CENTRAL PINE BARRENS COMPREHENSIVE PRESCRIBED FIRE MANAGEMENT PLAN

January 2021

Prepared by the Central Pine Barrens Joint Policy and Planning Commission
Science and Stewardship Program
Bob Panko - Fire Management Specialist
Polly Weigand – Science and Stewardship Program Manager
Shaun Ziegler – Senior Ecologist

Central Pine Barrens Joint Policy and Planning Commission
624 Old Riverhead Road
Westhampton Beach, New York 11978

Signature Page

The Commission's mission is "to manage land use within the Central Pine Barrens to protect its vital groundwater and surface water and the region's vast and significant natural, agricultural, historical, cultural and recreational resources for current and future Long Island residents".

As part of this mission the Commission is facilitating a collaborative and adaptive prescribed fire program to which the goals include planning, implementation and monitoring for the purposes of specifically improving ecosystem health as authorized by Central Pine Barrens Comprehensive Land Use Plan (CLUP, Section 7.6.9). This Plan is a guideline to achieve these goals and assure compliance with the State Environmental Quality Review Act (Article 8 of the New York State Environmental Conservation Law).

I certify this Plan as accepted by resolution of the Central Pine Barrens Joint Planning and Policy Commission.

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John W. Pavacic Date

Executive Director
Central Pine Barrens Joint Planning and Policy Commission

Acknowledgements

First and foremost, the Central Pine Barrens Joint Planning and Policy Commission wishes to recognize that the development of this Central Pine Barrens Prescribed Fire Management Plan and Program has been made possible thanks to contractual funding provided from the New York Environmental Protection Fund as dedicated by the New York State Legislature to the New York State Department of Environmental Conservation Division of Lands and Forests' Forest Health Program for southern pine beetle prevention and suppression.

We also wish to recognize the New York State Department of Environmental Conservation (NYS-DEC) Region 1 and the Albany Central Office staff especially Rob Cole, Forester within the Forest Health Unit. Rob provided the leadership and laid the groundwork that resulted in the dedication of the funds which in turn helped advance timely and collaborative prescribed fire operations within the Central Pine Barrens for the purposes of ecological health improvement, southern pine beetle resilience and wildfire risk reduction.

In addition to this leadership, this plan would not be possible without the extensive knowledge and expertise regarding land and fire management that was sourced from regional partnership. The NYS-DEC's Unit Management plans and Prescribed Fire plans for the Long Island Pine Barrens State Forests were key references in preparation of this Plan. We especially recognize the work of NYS-DEC Forest Ranger Bryan Gallagher. Ranger Gallagher has been the rock of Central Pine Barrens prescribed fire leadership, planning, organization, coordination, training and implementation throughout the past two decades and he continues every day in this leadership role as a key interagency partner. He is also the author of many of the Unit Management Plans and was always available for consultation about aspects of this Plan. John Wernet, Regional Forester of NYS-DEC Region 1 and Nate Hudson, Southern Pine Beetle Incident Commander, NYS-DEC Forest Health Unit have both also been integral in the development and implementation of hazard maps related to southern pine beetle that resulted in the development of prescribed burn and vegetation pretreatment plans identified within this greater plan and program.

We also recognize Andrew F. Windisch and his work "A Preliminary Wildfire History for The Long Island Central Pine Barrens" published by his employer of the time, The Nature Conservancy, in September 1994. This work was, and still is, a landmark chronology of wildfires that occurred in the Central Pine Barrens from 1931 until 1994. Without his work the details of this important fire history would likely have remained lost. Similarly, The Nature Conservancy (TNC) is recognized for its past fire management work in the Central Pine Barrens that helped create the foundation this Plan was designed to build upon. We especially recognize the work TNC conducted in digitizing the Windisch fire history maps and in creating a very accurate digital plant community map in the mid 2000's. Both of those products were invaluable in creating this Plan.

Thanks are extended to Christine A. Purpura, GIS Specialist, NY State Department of Environmental Conservation Albany, NY who provided Suffolk County wildland fire occurrence data from 1995 to 2020 that, combined with the Windisch report enabled us to incorporate 90 years of wildfire history analysis in the Central Pine Barrens in this Plan.

Finally, this Comprehensive Prescribed Fire Management Plan could not have been created without the support of the Suffolk County Water Authority and specifically the Administration and Information Technology staff that enabled collaborative remote workplace connectivity for the plan preparers and reviewers throughout the Covid-19 Pandemic of 2020.

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Executive Summary

The Central Pine Barrens is a globally rare, culturally rich and fire dependent ecosystem that continues to experience declines in ecosystem health and increased wildfire risk caused by a lack of fire disturbance. The two predominant factors associated with these alarming yet manageable ecological impairments include the continued development of the wildland urban interface (WUI) and failure to implement management as a means to mitigate the loss of this disturbance regimen while countering other anthropogenic ecosystem stressors (e.g. invasive species, habitat fragmentation). The recent arrival and decimation of pitch pines by the southern pine beetle serves as just one example that typifies declines in forest health that are currently being experienced in the Central Pine Barrens. The risk to and loss of homes and businesses that occurred during the 1995 Sunrise fire and the more recent 2012 Crescent Bow fire reinforces that this system as fire prone with a high WUI.

This Comprehensive Prescribed Fire Management Plan aims to provide the foundational framework to catalyze a sustained and scientifically based, landscape focused and collaborative management program within the Central Pine Barrens using prescribed fire as a primary and justified management tool. The cumulative goal of prescribed burning is a shifting mosaic of habitat types and successional stages on the CPB's landscape in an effort to strengthen ecosystem resiliency to pests and disease; increase native species diversity; ensure suitable habitat for rare and endangered flora and fauna; retain species-specific fire adaptations; reduce the risk of wildfire within public lands and increase public safety in communities adjacent to the woodlands of this fire dependent and regionally-valued ecosystem. To achieve these goals and objectives this plan develops a systematic and safe management approach with the intention to:

- encourage, establish, build, and participate in a cohesive and collaborative prescribed fire-based land management structure;
- strategically guide decision making in order to maximize management across the landscape reflective of ecological and social priorities/values and available resources;
- define key guidelines for operations, programs and safety that are necessary to develop the safest and most achievable program reflective of the above-mentioned goals.

This plan is holistic, comprehensive and scientifically based and begins with detailing ecological and historical context, fire history, weather, and fuels that lend to the development and influence of fire disturbance within the Central Pine Barrens. The Management Alternatives to Prescribed Fire section identifies the challenges of implementing alternative management without the effects of fire within this fire dependent system. Legal considerations including the associated laws and regulatory requirements are brought to the forefront as a section in the plan, to help ensure compliance is achieved with management action. Thereafter, planning and implementation considerations clearly identify the multiple management phases associated with prescribed fire operations including collaborative management, pre-and post-treatment plans as well as the types, coordination, components and approval process of prescribed burn plans. No plan would be complete without strategies for prioritizing prescribed management, which is justifiably one of the most important resources detailed into this plan in an effort to help maximize collaborative management across the many jurisdictions of the Central Pine Barrens reflective of priorities, previous planning, strategic tactics and available resources.

The Fire Management Unit section divides the Central Pine Barrens into five management units and describes the land protections, ownership, natural communities, unique ecological disturbances and land use history and most importantly the wildfire and prescribed fire management history, dominant

fuels, WUI risk, and prescribed fire priorities and goals in order to provide a strategic foundation to coordinate future management planning.

The final sections of the plan detail monitoring and research which is fundamental in order to facilitate an adaptive prescribed fire program that evaluates if programmatic goals and objectives are met. Public education and outreach, the last section of this plan prior to the conclusion, is recognized as crucially necessary for this plan to succeed and for prescribed fire to develop widespread acceptance as the public have little exposure to, or familiarity with, any kind of prescribed fire and/or forestry management practices, especially relating to fire in woodland environments. This section aims to increase the public's understanding of the role prescribed fire has in fuels mitigation, habitat and species health, ecological services and wildfire risk reduction with the outcome that fire implemented in a controlled and prescribed manner once again becomes a central cultural component of the Central Pine Barrens.

Management is not static, nor are the guidelines, history or recommendations put forth within this Plan. Accordingly, updates reflective of evolving knowledge, research and management shall be made to this Plan overtime to maintain it as a relevant, useful, and defendable guideline by which to advance prescribed fire for the greater purposes of maintaining the unique ecology, heralded rarity and valued culture that represents the Central Pine Barrens.

1. Introduction

The Central Pine Barrens is a disturbance dependent ecosystem located centrally in Suffolk County, New York that supports a high diversity of rare and endangered flora, fauna and ecological communities and lies adjacent to and within one of the largest human populations in the Country. It also provides filtration and percolation services for a large quantity of high-quality water to recharge the region's sole source aquifer and sustains a rich cultural history and a diversity of recreational opportunities. To protect this globally rare, ecologically significant, and culturally valuable ecosystem, and its services (provisions provided for human benefit), the Long Island Pine Barrens Protection Act was enacted in 1993 by New York State. This action effectively established land use protections while authorizing and assigning responsibility for protection of this significant resource to the Central Pine Barrens Joint Planning and Policy Commission (Commission; NYS ECL Article 57) through the development and implementation of a Comprehensive Land Use Plan (CLUP Revised 2012). The Commission's mission is "*to manage land use within the Central Pine Barrens to protect its vital groundwater and surface water and the region's vast and significant natural, agricultural, historical, cultural and recreational resources for current and future Long Island residents*".

The Commission is facilitating a collaborative and adaptive prescribed fire program, including planning, implementation and monitoring, for the purposes of specifically improving ecosystem health as authorized by the Central Pine Barrens Comprehensive Land Use Plan (CLUP, Section 7.6.9). Further, as a fire prone ecosystem with significant wildland urban interface, mitigating the risk of wildfire on public lands and increasing public safety in communities adjacent to woodlands are at the forefront of this prescribed fire program. Using fire to mitigate the risk of wildfire is an effective and encouraged tactic that is identified in Section 7.16.10 and Appendix B of the CLUP as well as the Central Pine Barrens Fire Management Plan (FMP). The FMP was developed in 1999 by the Wildfire Task Force (WFTF) in order to systematically and proactively coordinate a safe operational response to wildfires, increase public safety and reduce the potential for future wildfire ignitions. Further, the Ridge-Manorville-Calverton Community Wildfire Protection Plan (CWPP Section 5.3.3.) encourages development of a Comprehensive Adaptive Prescribed Management program for the benefit of ecology, public health and wildfire risk reduction within its focal area (CBPB-CWPP 2016). This Comprehensive Prescribed Fire Management Plan (RXFMP) has been developed to serve as a standard and integral guidance document for the Commission's Prescribed Fire Program as encouraged by the WFTF's Fire Management Plan – Chapter 11 (WTF 1999). The RXFMP specifies prescribed fire standards; implementation objectives and protocols; staffing qualifications; monitoring and evaluation; smoke management guidelines and education and outreach in order to reduce risk and liability; advance staffing and public safety and increase public awareness while ensuring operational goals are met.

It is widely recognized that a variety of driving forces and modifying disturbances are responsible for creating and maintaining the Central Pine Barrens' ecological structure and function including but not limited to high frequency low intensity fires, low frequency high intensity fires, severe weather events, historic timber harvesting, and forest pest infestations. Fire, both prior to and post European settlement, is one of the most formative disturbance regimes in the Central Pine Barrens and includes both naturally ignited and human-caused large fires that were known to burn across the Long Island landscape. However, this critical disturbance regime has been contemporarily lost from the landscape due to human influence in several ways. A leading cause is due to a culture of fire suppression that was initiated in the 19th century within the region following massive wildfire outbreaks. The legacy of fire suppression continues to occur in the region due to mass development of wildland urban interface within the Central Pine Barrens. Suppression was and is for good reason; but it should be recognized that suppression also removes the critical element of fire disturbance that assists in the maintenance of

healthy forests and ecosystems. Additionally, while the Central Pine Barrens has been protected from development and its boundaries protected, active ecosystem management, including adaptively managed disturbance implementation, has been stifled by the culture of preservation "i.e., hands off management" that accompanied these protection measures. Land use protections and fire suppression practices that were initiated to protect ecosystem and public health have instead resulted in a paradox – the facilitation of increased fuels, increased fire intensity and increased wildfire risk coupled with overall declines in ecosystem health and diversity.

Further, our human infrastructure, transportation corridors and land use have fragmented much of the Central Pine Barrens. Fragmentation interferes with the free movement of fire that was present from both naturally caused and aboriginal ignited fires during long past centuries. Urbanization and fire suppression have confined and reduced these natural and cultural fires to minimal acres, calling for the need to substitute their disturbance effects with prescribed fires on the landscape. The application of fire in this landscape, under carefully prescribed conditions and in carefully selected locations, is a component of good ecosystem management and stewardship.

The Central Pine Barrens geographically falls in the center of the range of the Atlantic Coastal Pine Barrens ecoregion, a zone of similar habitat (Bryce et al. 2010). The adjacent states and agencies with jurisdictional and management oversight of these pine barrens habitats have been using prescribed fire as a management tool for decades. It is urgently time for the Central Pine Barrens to benefit from best land management practices implementation like neighboring areas of the range for this globally rare and significant habitat type. Additionally, other pine barrens type habitats in this state, like the Albany Pine Bush, also have an active prescribed fire management program that is implemented in a highly urbanized environment. Properly stewarding this resource effectively requires adaptive, science based, justified, and adopted land management practices that have already been successfully exemplified in the surrounding states and other areas with pine barrens habitat. The Central Pine Barrens is really the last example of this type of habitat and ecosystem that is not being actively managed with prescribed fire and that lack of management has led to continuing declines in the health of the ecosystem and the species that reside here, gradually deteriorating the ecosystem services provisions that the citizenry relies on, while steadily increasing the risk to human health and property from increasing wildfire risk.

It is for these reasons that reintroducing prescribed fire management is particularly important and timely as declines in Central Pine Barrens health and increased potential for severe and intense wildfires are evident. For example, the forests are even aged, overstocked, and declining. Fuels have built up on the forest floors and ladder fuels have developed that can transport fire to the canopy. Canopies have closed, shading out early successional species and increasing development of organic matter which is driving transitions from historically xeric systems to mesic. These trends make the forest very susceptible to fire, pests and/or even collapse.

The Crescent Bow (2012) and the Sunrise (1995) fires exemplify this high risk for wildfire and the impact to the wildland urban interface. The arrival of and rapid decimation of pitch pine (*Pinus rigida*) caused by southern pine beetle (SPB, *Dendroctonus frontalis*) is another striking indicator of degraded forest health and susceptibility to pest and disease, which has brought the need for ecosystem management to the forefront. A chronic and equally alarming indicator of declines in Central Pine Barrens health is the increase in threatened and endangered species listings, many of which are dependent on fire, early successional habitats and particular host species.

To counter these trajectories, the Commission is proactively coordinating and implementing adaptive prescribed fire management as a surrogate for historic fire disturbance by mimicking both natural and

historical cultural fire ignitions that have shaped and sustained this unique fire adapted ecosystem through time. The cumulative goal of the prescribed burning is a shifting mosaic of habitat types and successional stages on the Central Pine Barrens landscape in an effort to strengthen ecosystem resiliency to pests and disease; increase native species diversity; ensure suitable habitat for rare and endangered flora and fauna; retain species-specific fire adaptations; reduce the risk of wildfire within public lands and increase public safety in communities adjacent to the woodlands of this fire dependent and regionally-valued ecosystem. More specifically, the following ecological, social and cultural aspects form the desired objective and outcomes of prescribed fire:

- To reduce accumulations of wildland fire fuel that increases the threat of wildfires to human life and safety, adjacent communities, public and private property, transportation corridors and other infrastructure.
- To restore and maintain the forests, grasslands and wetlands of the Central Pine Barrens in a manner that optimizes ecosystem and species health; maintains and/or increases the diversity of native flora and fauna and reduces impacts of non-native species invasions, all documented by systematic monitoring of conditions.
- To improve and sustain the Central Pine Barrens capacity for ecosystem service provision, including the filtration and percolation faculties for aquifer recharge.
- To restore and maintain habitats that support compatible outdoor recreational uses such as hiking, hunting, equestrian activities and bird watching, all of which contribute to community economic growth.
- To aid in the training of community fire department personnel and other stakeholders, in order to increase firefighter safety and expand strategic and tactical suppression options through more frequent exposure to wildland fires.
- To provide educational opportunities about wildland and prescribed fire by specifically conveying how fire has a natural role on the landscape; how it is an important component of the Central Pine Barrens ecosystem and how active prescribed fire management reduces the risk of severe outbreaks of wildfire and human health effects.

Program and site-specific burn objective success will be evaluated though the analysis of collected monitoring data. As such, a leading programmatic goal is to continually adapt the prescribed fire program and methods to ensure achievement of resource management, social, cultural and ecosystem health goals.

Holistically recognizing and sustaining the desired management outcomes requires intentional and strategic planning and prioritization especially as the large land areas, numerous ecosystems and the high-level wildland urban interface within the Central Pine Barrens exceeds the resources available by which to advance management. However, with intention and method applied to planning and prioritization, maximal benefit can be recognized.

Further, and irrespective of which lands or ecosystems are selected for focal management, a constant is the significant time, financial resources and risk investments that are necessary to achieve these goals and objectives. In the Central Pine Barrens, these costs are heavily compounded by the need to frequently first restored the site in an effort to overcome the legacies of fire suppression and lack of management. After such fuel reductions and ecosystem modifications are achieved during the restoration phase, a proactive opportunity then occurs to transition to a maintenance phase. This maintenance management can sustain the desired level of long-term ecosystem health or reduced wildfire risk at a significantly reduced cost. However, the investments in restoration management will only be recognized if phasing is intentionally and methodically planned, financed and implemented in a

way which transitions long term management of the Central Pine Barrens from restoration to maintenance. The benefits of this intentional management phasing not only include achieving the goals and objectives for the focal site over time at a reduced cost, but also protecting the initial investments made to modify the system to achieve its target condition while freeing up resources that may then allow restoration management to be advanced at new priority locations. Additional methods by which to advance collaborative and strategic management are detailed in Section 7 of this report.

2. Ecological and Historical Background

2.1 Location - Regional Extent

The Central Pine Barrens, as defined by the Long Island Pine Barrens Protection Act of 1993, is located in central Suffolk County, Long Island, New York and encompasses 106,000 acres (Figure 2.1). The Central Pine Barrens area is one system of the greater Atlantic Coastal Pine Barrens level three ecoregion defined by the EPA (Bryce et al. 2010, Figure 2.1). This ecoregion includes substantial and similar ecosystems within New Jersey, eastern Long Island, southeastern Massachusetts, Cape Cod, Martha's Vineyard, and Nantucket. The prevalence of this ecoregion is primarily driven by historic fire disturbance coupled with edaphic (soil) conditions that are predominantly coarse, sandy glacial till and outwash soils within the northern Atlantic coastal zone. There are some other instances of pine barrens community types within the region that exist due to local soil, or other abiotic factors in those areas, whether on ridge tops, windblown prehistoric lake sand deposits, or other formations allowing pines to maintain a competitive dominance. Some examples of these include the Albany Pine Bush, Rome Sand Plains, Montague Plains and Shawangunk Mountain ledges.

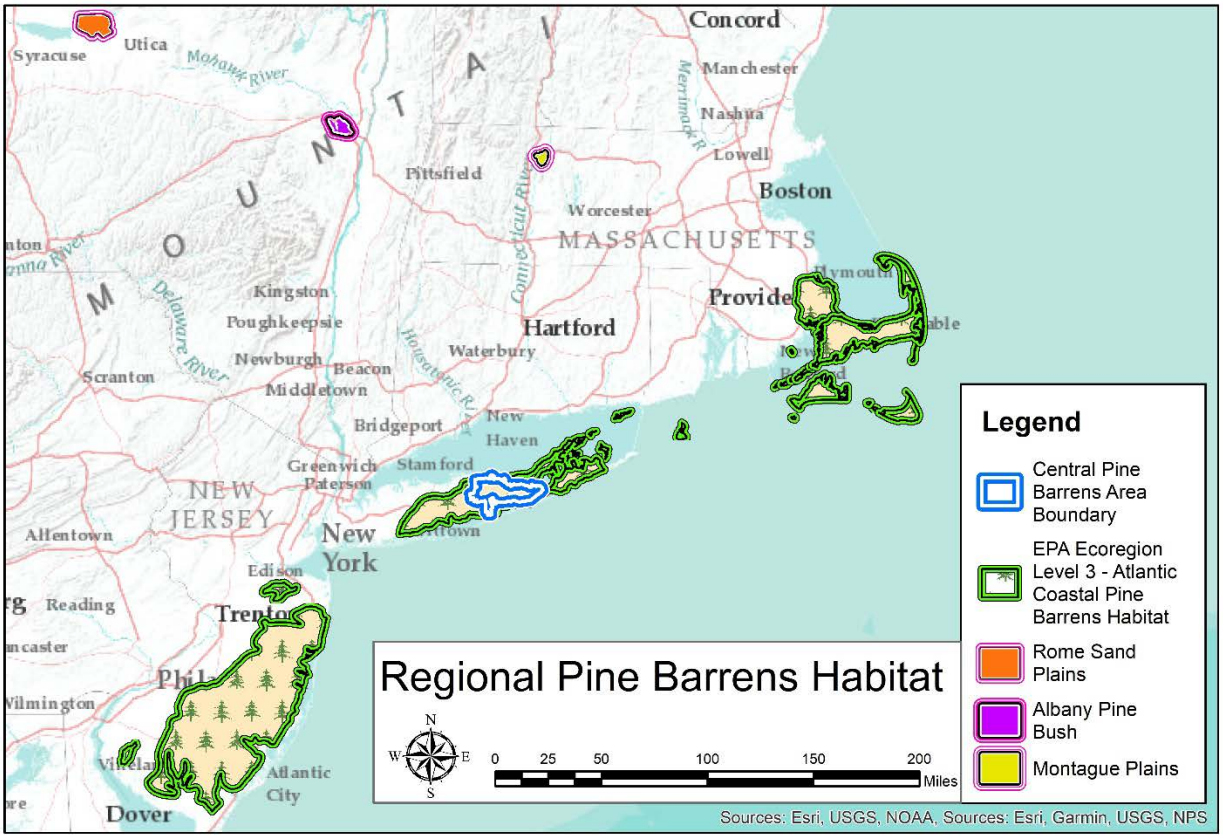


Figure 2.1 Regional Pine Barrens Habitat Map

2.2 General Descriptions of Ecosystem Drivers and Modifiers

The Central Pine Barrens Comprehensive Land Use Plan Volumes 1 and 2 serve as important references to this chapter and relate to many important aspects of comprehensive prescribed fire planning within the Central Pine Barrens (C 2012). Significant portions of this section have been adapted from the Central Pine Barrens Comprehensive Land Use Plan. These sections illustrate the formative forces and current conditions in this natural system and help to communicate and illustrate the importance and necessity of fire and disturbance in this ecological mosaic. Disturbance and fire are needed to maintain biodiversity and ecosystem service provision while reducing buildup of organic material and fuels that lead to increasing wildfire risk.

