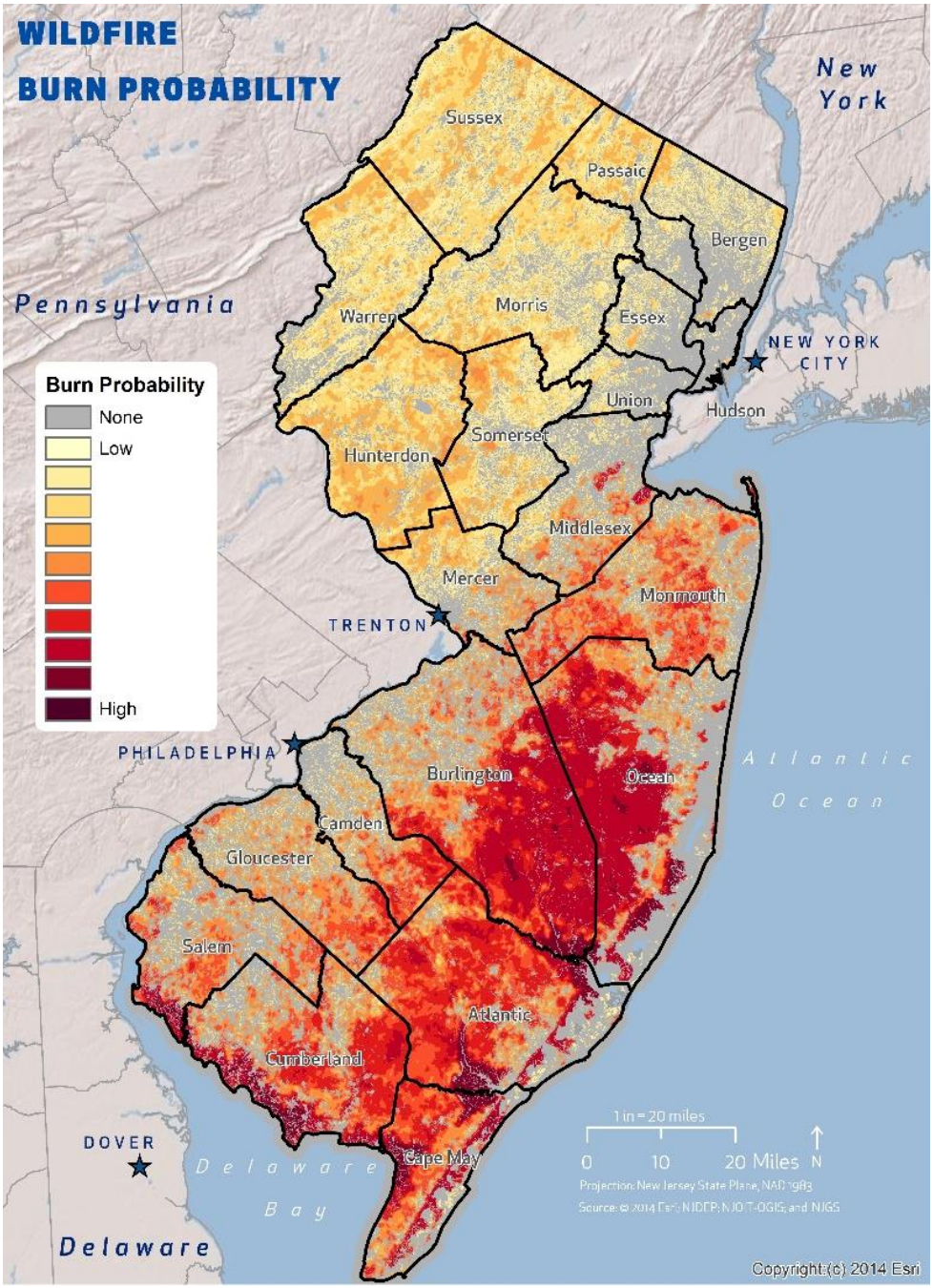
Table 4.12-5 New Jersey Statewide Burn Probability

Color	Burn Probability Category	Acres	Percent
	0	1,816,901	35.3 %
	0 to 1-in-46,425	0	0.0 %
	1-in-46,425 to 1-in-10,000	617,875	12.0 %
	1-in-10,000 to 1-in-4,643	630,296	12.2 %
	1-in-4,643 to 1-in-2,154	475,828	9.2 %
	1-in-2,154 to 1-in-1,000	411,969	8.0 %
	1-in-1,000 to 1-in-464	408,744	7.9 %
	1-in-464 to 1-in-215	355,517	6.9 %

Color	Burn Probability Category	Acres	Percent
	1-in-215 to 1-in-100	370,328	7.2 %
	1-in-100 to 1-in-10	66,359	1.3 %
	> 1-in-10	0	0.0 %
	Total	5,153,817	100.0 %

Source: NMSFA, 2023

Figure 4.12-2 Wildfire Burn Probability



Source: NMSFA, 2023

Potential Effects of Climate Change

How climate change will impact wildfires in New Jersey forests is uncertain based on existing literature and models, as there are few that focus specifically on the state. However, given predictions about how climate change will impact New Jersey temperatures, precipitation, and storms, and that fire is determined by these variations in climate, it is projected that wildfires in the state will become larger and more frequent.

As a result of increased temperatures due to climate change, wildfire seasons could be lengthened, starting earlier, and ending later, as the season depends on local weather conditions, drought, and the amount of precipitation that occurred through the winter as snow. With increases in the frequency and severity of storms, there is increased potential for lightning to ignite a fire. Also, possible increase in winds, which could occur from weather changes due to climate change, would also increase the spread of fires (NJDEP, 2020).

Additionally, climate change may negatively impact the health of forests making them more susceptible to fire. Increases in temperature, and resulting hot and dry periods, may intensify the danger of wildfires by drying out vegetation and soil. Trees stressed from insect infestations including invasive species are easier to burn providing an increased fuel source. This is more likely to occur as insect populations as well as their ranges expand in warmer temperatures such as those projected in the future in the State (NJDEP, 2020).

Increased wildfires will likely lead to excess health impacts from burns and the release of inhalable particulate matter and other toxic substances into the environment. Wildfire smoke can travel hundreds of miles causing impacts for New Jersey residents even from fires which are not located in the State (NJDEP, 2020).

4.12-5 VULNERABILITY ASSESSMENT

Vulnerable Jurisdictions

A review of the historic record indicates that all counties have experienced wildfire at one point. Further, all counties have identified wildfire as a hazard of concern in their hazard mitigation plans, as summarized in the table below. In addition to the rankings created by the counties, the table below includes the Hazard Risk Rating data from the National Risk Index. These ratings are relative to other jurisdictions and based on a risk equation consisting of a natural hazard risk component multiplied by a Community Risk Factor (CRF). Expected Annual Loss is the natural hazards risk component, measuring the expected loss of building value, population, and/or agricultural value each year due to natural hazards. The CRF is determined by combining the community's social vulnerability and community resilience. Social vulnerability measures the susceptibility of social groups to the adverse impacts of natural hazards while community resilience uses demographic characteristics to measure a community's ability to prepare for, adapt to, withstand, and recover from the effects of natural hazards.

Table 4.12-6 Wildfire Risk Rankings

County	NRI Wildfire Hazard Risk Rating	Ranking of Wildfire Hazard by County HMP
Atlantic	Relatively Moderate	Medium
Bergen	Very Low	Profiled, Not Ranked
Burlington	Relatively Moderate	Medium
Camden	Relatively Moderate	Medium
Cape May	Relatively Moderate	Medium
Cumberland	Relatively Moderate	Medium
Essex	Very Low	Medium
Gloucester	Relatively Low	Medium
Hudson	Very Low	Medium
Hunterdon	Very Low	Medium
Mercer	Relatively Low	Medium

County	NRI Wildfire Hazard Risk Rating	Ranking of Wildfire Hazard by County HMP
Middlesex	Relatively Low	Medium
Monmouth	Relatively Moderate	Medium
Morris	Very Low	Medium
Ocean	Relatively Moderate	High
Passaic	Very Low	Medium
Salem	Relatively Low	Low
Somerset	Very Low	Medium
Sussex	Very Low	Medium
Union	Very Low	Low
Warren	Very Low	Medium

Source: FEMA NRI (accessed June 2023), County Hazard Mitigation Plans (accessed June 2023)

Built Environment

Assessing Vulnerability to State Facilities

Table 4.12-7 shows estimated potential annual losses (EAL) for wildfire by county in the state of New Jersey. Total building EAL was derived from FEMA's National Risk Index while EAL for state owned assets was calculated using Replacement Cost Value for state owned facilities per county derived from LBAM data and the overall Expected Annual Loss Rate for Buildings by county provided by the NRI.

Table 4.12-7 Estimated Potential Annual Losses for Wildfire

County	Total Buildings	State-Owned Assets
Atlantic	$5,775,262.98	$39,436.66
Bergen	$14,703.84	$13.20
Burlington	$4,362,010.38	$28,032.04
Camden	$1,554,996.23	$7,663.19
Cape May	$2,058,085.16	$6,194.61
Cumberland	$1,328,754.49	$28,533.69
Essex	$3,990.76	$25.46
Gloucester	$943,169.68	$1,663.98
Hudson	$1,710.97	$5.74
Hunterdon	$36,621.74	$239.06
Mercer	$504,708.15	$16,733.56
Middlesex	$650,227.52	$2,138.80
Monmouth	$2,134,163.50	$6,103.04
Morris	$23,223.32	$72.47
Ocean	$4,866,831.00	$13,957.48
Passaic	$4,569.75	$13.55
Salem	$350,225.14	$1,730.86
Somerset	$59,036.22	$151.82
Sussex	$77,880.19	$212.20
Union	$7,823.95	$13.87
Warren	$11,299.88	$31.40

Source: FEMA NRI, NJOMB, 2023

Lifeline Impacts

FEMA created the eight Community Lifelines to contextualize information from incidents, communicate impacts in plain language, and promote a more unified effort across a community that focuses on stabilizes these lifelines during response. More information on these lifelines can be found in Section 4.1: Risk Assessment Overview. Table 4.12-8 showcases the most likely lifelines to be impacted by wildfire, including a short description of anticipated impacts.