Central Pine Barrens Geology

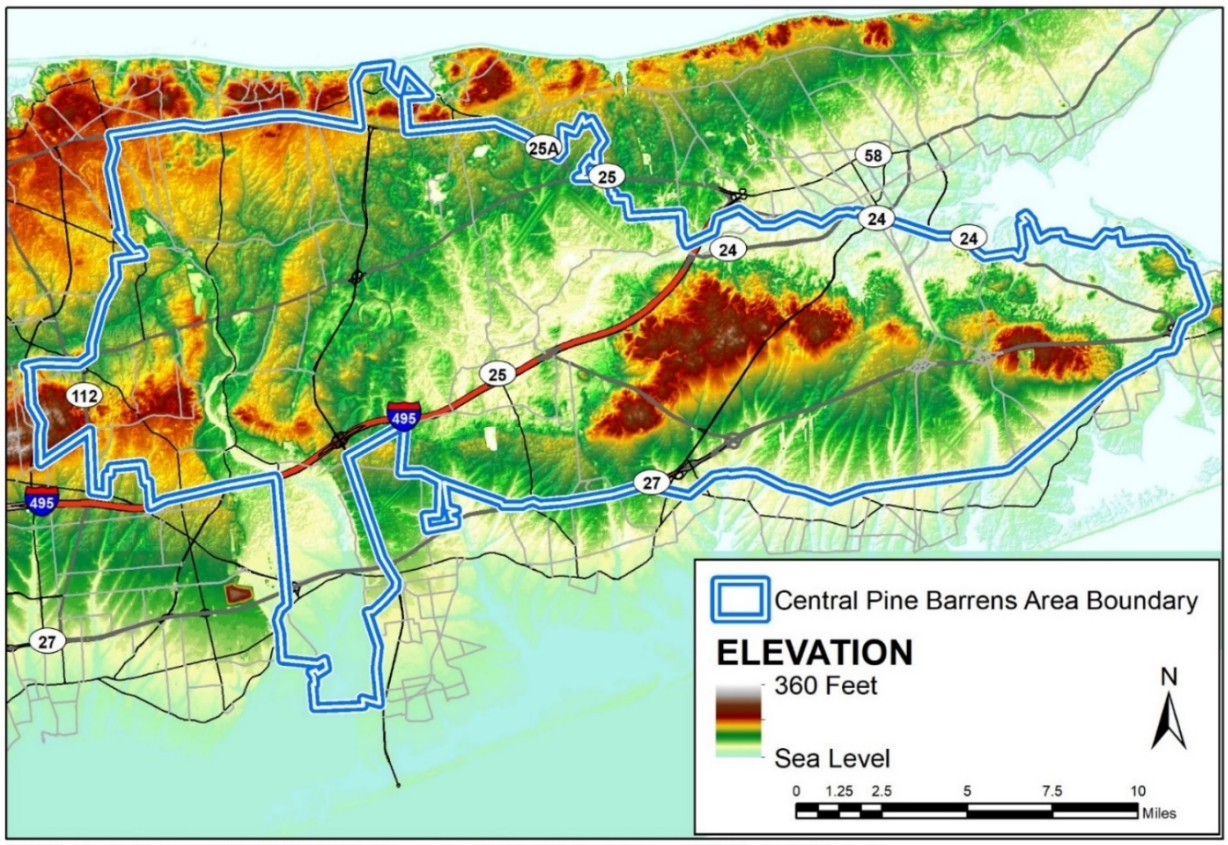
The geologic formations of Suffolk County, including those underlying the Central Pine Barrens area, consist of thick deposits of unconsolidated, water-bearing sediments resting upon a relatively impermeable, crystalline bedrock surface. The sequence of events that shaped Suffolk County's geology is not known with certainty, but most likely began with the formation of the original basement rocks in early Paleozoic to Precambrian time more than 400 million years ago and the basement rock was metamorphosed into mountainous topography. Streams then eroded this topography and sedimentation initiated the formation of the Lloyd and Magothy aquifers and reduced the land to a nearly planar surface that gently graded to the southeast. During this period, an extensive clay unit (Gardiners Clay) was deposited in shallow marine and brackish waters along the shores of what is now Suffolk County created a confining layer to the aquifers. A long period of non-deposition, or possibly deposition followed by erosion, occurred during this Cretaceous period; however, streams continued flowing across Long Island cutting deep valleys into the Magothy.

The late Pleistocene (Wisconsinan) glaciation (some 20,000 to 200,000 years ago) most recently shaped Long Island's geologic record by filling the valleys, burying older glacial deposits and creating the Ronkonkoma moraine along Suffolk's "spine" and South Fork, and the Harbor Hill moraine along the North Shore and North Fork (Figure 2.2). The Ronkonkoma moraine transects the middle of the Central Pine Barrens in an east-west direction while the Harbor Hills moraine is located to the north. Erosion of these morainal glacial till deposits (as the Wisconsin glacier retreated from Long Island) created extensive outwash plains of sand and gravel in the intermorainal area and south to the Atlantic Ocean. These highly permeable deposits comprise the upper glacial aquifer and represent the majority of Suffolk's surficial sediments. Some local confining clay units (e.g., the Smithtown clay) were also formed from glacial materials in intermorainal lakes and tidal lagoons. Since the end of glaciation about 12,000 years ago, Holocene beach and marsh deposits have been formed along the marine edge, and within ponds and stream corridors, such as the Peconic River.

The coarse textured glacial outwash surficial sediments have created the soil series we see today on the landscape and will be discussed in more detail in the following soil section. These geological processes set the stage for the ecotypes and species community assemblages, and the various adaptations the species have developed to cope with quick draining, nutrient poor soils, and the disturbance that is common through fire in these conditions.

Central Pine Barrens Topography

The elevations within the Central Pine Barrens range from mean sea level along Flanders Bay, to a high of 331 feet at Bald Hill, which is on the Ronkonkoma Moraine, just southwest of the Eastern Campus of Suffolk County Community College south of Riverhead. The following map displays a representation of Central Pine Barrens elevation and topography (Figure 2.2).



U.S. Geological Survey, 20151214, USGS 13 arc-second n41w073 1 x 1 degree: U.S. Geological Survey.

Figure 2.2 Central Pine Barrens Elevation Map (Source US. Geological Survey)

The watershed of the Peconic River and its tributaries extends from the Harbor Hills Moraine to the north and the Ronkonkoma Moraine to the south. The elevation of the river goes from mean sea level at Flanders Bay, rising in a westerly direction to a high of approximately 40 feet in the Peasys Pond area (Robert Cushman Murphy County Park) and approximately 80 feet in the wetland area west of William Floyd Parkway, which comprises the headwaters of the Peconic River. North and west of the Peconic River, elevations generally rise to the Harbor Hills Moraine where they can exceed over 200 feet above mean sea level in many places. South and west of the river, elevations generally rise to the Ronkonkoma Moraine where they exceed over 250 feet in many places. South of the Ronkonkoma moraine elevations decrease along the outwash plains within the Central Pine Barrens area.

Similarly, the Carmans River originates in the western side of the Central Pine Barrens at Middle Island at an elevation of approximately 70 feet. It cuts through the Ronkonkoma Moraine as it flows south

through Southaven County Park and Wertheim National Wildlife Refuge where it then discharges to Bellport Bay at mean sea level.

Slopes within the area of the Central Pine Barrens where outwash plains and recent deposits can be found are generally flat to gently rolling and range from 0 to 15%. The moraine areas are very hilly and undulating containing slopes that range from 15 to 35% in many areas, especially in Manorville Hills.

In addition to common glacial features which include moraines, outwash plains and recent geologic deposits, glacial erratics, kettle holes, kames, drumlins and swale areas can be found in or adjacent to the moraine areas in the Central Pine Barrens. A kettle hole is a depression in glacial drift formed by the melting of a detached block of stagnant ice that was buried in the drift. It often contains a lake or swamp and many any of the ponds within the Central Pine Barrens area are kettle holes. Kames are mounds, knobs or short irregular ridges left by the glaciers that consist of stratified, poorly sorted sand and gravel, and at some locations they are overlain by a thin ablation till. Swale areas occur when two steeply sided hill areas converge on one another leaving a steep sloped gully or ravine. Many of these are found throughout the moraine areas. A good example is found south of Birch Creek in the Flanders area at Sears Bellows County Park.
Kame-and-kettle topography, also known as knob-and- kettle topography, is an undulating landscape in which a disordered assemblage of knolls, mounds, or ridges of glacial drift is interspersed with irregular depressions, pits, or kettles that are commonly undrained and may contain swamps or ponds.

Central Pine Barrens Hydrology

The Central Pine Barrens encompasses regions of deep recharge to Long Island's sole source aquifer, as well as subsystems with shallow flow components that discharge to the Peconic and Carmans rivers. Protections for these water resources, especially the sole source aquifer, and the ecosystem service provisions of filtration and percolation to the recharge supply helped advance the ecosystem protections for the Central Pine Barrens through the Long Island Pine Barrens Protection Act.

Maintaining ample and high-quality water resources requires precipitation, infiltration and cleansing which is best provided by an intact, healthy, condition and area-adapted, functioning ecosystem. The deep aquifer recharge within the Central Pine Barrens occurs on both sides (north and south) of the groundwater divide, which traverses central Brookhaven and splits into north and south fork branches, beginning in the area near the northwest corner of Brookhaven National Lab (BNL), and extending eastward. The boundaries of the Central Pine Barrens area approximate those of deep-flow Hydrogeologic Zone III, with the exception of the westernmost portion of the zone, as defined by the 208 Study (LIRPB, 1978) and later delineated by the SCDHS for the Suffolk County Sanitary Code. The Peconic River and upper reaches of the Carmans river drain the east-central and south-central portions of Hydrogeologic Zone III, respectively, and represent subsystems with shallow flow components within the deep recharge area. The Central Pine Barrens also includes areas surrounding the lower freshwater portion of the Carmans River, which extends into shallow-flow Hydrogeologic Zone VI.

Runoff is low and estimated to be only about 0.5 inches per year due because of rapid percolation and infiltration with generally level to gently sloping topography (Krulikas 1986). A total of 50% of the precipitation is lost to evaporation and evapotranspiration (Peterson 1987), with recharge to the aquifer system under average precipitation conditions calculated to range from 22 to 26 inches per year (or 1.05 to 1.24 million gallons per day (mgd) per square mile, with recharge patterns reflecting precipitation

patterns (Peterson 1987). Total recharge for the 100,000-acre (156 square miles) Central Pine Barrens area, therefore, is on the order of 164-193 mgd.

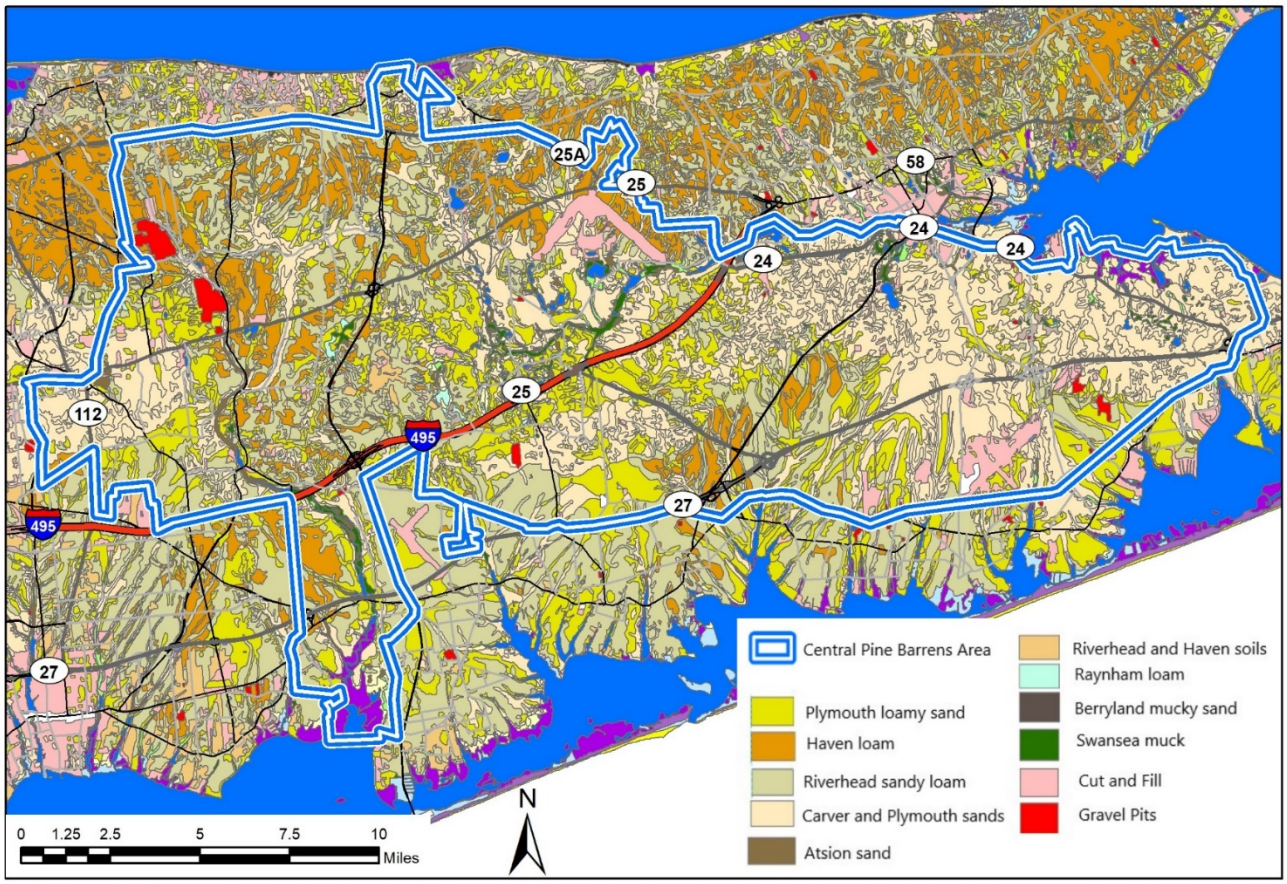
Central Pine Barrens Soils

This section seeks to describe in some detail the specific characteristics of the soil series or types, and their locations and extents on the Central Pine Barrens area landscape. Details are provided about the soil associations, textures, slopes, drainage, supported vegetation communities and human land use. As an overarching general summary and synthesis, the soil descriptions illustrate their important and unique environmental influence on vegetation type and successional trajectories observed over time in the Central Pine Barrens. This section incorporates the most current available information from the United States Department of Agriculture's Natural Resource Conservation Service Web Soil Survey referenced in August 2020.

The soils of the Central Pine Barrens are very coarse leading to quick draining and drying processes that are very prone to drought-like conditions shortly after rain events. As a result of their high rates of percolation, low organic matter, and low cation exchange capacity, these soils also have high nutrient leaching, low pH and little nutrient accumulation over time. The low nutrient, acidic and droughty soils lead to conditions that only vegetation adapted to these conditions is able to develop and sustain, namely pitch pine, scrub and tree oak and ericaceous shrub components, depending on finer scale variations in soil. These species associations are specifically adapted to the harsh xeric conditions promoted by the soils and serve as pioneering species during early successional periods, after disturbance, where they most successfully compete. The low water availability in these systems also reduces the water content and moisture contained within the vegetation, significantly impacting its flammability generally and throughout different seasons.

As noted in the Geological Overview, several soil associations typify the Central Pine Barrens region. Soils of the Central Pine Barrens have developed on coarse sandy and gravelly unconsolidated sediments deposited by the last two advances of Pleistocene glacial ice. The advance approximately 60,000 years ago deposited the hilly Ronkonkoma Moraine, which runs from Nassau through the Central Pine Barrens and out to Montauk Point. The final glacial advance 23,000 years ago formed the Harbor Hill moraine along the North Shore and North Fork. During glacial retreat, sand and gravel washed from the morainal deposits formed extensive outwash plains between the two moraines and south of the Ronkonkoma Moraine to the Atlantic Ocean. This glacially deposited material is heterogenous in composition and texture. The Central Pine Barrens have developed primarily in areas where the deposits are coarse and have given rise to soils in the Plymouth-Carver association that are coarse textured, well-drained to excessively well-drained, acidic, and nutrient poor. Pine Barrens also may be found on medium to moderately coarse-textured Haven and Riverhead soils, associated with Plymouth-Carver soils in the southern and northwestern portions of the Central Pine Barrens.

Four main soil associations are located within the Central Pine Barrens area, these are identified as: Haven-Riverhead Association; Plymouth-Carver Association - Rolling and Hilly; Plymouth-Carver Association - Nearly Level and Undulating; and Riverhead-Plymouth-Carver Association. The geographic distribution of soil series within the Central Pine Barrens area is shown in Figure 2.3. The soil series information was taken from the Web Soil Survey (WSS) referencing the 1975 USDA NRCS Suffolk County Soil Survey and incorporated updates since time of access in 2020.



Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at the following link: http://websoilsurvey.sc.egov.usda.gov/. Accessed [08/2020].

Figure 2.3 Pine Barrens Soil Series Map (Source NRCS Web Soil Survey)

Haven-Riverhead Association: The Haven-Riverhead Association is located as a band varying in width from two to four miles wide along the northern portion of the Central Pine Barrens area (Figure 2.3). According to the Soil Survey, this association consists of deep, nearly level to gently sloping, well-drained, medium-textured and moderately coarse textured soils on outwash plains. Characteristically it is nearly level with short gentle slopes along shallow drainageways with some areas pitted by steep-sided kettle holes. Slopes range from 1 to 12% in this association (USDA NRCS Web Soil Survey 2020). This association constitutes approximately 25% of the Central Pine Barrens area and is comprised of approximately 40% Haven soils and approximately 30% Riverhead soils, with the remaining 30% of this association consisting of minor soils. The Haven and Riverhead soils are found together across most landforms. However, Haven soils are most extensive at slightly higher elevations and at greater distances from drainageways. Haven soils are deep, well drained and medium textured soils, whereas Riverhead soils are described as deep, well drained and moderately coarse textured soils. The surface layer of Haven soils is loam and their subsoil is loam or silt loam. The surface layer and subsoil of Riverhead soils is sandy loam. Both Haven and Riverhead soils are present throughout the county with Haven soils mostly found on outwash plains located between the two terminal moraines. Riverhead soils are found on rolling to steep areas on the moraines and in level to gently sloping areas on outwash plains. Slopes for Haven soils can range from 0 to 12%, but generally range from 1 to 6%. Slopes for Riverhead soils are characterized as nearly level to steep; however, they are generally nearly level to gently sloping. The substratum for both Haven and Riverhead soils is sand and gravel. The depth to the substratum for Haven soils ranges from 18 to 36 inches and 22 to 36 inches in Riverhead soils.

Minor soils of this association include steeper Carver and Plymouth soils that are found on the sides of drainageways and on the steep sides of kettle holes. Soils of the Haven series thick surface layer are found in the bottom of shallow depressions. Soils within this association that have a high-water table include Canadice, Raynham, Scio, and Sudbury soils. Raynham, Scio, and Sudbury soils are found in low-lying areas near ponds or marshes. The largest such area is near Brookhaven National Laboratory.

Native vegetation for the Haven-Riverhead association consists of black oak, white oak, red oak, and scrub oak. Native vegetation for the Haven soils is predominantly pitch pine dominant vegetation community associations. The majority of the areas within this association have been cleared. The soils of this association from the Brookhaven-Riverhead town line eastward, comprise the largest area of farmland in the county. These lands are recognized as prime agricultural soils used extensively to grow potatoes and other vegetables. These soils are predominantly gently sloping to nearly level and have moderate to high available moisture capacities.

Plymouth-Carver Association - Rolling and Hilly: The Plymouth-Carver Association constitutes 50% of the Central Pine Barrens and is located in a central band varying in width from one to two miles wide from the western boundary and widening to four to five miles wide east of Yaphank to Riverhead. This association consists of deep, excessively drained, coarse-textured soils that are located on the Ronkonkoma moraine. The soils within this association are characterized as strongly sloping to steep with slopes ranging from 8 to 35%.

Minor soils in this association include Haven and Riverhead soils that are nearly level and scattered throughout this association. Atsion and Berryland soils along with the land type identified as Muck have a high-water table and are situated adjacent to streams, ponds and marshes. The largest areas of these soils and land type are along the Peconic River and nearby ponds, with these areas extending eastward from the headwaters of the river to its mouth in Riverhead. There is extensive cut and fill land in the western portion of this association. The soils of this association have a characteristically poor cover of scrub oak, white oak, black oak and pitch pine. Additionally, only a small portion of this association has ever been farmed.

Riverhead-Plymouth-Carver Association: The Riverhead-Plymouth-Carver Association accounts for 10% of the Central Pine Barrens and extends into the southern outwash plain in a west to east band ranging from less than one half to two miles in width along the southern portion of the Central Pine Barrens area boundary. This association is described as nearly level to gently sloping with 1 to 6% slopes that range from 8 to 35% on the sides of drainage channels. Riverhead soils are sandy loams of moderately coarse texture that are deep and well drained whereas the Plymouth and Carver soils are coarse textured deep loamy sand to sand and as a result are excessively well drained. The portion of this association that adjoins the Great South Bay and Moriches Bay along its southern edge is indented by many short tidal creeks.

The nearly level Riverhead and Plymouth soils are dominant on broad, flat areas between intermittent drainageways with Riverhead soils at slightly higher elevations and greater distances from the drainageways than the Plymouth soils. Carver soils are located on the sides of intermittent drainageways.

Minor soils within this association include Haven soils that are adjacent to Riverhead soils but at slightly higher elevations. Other minor soils within this association include Berryland, Walpole and Wareham

soils and the land type Tidal marsh that have a high-water table. These later soil types and land type are found along the margins of tidal creeks or at the southern ends of drainageways that have elevations near that of the water table. Native vegetation within the Riverhead soils areas of this association consists of black oak, white oak, red oak, and scrub oak. Within the Carver and Plymouth soils it consists of scrub oak, white oak, black oak, and pitch pine. This association is largely in woods within the inland area of the Central Pine Barrens.

Plymouth-Carver Association, Nearly Level and Undulating: This association is found only in two areas within the Central Pine Barrens area. One is in the vicinity of Coram and the other covers a broad sandy plain that extends eastward from Eastport to Hampton Bays. The only breaks in these flat areas occur from widely spaced drainageways. This association constitutes approximately 15% of the Central Pine Barrens area. This association is described as deep, excessively drained, coarse-textured soils on outwash plains and is characteristically nearly level. The western part of this association consists of more strongly sloping soils than the eastern part. The eastern area was laid down by glacial outwash and is not pitted. Slopes within this association generally range from 1 to 8% with a few areas that are steeper. The Dwarf Pine Barrens are the unique ecosystem occurring on this highly droughty and low nutrient soil type caused by the extremely coarse soil textures and limited o (organic) soil horizon. The western part of this association has been used mainly for housing and developments. The eastern part of this association is wooded except for the airfield area at Westhampton Beach.

Central Pine Barrens Climate

Long Island and the Central Pine Barrens area have a temperate maritime climate characterized by being humid and mild. Temperatures in the Central Pine Barrens are buffered and made more consistent throughout the year by the coastal maritime influence of Long Island Sound, the Atlantic Ocean and the island's surrounding embayments including Great South Bay, Moriches Bay, Shinnecock Bay and the Peconic Bay system.

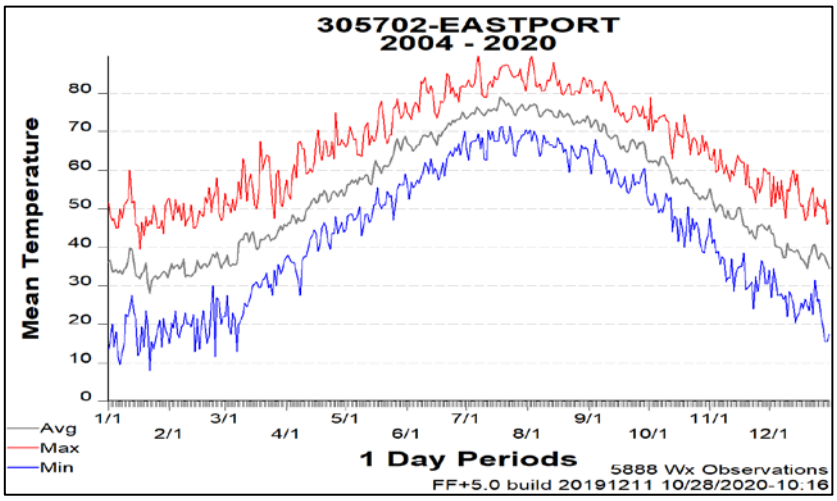


Figure 2.4 Central Pine Barrens Average Temperature Chart

The Central Pine Barrens area has an annual average temperature of approximately 53 degrees Fahrenheit, with average high temperatures of 61.5 and average low temperatures of 45 degrees (Figure 2.4). On average, the area experiences seven days per year with temperatures above 90 degrees and 11 days where temperatures remain below freezing throughout the day.