Table 4.12-8 Lifelines Most Likely Impacted by Wildfire

Lifeline Categories	Notable Impacts
Safety and Security	Community safety may be threatened due to potential direct harm from wildfire impacts and compounding effects on administration of services. Transportation infrastructure issues may directly impact the abilities of law enforcement, fire service, search and rescue, and other government services.
Food, Hydration, Shelter	Wildfire can cause damage to structures which provide shelter, while the food supply chain may be disrupted due to impacts on agriculture transportation infrastructure. Due to the high temperatures associated with wildfire, hydration can be difficult to maintain especially for firefighters engaged in suppression activities.
Health and Medical	Potential impacts to the Health and Medical lifeline due to wildfire can include physical damage to medical facilities. Facilities can be impacted due to power disruptions or damage patient movement and medical supply chains can be impacted by dangerous conditions on roadways in areas where wildfires are burning.
Energy	Wildfire has the potential to cause direct damage to energy infrastructure and its ability to provide power to the grid, disrupting service. Power lines made of wood area especially susceptible. Additionally pipelines that provide a source of fuel could be ignited, leading to a catastrophic explosion
Communications	Many types of communications equipment are impacted by power failures or destruction of communication lines which could occur because of wildfire. Wi-Fi and cellular data infrastructure can be crippled in such cases leaving many without access to communication lifelines.
Transportation	Anticipated impacts present a causal relationship for the Transportation lifeline in response and recovery due to direct damage to infrastructure and dangerous road conditions from wildfire. There is potential for major roadways in the state to be impacted by severe wildfire. Damage to the Transportation lifeline has cascading effects among other lifelines which depend on movement of people or goods.
Hazardous Materials	Hazardous Materials facilities could be impacted directly by wildfire or indirectly by power disruptions due to effects to energy infrastructure. Transport of hazardous materials can be impacted by hazardous roadway conditions due to wildfire. Wildfire can burn through hazardous material releasing it into the air.
Water Systems	Wildfire may cause direct damage to the Water System lifeline, physically damaging infrastructure components such as distribution pipes and pumps. Additionally, wildfire can lead to contamination of drinking water supplies with known pollutants and other potentially harmful compounds.

New Jersey has a substantial amount of major highway that runs through areas vulnerable to wildfire. State Highway Route 206 runs through the center of the Pinelands, which is the area most potentially vulnerable to wildfires. Several wildfire events have occurred in the last in 10 years that have caused the temporary closure of this roadway. County Route 539 also runs through the center of the Pinelands and has been impacted by several wildfires in the past decade. The stretches of this roadway that are the most vulnerable are in the southern portions of Burlington and Ocean Counties. The Garden State Parkway is also vulnerable to wildfire; more specifically the stretches that run through the southern portion of Ocean County. State Highway Route 72 and Route 70 are also vulnerable and have also been closed as a result of fires in the past decade. The sections of these highways that run through the eastern part of Burlington County and the western area of Ocean County are considered highly vulnerable.

Critical Facilities Exposed to the Wildfire Hazard Areas (Extreme to High) Area

The Northeast-Midwest State Foresters Alliance (NMSFA) is an organization which is comprised of the state forestry agencies from 20 New England, Mid-Atlantic, and Midwestern states plus the District of Columbia. The NMSFA created a wildfire risk assessment tool which allows for users to select an area of interest to generate an in-depth wildfire risk report.

The Wildfire Hazard Potential (WHP) dataset from the NMSFA risk assessment tool represents an index that quantifies the relative potential for wildfire that may be difficult to control. Table 4.12-9 depicts the risk categories which comprise the hazard potential ranging from 1 to 8. Areas which are not at risk from wildfire, such as highly urbanized areas, fall under the category "Minimal Direct Wildfire Impacts." 64.7% of the state's total area is considered at some level of risk from wildfire.