Long-term average precipitation amounts are approximately 48 inches per year. Precipitation has reached highs of nearly 70 inches per year, to lows around 30 inches per year. Monthly precipitation rates are fairly consistent throughout the year, so that no distinct wet or dry seasons are distinguishable.

The Central Pine Barrens Commission's Eastport Remote Automated Weather Station (RAWS) data has been used for data acquisition and graphs throughout the climate section. From 2015 to 2019, the average rainfall was above average at almost 55 inches which accounts for periodic tropical systems which bring heavy rains in the fall of some years, skewing the normal annual precipitation March, August, November, and December are the wettest months averaging about 4.5 inches, while June, July, and September are the driest months, averaging between 3 and 3.5 inches (Figure 2.5).

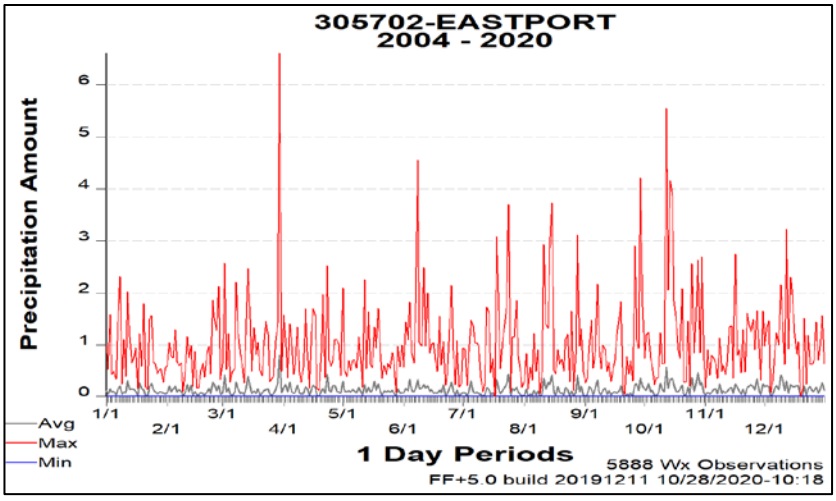


Figure 2.5 Central Pine Barrens Precipitation Chart (inches)

From 2015 to 2019, the average rainfall was above average at almost 55 inches which accounts for periodic tropical systems which bring heavy rains in the fall of some years, skewing the normal annual precipitation March, August, November, and December are the wettest months averaging about 4.5 inches, while June, July, and September are the driest months, averaging between 3 and 3.5 inches (Figure 2.5).

The average annual relative humidity in the Central Pine Barrens area is 71%. Relative humidity is often lowest during the late winter and early spring before vegetative green up when relative humidity can be in the 20s during the day and rarely dropping to lower than the high teens (Figure 2.6).

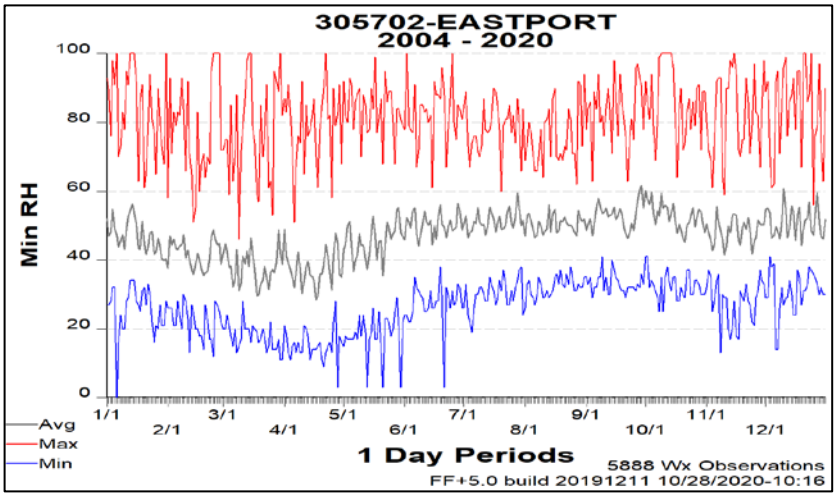


Figure 2.6 Central Pine Barrens Minimum Relative Humidity Chart

General winds experienced in the Central Pine Barrens are continental winds originating from a southwesterly direction for most of the year, shifting slightly to the west northwest during the winter months and bringing colder drier air masses during these shifts. Storms called

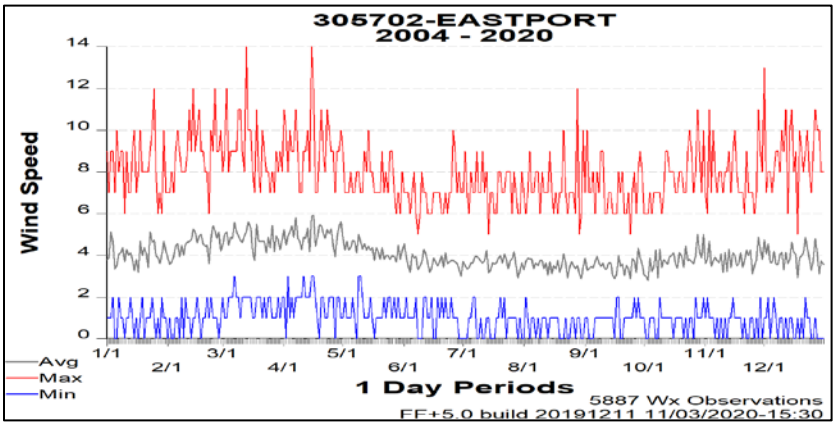


Figure 2.7 Central Pine Barrens Wind Speed Chart

Nor'easters can bring ocean driven weather in shifting the wind direction to the northeast during those events. Nor'easters can occur during any time of year, but most commonly occur between September and April. Average annual wind speed experienced in the Central Pine Barrens area is approximately 9.5 mph (Figure 2.7). Often winds are light and variable to slightly breezy through much of the year outside of storm events.

Due to Long Island's close and extensive maritime influence and long coastline, local winds have a strong sea and land breeze pattern that develops. Sea and land breezes are very common and often develop during days with higher solar radiation and lower cloud cover. During the day, once the land surface heats up compared to the oceanic air mass offshore, the higher pressure, more dense, cooler air from offshore begins to flow on shore creating a reversal from late evening and overnight conditions where the more rapidly cooling land surface air becomes denser and flow is reversed to pushing air offshore. This regular and predictable cycle in shifting local wind patterns is important to identify for management planning and practices, especially as it pertains to prescribed fire.

2.3 Human Land Use

For thousands of years, humans have been a major purveyor of disturbance of the Pine Barrens, having lived in and intentionally modified this ecological system as a whole for "our" own utilitarian benefit. The following section provides insights into two phases of human land use – Native American and post-colonial because, in order to best advance management within a disturbance-dependent ecosystem, it is necessary to understand the role humans have played in creating and influencing modern Pine Barrens ecology.

Native Americans (Algonquin Tribe)

About 3,000 years ago, at the start of the "Early Horticulture" (or Woodland) period, changes in settlement and subsistence patterns resulted in a shift to increased utilization of coastal habitat (Snow 1980; Patterson and Sassaman 1988). Horticulture (the maintenance of garden plots) apparently began at this time and developed into agriculture (cultivation of fields) during the last millennium. Evidence exists that Cape Cod supported relatively dense populations of Native Americans and Long Island likely did as well, although specific data on population density are lacking (Patterson and Sassaman 1988). Sedimentary charcoal studies, which indicate the frequency of forest fires throughout New England, and archaeological site distributions suggest that before European settlement, fires were most common in areas where Native American populations were greatest and land-use practices were most intensive (Patterson and Sassaman 1988). The greatest amounts of charcoal were found in central-coastal Massachusetts, Cape Cod (Duck Pond) and Long Island (Deep Pond), the only Long Island site reported by Patterson and Sassaman 1988. At Duck Pond, "abundant charcoal throughout the stratigraphic column suggests that fire has played an important role in maintaining Pine-Oak forests throughout the Holocene" (Winkler 1982).

There is evidence that many fires were routinely and deliberately set by Native Americans for a variety of land management purposes. For clearing fields, Native American women set fire to piles of wood set around the base of standing trees (Cronon 1983). Crops of corn, beans and squash were planted among the standing dead trees; the same site could be used for eight to ten years before the soil lost its fertility (Cronon 1983). Fire also was used to make travel easier by removing underbrush and as a hunting aid (Day 1953). Cronon hypothesizes that Native Americans used fire not merely to drive game, or attract

game to specific areas for hunting, but to intentionally create a mosaic of successional forest types, open the canopy, and improve the growth of grasses and berries that provided food for game (Cronon 1983). They would thereby have increased the food supply available for game, and supported the great abundance of elk, deer, beaver, hare, bears, turkey, grouse, and other species that impressed English colonists. Burning also may have been used to destroy plant diseases and pests "fleas which inevitably became abundant around Indian settlements" (Cronon 1983). Some increase in fire frequency associated with Native American habitation was likely also due to accidental escape of campfires. Until recently fire was utilized by the local Shinnecock Nation who used fire to maintain their historic grasslands in the Shinnecock hills through the 1990's and is a practice still used on these lands by National Golf Course.

Reports of fire are common from the time of the very earliest explorers, although the purpose or use of specific fires was rarely noted. Later, settlers were more specific in their observations. In 1632, Thomas Morton described Native American customs of setting fire broadly on the landscape twice a year, in both the spring and the fall. This frequent burning was the cause of the open, park-like forest remarked upon by early settlers in southern New England. As William Wood observed, the fire "consumes all the underwood and rubbish which otherwise would overgrow the country, making it unpassable, and spoil their much-affected hunting" (William Wood 1634).

Although Native Americans moved their villages seasonally, they reoccupied the same fixed sites for many years. Thus, the area around the villages and planting sites would have been heavily impacted by intensive food gathering and cultivation, garbage accumulation (middens), and cutting of firewood. Native Americans burned huge fires all night long, both during the summer and during the winter (Cronon 1983). They needed to move to winter camps because the summer sites were stripped of fuel (Cronon 1983, Day 1953). Such heavy use of firewood, combined with wildfires, could explain the "open plains 25 or 30 leagues in extent, entirely free from trees" reported by Verrazzano on his visit to Narragansett Bay in 1524 (Brevoort 1874, Wroth 1970). William Wood described similar treeless expanses a century later for Massachusetts Bay (Wood 1634).

It seems likely that Native American land use practices had a major impact on the vegetation of at least the localized coastal sites that they inhabited and more than likely these impacts continued into more interior locations. Fires, land-clearing and fuelwood cutting would have opened up the forests and disturbed the soil, creating conditions favorable to the growth of Pine Barrens and grassland species. The landscape in the vicinity of settlements may have been a mosaic of forests and fields in varying stages of succession, created by shifting patterns of settlement and cultivation (Patterson and Sassaman 1988).

European and Modern Land Use

Human land use has been a most influential force that inadvertently expanded the Central Pine Barrens to its maximal extent while also significantly modifying the vegetative communities within for utilitarian benefit. This significant human impact dictates the need to consider the legacy of land use when developing management plans. In Suffolk County, colonial development proceeded from east to west, especially along the shoreline near sheltered harbors where ships could safely moor. These harbors were the areas of concentrated development, and had economies based upon marine-dependent industries such as whaling and boat building, as well as agrarian industry that needed transportation access to distribute their agricultural products to New York City.

Central Suffolk County appears to have been sparsely settled. In 1691, a colonial governor described the middle of the island as "altogether barren" (Gabriel 1960). The name "barrens" was applied by settlers to any land that was not good for agriculture and/or had few or spread-out trees. The Carver-Plymouth soils are too droughty and nutrient-poor to support crops, but settlers may well have tried, nevertheless. Successful agriculture occurred on soils which are now recognized as prime agricultural (Haven and Riverhead) and as a result many of which are still being farmed today. Harvesting of cranberries and blueberries has long been important in the Central Pine Barrens but for commercial purposes has long since faded.

Historically, lumbering and woodcutting were among Suffolk County's most prominent industries. Before the Civil War, Suffolk County was recognized as the first woodcutting county in New York State. Numerous cutting camps sprang up throughout the area to harvest hardwoods, such as white oak, to satisfy New York City's seemingly insatiable appetite for wood. This cordwood was used as a fuel and as a building material. Pine was harvested only after hardwoods became scarce. The forested areas were recut every 20-25 years, resulting in mass clear cutting and development of early successional stands of pitch pine and scrub oak.

Initially the wood was harvested and brought to coastal landings where it was shipped to New York City by water, however the completion of the Long Island Railroad's main line in 1844 expedited transport and trade as well as development into the “Barrens”. This combination of development and disturbance within early successional growth of a fire prone ecosystem created conditions in which numerous large-scale fires, routinely ravaged the young trees spared by the woodcutters. Many of these fires ignited by sparks from the wood-burning engines of the Long Island Railroad (Tredwell 1912); however, arson fires also were frequently set, apparently motivated by the New York State mandated wages for fire-fighters (1895). Tredwell reveals the following observation offered in 1853 “. . . since the [rail]road was opened...there has scarcely been a day, from May to November, in which some portion of these forests have not been burned. Many of these fires destroy thousands of cords of cut cured wood awaiting transportation, and this local commerce has about ceased” (Tredwell 1912). These fires caused devastating economic losses and an understandable fear of fire. By 1911, much of the Central Pine Barrens had been burned so badly that the middle of the island was untaxed because the land was unproductive. As a result, a fear of wildfire and culture of fire suppression was initiated and has since forth been sustained to date due to continued mass development and urbanization of the region.

Many other traditional activities occurred in the Central Pine Barrens that also modified vegetative communities uniquely. These activities included cranberry and blueberry farming in the vicinity of the Peconic River; brick, bog iron and charcoal forges; sand mining; tanning; the use of water-powered mills for grinding grain and milling lumber; row, nursery, and duck farming; harvesting of wood and wood products (such as Atlantic white cedar and sap) for shipbuilding, shingles, turpentine and pine tar and recreation activities such as gun clubs and hunting lodges and the operation of taverns, inns and general stores.

It is quite likely that the area occupied by pine barrens could have expanded during the 1700's and 1800's due to the combined effects of timbering, land clearing, mining and repeated fire. These activities and other associated post-settlement land use practices, including land clearing for agriculture and settlements; draining of wetlands and construction of transportation corridors, has resulted in increased fire frequencies, introduction of exotic species and habitat loss and fragmentation that has caused regional vegetation change on Long Island.

Some noteworthy, more modern cultural history is that during World War One, Camp Upton was created for the training of soldiers. The 40,000 men at Camp Upton in 1917 doubled Suffolk's population. Camp Upton later became the campus for the Brookhaven National Laboratory (and is highlighted more comprehensively in the Unique Land Use History section of the Brookhaven Fire Management Unit). In other parts of the Central Pine Barrens, significant clearing took place to erect radio towers to transmit wireless communications to Europe. As technology changed these sites were decommissioned and these lands ultimately succeeded into natural areas, most notably the Rocky Point and David Sarnoff Pine Barrens State Forests, with successional vegetation that mirrors this land use history.

In most recent history, the Long Island Railroad changed the population settlement pattern of Suffolk County with the densest populations are now being found in western Suffolk County as the train enabled residential development to house people who worked in New York City. However, it also provided transportation for tourists who wanted to enjoy the marine sports and cool summers of Long Island's shore. The popularization of the automobile continued and accelerated this residential development pattern, concentrating residential development in western Suffolk County while the agrarian economy continued in eastern Suffolk. The development of the Long Island Expressway from 1955 to 1972 impacted development in the Central Pine Barrens to a great extent. Until this time, general access to the Central Pine Barrens was limited due to lack of transportation links. The construction of the 70-mile, four lane, limited access expressway through the center of the Island decreased travel time to westerly employment destinations in Nassau County and New York City. This made the relatively cheap vacant land in the middle of Long Island attractive for residential development. As a result, the population in the Central Pine Barrens almost doubled in each decade from 1960 to 1980, from 12,500 in 1960 to 43,000 in 1980 and by 1990 an estimated 57,000 people resided in the Central Pine Barrens. The increased development of the Central Pine Barrens mirrored the development that was occurring throughout Suffolk County.

A greater awareness of the impact of population growth and development on natural habitats and ecologic processes occurred as the population of the county grew and matured. In 1978 New York State formed a group to plan for preservation of 40,000 acres of woodlands between Yaphank and Riverhead, the Suffolk County Pine Barrens (SPLIA 1978). Between 1978 and 1993 popular demand for a 40,000 acre preserve grew to support a 100,000 acre preserve approved by the State Legislature. On July 14, 1993, Governor Cuomo signed the Long Island Pine Barrens Protection Act into law which protected the Central Pine Barrens from development.

However, increased residential developments in conjunction with the advent of modern fire suppression techniques, have greatly reduced the extent of fire in the Central Pine Barrens. Arsonists and negligence still cause many fires in the Central Pine Barrens, as apparently has been the case for more than 100 years (Bayles 1873). However, these fires are aggressively controlled so that the extent of the acres burned is kept quite limited. With the removal of fire as a widespread ecological process and disturbance, the vegetation of the Central Pine Barrens is changing through natural succession and duff accumulation into more Oak-dominated forests and on to more mesic forests in many areas. Fully protecting and maintaining the unique ecology of the Central Pine Barrens also requires active management and prescribed fire as a surrogate for wildfire and other natural disturbances which have been and will continue to be suppressed due to the high degree of urbanization and development occurring in and around the Central Pine Barrens.

Cultural, Social, and Economic Resources

The Central Pine Barrens having a long history of human use, contains a wealth of cultural resources namely significant historic and/or archaeological resources worthy of preservation. These resources contribute both to the visual enhancement of the landscape and to present knowledge of land use and ecology in the Central Pine Barrens. Data collected from such resource sites can contribute to our knowledge of past climatic and precolonial ecological conditions, thereby assisting in the development of an ecological model of the Central Pine Barrens. In addition, many significant resources are located together with other sensitive resources such as wetlands. These significant cultural resources also trace, with unusual fidelity, the heritage of this area of Suffolk County.

Extensive remnants of Suffolk County's historic past can be found within the Pine Barrens zone. The heritage of Native Americans remains present, especially in coastal areas as evidenced by middens, surface artifacts and burial grounds. The region is dotted with the remains of old carriage roads, townscapes and structures which provide mute testimony as evidence of the former isolated, inland settlements. Although the Central Pine Barrens region is often overlooked in serious evaluations of Long Island's architectural and social history, the region contains excellent examples of American architecture reflecting the 18th through the early 20th century schools. The region was involved in various incidents during the Revolutionary War. Numerous landscape features, such as Camp Upton's World War I trenches, also trace Long Island's heritage. Furthermore, the area contains some of Long Island's most famous landmarks, including magnificent Victorian homesteads, elegant hunting lodges, and the structure which spawned an entire American architectural style, the Big Duck.

Fire Towers

In 1918 the New York State Conservation Commission funded two fire towers. One was on Telescope Hill and one on Flanders Hill. The towers were used in detection to rapidly identify and locate wildfire ignitions and spread and by 1920, 101 fires totaling 17,000 acres were reported in and around the Central Pine Barrens area. The intelligence gathered from these towers helped to communicate response needs through early detection and issue warnings of impending wildfire spread and fire danger. Wildfires were frequent and often grew relatively large in size with varying intensities and durations across the landscape. This history of fire tower need and operation in the Central Pine Barrens area helps to illustrate what a common part wildfire was of the social ecological system. With the continued population increase, habitat fragmentation with hard infrastructure that reduces wildfire spread; development and increase of road networks and vehicular traffic; improved communication networks, and increasing air traffic, fire towers gradually became obsolescent and most were dismantled beginning in the 1950's through the 1970's.

Contemporary Social and Economic Resources

Current social and economic resources in the Central Pine Barrens area consist largely of single-family homes and interspersed residential communities with service businesses located on major thoroughfares. Most of these resources are exist in the Compatible Growth Area, an area designated by the Long Island Pine Barrens Protection Area Act ("the Act") that allows new development that meets specific land use development standards and serves as a buffer to the Central Pine Barrens' Core Preservation Area where new development is generally prohibited without a permit from the Central

Pine Barrens Commission. The Central Pine Barrens Core Preservation Area was also created by the Act, comprises the largest intact areas of undeveloped pine barrens.

2.4 Vegetation, Wildlife, and Natural Communities Classification

The following ecological community descriptions are directly referenced from the 2014 Ecological Communities of New York 2nd edition, edited update of Carol Reschke's original work (Edinger et al. 2014). The following identified community types are those in the Central Pine Barrens area, which together in their varying extents, broadly define the ecosystem known as the Central Long Island Pine Barrens. These community types include: Pitch Pine-Oak forest, Pitch Pine-Oak-Heath woodland, Coastal Oak-Heath forest, Pitch Pine-Scrub Oak barrens, and Dwarf Pine plains. These community types are described in more detail below and represent the predominant community associations involved in the priority focal areas for prescribed fire treatment through this plan. It should be noted that several smaller areas contain important interspersed remnant grassland patches, early successional old fields, and wetlands.

Pitch Pine-Oak Forest: The Pitch Pine-Oak forest community is a mixed forest that typically occurs on well-drained, sandy soils of glacial outwash plains or moraines. The dominant trees are pitch pine (*Pinus rigida*) mixed with one or more of the following oaks: scarlet oak (*Quercus coccinea*), white oak (*Q. alba*), red oak (*Q. rubra*), or black oak (*Q. velutina*). The relative proportions of pines and oaks are quite variable within this community type. Examples can range from having widely spaced pines that are often emergent above the oak canopy to a nearly pure stand of pines with only a few widely spaced oak trees. The shrub layer is well-developed with scattered clumps of scrub oak (*Q. ilicifolia*) and a nearly continuous cover of low heath shrubs such as lowbush blueberries (*Vaccinium pallidum, V. angustifolium*) and black huckleberry (*Gaylussacia baccata*). The herbaceous layer is relatively sparse; characteristic species are Pennsylvania sedge (*Carex pensylvanica*), bracken fern (*Pteridium aquilinum* var. *latiusculum),* and wintergreen *(Gaultheria procumbens*).

Characteristic birds with varying abundance include eastern towhee (*Pipilo erythrophthalmus*), common yellowthroat (*Geothlypis trichas*), field sparrow (*Spizella pusilla*), prairie warbler (*Dendroica discolor*), pine warbler (*Dendroica pinus*), and blue jay (*Cyanocitta cristata*). More data on characteristic fauna are needed.

Pitch Pine-Oak-Heath Woodland: The Pitch Pine-Oak-Heath woodland community is a pine barren community that occurs on well-drained, infertile, sandy soils in eastern Long Island. The structure of this community is intermediate between a shrub-savanna and a woodland. Pitch pine (*P. rigida*) and white oak (*Q. alba*) are the most abundant trees, and these form an open canopy with 30 to 60% cover. Scarlet oak (*Q. coccinea*) and black oak (*Q. velutina*) may also occur in the canopy. The shrub layer is dominated by scrub oaks (*Q. ilicifolia, Q. prinoides*), and includes a few heath shrubs such as huckleberry (*Gaylussacia baccata*) and lowbush blueberry (*V. pallidum*). Blackjack oak (*Q. marilandica* var. *marilandica*) may also occur in low percentages. The density of the shrub layer is inversely related to the tree canopy cover; where the trees are sparse, the shrubs form a dense thicket, and where the trees form a more closed canopy, the shrub layer may be relatively sparse. Stunted, multiple-stemmed *Q. alba* may be present in the shrub layer if the site has burned regularly.

Characteristic species of the groundcover include bearberry (*Arctostaphylos uva-ursi*), Pennsylvania sedge (*C. pensylvanica*), golden heather (*Hudsonia ericoides*), beach heather (*H. tomentosa*), and pinweed (*Lechea villosa*). Like other closely related pine barren communities, the woodland provides habitat for

coastal barrens buckmoth (*Hemileuca maia* ssp. 5) and prairie warbler (*D. discolor*). Pitch Pine-Oak-Heath woodland is distinguished from Pitch Pine-Scrub Oak barrens in having openings dominated by heaths. Pitch Pine-Scrub Oak barrens are characterized by openings dominated by grasses and forbs. This community may have a fairly low species richness; it is more diverse than Dwarf Pine plains, but less diverse than Pitch Pine-Scrub Oak barrens.

Coastal Oak-Heath Forest: This is a large matrix of low diversity hardwood forest that typically occurs on dry, well-drained, sandy soils of glacial outwash plains or moraines of the coastal plain. The forest is usually co-dominated by two or more species of oaks: scarlet oak (*Q. coccinea*), white oak (*Q. alba*) and black oak (*Q. velutina*). Chestnut oak (*Q. montana*) is also a common associate. Pitch pine (*P. rigida*), sassafras (*Sassafras albidum*), and other tree species typically have very low cover in the canopy. American chestnut (*Castanea dentata*) may have been a common associate in these forests prior to the chestnut blight; chestnut sprouts are still found in some stands. The shrub layer is well-developed typically with a low nearly continuous cover of dwarf heaths such as lowbush blueberries (*V. pallidum, V. angustifolium*) and black huckleberry (*G. baccata*).

The herbaceous layer is very sparse; characteristic species are bracken fern (*P. aquilinum var. latiusculum*), wintergreen (*G. procumbens*), and Pennsylvania sedge (*C. pensylvanica*). Herb diversity is greatest in natural and artificial openings with species such as frostweed (*Crocanthemum canadense*), false-foxglove (*Aureolaria spp.*), bearberry (*A.uva-ursi*), goat's-rue (*Tephrosia virginiana*), bush-clovers (*Lespedeza spp*.), and pinweeds (*Lechea spp*.). This community can occur with several types of barrens and woodland communities as part of the broadly defined ecosystem known as the Pine Barrens. Data on characteristic fauna are needed.

Distribution is restricted to the interior portions of the Coastal Lowlands ecozone, concentrated on outwash plains; possibly knolls and mid to upper slopes of moraines. Known examples range from Hither Hills and Montauk Mountain; and west probably to the morainal hills of northwestern Suffolk County. Numerous examples occur in the central portion of this range (the periphery of the Long Island Pine Barrens) south of the Ronkonkoma Moraine. Occurrences are sparser in the eastern and western portions of the range. The community range possibly extends westward into eastern Nassau County on the end moraine of western Long Island and has been reported from a narrow strip of outwash on the north shore of Long Island.

Pitch Pine-Scrub Oak Barrens: The Pitch Pine-Scrub Oak barrens is a shrub-savanna community that occurs on well-drained, sandy soils that have developed on sand dunes (primarily glacial lacustrine dunes), glacial till, and outwash plains. This community is adapted to and maintained by periodic fires; natural frequency of fires ranges from 6 to 15 years. Pitch pine (*P. rigida*) is the dominant tree; the percent cover of pitch pine is variable, ranging from 20 to 60%. The shrub layer dominants are scrub oaks (*Q. ilicifolia* and *Q. prinoides*), which often form dense thickets. Beneath this tall shrub canopy is a low shrub layer primarily composed of sweet fern (*Comptonia peregrina*), lowbush blueberries (*V. angustifolium*, *V. pallidum*), black huckleberry (*G. baccata*), and scattered New Jersey tea (*Ceanothus americanus*). These scrub oak thickets cover 60 to 80% of the community; pitch pines are scattered through the shrub thicket, occurring as emergent trees within an extensive shrubland.

Within the shrub thickets are small patches of sandplain grassland dominated by the following grasses: little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), big bluestem (*Andropogon gerardii*), and Indian grass (*Sorghastrum nutans*). These grassy areas are usually found near ant mounds, along trails, and in some of the low areas between dunes where the water Ta may be very close to the

soil surface. This community can be rich in species. Characteristic forbs include bush-clovers (*Lespedeza capitata, L. hirta, L. procumbens,* and *L. stuevii*), pinweed (*Lechea villosa*), milkwort (*Polygala nuttallii*), goat's-rue (*Tephrosia virginiana*), horse mint (*Monarda punctata*), bracken fern (*P. aquilinum* var. *latiusculum),* and wild lupine *(Lupinus perennis*). Purple moss (*Ceratodon purpureus)* is a common moss in Pitch Pine-Scrub Oak barrens (N. Slack *pers. comm.*). Larger grassland areas with less than 50% cover of shrubs may be classified as Successional Northern Sandplain grassland. Pitch Pine-Scrub Oak barrens are distinguished from Pitch Pine-Oak-Heath woodland in having openings dominated by grasses and forbs. Pitch Pine-Oak-Heath woodland is characterized by openings dominated by heaths.

The coastal barrens buckmoth (*Hemileuca maia* ssp. 5) and frosted elfin (*Callophrys irus*), are rare lepidopteran of Pitch Pine-Scrub Oak barrens on Long Island. Characteristic birds with varying abundance include eastern towhee (*Pipilo erythrophthalmus*), brown thrasher (*Toxostoma rufum*), pine warbler (*Dendroica pinus*), prairie warbler (*D. discolor*), ovenbird (*Seiurus aurocapillus*), common yellowthroat (*Geothlypis trichas*), field sparrow (*Spizella pusilla*), chipping sparrow (*S. passerina*), and gray catbird (*Dumetella carolinensis*, Levine 1998, Drennan 1981).

Dwarf Pine Plains: The Dwarf Pine plains is a globally rare woodland community dominated by stunted individuals of pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia*) that occur on nearly level outwash sand and gravel plains in eastern Long Island. This community is "fire dependent" meaning that frequent fires are necessary to maintain the species composition. The soils are infertile, coarse textured sands that are excessively well-drained. The canopy of dwarf pitch pines and scrub oaks is generally from 1.2 to 2.4 meters (4 to 8 ft) tall, and it may form a dense thicket. The community includes very few species of vascular plants. The majority of the biomass in the community consists of seven woody plant species: pitch pine, scrub oak, black huckleberry (*G. baccata*), lowbush blueberry (*V. pallidum*), golden heather (*H. ericoides*), bearberry (*A. uva-ursi*), and wintergreen (*G. procumbens*). The huckleberries and blueberries form a low shrub canopy under the pines and oaks.

In areas of Dwarf Pine plains that appear to have never been cleared by humans (based on old aerial photos going back to 1930), there are very few lichens or herbs (M. Jordan *pers. comm.*). Artificially cleared areas may include foliose and fruticose lichens such as *Cetraria arenaria*, several reindeer lichens (*Cladonia mitis*, *C. stellaris*, *C. submitis*), British soldier lichen (*Cladonia cristatella*), *Punctelia rudecta*, *Parmelia saxatilis*, and dog-lichen (*Peltigera canina*). These sandy openings may include a few low herbs such as frostweed (*C. canadense*), cow-wheat (*Melampyrum lineare*), jointweed (*Polygonella articulata*), stiff-leaf aster (*Ionactis linariifolius*), flat sedge (*Cyperus houghtonii*), and orange-grass (*Hypericum gentianoides*). There are also reports of grassy openings and areas of frost pockets that occur in the lower elevation gullies with Pennsylvania sedge (*C. pensylvanica*), golden heather, and bearberry being the dominant species.

This community is a favored nesting area for prairie warbler (*D. discolor*) and brown thrasher (*T. rufum*); pine warbler (*D. pinus*), ovenbird (*S. aurocapillus*), and northern harrier (*Circus cyaneus*) are also characteristic birds. Notably, the largest and most dense population of coastal barrens buckmoth (*H.maia* ssp. 5) in New York occurs in the Dwarf Pine plains.

Successional Old Field: A meadow dominated by forbs and grasses that occurs on sites that have been cleared and plowed (for farming or development), and then abandoned is a Successional Old Field. Fields that are mowed at an interval (*e.g.,* less than once per year) that favors the reproduction of characteristic successional old field species are included here. Characteristic herbs include goldenrods (*Solidago altissima, S. nemoralis, S. rugosa, S. juncea,* and *Euthamia caroliniana*, and *E. graminifolia*); calico aster

(*Sympyotrichum lateriflorum* var. *lateriflorum*), New England aster (*Sympyotrichum novae-angliae*), common evening primrose (*Oenothera biennis*), wild strawberry (*Fragaria virginiana*), ragweed (*Ambrosia artemisiifolia*). Broomsedge (*Andropogon virginicus*) is predominantly the most abundant native grass and Little bluestem (*Schizachyrium scoparium*) may be present in some examples but is more characteristic of successional northern sandplain grassland. Non-native species are common and generally include bluegrasses (*Poa pratensis, P. compressa*), timothy (*Phleum pratense*), quackgrass (*Elymus repens*), smooth brome (*Bromus inermis*), sweet vernal grass (*Anthoxanthum odoratum*), orchard grass (*Dactylis glomerata*), as well as common chickweed (*Cerastium arvense*), old-field cinquefoil (*Potentilla simplex*), Queen-Anne's-lace (*Daucus carota*), hawkweeds (*Hieracium* spp.), dandelion (*Taraxacum officinale*), and oxtongue (*Picris hieracioides*).

Shrubs may be present, but collectively they have less than 50% cover in the community. Characteristic shrubs include bayberry (*Morella caroliniensis*), blackberries (*Rubus* spp.), sumac (*Rhus typhina, R. glabra, R. coppelinum*), and eastern red cedar (*Juniperus virginiana*). Invasion by Autumn olive (*Elaeagnus umbellata*) is common.

Characteristic butterflies include black swallowtail (*Papilio polyxenes*), orange sulphur (*Colias eurytheme*), eastern tailed blue (*Everes comyntas*), and American copper (*Lycaena phlaeas*). Characteristic birds include field sparrow (*Spizella pusilla*), savannah sparrow (*Passerculus sandwichensis*), and American goldfinch (*Carduelis tristis*). Characteristic mammals include meadow vole (*Microtus pennsylvanicus*) and woodchuck (*Marmota monax*).This is a relatively short-lived community that succeeds to a shrubland, woodland, or forest community.

Coastal Plain Pond: The aquatic community of the permanently flooded portion of a Coastal Plain pond with seasonally and annually fluctuating water levels. These are shallow, groundwater-fed ponds that occur in kettleholes or shallow depressions in the outwash plains south of the terminal moraines of Long Island, and New England. A series of coastal plain ponds are often hydrologically connected, either by groundwater, or sometimes by surface flow in a small Coastal Plain stream. Water is typically acidic, darkly stained, and has low transparency. However, coastal plain ponds in adjacent states typically have high transparency (P. Swain *pers. comm.*). The substrate is typically sand to muck.

Aquatic vegetation may be abundant; characteristic plants include water-shield (*Brasenia schreberi*), white water-lily (*Nymphaea odorata*), bayonet-rush (*Juncus militaris*), Robbins spikerush (*Eleocharis robbinsii*), bladderworts (*Utricularia purpurea, U. fibrosa*), water milfoil (*Myriophyllum humile*), naiad (*Najas flexilis*), waterweed (*Elodea* spp.), pondweed (*Potamogeton oakesianus*), pipewort (*Eriocaulon aquaticum*), brown-fruited rush (*Juncus pelocarpus*), golden-pert (*Gratiola aurea*), water bulrush (*Schoenoplectus subterminalis),* Small's yellow-eyed-grass (*Xyris smalliana*), horse-tail spikerush (*Eleocharis equisetoides*), and various peat mosses (*Sphagnum torreyanum, S. lescurii, S. cuspidatum,* and *S. macrophyllum*). See coastal plain pond shore for pond margins dominated by emergent vegetation after water drawdown.

Characteristic fishes include chain pickerel (*Esox niger*), banded sunfish (*Enneacanthus obesus*), and eastern mudminnow (*Umbra pygmaea*). Some coastal plain ponds are breeding ponds for tiger salamander (*Ambystoma tigrinum*). Other characteristic fauna may include painted turtle (*Chrysemys picta*), wood duck (*Aix sponsa*), and muskrat (*Ondatra zibethicus*). More data on this community are needed.

2.5 Ecological Justification for Fire Management

The Long Island Central Pine Barrens region is a complex mosaic of Pitch Pine woodlands, Pine-Oak forests, Coastal Plain ponds, swamps, marshes, bogs and streams. These Pine Barren ecological communities are distributed on the landscape in a complex mosaic determined by an interaction of environmental factors and history. The key environmental factors controlling vegetation types are: (1) soil saturation (depth to water table), (2) soil texture and nutrients, (3) fire regime and (4) human disturbance (clearing, logging). Insects (e.g., gypsy moth, southern pine beetle), disease (e.g., oak wilt), frost damage and coastal proximity are secondary factors that also may influence vegetation composition. All combined, these unique forces are responsible for the mass creation and evolution of unique assemblages of species and vegetative communities to such a degree that the Central Pine Barrens is recognized as a globally rare ecosystem which supports some of the rarest species found in New York State.

The combination of droughty, acidic and nutrient-poor soils and frequent fire have created a harsh xeric, or very dry and arid environment to which relatively few species have been able to adapt. Consequently, present plant communities of the dry uplands generally are of low diversity and productivity. Upland Pine Barrens natural communities are characterized by plant and animal species that have evolved in the presence of frequent fires and are thus uncommon in the mesic (moist), deciduous forests that surround the Central Pine Barrens both on Long Island and mainland New York. As a result, the biota of the Central Pine Barrens tends to be unusual, and includes many rare species especially adapted to the routinely harsh, xeric, and frequently disturbed Pine Barrens conditions. Wetlands such as those adjacent to Coastal Plain ponds and rivers are sustained by exposed groundwater and to a lesser degree clay lenses but have also in many cases have been strongly influenced by disturbance, including fire.

The Central Pine Barrens is an ecological system in which the biodiversity, the structure and the function is regulated and maintained, both in time and space, through disturbance, namely fire, of varying intensity and scale. One key aspect indicating the important role and history of fire as well as the justification for its use as a management tool on the landscape is that the Central Pine Barrens system itself and its resident flora and fauna are adapted to, resilient and/or resistant to fire and other disturbance processes. Resistance at the system level relates to the ability of communities to remain relatively unchanged when challenged by a disturbance while resilience describes community capacity to absorb disturbance and reorganize through change to retain, or swiftly redevelop, function, structure, identity and feedbacks.

The dominant tree species in the frequently burned, or regenerating disturbed areas is the namesake Central Pine Barrens pitch pine, (*P. rigida)* which is highly fire adapted, fire resilient and also somewhat fire resistant. The majority of the co-dominant species, both in the overstory and understory have adaptations, resiliency and/or resistance to fire as well. Fire adapted at the species level refers to evolutionary development of traits or features that better match, handle or tolerate environmental conditions or processes. Fire resilience at the species level more specifically describes an individual's adaptations, traits, or characteristics that allow it to rebound, reorganize or rebuild readily after fire.

Fire resistance refers to the ability of individual of a species to absorb or deflect effects from fire and survive, remaining relatively unchanged. Fire resilience and fire resistance evolve in species that are repeatedly exposed to the stimulus of fire through generational time. The existence of fire resistance and resilience at both the system and species level is one of the primary justifications for prescribed fire implementation in this landscape. This fire resistance and resilience greatly benefits species in

environments where fire occurs, however these adaptations enabling fire resistance and resilience come at a cost. In areas where fire has become infrequent or absent, the costs of fire adapted traits often reduce the competitive ability of those species though prolonged fire absence, and in part, lead to their replacement on the landscape. The existence of fire resiliency and resistance in the system and its species is one ecological demonstration of the importance of fire and the need for it to be a part of the system to maintain and sustain high structural, functional and ecological health.

Fire disturbance creates, facilitates and maintains the patchwork dynamic constituted by the juxtaposition of varying successional stages that allows the diversity of ecological communities and species across the Central Pine Barrens. Without this periodic disturbance, the Central Pine Barrens is gradually becoming more homogenous through successional change resulting from a variety of factors and processes. In the absence of fire, organic matter, duff and fuel accumulation has been observed along with increases in species density, leading to increasing water holding and evaporative capacity and decreasing light penetration. These observed changes are facilitating a transition to oak and deciduous dominated forests. Primary and secondary successional changes can be largely attributed to the process of increasing mesification, or wetter and shadier conditions, resulting from the specific factors mentioned above. The identified factors and mesification reduces Central Pine Barrens ecosystem health, reduces and impedes pitch pine, and barrens species regeneration, and results in community state shifts.

Successional transitions and their associated structural and functional changes, allowed and promoted through lack of fire and disturbance, has led to periods of decline in ecosystem health and increased susceptibility to insect, pest, and disease pressures, as well as inter and intraspecific species competition stresses. One of the key recent indicators of these declines, catalyzing much of the renewed sense of urgency and commitment to developing and implementing active forest management, is the recent arrival and subsequent mass outbreak of southern pine beetle. Whether through climate change range shifts or normal periodic shifts in range cycles, the southern pine beetle arrival was detected in the Central Pine Barrens area in 2014. The reduced ecosystem health and impaired structure and function made the Central Pine Barrens extremely vulnerable and susceptible to this insect pest invasion. Active forest management involving prescribed fire is one way to improve and increase the resiliency of the system and to create a healthier forest system that is more able to resist and recovery from pest and disease outbreaks.

Over time, stresses build up and have negative synergistic effects creating a positive feedback loop in which declines in ecosystem health, structure, and function facilitate more declines in the system. Collectively, these are the conditions and impacts that are currently being observed in the Central Pine Barrens, in large part, due to long term, continuous and absolute fire suppression. Without regular fire disturbance, the rare species inhabiting, and the rare ecological communities comprising the Central Pine Barrens are being steadily lost and displaced causing a significant loss of biodiversity, resiliency, ecosystem health and services.

2.6 Pine Barrens Fire and Disturbance Ecology

Pine barrens have developed through their relationship with and evolution with fire. The variation in the described community types above most closely ties back to fire and how often fire returns to the community and how intense and severe the fire is when it does. Growth of upland Pine Barrens community types is controlled by an interaction between the fire regime and the soil texture and fertility. Both fire and soil characteristics are used in conceptual models. General assumptions are that

coarse, droughty soils should tend to be more fire prone. The Dwarf Pine plains are thought to have historically had the shortest fire return interval, perhaps as frequently as every 10-30 years, or even as often as 6 years. Pitch Pine-Oak-Heath woodland communities may have burned an average of every 20-35 years. The most extensive occurrences of this community are as transition zones between the Dwarf Pine plains and surrounding Pine-Oak forests. The mean fire return interval in Pine-Oak forests may have ranged from 40-60 years in pine-dominated areas to 50-100 years in oak-dominated areas. Oak forests dominate natural areas with fire return intervals greater than 100 years. These estimates of fire return intervals are imprecise and need further verification and correlation with vegetation types through continued monitoring and research.

Fire also may be a significant environmental factor for Pine Barrens wetlands which are likely to have been burned over during periods of drought in the past. Coastal Plain Atlantic White Cedar swamps depend on fire, or other disturbance to create the sunlit conditions necessary for seed germination and seedling survival (Laderman 1989). Without fire, the rare Atlantic white cedar (*Chamaecyparis thyoides*) may eventually be replaced by shade-tolerant red maple (*Acer rubrum*). The role of fire in the ecology of Coastal Plain ponds is unknown. Occasional fire may be necessary to eliminate shrub and tree species from coastal plain ponds, and to reduce organic matter (Schneider and Zaremba 1991). Grasslands on Long Island and in the Central Pine Barrens also require disturbance, most effectively performed by fire, to sustain and prevent succession to forest conditions through the invasion and establishment woody tree and shrub species.

Fire severity may be just as important as the fire return interval in shaping Pine Barrens vegetation. Anecdotal evidence suggests that severe, stand-replacing fires that consume most or all of the soil organic matter may have contributed to the creation of the dwarf pine plains and pitch pine oak heath woodland communities.

Pine Barrens vegetation types throughout the northeast are located in regions with humid climates and ample rainfall and are surrounded by mesic hardwood forests. Despite these factors, the unusual Pine Barrens plants and animals manage to persist. Pine Barrens resist invasion by deciduous forest species as result of the reinforcing interactions of droughty, nutrient-poor soils with highly flammable, fire-adapted vegetation and frequent wildfire. As long as fire remains a consistently occurring disturbance, the environment created through these interactions will remain unsuitable for development of mesic hardwood forest communities while remaining conducive to the Pine Barrens vegetation.

As stated in the ecological justification, the Central Pine Barrens truly is an ecological system in which the biodiversity is regulated and maintained through disturbance, namely fire, of varying intensity and scale. This disturbance promotes and maintains diversity of ecological communities and biodiversity across the region. Without this periodic disturbance, the Central Pine Barrens transitions through unimpeded successional change with increasing organic matter and fuel accumulation facilitating transition to oak dominated forests, encouraging increasing mesification and community state shifts. This is a condition that is currently being observed in the Central Pine Barrens in part due to long term fire suppression.

Pine Barrens soils typically are 80-96% sand and drain very rapidly. Only vegetation that can withstand these droughty soils, and the soil's low nutrient levels and acidity, can persist. Many Pine Barrens plants produce waxes, resins, or volatile oils which help leaves retain moisture, and which may also reduce insect herbivory. The very existence of these waxy compounds which allows the vegetation to exist on the Pine Barrens soil also increases the potential for fire. The compounds are highly flammable and

contain volatile oils which vaporize when heated. The vapors ignite at relatively low temperatures and greatly increase the likelihood that fires will reach the tree crowns. The oils and resins also increase the amount of heat emitted during a fire. Additional characteristics that favor fire include litter that decomposes slowly and thus tends to accumulate on the soil surface, litter of low water-absorbing capacity, litter of low mineral content, high plant surface-to-volume ratio, high dead-to-live plant tissue ratio, and "ladder fuels" that carry flames upward from the ground.

Fire adapted plant communities burn more readily than non-fire-dependent communities because natural selection has favored development of characteristics that make them more flammable. Positive feedback between flammability and fire-dependence would favor the persistence of fire-dependent communities and inhibit invasion by species of nearby alternative communities. Latham and Johnson (1993) have postulated that fire-facilitating species, including those of the Pine Barrens, are also tolerant of nutrient scarcity. Fire-facilitators thus may gain a competitive advantage from fire due to long-term decreases in nitrogen availability, as well as to outright elimination of fire-sensitive competitors. Fire-facilitating species produce biomass and litter that are highly flammable, thereby increasing the likelihood and severity of wildfire. Frequent severe fires decrease nutrient levels, further favoring the fire-facilitators. This Pine Barrens-stabilizing feedback loop is destabilized and broken down, being replaced with more continuous successional trajectory by suppression of fire, nutrient enrichment, or prolonged wet weather. Under these conditions fire frequency decreases, nutrient-demanding, fire-intolerant plant species increase (i.e., oak, hickory and beech), and Pine Barrens species decline. With prolonged fire suppression, vegetational succession leads to succession and the replacement of Pine Barrens by Oak forests through a variety of processes including competition for light and mesification through duff and organic matter accumulation.