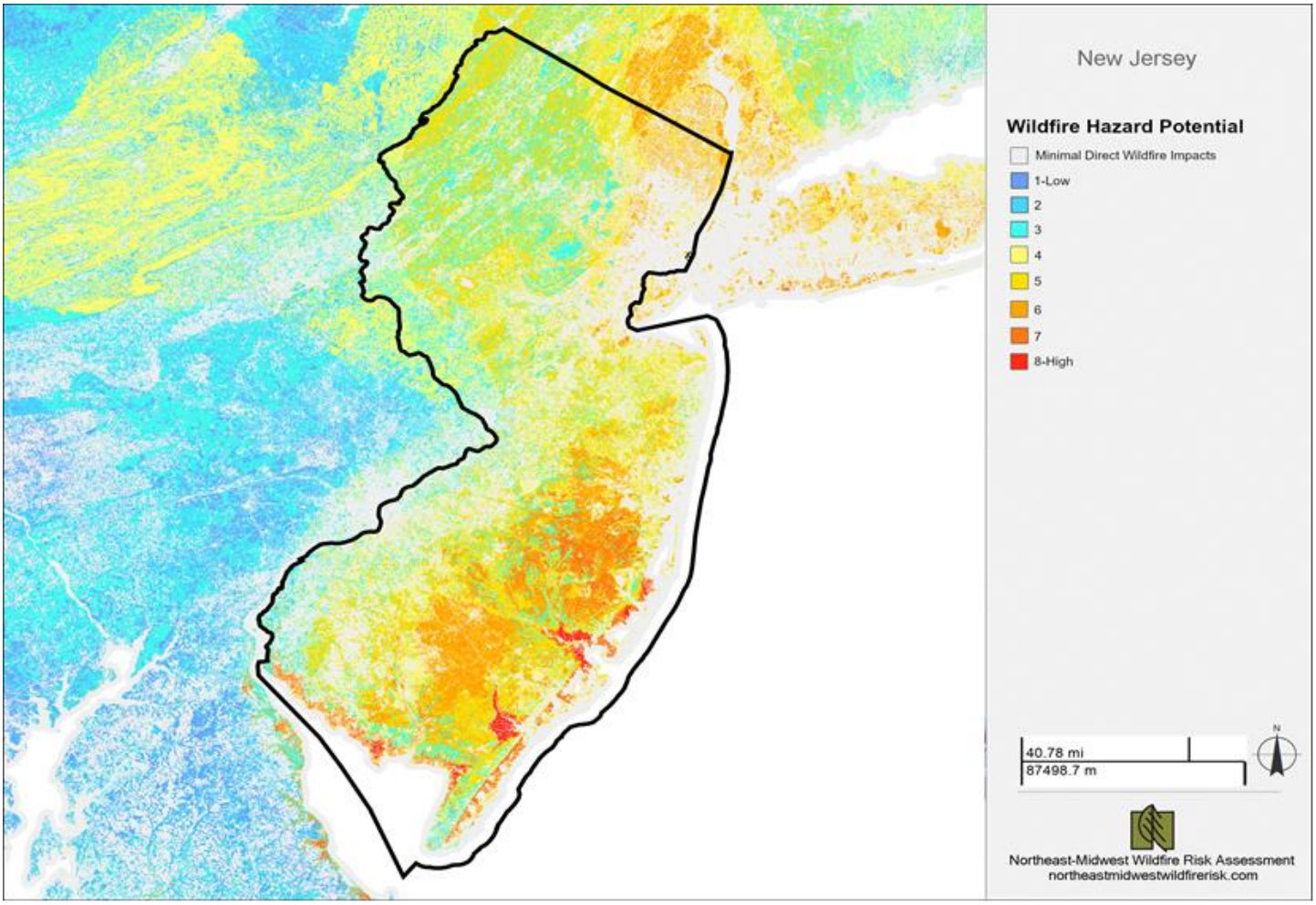
Table 4.12-9 Wildfire Hazard Potential Categories in the State of New Jersey

Color	Wildfire Hazard Potential Category	Acres	Percent
	Minimal Direct Wildfire Impacts	1,816,901	35.3 %
	1-Low	215	0.0 %
	2	32,729	0.6 %
	3	625,151	12.1 %
	4	751,759	14.6 %
	5	1,295,787	25.1 %
	6	445,882	8.7 %
	7	158,180	3.1 %
	8-High	27,211	0.5 %
	Total	**5,153,815**	**100.0 %**

Source: NMSFA, 2023

Figure 4.12-3 is a map depicting Wildfire Hazard Potential in the State of New Jersey. High risk areas are generally located in South Jersey especially near the Pinelands, while areas which are minimal risk are in the highly urbanized Northeastern portion of the state. Areas at low risk are typically more water rich such as the Highlands or the areas around the Delaware River.

Figure 4.12-3 Wildfire Hazard Potential Map for the State of New Jersey



Source: NMSFA, 2023

Critical facilities are important for ensuing the day-to-day functioning of a society. These facilities include utilities, hospitals, and schools, among others similar in nature. They are also important in emergency response; thus, it is vital that in the event of a disaster they continue to operate. Table 4.12-10 illustrates the number of critical facilities which are in wildfire areas considered low to moderate risk (categories 1-4), while Table 4.12-11 illustrates the number of critical facilities located within moderate to high wildfire risk areas (categories 5-8).

Table 4.12-10 Critical Facilities Located Within Low-to-Moderate Risk Areas (Categories 1-4)

County	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Financial	Cultural
Atlantic	14	1	7	26	0	9	2	1	456
Bergen	34	0	4	15	1	9	0	0	1,856
Burlington	32	4	16	57	7	21	9	5	557
Camden	15	1	19	44	2	4	6	4	1,495
Cape May	15	3	8	12	2	5	4	1	495
Cumberland	22	1	12	24	5	7	2	2	961
Essex	7	0	0	13	5	5	4	0	5,599
Gloucester	13	0	4	35	6	14	4	1	522

County	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Financial	Cultural
Hudson	2	0	0	7	0	0	0	0	2,606
Hunterdon	45	1	11	64	3	15	18	2	1,730
Mercer	43	0	0	77	1	18	7	4	473
Middlesex	41	4	2	96	2	14	5	7	729
Monmouth	45	0	5	69	6	17	9	2	1,138
Morris	67	5	9	77	11	28	4	5	1,138
Ocean	17	1	7	18	3	30	2	0	268
Passaic	6	0	2	26	4	7	0	1	134
Salem	13	3	8	17	2	7	7	0	633
Somerset	29	0	7	45	8	17	6	3	715
Sussex	29	4	4	45	10	20	6	2	312
Union	4	1	2	17	0	6	1	0	771
Warren	27	6	1	33	3	10	11	0	815
Total	**520**	**35**	**128**	**817**	**81**	**263**	**107**	**40**	**23,403**

Source: HIFLD, 2006, 2007, 2012, 2014, 2017, 2018, 2019, 2020, 2021, 2022; NJOGIS, 2019, 2020; NJ TRANSIT, 2021; PANYNJ, 2023; USDOT, 2022; NMSFA, 2023

Table 4.12-11 Critical Facilities Located Within Moderate to High-Risk Areas (Category 5-8)

County	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Financial	Cultural
Atlantic	45	1	3	37	1	4	3	2	689
Bergen	47	3	18	54	8	20	1	1	2,642
Burlington	40	0	16	45	4	5	1	9	572
Camden	35	1	8	23	0	8	5	0	255
Cape May	19	1	3	8	2	3	1	1	169
Cumberland	23	0	9	14	0	5	1	0	256
Essex	5	0	2	33	2	5	2	1	2,273
Gloucester	4	0	2	30	3	6	2	1	186
Hudson	0	0	3	26	0	1	1	0	78
Hunterdon	24	3	3	20	3	12	1	2	771
Mercer	12	1	1	13	2	4	1	2	382
Middlesex	42	2	4	57	3	5	2	2	390
Monmouth	42	1	15	49	5	7	1	3	775
Morris	51	1	11	57	7	18	5	2	1,458
Ocean	68	1	15	21	4	14	5	1	289
Passaic	14	1	3	18	0	10	3	1	254
Salem	6	1	0	7	0	0	0	0	62
Somerset	21	3	14	61	3	14	2	3	937
Sussex	45	1	7	45	7	13	1	0	337
Union	4	1	7	19	1	9	2	3	618
Warren	33	0	4	7	2	6	1	1	260
Total	**580**	**22**	**148**	**644**	**57**	**169**	**41**	**35**	**13,653**

Source: HIFLD, 2006, 2007, 2012, 2014, 2017, 2018, 2019, 2020, 2021, 2022; NJOGIS, 2019, 2020; NJ TRANSIT, 2021; PANYNJ, 2023; USDOT, 2022; NMSFA, 2023

Bridges

Bridges are a critical node in our transportation infrastructure. The wildfire hazard typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed or weakened possibly affecting structural integrity. Table 4.12-12 below shows the number of bridges in each county that are located within areas at risk from wildfire. There are 900 Bridges in the state located within low-to-high risk wildfire areas. Of these, 432 are in areas considered high risk.

Table 4.12-12 Number of Bridges at Risk from Wildfire

County	Bridges within Wildfire Hazard Potential Areas Category 1-4	Bridges within Wildfire Hazard Potential Areas Category 5-8
Atlantic	6	28
Bergen	7	17
Burlington	47	38
Camden	19	13
Cape May	0	1
Cumberland	16	12
Essex	2	6
Gloucester	43	20
Hudson	0	2
Hunterdon	90	32
Mercer	39	38
Middlesex	12	24
Monmouth	48	50
Morris	34	20
Ocean	10	24
Passaic	4	7
Salem	24	11
Somerset	25	50
Sussex	19	10
Union	2	16
Warren	21	13
Total	**468**	**432**

Source: USDOT, 2022; NMSFA , 2023

To assess the vulnerability of the state-owned and leased facilities provided by the New Jersey Office of Management and Budget (NJOMB), an analysis was conducted with the wildfire hazard potential areas. Using GIS, these hazard areas were overlaid with the state facility data to determine the number of vulnerable state facilities. Table 4.12-13 summarizes the state-owned and -leased facilities vulnerable to the landslide by county. Table 4.12-14 summarizes the facilities vulnerable by state agency. There are no State facilities in an area of Wildfire Hazard Potential Category 8. There are 14 State facilities in an area of Wildfire Hazard Potential Category 7; these facilities are all in Bass River State Forest or Brendan T. Byrne State Forest in Burlington County.

Table 4.12-13 Number of State-Owned and -Leased Facilities at Risk from Wildfire by County

County	State Facilities within Wildfire Hazard Potential Areas Category 1-4	State Facilities within Wildfire Hazard Potential Areas Category 5-7
Atlantic	7	31
Bergen	1	7
Burlington	115	141
Camden	9	38
Cape May	24	35
Cumberland	61	11
Essex	0	0
Gloucester	0	1
Hudson	0	15
Hunterdon	142	65
Mercer	88	9
Middlesex	7	120
Monmouth	152	69
Morris	37	31
Ocean	14	44
Passaic	9	127
Salem	31	46
Somerset	26	29

County	State Facilities within Wildfire Hazard Potential Areas Category 1-4	State Facilities within Wildfire Hazard Potential Areas Category 5-7
Sussex	114	252
Union	0	6
Warren	75	42
Total	**912**	**1,119**

Source: NJOMB, 2023; NMSFA, 2023

Table 4.12-14 Number of State-Owned and -Leased Facilities at Risk from Wildfire by Agency