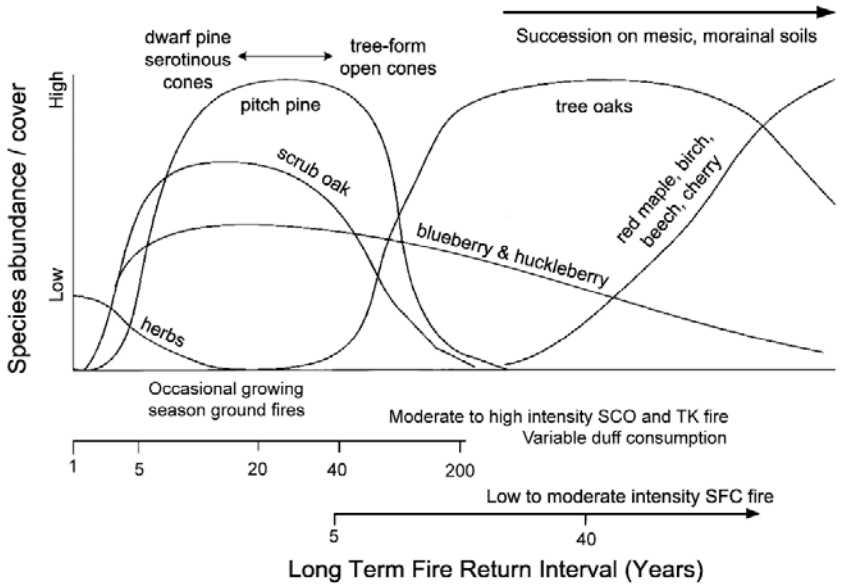


Figure 2.8 Central Pine Barrens Fire Regime Species Response Model (Jordan et al. 2003)

The following conceptual and state and transition models developed by Jordan, Patterson and Windisch in 2003 help to illustrate the cycles of change and disturbance that occur in the Central Pine Barrens area through time based on soil and community starting point. These models help to depict and communicate how integral disturbance is in the facilitation of a mosaic of diverse ecological community types across the landscape and the important role fire plays in that process. The first model in Figure 2.8 shows the fluctuation in individual species abundance through time and the impact of fire and fire return interval on altering the stage of different species abundances on the landscape. In this conceptual model of species responses to fire regime (Figure 2.8) TK is a top-killing, high intensity (temperatures)

surface or crown fire, sometimes with an associated ground fire. SCO is a scorching, moderate intensity surface fire that may heat-kill small–medium size trees. SFC is a surface fire, typically low intensity in the dormant season, that top-kills only the smallest woody stems, and burns only surface fuels above the duff layer. Ground fire burns the forest floor duff layer.

The second model (Figure 2.9) depicts ecological community types across the Central Pine Barrens area and how soil type and fire regime and return interval influence the states (curved arrows) and transitions (straight arrows between boxes) of these different systems across the landscape. The large, curved arrows indicate fire type that could convert any of the vegetation types represented by boxes into shrubland. All time intervals are approximate. A severe fire consumes all organic matter on the soil surface.

The third model, Figure 2.10, illustrates a more general succession transition model combining elements from the previous model of fire and fire regime with soil, coupled with other disturbance types to illustrate commonalities in the impacts of fire and other disturbances in the development and maintenance of major ecotypes. This state transition model depicts successional pathways following land clearing or all-terrain vehicles (ATV) that removes roots and exposes bare soil. All time intervals are approximate. Arrows going to the right indicate successional transitions and fire regimes that facilitate transitions.

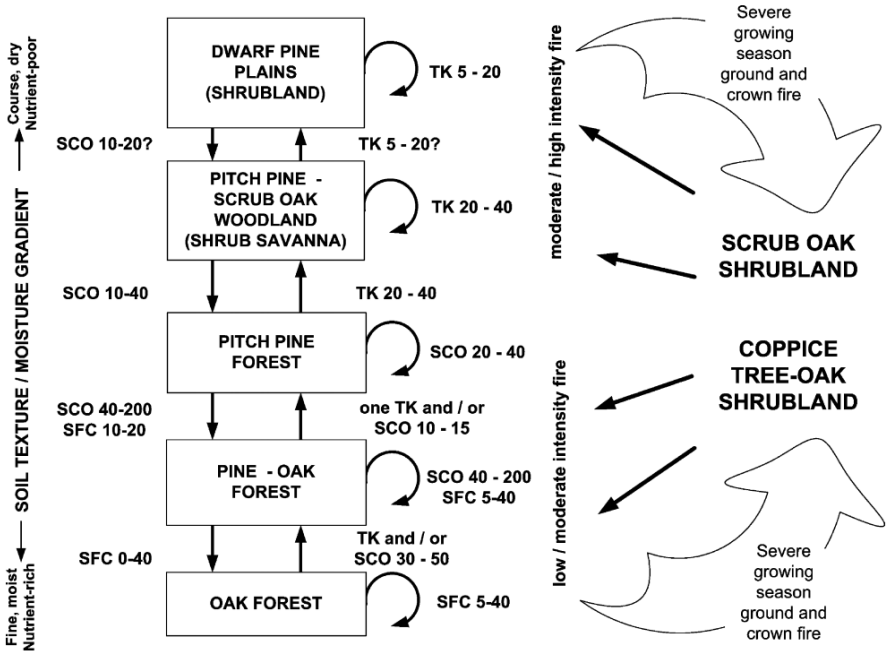


Figure 2.9 Central Pine Barrens State and Transition Ecology Model (Jordan et al. 2003)

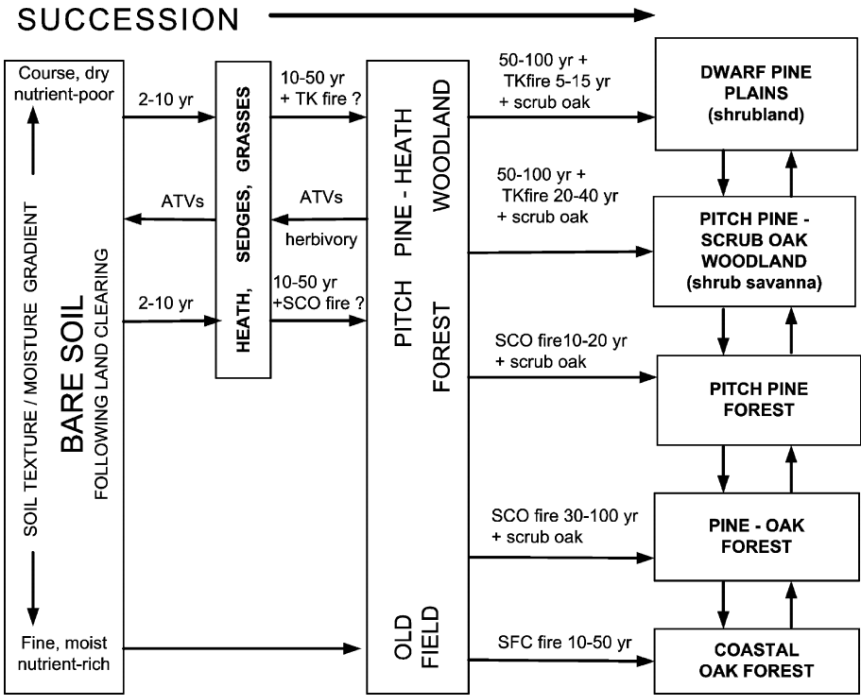


Figure 2.10 Central Pine Barrens Successional Model (Jordan et al. 2003)

Many Pine Barrens plant species exhibit adaptations to fire, such as the pitch pine (*P. rigida*) and scrub oak (*Q. ilicifolia*). These specific fire adaptations help to illustrate the important role of fire in this system and the importance of reintroducing routine fire as an ecological management tool. As mentioned earlier, these adaptations come at a cost and without fire these species are not able to germinate, grow, and persist as they are replaced by species that do not bear the cost of maintaining these fire adaptations in systems where fire is lacking or suppressed. Fire-resistant pines are tall, self-pruning, have thick bark, long needles, large seeds and are slow to initiate seed production. Fire-resilient pines have low-to-moderate fire tolerance as mature trees, but produce cones at a young age, produce abundant small, readily dispersed seeds, and have a high degree of cone serotiny. Serotinous cones are cones that open only after being heated to high temperatures, such as occur during a fire. Reproductive behavior of fire-resilient pines is typical of "r-selected" pioneer species producing many seeds that survive through infrequent catastrophic fires and have high potential for explosive reproduction. Pitch pines are in the fire-resilient group, but they also possess some attributes of the fire-resistant group, especially their relatively long needles and thick bark, which increase its fire-resistance. However, *P. rigida* also possesses the fire-resilient attributes of precocious cone production and production of abundant small seeds. Pitch pine is usually not serotinous, but in areas with an unusually high fire frequency (short fire return interval) the serotinous trait is favored. For example, pitch pine in both the New Jersey and Long Island Dwarf Pine plains have a high frequency of cone serotiny.

Pitch pines also have the capacity to resprout vegetatively from dormant epicormic buds, located both beneath the trunk's bark and on the root collar. In the frequently burned Dwarf Pine plains, vegetative pitch pine sprouts may bear cones as young as 3 years. The ability to resprout declines with age in tall pitch pines (Andresen 1959). However, the effect of age on resprouting of dwarf pines in the Long Island pine plains is not known. Although vegetative reproduction often predominates, production of seedlings is important for replacement of senescent trees. Pitch pine seedlings survive and grow best under the conditions of full sunlight, exposed mineral soil, and reduced competition, conditions that usually follow severe fires.

Scrub oak also is fire adapted, and rapidly recovers from even a hot crown fire. The plants have large root collars, just below the soil surface, which bear numerous dormant buds that resprout readily when

above-ground branches are killed. New shoots grow rapidly, often setting fruit after three years, and reaching maximum size in 7-10 years. Acorn production reaches a maximum when the sprouts are 5-7 years of age, and slowly declines thereafter. Scrub oak seedlings can become established only during the first few years following fire, due to decreased predation by white-footed mice. In addition to rejuvenating acorn production, fire has been found to stimulate a four to nine-fold increase in scrub oak foliage and shoot production during at least the first four years following fire in a scrub oak habitat in Pennsylvania. Concentrations in the foliage of crude protein, phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg) also increased following fire. Fire-stimulated increases in forage quantity and quality are important for maintaining populations of lepidopteran species (primarily moths) that feed primarily on scrub oak.

Ericaceous shrubs including blueberries, huckleberry and wintergreen, and herbs such as bracken fern, also quickly resprout and regain former biomass and production levels following fire in low pH soils. Periodic fire is required to open the canopy and provide the light levels required by herbaceous species typical of grassy openings in the pine barrens.

Overall, the successional cycles in the Central Pine Barrens communities, and the individual species in those communities, are inextricably linked to and adapted to experiencing regular fire on periodic intervals. The current conditions in the Central Pine Barrens are showing declines in ecosystem health and biodiversity with declines in species richness and abundance and loss of the rare and unique species in these environments from the loss and suppression of regularly returning fire. To maintain the rare species and communities and to sustain the important ecology and ecosystem services provided by healthy diverse systems, prescribed fire needs to be implemented as an ongoing and holistic management tool.

3. Weather, Fire History and Fuels

3.1 Weather Pattern and Fire History Analysis

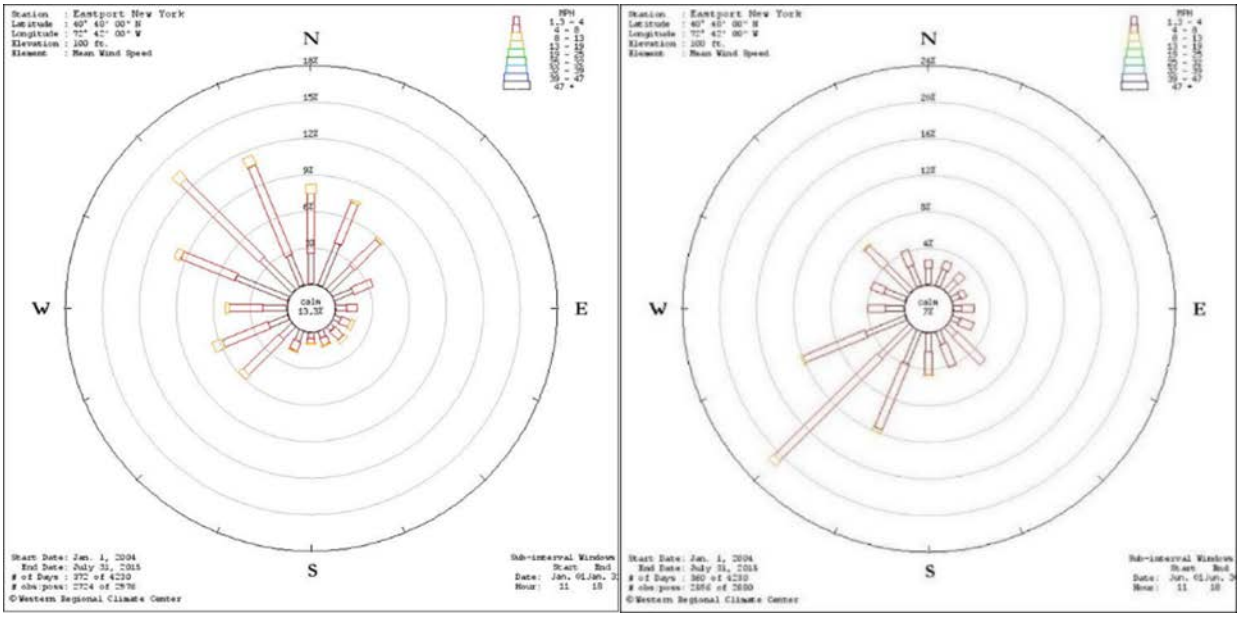


Figure 3.1 Winter (January (left) and Summer (June - Right) Winds at Eastport RAWS

The overarching climate and climatic parameters were described and discussed in the second chapter of this plan. Here, a transition is made from the broader long-term patterns and parameters that define regional climate into the finer scale variations in conditions and systems across time and space that constitute weather. The primary drivers and influencers of fire behavior are fuels, weather and topography. In this section, weather patterns and their relationship to and influence on the fire environment and historical fire occurrence are discussed.

In Long Island, where topography is relatively flat, wind direction is one of the most critical factors in the direction of fire spread. The prevailing wind is generally from the west and is such in New York State overall. On Long Island, a southwest component becomes evident during the warmer months while a northwest component is characteristic of the colder half of the year. According to wind rose generated from the 2004 to 2015 Eastport RAWS data, during the months of April through September the primary daytime wind direction is southwest (Figure 3.1).

Starting in October and carrying through the winter months the primary daytime wind vector shifts to a more northwest direction. In fall, winter and through April cold fronts pass through with winds shifting from the prevailing southwest to northwest, persist a day or two, then return to the normal southwest flow. Due to the orientation of Long Island and the large bodies of water that surround it, the area is prone to unique wind patterns, with alternating land and sea breezes throughout the day. A 180-degree switch in wind direction is not uncommon and those types of shifts usually occur in the afternoon after the land mass heats up by direct sunlight and toward evening when this sea breeze reverses as the land cools.

Keetch-Bryam Drought Index (KBDI)

Table 3.1 KBDI Levels Description

Level and Description	When This Occurs in CPB
KBDI = 0 - 200:	
Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity.	Early March thru Early June
Typical of spring dormant season following winter precipitation.	
KBDI = 200 - 400:	
Typical of late spring, early growing season.	June to Late July
Lower litter and duff layers are drying and beginning to contribute to fire intensity.	
KBDI = 400 - 600:	
Typical of late summer, early fall.	Late July thru August
Lower litter and duff layers actively contribute to fire intensity and will burn actively.	
KBDI = 600 - 800:	
Often associated with more severe drought with increased wildfire occurrence.	July thru September in
Intense, deep burning fires with significant downwind spotting can be expected. Live	Exceptionally Dry Years
fuels can also be expected to burn actively at these levels.	

The Keetch-Bryam Drought Index (KBDI) is a measurement system specifically for fire potential assessment developed for the National Wildfire Coordinating Group by the U.S. Forest Service (Keetch and Byram 1968). The KBDI attempts to measure the amount of precipitation necessary to return the soil to full moisture holding capacity from its current daily rating, and the scale runs from 0 to 800, with 0 fully saturated and 800 at maximum dryness. Table 3.1 which is populated from the US Forest Service / Wildland Fire Assessment System website, displays how KBDI values and description correlated directly to conditions within the Central Pine Barrens that can be seen represented in Figure 3.2 (https://www.wfas.net/index.php/keetch-byram-index-moisture--drought-49).

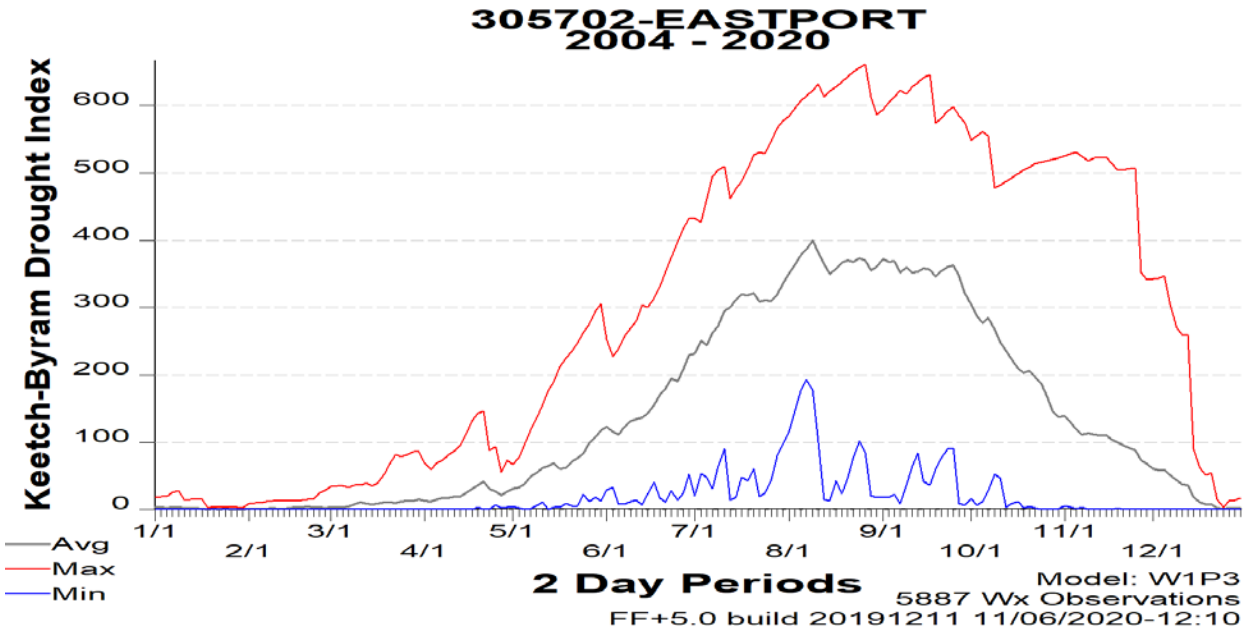


Figure 3.2 KBDI Trends at Eastport RAWS 2004-2020

Live Fuel Moistures Variability

Live fuel moistures (moisture by weight in a living plant) vary throughout the year and can significantly impact fuel availability, fire behavior and fire severity. Many of the fuel models found in the Central Pine Barrens are "dynamic" models meaning that live fuel moistures have a large impact on fire behavior. Many of the models that are not labeled as "dynamic" models also use live woody moisture as an input into predictive calculations. This live fuel moisture is one of the factors of alignment of conditions during a given season or given day that make the difference of a wildfire becoming a large, major fire or remaining as a small, localized event.

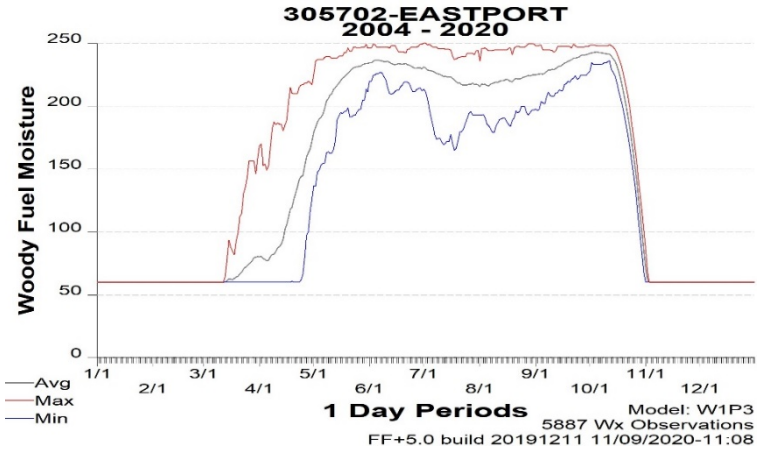


Figure 3.3 Live Woody Fuel Moisture Seasonal Variation (Eastport RAWS)

Live woody fuel moisture variability is a component of prescribed burn prescriptions, especially in pine dominated fuels (Figure 3.3). Seasonal changes in these moistures go hand in hand with the KBDI seasonal changes already discussed in writing prescribed burn prescriptions to achieve the desired burn outcomes.

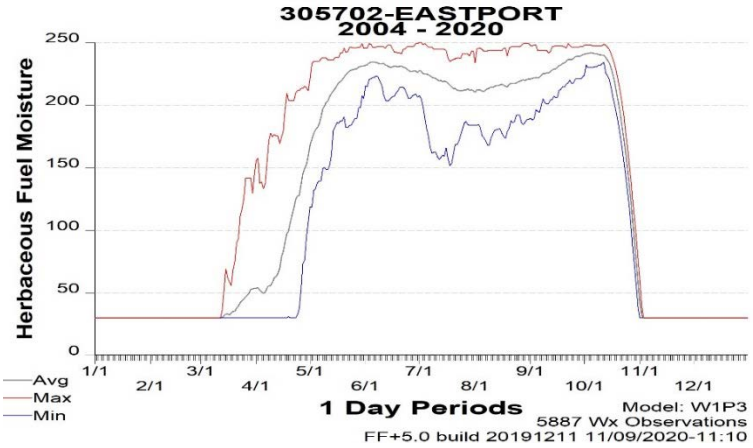


Figure 3.4 Live Herbaceous Fuel Moisture Seasonal Variation (Eastport RAWS)

Herbaceous fuel moisture is also seasonally significant. The simplest example is in grass fuels. As the season progresses grass fuels change from dormant with very low herbaceous live fuel moistures to full green up with high live fuel moistures (Figure 3.4). This means that the grass fuels rapidly transition from available fuels to unavailable as the season moves from April to mid-May.

To demonstrate the impact on fire behavor from changing live fuel moistures, the following data on fire behavior was generated through BEHAVE fire modeling software (Table 3.2). As can be observed, rate of spread, surface flame length and scorch height increases with decreasing live fuel moistures.

Table 3.2 Predicted Variability of Fire Behavior in Fuel Model SH6 Using BehavePlus 6.0

Live Woody Moisture (%)	Surface Fire Rate of Spread (ch/h)	Surface Flame Length (ft)	Scorch Height (ft)
60	27.7	8.9	65
120	13.7	6.8	43
240	7.6	5.1	26

Spring Fire Season

As is common for most of the northeastern United States, Long Island typically experiences two distinct wildland fire seasons. The first is the spring season which occurs from March through early June. Fire history shows that 80% of the large fires occurred during April and May and totaled 50% of total historic burned acreage. During this time of the year, the fuels transition from winter dormancy to summer growing season. Live fuel moistures of most surface fuels are very low during dormancy (60%) at the of the start spring fire season and reach full moisture after green-up by mid-June (150%-200%). In mid-April live fuel moistures of 1-year old pine needles in the crowns of the pitch pines may experience the "spring dip" during which their live fuel moistures fall below 100%. During this "spring dip" the pitch pine canopy is more vulnerable to crown fire.