Agency	State Facilities within Wildfire Hazard Potential Areas Category 1-4	State Facilities within Wildfire Hazard Potential Areas Category 5-7
State	2	1
Agriculture	9	0
Banking And Insurance	0	0
Chief Executive	1	0
Children and Families	26	6
Community Affairs	0	0
Corrections	132	30
Education	2	4
Environmental Protection	442	802
Health	23	30
Higher Education	0	0
Human Services	45	14
Inter-Departmental	0	0
Judiciary	0	0
Juvenile Justice Commission	11	141
Labor and Work Force Development	3	0
Law And Public Safety	0	0
Legislature	0	1
Military And Veterans Affairs	34	17
Miscellaneous Commissions	0	0
Motor Vehicles Commission	9	3
Personnel	0	0
State Police	11	10
Transportation	42	32
Treasury	120	28
Total	**912**	**1,119**

Source: NJOMB, 2023; NMSFA, 2023

Population and Economy

Economic Impacts

The economic cost of wildfires can be exorbitant. Wildfires impact human health, degrade ecosystems, interrupt economic activity, and yield considerable fiscal costs for prevention and recovery (Levitz, 2023). Wildfires elsewhere in the U.S. have been multibillion-dollar disasters. While New Jersey has not experienced wildfires of that magnitude, given predictions about how climate change will impact New Jersey temperatures, precipitation, and storms, and that fire is determined by these variations in climate, it is projected that wildfires in the state will become more larger and more frequent.

The total economic impacts of wildfire go beyond the cost of damages, as they include health costs and indirect losses due to power shut-offs, business closures, travel cancellations, supply chain disruptions, among other costs. In vulnerable areas like the Pinelands, declining tourism following a wildfire could lead to employment losses in a spike in unemployment claims. Wildfires could lead to an uptick in hospital admissions and related health costs. Wildfires could also cause shifts in the housing market. As fires destroy homes and displace residents, cities may struggle to bounce back causing a stagnant or declining population in counties with large wildfire events (BACEI, 2021).

Population Impacts and Changes in Development

Larger and more intense wildfires are creating the potential for greater smoke production and chronic exposures in the U.S. Wildfire smoke contains particulate matter, carbon monoxide, nitrogen oxides, and various volatile organic compounds and can significantly reduce air quality, both locally and in areas downwind of fires (CDC, 2020). The effects from wildfires can range from eye and respiratory tract irritation to more serious disorders, including reduced lung function, bronchitis, exacerbation of asthma and heart failure, and premature death. Children, pregnant people, and the elderly are especially vulnerable to smoke exposure (EPA, 2023).

Socially Vulnerable and Underserved Communities

As noted above, wildfire smoke exposure is associated with a host health impacts. Public health recommendations to reduce exposure to wildfire smoke include staying indoors in places with adequate air filtration, reducing activity during smoke events, reducing other sources of indoor air pollution, using air filters, and, for those who cannot stay indoors (e.g., agricultural and outdoor workers), wear suitable respiratory protection when outdoors (Vargo, et al, 2023).

Making these kinds of changes can be difficult for people with limited resources. For example, people with poor indoor air filtration at home, those without access to clean air spaces, and people experiencing homelessness may be especially challenged to reduce their personal exposure to wildfire smoke. Many of the self-protective actions are costly, and therefore unlikely to benefit some populations (Vargo, et al, 2023). Table 4.12-15 and Table 4.12-16 outline the estimated population of disadvantaged, socially vulnerable, and overburdened communities within New Jersey located in the wildfire area within each county.

Table 4.12-15 New Jersey Disadvantaged Communities within Wildfire Hazard Potential Areas Category 1-4

County	Total Countywide Population	Disadvantaged Communities Identified by the White House Climate and Economic Justice Screening Tool		Socially Vulnerable Communities Identified by the CDC/ATSDR Social Vulnerability Index		Overburdened Communities Identified by the NJDEP Overburdened Communities under the Environmental Justice Rule	
		Total Disadvantaged Population in Wildfire Area	% of Population that is Disadvantaged and in Wildfire Area	Total Socially Vulnerable Population in Wildfire Area	% of Population that is Socially Vulnerable and in Wildfire Area	Total Overburdened Population in Wildfire Area	% of Population that is Overburdened and in Wildfire Area
Atlantic	274,534	9,885	4%	21,665	8%	16,039	6%
Bergen	955,732	1,511	0%	5,614	1%	18,372	2%
Burlington	461,860	8,458	2%	25,291	5%	39,530	9%
Camden	523,485	16,240	3%	43,724	8%	46,814	9%
Cape May	95,263	7,245	8%	7,773	8%	7,931	8%
Cumberland	154,152	20,581	13%	30,891	20%	28,176	18%
Essex	863,728	8,900	1%	13,161	2%	23,937	3%
Gloucester	302,294	2,769	1%	13,716	5%	19,576	6%
Hudson	724,854	452	0%	1,426	0%	3,437	0%
Hunterdon	128,947	642	0%	661	1%	2,552	2%
Mercer	387,340	15,252	4%	27,774	7%	52,573	14%
Middlesex	863,162	12,116	1%	25,354	3%	95,798	11%
Monmouth	643,615	4,032	1%	16,094	3%	17,946	3%
Morris	509,285	7,188	1%	17,671	3%	26,704	5%
Ocean	637,229	16,817	3%	17,026	3%	17,152	3%
Passaic	524,118	2,998	1%	13,358	3%	10,225	2%
Salem	64,837	2,527	4%	7,882	12%	9,226	14%
Somerset	345,361	1,382	0%	9,874	3%	46,783	14%
Sussex	144,221	476	0%	5,370	4%	4,263	3%
Union	575,345	5,953	1%	11,385	2%	19,357	3%
Warren	109,632	1,491	1%	11,120	10%	3,279	3%
Total	**9,288,994**	**146,915**	**2%**	**326,830**	**4%**	**509,670**	**5%**