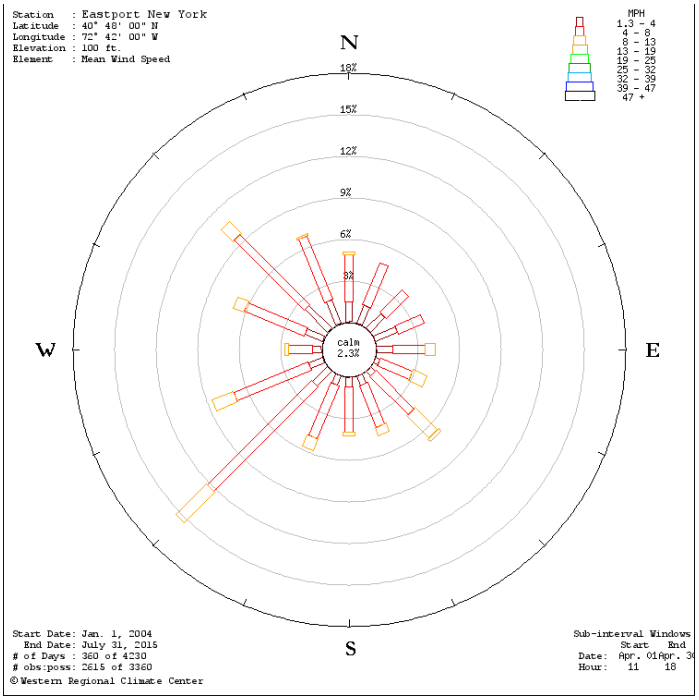


Figure 3.5 April 2004-2016 Wind Vectors Eastport RAWS

The KBDI scale is reset to 0 in early March, and the KBDI's in April are usually well below 100. The KBDI slowly builds throughout May and by early June is usually near the 200 mark (Figure 3.2).

Generally, fire spread direction during the spring fire season is wind driven from southwest to northwest as seen by the wind rose (Figure 3.5) for April 2004-2016 data period at the Eastport RAWS. The primary winds are southwest with northwest being the second most common vector.

Summer/Fall Fire Season

The second fire season occurs from midsummer thru fall (July thru October). This season is a slight anomaly from the standard "Eastern Fall Fire Season" of the northeastern US which generally does not include summer months. Historically in the Central Pine Barrens, July and August fires accounted for 17% of the ignitions of large fires from 1931-2020. While having a comparatively low percentage of ignitions, these fires have resulted in significant acres burned especially during years when drought conditions continued into late summer and KBDIs were persistently high. During this time of the year, the fuels transition from summer growing season to fall and winter dormancy. The first half of this burn season is the wettest time of the year, as it relates to fuel moisture with live fuel moistures of surface

fuels being very high (150%-250%) and new needles on the pines generally having high live fuel moistures of 150% or higher. Meanwhile dead fuel moistures of light surface fuels vary with alternating rain and dry periods. In September and October, live fuel moistures decline as the vegetation begins dormancy.

The KBDIs peak during the summer/fall fire season with KBDI rising steadily through July and often reaching peaks of 500 or higher in early to mid-August. The KBDIs usually drop precipitously starting in mid-September to early October, perhaps in concert with rains from tropical or other low-pressure weather systems.

The wind rose in Figure 3.6 indicates the dominant wind during the month of August is from the southwest; however, it should be noted that there is variablilty in wind direction during this time period, as the four major fires occurring in August 1963, July 1964, and August 1995 had predominantly northwest winds.

From the prescribed fire planning perspective, one could expect to see southwesterly winds in August, but be mindful of potential sea-breeze or factors that cause wind shifts to the northwest.

The October 2004-2014 wind rose indicates the primary daytime winds are predominantly from the southwest to northwest, which is a more visible trend to westerly winds than that were identified in the previous wind roses (Figure 3.7). Although October is generally a very active fire month in the northeast United States due to leaf fall, there has only been one large fire in the Central Pine Barrens of fire records with date of origin (599 acres) which occurred in October 1995 during a drought.

From the prescribed fire planning perspective, the late summer / fall generally has KBDI levels and live woody moisture readings that may be the best suited months to ignite first entry prescribed burns on untreated shrubby pine forest areas.

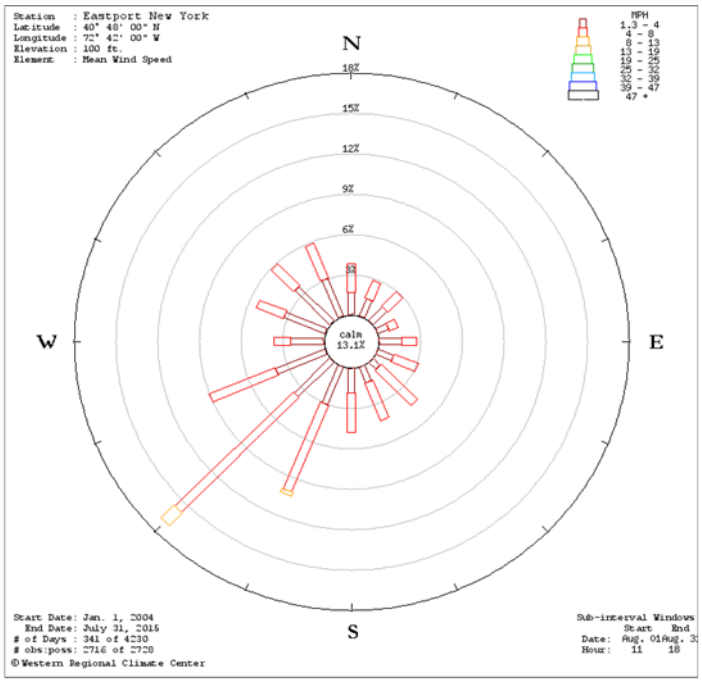


Figure 3.6 August 2004-2016 Wind Vectors Eastport RAWS

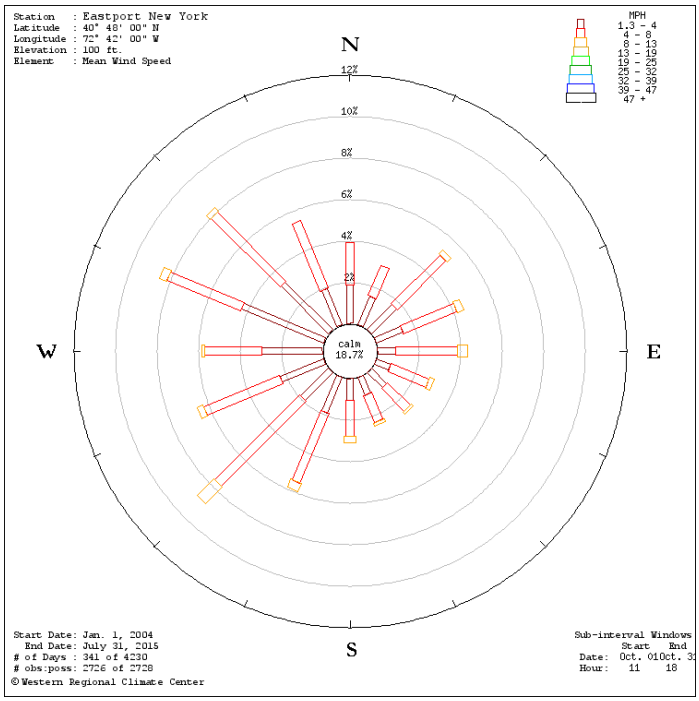


Figure 3.7 October 2004-2016 Wind Vectors Eastport RAWS

Drought and the El Nino Southern Oscillation

Not surprisingly, large fire history in the Central Pine Barrens is also correlated with periods of drought and the El Nino Southern Oscillation (ENSO) cycle. The ENSO cycle occurs when the waters along the Pacific coast warm and influence the continental weather patterns causing sustained periods of warmer and drier weather. During the period of record of fire history (1931-2020) those years with large acreage fires were almost always years where Long Island was experiencing drought conditions (Figure 3.8). Regarding these large fires in the Central Pine Barrens, they primarily occurred during La Nina phases of the ENSO cycle or when the ENSO was transitioning from or to a La Nina phase. Large fires in the Central Pine Barrens for which the date of origin is known have rarely occurred during the El Nino phases of the cycle.

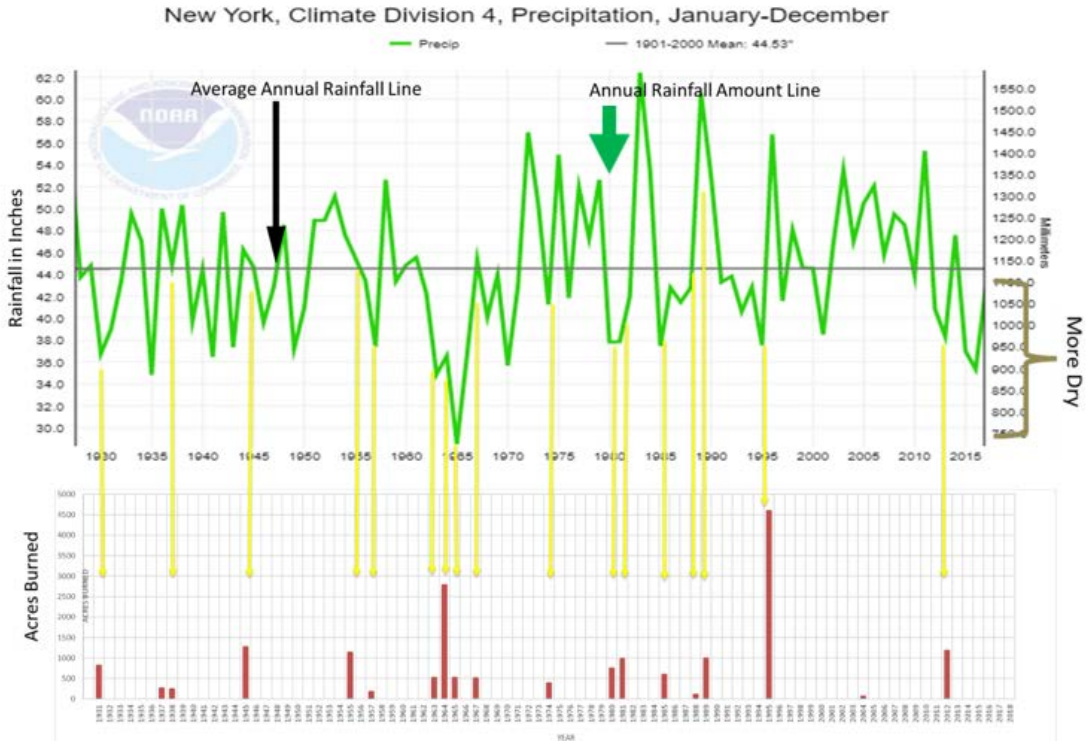


Figure 3.8 A Correlation of Precipitation Rate and Acres Burned from 1930 to 2018 within the Central Pine Barrens (NOAA National Centers for Environmental information, Climate at a Glance: Divisional Time Series https://www.ncdc.noaa.gov/cag/)

Fire History Overall Summary

For the purposes of conducting prescribed fires in the Central Pine Barrens, it is valuable to analyze modern (1900's to present) fire history on the landscape as this history can help determine the frequency and seasonality by which prescribed fire should be applied in order to emulate desired natural or cultural fire effects on the landscape.

The most comprehensive Central Pine Barrens fire history (1931-1994) is sourced from "A Preliminary Wildfire History for The Long Island Central Pine Barrens" written by Andrew G. Windisch in 1994, who at the time worked for The Nature Conservancy. Windisch examined a series of aerial photos from the 1930's to 1994 to find wildfire scars and drew them onto USGS topographic quadrangle maps. In

addition, Windisch corroborated his observations with news reports, fire reports and even tree core sampling. Windisch's focus was on major wildfires which he defined as over 50-100 acres. Fire scars of five acres or less were also recorded and are included in the data. The NYS-DEC Office of Forest Protection has also maintained and continues to maintain records of wildfires suppressed by local fire departments which were an additional source used to comprehensively document regional fire history and identify seasonal and other trends.

Over the last 90 years (from 1931 to 2020) data sourced from Windisch and NYS-DEC details a total of 218 fires that burned a total of 42,026 acres in the Central Pine Barrens. Unfortunately, many large fires documented in the database do not have accurate dates of origin, and many are only reported in a range of years of probable occurrence.

In the last 20 years (1995-2020), there have been a striking number of ignitions with a total of 4,600 wildfires suppressed as reported by the multiple fire districts of the Central Pine Barrens. The vast majority of these 4,600 fires were reported as 0.1 acre (the smallest allowable entry level) with only 46 (1%) 10 acres or larger and only 12 (0.26%) 50 acres or larger. It should be noted that some of these more sizable fires seemed to be of questionable acreage and location in the dataset. Overall, although fire ignitions occurred frequently, suppression resulted in small scale fires that did not contribute to Central Pine Barrens disturbance ecology landscape.

According to the Northwest Fire Science Consortium "Fire severity refers to the effects of a fire on the environment, typically focusing on the loss of vegetation both above ground and below ground but also including soil impacts (Fitzgerald and Bennet 2013) while Science Direct identifies the fire severity is measured through tree mortality, canopy reduction and crown scorch (DellaSala and Hanon 2015)

While small scale fires are important to cumulative fire history, it is the larger scale fires that are important to recognize for their effects in shaping and influencing Pine Barren ecology. Fires with higher levels of fire severity are the ones that alter or reset the vegetative succession timeline. While it is not unusual for small fires in the Central Pine Barrens to have high severity results, small fires of high severity only impact small portions of the Central Pine Barrens. Large fires with high fire severity impact and disturb large areas of the Central Pine Barrens. The ten largest wildfires in this 90-year modern fire history are listed in Table 3.3. Some of these fires are only estimates of total acreage. For instance, Windisch noted that Fire #58 in July 1964 in Southampton may have been as large as 6,000 acres, but he could not definitely say that from his analysis of fire scars. In total, there were 42 fires of 100 or more acres from 1931-2020.

For this Plan, an analysis was conducted by Commission of 30 of the large fires which occurred from 1931 thru 2020 and which had known dates of origin. Of these, a total of 26 of the fires analyzed were in excess of 100 acres in size while four of the fires were smaller in size and accounted for 59 acres, 63 acres, 96 acres and 75 acres, respectively. Three of these smaller acreage fires were included because they were some of the largest fires that have occurred since the 1995 Sunrise and Rocky Point fires and only one fire, the 2012 Crescent Bow fire has been the only fire since 1995 to have exceeded 100 acres. The fourth was included because it was one of a series of multiple fires in 1967 that occurred at the end of a drought cycle.

In this analysis April and May were identified as the most frequent months for outbreaks of large fires (Table 3.4). A total of 80% of the large fires in this 90-year period burned in April and May and accounted for 49% of the almost 18,000 total acres burned in this study group. In addition, 53% of these fires occurred in April alone, which is the month in which fire ignitions most frequency occurred.

Table 3.3 Central Pine Barrens Ten Largest Wildfires 1931-2020 Ordered by Acres

Fire Year	Fire Name	Acres Burned	Location	Included in CPB Fire Analysis?
Est. 1930-7	Windisch Fire 5	3827	BNL into Brookhaven State Park	No, Unknown Date of Origin
Est. 1941-6	Windisch Fire 19	3223	Rocky Point	No, Unknown Date of Origin
August 1995	Sunrise Fire	3198	Dwarf Pines	Yes, Date of Origin 08/24/1995
July 1964	Windisch Fire 58	2783	Southampton	Yes, Date of Origin 07/01/1964
August 1995	Rocky Point	1395	Rocky Point	Yes, Date of Origin 08/21/1995
April 2012	Crescent Bow	1124	Brookhaven National Lab toward Manorville	Yes, Date of Origin 04/08/2012
Est. 1938 – 40	Windisch Fire 15	984	Eastern Sarnoff Pine Barrens State Forest	No, Unknown Date of Origin
1944	Windisch Fire 17	870	Calverton to Riverhead Area	No, Unknown Date of Origin
May 1981	Windisch Fire 91	829	BNL to Calverton National Cemetery	Yes, Date of Origin 05/25/1981
April 1931	Windisch Fire 3	817	Manorville	Yes, Date of Origin 04/20/1931

A lower number of ignitions occurred in July and August, however during drought periods, wildfires ignited during this time period were significantly larger and accounted for 48% of the acres burned from 1931- 2020. The prior weather and KBDI discussion indicate that the large July / August burns occurred during periods of prolonged drought likely with very high KBDI ratings and lower than normal live fuel moistures present.

Table 3.4 An Analysis of Seasonality and Acreage of 30 Large Fires with Known Dates of Origin Occurring from 1931-2020

Total Fires (#)	30	Total Acres		17956
Month	Count	Percent	Acres	% Acreage
April	16	53%	5386	30%
May	8	27%	3492	19%
July	2	7%	3368	19%
August	3	10%	5111	28%
October	1	3%	599	3%

Weather and Fire History Summary Implications for Prescribed Burning

As identified earlier, fire severity refers to the effects of a fire on the environment, typically focusing on the loss of vegetation both above and below ground but also including soil impacts. Severity will vary with season, drought status and burning techniques.

Spring: April and May are the most frequent months for large fires to occur, but they are also months when the KBDI's are low. Large fires that burn under low KBDI conditions would occur on days when brisk winds, low moisture in fine and medium surface fuels and good fuel bed continuity come into alignment. Those days would be characterized by high burning index and energy release component readings. Because soil moistures and large class fuel moistures are high during these fires, severity would mostly be restricted to the crown, but soil severity could be high if fires are occurring during deep drought periods.

Applying this information, it can be concluded that prescribed burning in April and May would be most favorable for burns where the goal is to reduce fine and medium surface fuels and to top-kill shrubs that are transitioning from dormancy to growing season. When KBDI's are 100 or less, heavy fuels will not be available for burning due to high moisture retention. As unavailable fuels, heavy dead fuel logs and jackpots of heavy fuels would need no significant preparation work prior to or during burn implementation. The April wind rose shows that southwest winds should prevail during these burns unless there is predicted cold front passages or sea breeze effects (Figure 3.5).

Summer: June, July and August are months that can be very dry and KBDIs usually reach their highest annual levels. With higher KBDI levels, fire severity generally increases with more consumption of vegetation of both ground and surface fuels, increased tree scorch and mortality. The Sunrise Fire of August 1995 is certainly an example of high fire severity. Using this information for prescriptions, it could be expected that fires in these months would likely consume soil organics, expose mineral soils and consume heavy dead surface fuels.

In June, July and August, burns with jackpots of dead and down heavy fuels could be burned with high levels of consumption. Such burns could expose good patches of mineral soil seedbed for pitch pine and herbaceous regeneration. These kinds of burns will create a desirable mosaic. The August wind rose indicates that winds are generally southwest, but sea breezes and frontal systems can impact overall direction (Figure 3.6).

Fall: Weather and fire history both indicate that in September and October the KBDI's plummet and that large fires are rare. These months provide the opportunity to burn oak dominated forests by taking advantage of fresh leaf drop and burning over damp soils. These would be very low severity burns, with a focus on fuel load reduction being the goal. As most plant food reserves are now in the roots, tree mortality would be minimal from burns. This is also a time to experiment with burning of Pitch Pine-Oak forests that have not been mechanically thinned or for advancing first entry burns in Pitch Pine Heath habitats. Fine fuels in densely brushy fuel beds may be sheltered from moisture, allowing for burning while under overall wetter conditions. Fall burns provide the opportunity to focus on reducing fuel loading in shrubby areas to prepare them for future spring or growing season burns.

Winter: There are no records of large fires occurring during the winter months in the past 90 years so it can be concluded that winter fire has not contributed to the fire ecology of the Central Pine Barrens. During the winter there is very little fire danger risk. Winter then can be a good time of the year for "first entry" burns into un-treated shrubby fuels to help prepare these sites for future burns at more ecologically beneficial times of the year. It can also be a good time of the year for pile burning of

concentrated heavy fuels and training burns. From mid-December until mid-March if frost is present usually only the surface fuels will be consumed unless there is a concentrated heat source such as pile burning.

3.2 Fuel Models and Distribution

The intent in this section is to describe which fuel models characterize the major plant communities of the Central Pine Barrens using what is recognized as the standard report and guideline on fuel models nationwide - *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model* which is the standard report on fuel models used nationwide (Scott and Bergan 2005). Fuel models are a way to classify fuel behaviors by describing such similarities as volatility, volume, distribution, and continuity. The fuel model descriptions are taken from the descriptions in this technical report with local adaptations. The Central Pine Barrens has four basic communities of wildland fire fuels: Pine-dominated forests, Oak dominated forests, Grasslands and Wetlands (Table 3.5). As previously described in this Plan, these habitats have been sculpted by various forces since glacial retreat about 12,000 years ago. These forces included indigenous use of fire, timber harvesting, agriculture, modern settlement and large fires associated with that settlement and severe weather events.

Table 3.5 Dominant Plant Communities of the Central Pine Barrens

Central Pine Barrens Plant Communities	% of CPB	Acres
Pine Dominated Habitats	26%	28027
Oak Dominated Habitats	39%	41803
Grasslands (including both Pine and Oak Grass Savanna's)	4%	3958
Wetlands	2%	2502
Other (agriculture, roads, lawns, plantations, sand/sparse veg.)	28%	29507

Fire Return Interval (FRI) of these fuels are also described to help inform management. The FRI is defined as the time between two successive fires in a defined area and is determined on a landscape ecological community type basis rather than single point basis. This determination is made by using both historical and scientific analysis based on successional dynamics. FRI "departure" is the term to describe whether fires have occurred within the time frames of the expected and ecologically appropriate FRI or whether fire is "overdue". The FRI for each of the fuel communities are identified below while specifics about the current state of FRI departure will be discussed in the individual fire management unit descriptions (Section 9).

For the purposes of mapping and planning the Central Pine Barrens has been parsed into five units termed Fire Management Units that will be discussed in Section 8 are indicated on the below mentioned figures.

Table 3.6 Pine Communities and Represented Acreage within Central Pine Barrens and Fire Return Intervals

Pine Communities	% of CPB	Acres	FRI in Years
Pitch Pine Forest & Pitch Pine Heath Woodland	14.09%	14940	40 to 60
Pitch Pine / Oak Forest	8.18%	8667	40 to 60
Dwarf Pine Plains / Dwarf Pine Forest /Oak Scrub & Shrub Pinelands	3.67%	3887	7 to 15
Pitch Pine Tree Oak Scrub Oak Woodland	0.36%	378	7 to 30
Successional Pitch Pine & Successional Pitch Pine / Oak Forest	0.15%	154	40 to 60

Pine Dominated Forests

For the purposes of fuels description, the Pine forest communities are narrowed to five forest types. The Pitch Pine forest; Pitch Pine Heath woodland; Pitch Pine Oak forest; Dwarf Pine Plains/Dwarf Pine forest/Oak scrub and pineland account for the majority of the pine fuel types. The Pitch Pine Tree Oak Scrub Oak woodland and Successional Pitch Pine and Successional Pitch Pine/Oak forest cover only 0.5% the lands of the Central Pine Barrens (Table 3.6). The Pine communities make up about 26% of the Pine Barrens by area and with exception of the Dwarf Pine Plains which is located in the south eastern section of the Pine Barrens in Westhampton Beach, the Pitch Pine dominant ecosystems are distributed across the Central Pine Barrens (Figure 3.9).

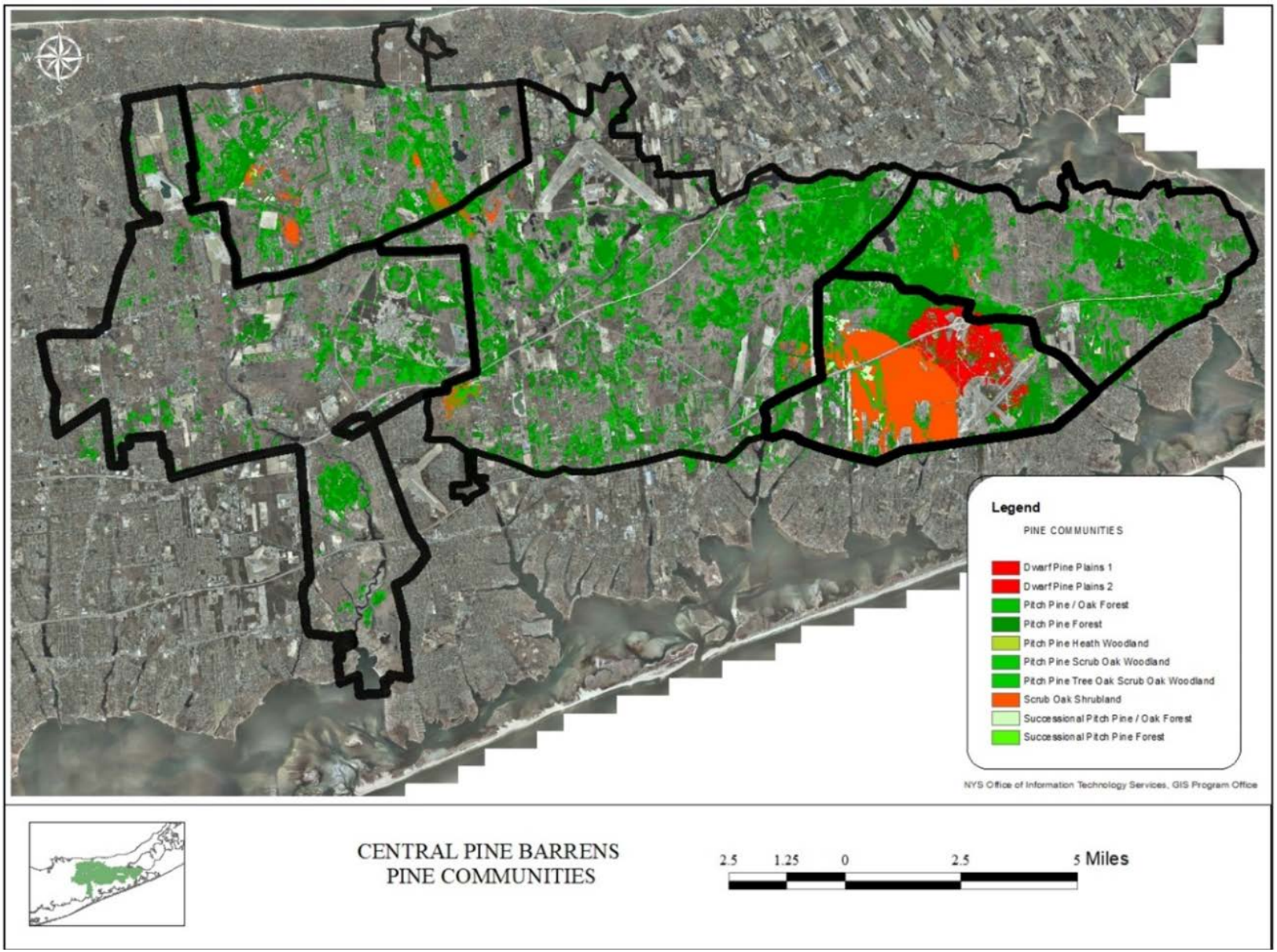


Figure 3.9 Types and Distribution of Pine Communities in the Central Pine Barrens

These pine forests are dependent upon disturbance to maintain forest health. Factors that measure forest health include the density of trees per acre, the stage of understory succession, the amount of understory fuel loading, plant composition of the forest floor and the volume and distribution of non-native plants and animal pests. Historically fire was a primary disturbance regimen in these pine forests. Fire would kill some trees which would reduce the basal area of tree stems per acre. Fire would also top kill and consume shrubs thereby reducing the understory fuel loading and exposing the forest floor to more sunlight and reduced competition. Fire would also consume forest floor branches, pine straw and leaf litter and other organic material, mineralize nutrients and create an exposed and enriched mineral soil seedbed allowing for species enrichment and recruitment.

A leading indicator of current forest health is the number of years of departure past the FRI without fire disturbance in a given area. For example, in the David Sarnoff Pine Barrens State Forest located west of County Road 104 (an area covering 1600 acres and primarily a Pitch Pine – Oak forest), there has been no significant fire disturbance in at least 90 years (since 1930, with no definitive data on large fires prior to 1930 available). Pitch Pine-Oak forest has a 40-to-60-year FRI. Therefore, the FRI departure on the west side of Sarnoff is presently at least 30 to 50 years. This portion of forest exemplifies degraded forest health and this FRI departure. The basal area in this area is currently twice what is desirable. The understory of Scrub oak (*Quercus ilicifolia*) is in places 13 feet high creating a high amount of volatile fuel in the understory. The forest floor is entirely shaded with little or no herbaceous component or barren areas that are critically necessary for many wildlife species such as the Atlantic coastal buckmoth.

This example of FRI departure is specifically cited in this Fuels section in order to call attention to the fact that Pine communities of the Central Pine Barrens generally are experiencing a higher level of FRI departure. The majority of the fuels in the pine communities are at the highest and most volatile end of below listed shrub and forest understory fuel models (e.g., SH8). Specific FRI departure information will be described in each of the Fire Management Units.

<u>Standard Fire Behavior Fuel Models in Pine Forests (Scott and Bergen 2005):</u>

- Pitch Pine / Pitch Pine-Oak
  These forests include a large shrub component that adds to volatility, flame length and crowning potential. The majority of the fuels are the Shrub models listed below. The surface fuels in the Pine-Oak forest type are composed of pine needle and leaf litter and dead twigs that readily transmit fire throughout much of the year and are reflected in the litter models listed below.
    - Low to High Load Humid Climate Shrub: SH4 / SH3 / SH6 / SH8
    - Low to High Load Timber Litter: TL1 / TL2 / TL3 / TL4 / TL8
    - Low to Moderate Load Activity *(mechanical reduction)*/Low Load Blowdown Fuels: SB1 / SB2

- Pitch Pine-Oak-Heath Woodlands
  The forest type consists of Pine Oak forest with a dense understory of scrub oak, blueberry, and huckleberry. The dense shrub layer that characterizes this forest type provides a heavy fuel layer year-round.
    - Low to Moderate Load Humid Climate Shrub and Timber/Shrub: SH4 / SH3 / SH6

- Pitch Pine-Scrub Oak Barrens
  The shrub layer transmits fire spread into the tree canopies leading to crown fire. In areas of dense pitch pine, crowning and spotting are common during the growing season due to the presence of volatile resins. The abundance of standing dead shrubby fuels also intensifies the fire risk.

    - Low to Very High Load Humid Climate Shrub: SH4 / SH6 / SH8 / SH9

- Dwarf Pine Barrens
  This shrubland/forest type has the high fire frequency and intensity characteristics of the "chaparral" fuel that it is. It is similar to classic "California chaparral". The Dwarf Pine Barrens has high stand density and high fuel bed continuity which is attributed to short statured pitch pines that do not exhibit cladoptosis (self-pruning). These characteristics collectively create stand replacement fuels (meaning that post fire only ash and charred stumps/tree trunks remain, and the succession is reset). The primary carrier of fire is the live green fuels of these dwarf stands of pine. The forest floor is made up of a thin layer of pine needle litter and twigs and branches of the woody vegetation. If fire behavior factors are in alignment, long flame lengths and rapid rates of spread growing into crown fires can be expected.

    - High Load Blowdown: SB4
    - High Load Dwarf Conifer with Understory: TU4
    - Very High Load Humid Climate Shrub: SH9
    - Long Needle Litter: TL8

  Note: Since the primary carrier of fire in Pitch Pine Grass savanna is grass, those fuels are described in the Grasslands fuels section below and are characterized as TU3, Moderate Load, Humid Climate Timber-Grass-Shrub (Dynamic).

Oak Dominated Forests

Oak dominated forests generally consist of two primary forest types: Oak forest with a greater than 100-year fire return interval (FRI) and Oak-Pitch Pine forest with a 60-100-year FRI (Table 3.7). These forests make up about 39% of the Central Pine Barrens landscape.

Table 3.7 Oak Communities with Percent Central Pine Barren Area, Acres and Fire Return Interval

Oak Hardwood Communities	% of CPB	Acres	FRI in Years
Oak / Pitch Pine Forest	22.52%	23875	60 to 100
Oak Forest	16.25%	17224	100 or more
Successional Oak Forest	0.42%	443	unknown
Tree Oak Pitch Pine Scrub Oak Woodland	0.10%	102	7 to 30
Tree Oak Scrub Oak Woodland	0.09%	98	7 to 30
Tree Oak Heath Woodland	0.06%	60	7 to 30

For the purposes of describing fuels the Oak forest communities are narrowed to the six forest types as reflected in Table 3.6 and Figure 3.10. The Oak Pitch Pine forest and Oak forest, the most abundant of the oak fuel types have a long disturbance interval and long FRI of 60 to 100 years or greater, respectively. The remaining vegetation types cover less than 1% of the Central Pine Barrens, and with exception of the Successional Oak forest, are a volatile group of fuels with a short FRI.

Standard Fire Behavior Fuel Models in Oak Hardwood Forests (Scott and Bergen 2005):

- Oak / Pitch Pine forests, Oak forest and Successional Oak forest communities:
  Stands consist of a mixture of hardwood and scattered pines with minimal understory vegetation and a thin bed of loose-leaf litter and twigs. In the Oak-Pitch Pine forests, the greater density of pines contributes to a more volatile hardwood / pine needle litter than just hardwood leaf litter. There may also be a higher component of twigs and branches mixed in the litter. Freshly fallen leaves that have not been compressed by snow or rain are a more available fuel and will burn hotter than litter layers that have been more tightly compacted by snow, decay or other conditions.

    - Moderate Load Humid Climate Timber-Shrub: TU2
    - Low Load and Moderate Load Broadleaf Litter: TL2 / TL6
    - Very High Load Broadleaf Litter: TL9

- Scrub Oak and Heath communities:

    - Moderate Load, Humid Climate Shrub: SH3

  Note: Since the primary carrier of fire in the Tree Oak Grass Savannah is grass, those fuels are described in the Grasslands Fuels and are characterized as TU3, Moderate Load, Humid Climate Timber-Grass-Shrub (Dynamic).

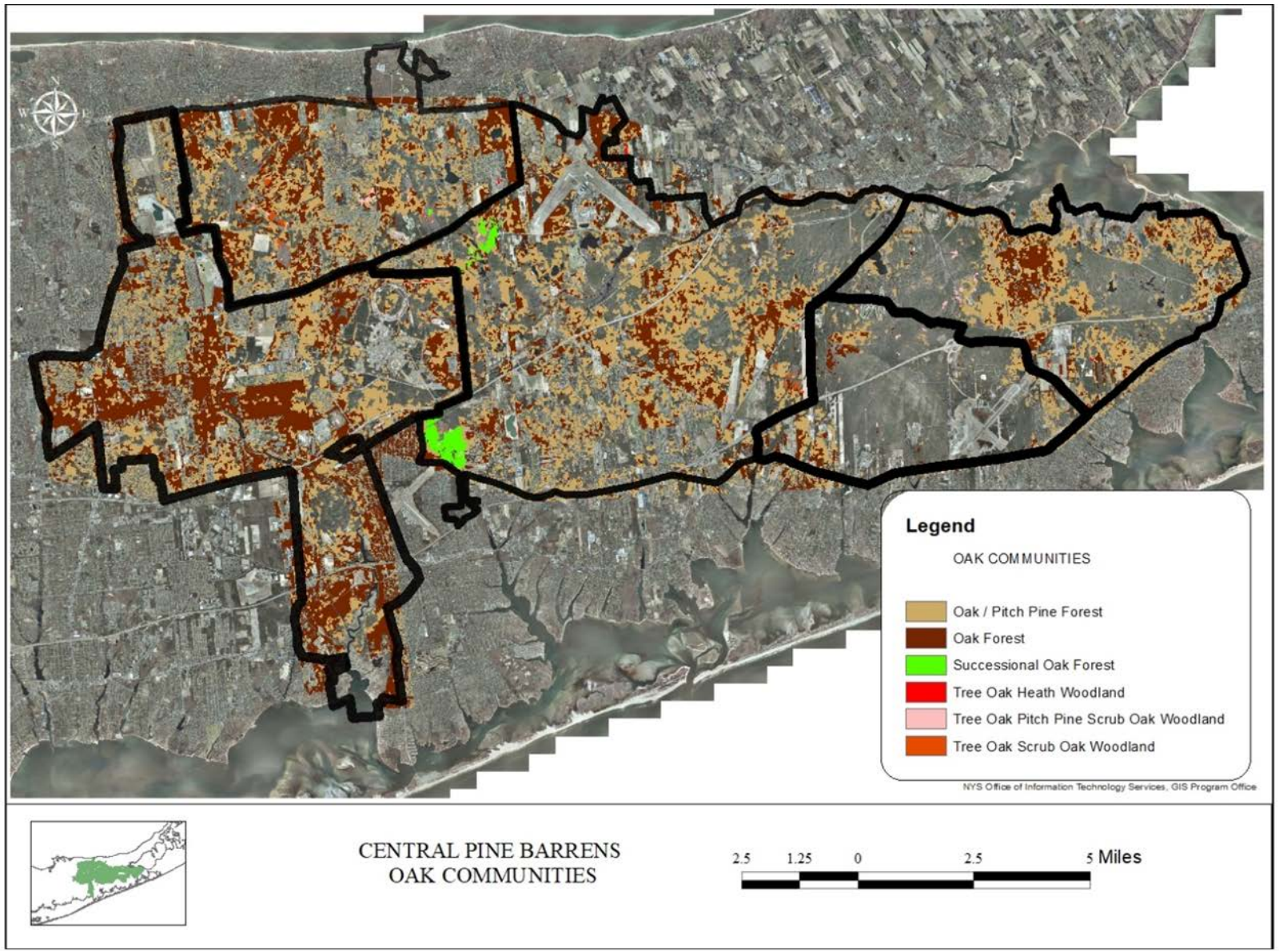


Figure 3.10 Types and Distribution of Oak Communities in Central Pine Barrens

Grassland Communities

Grasslands consist of sandplain and early successional habitats that are often remnants of past larger fields or pastures or created/maintained to ensure public safety and access within transportation (roadsides, airport clear zones and accident potential zones) and utility corridors. The Grassland communities account for a small portion (4%) of the Central Pine Barrens. For the purposes of describing fuels, the 300 acres of Pitch Pine Grass savanna and 140 acres of Tree Oak Grass savanna where the grass understory is the primary carrier of fire are classified as a grassland vegetative community and described in this section (Table 3.7). The fire return interval for these three habitats is comparatively short at seven (7) years or less which is comparatively short to that of the other vegetation communities (Table 3.8 and Figure 3.11).

Table 3.8 Grassland Communities with Percent Central Pine Barren Area, Acres and Fire Return Interval

Grassland Communities	% of CPB	Acres	FRI in Years
Grassland	3.33%	3529	7 or less
Pitch Pine Grass Savanna	0.27%	291	7 or less
Tree Oak Grass Savanna	0.13%	138	7 or less

Fuel Models in Grasslands

Grass and herbaceous fuels are light and flammable, especially during dormancy which occurs after the onset of frost in the fall and persists through mid-May. Grass and the Timber-Grass-Shrub models are "dynamic" as they do contain a live fuel component and progressively have higher wet fuel moistures as green up progresses. By mid-May they become difficult to burn due to the live fuel moisture content. Grassland fuels are variable in the characteristics of fuel continuity and fuel loading and each area needs to be evaluated for these characteristics for prescribed fire management. Under dry conditions, grass and other herbaceous fuels are characterized as stand replacement burns with rapid rates of spread and long flame lengths.

Grasslands can naturally contain up to 25 - 40 % shrubs characteristic of grasslands. However, the current condition of regional grasslands is degraded, as they are being invaded by pines, hardwood trees and an over-abundance of shrubs as well as non-native grasses and forbs due in part to infrequent management, dormant season burning, and climate change. Without disturbances (fire, mechanical treatment, hand removal, chemical treatment) these native and non-native invasives are predicted to transition from grasslands into the next phases of succession as a shrub and tree dominated habitats or monotypic stands of non-native shrubs (i.e., Autumn olive thickets). The reduction in fire disturbance since European settlement of Long Island has resulted in loss of the vast majority of grasslands that were once present. NYS-DEC, The Nature Conservancy and the US Fish and Wildlife Service have been routinely prescribed burning grasslands on Long Island since the late 1990's. However, since 2008, NYS-DEC is the only agency still reliably burning these grasslands.

Standard Fire Behavior Fuel Models (Scott and Bergen 2005):

- Grasslands
  - Low to High Load Humid Climate Grasses (Dynamic): GR3 / GR5 / GR6 / GR8
- Pitch Pine and Tree Oak Grass Savannas:
  - Moderate Load, Humid Climate Timber-Grass-Shrub (Dynamic): TU3
  - Low to High Load Humid Climate Grasses (Dynamic): GR3 / GR5 / GR6 / GR8

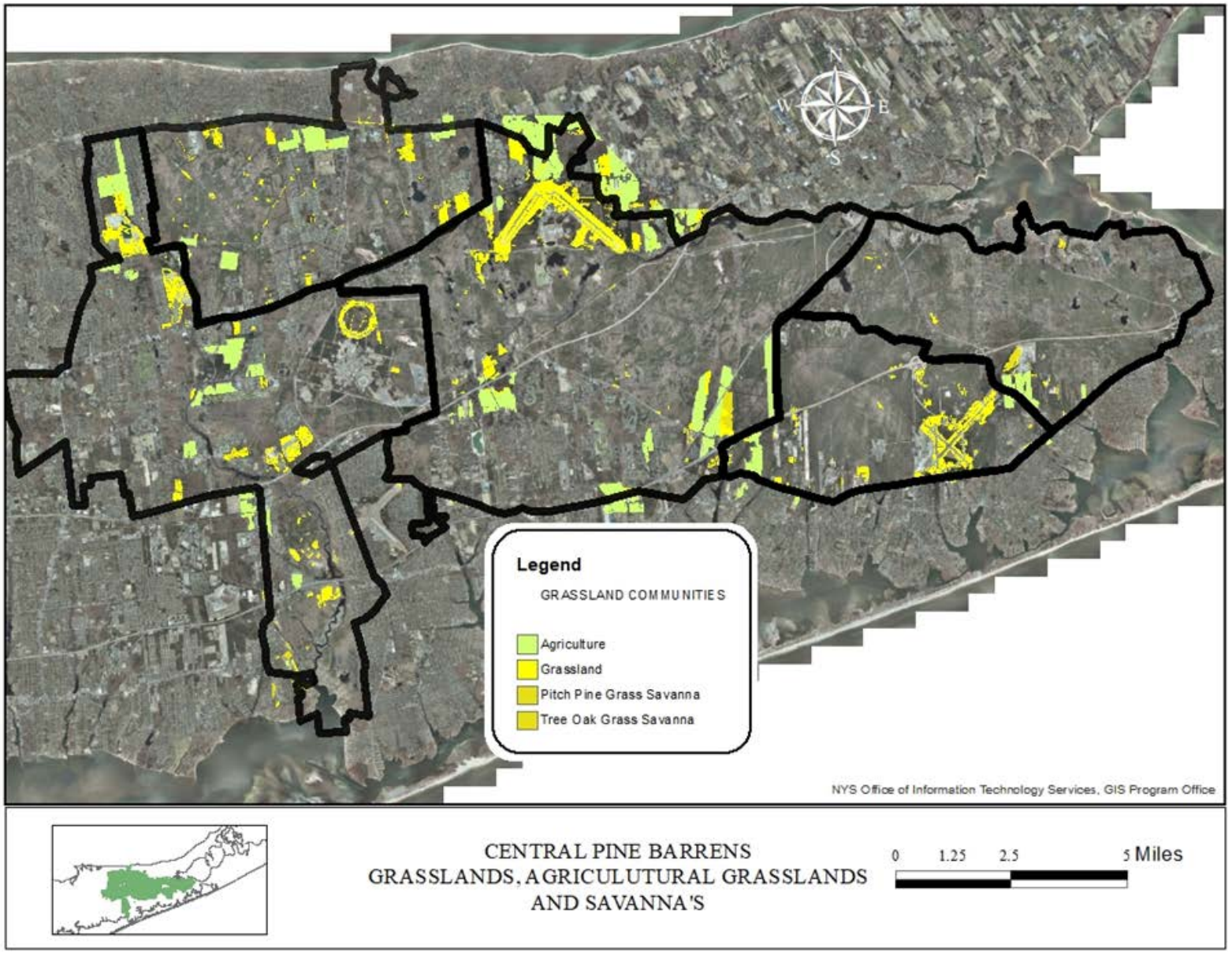


Figure 3.11 Grassland Communities and Savannahs Distribution in the Central Pine Barrens

Wetland Communities

Regional wetlands are comprised of kettle holes, coastal plain ponds, abandoned cranberry bogs, riverine systems and upland freshwater marshes; or coastal areas that consist of salt water tidal marshes (Table 3.8). They are distributed across the Central Pine Barrens but only account for a small percentage (2%) of the vegetative communities' total cover (Figure 3.12). Wetlands experience wildfires especially during periods of drought, however as such occurrences are not predictable, standard fire return intervals are not currently known (Table 3.9).

Table 3.9 Wetland Community Types within the Central Pine Barrens by Percent Area, Acres and Fire Return Interval (FRI)

Wetland Communities	% of CPB	Acres	FRI in Years
Forested Wetland	0.55%	582	unknown
Freshwater Wetland	0.70%	746	unknown
Tidal Wetland	1.11%	1173	unknown

Fuel Models in Wetlands

There are three types of wetlands in the Central Pine Barrens: Freshwater Wetlands, Forested Wetlands and Tidal Wetlands (Table 3.9). The first two generally occur in upland and terrestrial systems and are differentiated by type of system: riverine (river) or lacustrine (lake/pond) and dominant plant cover (i.e., grass/shrub versus tree/shrub). They are most densely found throughout the headwaters and banks of the Peconic River and Carmans River. Otherwise, they are found scattered around the remnant glacial features of kettles and coastal plain ponds (Figure 3.12).

Wetlands can be seasonal barriers to fire as can be seen in Figure 3.13. The level to which wetlands burn or are a barrier may vary with periods of extended drought and size of the wetland. Figure 3.13 exemplifies that freshwater wetlands have been barriers to slow or stop fire spread on large fires in the Central Pine Barrens, but large fires have also burned through, flanked past or spotted over wetlands. It is noteworthy that Fire #55 burned in August 1963 in the middle of a severe multi-year drought when Keech Byrum Drought Indices are generally as high as they get annually. Yet even under these conditions, the northern section of the Coastal Plain Pond wetland system, which is one of the widest sections of the system with open water, held the fire's eastern flank. The variability of water resources and size can also be observed within the boundaries of the Crescent Bow fire which occurred in April of 2014. This fire burned through or over the middle and narrowest section of Coastal Plain ponds of Robert Cushman Murphy County Park but were partially confined by the wider Peconic River riparian wetlands of Peconic River County Park on the southern and eastern flanks.