Source: United States 2020 Census; White House Climate and Economic Justice Screening Tool; CDC/ATSDR Social Vulnerability Index; NJDEP Overburdened Communities under the Environmental Justice Rule; NMSFA , 2023

Table 4.12-16 New Jersey Disadvantaged Communities within Wildfire Hazard Potential Areas Category 5-8

County	Total Countywide Population	Disadvantaged Communities Identified by the White House Climate and Economic Justice Screening Tool		Socially Vulnerable Communities Identified by the CDC/ATSDR Social Vulnerability Index		Overburdened Communities Identified by the NJDEP Overburdened Communities under the Environmental Justice Rule	
		Total Disadvantaged Population in Wildfire Area	% of Population that is Disadvantaged and in Wildfire Area	Total Socially Vulnerable Population in Wildfire Area	% of Population that is Socially Vulnerable and in Wildfire Area	Total Overburdened Population in Wildfire Area	% of Population that is Overburdened and in Wildfire Area
Atlantic	274,534	21,877	8%	57,905	21%	45,066	16%
Bergen	955,732	6,786	1%	29,573	3%	76,944	8%
Burlington	461,860	8,033	2%	11,791	3%	16,027	3%
Camden	523,485	8,747	2%	22,814	4%	27,214	5%
Cape May	95,263	3,246	3%	3,517	4%	2,273	2%
Cumberland	154,152	14,481	9%	29,911	19%	20,520	13%

County	Total Countywide Population	Disadvantaged Communities Identified by the White House Climate and Economic Justice Screening Tool		Socially Vulnerable Communities Identified by the CDC/ATSDR Social Vulnerability Index		Overburdened Communities Identified by the NJDEP Overburdened Communities under the Environmental Justice Rule	
		Total Disadvantaged Population in Wildfire Area	% of Population that is Disadvantaged and in Wildfire Area	Total Socially Vulnerable Population in Wildfire Area	% of Population that is Socially Vulnerable and in Wildfire Area	Total Overburdened Population in Wildfire Area	% of Population that is Overburdened and in Wildfire Area
Essex	863,728	13,712	2%	22,369	3%	45,166	5%
Gloucester	302,294	2,904	1%	10,869	4%	14,213	5%
Hudson	724,854	9,541	1%	14,050	2%	17,074	2%
Hunterdon	128,947	385	0%	394	0%	1,133	1%
Mercer	387,340	1,958	1%	5,013	1%	13,685	4%
Middlesex	863,162	14,352	2%	30,450	4%	87,600	10%
Monmouth	643,615	2,476	0%	18,621	3%	15,755	2%
Morris	509,285	3,456	1%	9,526	2%	19,838	4%
Ocean	637,229	45,124	7%	43,620	7%	43,182	7%
Passaic	524,118	7,376	1%	20,550	4%	17,437	3%
Salem	64,837	108	0%	708	1%	1,072	2%
Somerset	345,361	452	0%	5,613	2%	32,546	9%
Sussex	144,221	163	0%	1,965	1%	1,758	1%
Union	575,345	9,559	2%	16,244	3%	26,500	5%
Warren	109,632	0	0%	5,921	5%	899	1%
Total	**9,288,994**	**174,736**	**2%**	**361,424**	**4%**	**525,902**	**6%**

Source: United States 2020 Census; White House Climate and Economic Justice Screening Tool; CDC/ATSDR Social Vulnerability Index; NJDEP Overburdened Communities under the Environmental Justice Rule; NMSFA , 2023

NMSFA estimated the risk to potential structures statewide. According to NMSFA, expected risk to potential structures (RPS) integrates wildfire likelihood and intensity with generalized consequences to a home on every pixel. For every place on the landscape, it poses the hypothetical question, "What would be the relative risk to a house if one existed here?" This allows comparison of wildfire risk in places where homes already exist to places where new construction may be proposed.

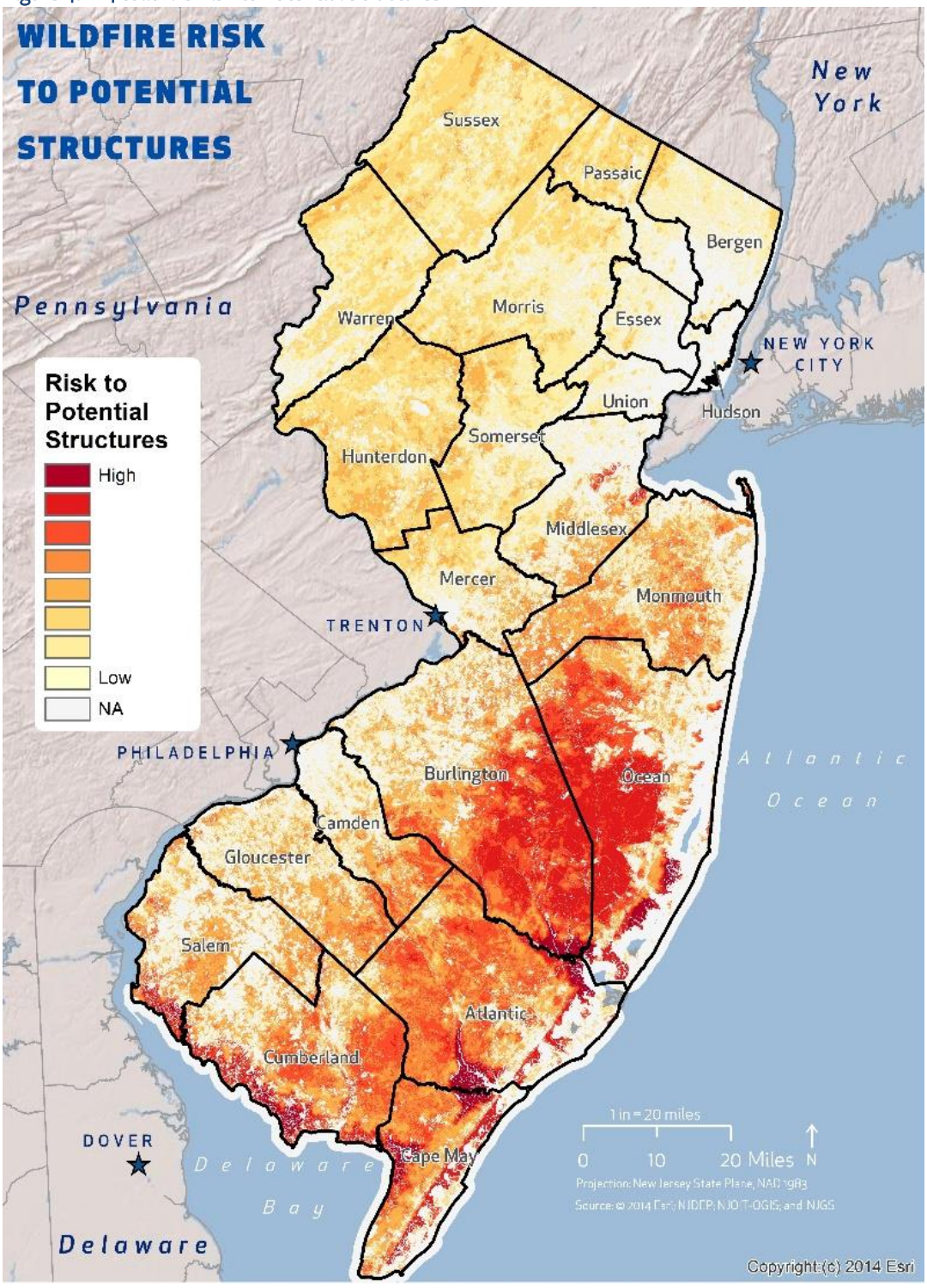
Table 4.12-17 summarizes the number and percent of acres in each risk to potential structures category statewide. Approximately 35% of land statewide has minimal direct wildfire impacts. Only 0.8% of land in the state has a high risk to potential structures (NMSFA, 2023).

Table 4.12-17 Risk to Potential Structures

Color	Risk to Potential Structures Category	Acres	Percent
	Minimal Direct Wildfire Impacts	1,816,901	35.3 %
	1-Low	0	0.0 %
	2	681,645	13.2 %
	3	857,935	16.6 %
	4	621,686	12.1 %
	5	482,120	9.4 %
	6	398,991	7.7 %
	7	251,858	4.9 %
	8-High	42,681	0.8 %
	Total	**5,153,817**	**100.0 %**

Figure 4.12-4 shows the wildfire risk to potential structures across counties. As shown, the counties with the greatest concentration of categories 6, 7, and 8 risk to potential structures are in south Jersey, particularly Atlantic, Burlington, Cape May, Cumberland, Ocean, and Salem counties. The highest burn probabilities statewide are found along the Delaware Bayshore from Salem to Cape May counties and along the back bays of the Atlantic Coast from Ocean to Cape May counties (NMSFA, 2023).

Figure 4.12-4 Wildfire Risk to Potential Structures



Ecosystems & Natural Assets

Air Quality

Wildfire smoke releases carbon monoxide, volatile organic compounds, carbon dioxide, hydrocarbons, nitrogen oxides, and fine particulate matter (PM2.5) which is the most prevalent pollutant released. Wildfire events can cause significant negative environmental impacts and public health concerns, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases.

Forests and Vegetated Lands

Wildfires can have significant positive and negative impacts on the environment. The loss of vegetation, biodiversity and habitat is a concern, especially where threatened and endangered species are located. However, many of the State's listed threatened and endangered species thrive in the open conditions that had historically resulted from the natural fire regime. Exposed soils are vulnerable to wind and water erosion which may impact the quality of downstream water bodies and drinking water supplies. The composition of plant communities, as well as their vegetative and growth characteristics, is affected by fire. For example, many plant species have adapted to fire and are dependent on it for reproduction (NJFFS, 2013).