Tidal Wetlands occur in two locations within the Central Pine Barrens: along the south shoreline of Flanders Bay in Hubbard County Park (Southampton FMU) and the mouth of Carmans River in Wertheim NWR (Brookhaven FMU). From 1931 to 2020 there is no history of fire in the Hubbard County Park tidal wetlands. There is anecdotal evidence of past fire activity there such as old, charred fence posts and a char layer observed in windthrown tree root masses. This shoreline has become invaded in large areas by non-native Common reed (*Phragmites australis*) which may result in future and increased fire activity. In Wertheim, the tidal wetlands have similarly been largely invaded by non-native Phragmites and the US Fish and Wildlife Service used prescribed fire in these marshes as part of invasive plant control treatments (Figure 3.14).

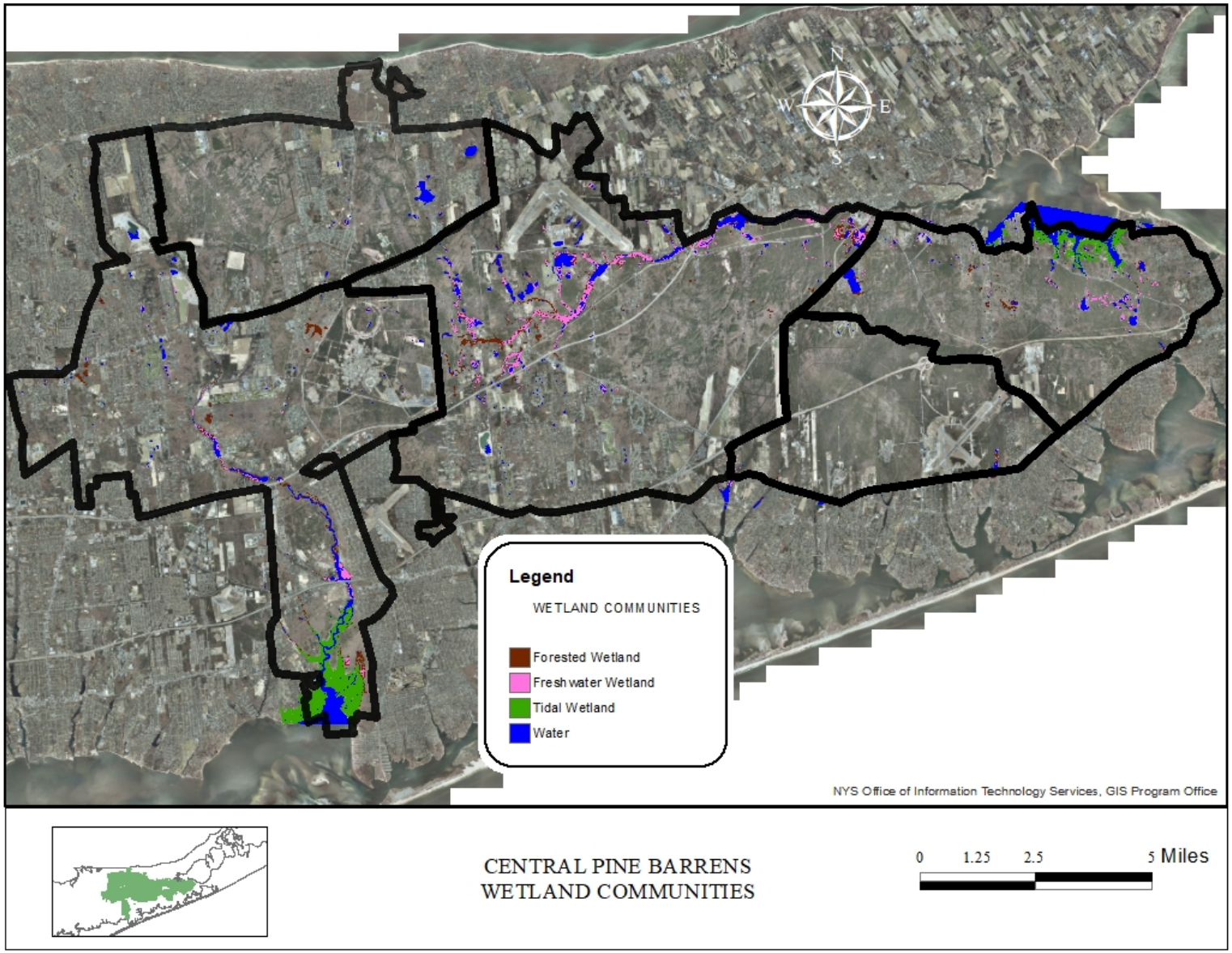


Figure 3.12 Wetland Communities in the Central Pine Barrens

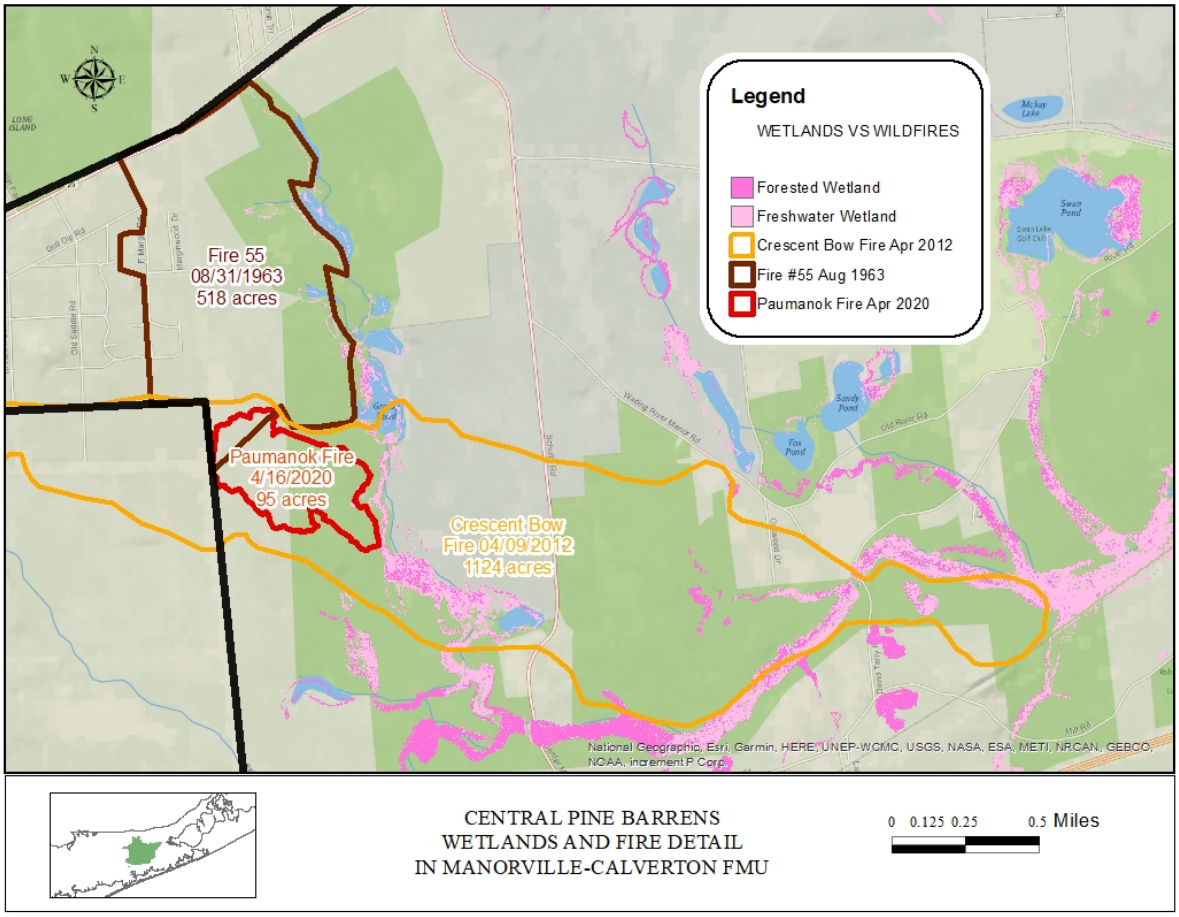


Figure 3.13 Wildfires in 1963, 2012 and 2020 Showing Wetlands Helping to Restrict Fire Spread

Freshwater and tidal wetlands are both susceptible to and experiencing non-native plant invasions, and one species stands out: the non-native and invasive Common reed (*Phragmites australis*). This species can rapidly form dense stands of stems in both inland freshwater and tidal wetlands. Phragmites develops into a thick and tall (10 feet) monoculture that chokes out native plants and creates high fuel load. Prescribed fire is part of eradication control actions, often used to clear the treatment area of the abundance of emergent vegetation in order more easily and readily advance mechanical, hand removal or other treatments of its rhizomatous root system.

<u>Standard Fire Behavior Fuel Models for Forested, Freshwater and Tidal Wetlands (Scott and Bergen 2005):</u>

- Forested Wetlands and Freshwater Wetlands:
  - Moderate Load, Humid Climate Timber-Shrub: TU2
  - Moderate Load, Humid Climate Timber-Grass-Shrub (Dynamic): TU3
  - Low to High Load Humid Climate Grasses (Dynamic): GR3 / GR8 / GR9 (with Phragmites)
  - Open Water: NB8

- Tidal Wetlands:
  - Low to High Load Humid Climate Grasses (Dynamic): GR3 / GR8 / GR9 (with Phragmites)
  - Open Water: NB8

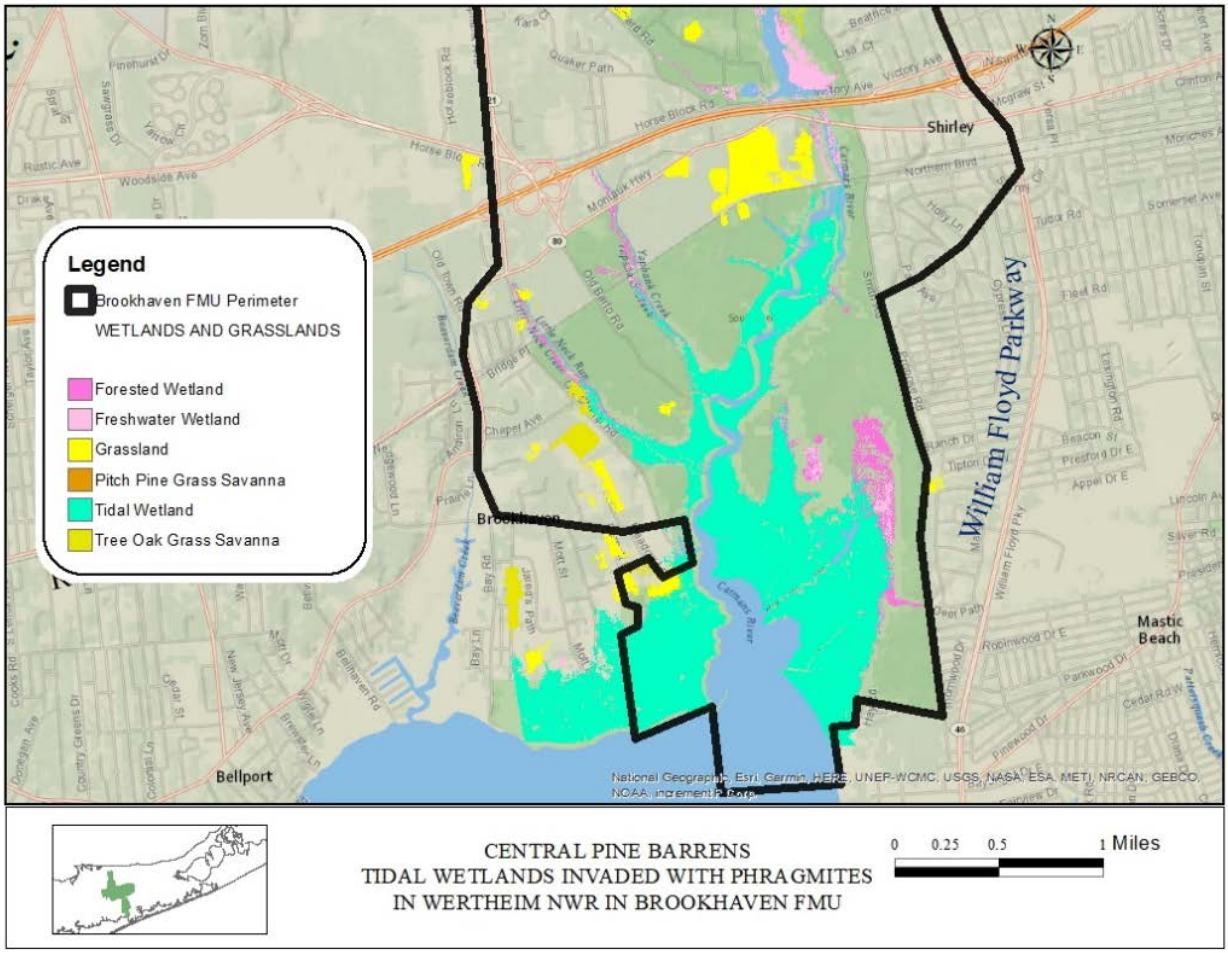


Figure 3.14 Grassland and Wetland Communities within Wertheim NWR

The remaining 28% of the Central Pine Barrens consists of developed lands and roadways; other riparian areas; landscaped lands; lands with exotic vegetation; agricultural lands; otherwise, barren lands (e.g., former sand mines) or open water (Figure 3.15). While these are not wildland fire habitats, a large percentage of the urban or developed areas are within the wildland urban interface and contain wildland fuels.

<u>Standard Fire Behavior Fuel Models for Non-Burnable Communities (Scott and Bergen 2005):</u>

- Urban/Developed: NB1
- Agriculture: NB3
- Open Water: NB8
- Bare Ground: NB9

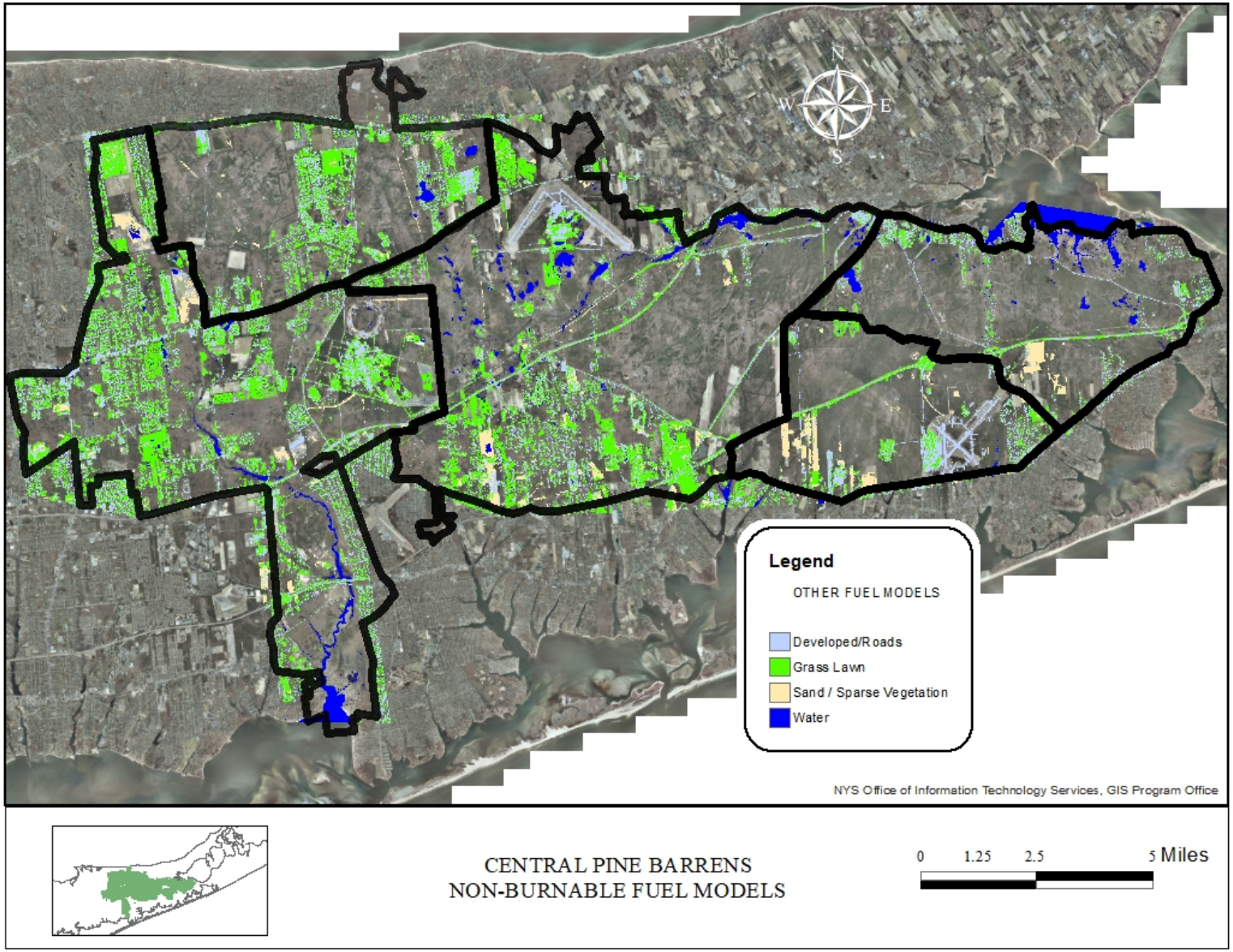


Figure 3.15 Non-Burnable Fuel Models

4. Management Alternatives to Prescribed Fire

There are alternatives to prescribed burning for purposes of land management in the Central Pine Barrens. This plan encourages prescribed fire as the most efficient and economical land management practice for ecological benefit as well as the reduction in catastrophic wildfire risk and the reduction of fuels on the landscape. The plan recommends prescribed fire use as a management tool in a holistic management program in concert with a variety of additional tools and techniques. This section aims to define and discuss some other management actions or alternatives that could possibly be considered to achieve ecological and wildfire risk reduction goals and discusses the drawbacks of using those management techniques alone if prescribed fire was not implemented. One alternative is to take no management action(s) the implications being that the ecosystem's evolution over time would be modified and influenced by natural disturbances as well as increasing anthropogenetic stressors such as habitat fragmentation, development, invasive species and climate change. A second alternative is to manage the forests and grasslands using just mechanical or chemical treatments as a substitute for prescribed burning. The third alternative is to allow wildfires to burn in a managed manner that would not threaten people or infrastructure and at the discretion of the local fire professionals in order to provide fire disturbance on the landscape as opposed to using prescribed burning.

Advancing A No Management Action

Whether an intentional or passive action, advancing a no management action is in fact a management decision. This decision means that there are no fire or other land management actions conducted outside of full suppression of all wildfires. Ecosystem disturbances would be limited to weather events, climate related changes, unplanned human or naturally ignited wildfires, invasions of non-native flora and fauna and native shrub and tree succession within grasslands. The net result would be decreased plant and animal diversity; habitat homogenization; continued declines in ecosystem health; increased susceptibility to disease and pests and ecosystem services. Basal area and density of tree stems per acre would increase in pine dominated stands and understory fuels would increase both in total fuel loading and fuel continuity. With the increases of tree density and understory fuel conditions, wildfires that are not immediately contained would be expected to become high severity, catastrophic stand replacement events. As such the forests would become more receptive to large scale wildfires. These wildfires would continue to threaten communities and neighborhoods that are adjacent to or embedded in the Central Pine Barrens. Besides the increased and increasing wildfire risk, the no management action would promote forest succession into alternative stable states comprised of mesic climax species creating communities that result in loss of primary succession, secondary succession and pioneer and niche species habitats that holistically and uniquely create the Central Pine Barrens ecosystem.

The no fire management action except for suppression is deemed as an unacceptable alternative if these fire dependent Pine Barrens are to be conserved for the future and would be contrary to the goals of the Long Island Pine Barrens Protection Act of 1993. Management in a disturbance dependent ecosystem is necessary to protect, sustain and promote a healthy diverse ecosystem with high levels of ecosystem services and to improve human safety for the protection of life and property through the reduction in wildfire risk and wildfire severity.

Mechanical and Chemical Treatments

Mechanical and chemical (herbicide/pesticide**)** treatments can be employed as a partial, but not complete, substitute for the disturbance provided by burning. The alternative considered here would be to apply mechanical and chemical treatments exclusively without prescribed burning. Mechanical treatments have been the primary management action in the forested areas of the Central Pine Barrens, especially since the 2014 onset of southern pine beetle outbreaks. Mechanical and chemical treatments do not mimic fire, but if used properly can reduce available fuel loading, disrupt fuel continuity as well as alter fuel arrangement and density, thereby diminishing the risk of wildfire. These treatments, advanced without prescribed fire, can create fuel breaks to reduce the risks of wildfire spread to human infrastructure and to natural habitats. But mechanical fire break construction and installation also has a propensity to facilitate the development of shrubby volatile thickets and the establishment of invasive plant species thus requiring continued and long-term monitoring and management. Mechanical and chemical treatments, especially if utilized together, can also be done on broadcast basis, once again reducing wildfire risks by re-arranging fuel structure, arrangement, composition, continuity and availability. But as in the case with firebreaks, they require frequent re-treatment due to first and second successional growth return.

Mechanical and chemical treatments can also be used alone to thin and reduce vegetation however neither of these practices readily consume organic matter as immediately as fire does. This serves as a challenge in maintaining the low organic matter xeric ecosystems on which the Pine Barrens depends. In cases where cut fuels are removed from the treatment site (timber harvest or just removal) fuel loading can be decreased. There is no commercial market for these removed forest products, so there is a substantial, and unfeasible at scale, direct cost in paying for removal. Additionally, significant residual material remains on site after mechanical and chemical treatments These residuals remain on site, often blocking sunlight to the forest floor, while serving as additional available fuels contributing to wildfire risk. Pitch pine regeneration post disturbance requires the organic materials to be removed exposing the desirable mineral soil seedbed. In mowed grasslands these residuals create a thatch layer that serve as a barrier to native grass and forb seed germination as well as a deterrent to ground foraging and nesting animal species.

Mechanical and chemical treatments are generally more effective than fire to reduce or eliminate non-native species. This may be because prescribed fires generally do not reach the high severity level needed to consume seeds or roots in organic soils. In some cases, it is because the non-native plant benefits from fire. But overall mechanical and chemical treatments are beneficial and effective tools in removing invasives.

A benefit to mechanical and chemical treatments is that they can be applied in close proximity to human infrastructure including communities, homes, businesses and transportation corridors without risk of fire impingement or nuisance smoke.

However, as a standalone alternative to prescribed fire, mechanical and chemical treatments come with a greater cost and risk. They are considerably more expensive in treatment costs per acre than prescribed burning. Widespread chemical treatments can cause chemical pollution to soils and water resources that are highly valued and sensitive in the Central Pine Barrens system. Widespread mechanical disruption to soils can encourage erosion and lead to damages to natural and cultural resources. Environmentally, chemical and mechanical treatments do not effectively or identically replicate natural processes. The use of mechanical and chemical treatments alone as an alternative to

prescribed burning would not assure the perpetuation of the goals of the Long Island Pine Barrens Protection Act of 1993.

Mechanical and chemical treatments are critical actions in some locations as a preparatory step in the process of restoring areas that have suffered from lack of natural disturbances (such as fire) before prescribed fire can safely and effectively be employed. These treatments are necessary before prescribed burning to modify the fuels to ensure that prescribed fires are implemented in a controlled and safe manner that have a high likelihood of meeting restoration goals and objectives to improve ecological health and reduce wildfire risk and fuel. Mechanical and chemical treatments are often used immediately before and after prescribed burning. Before burning they can reduce available fuel loading and arrangement making prescribed burns safer and easier. After burning, mechanical or chemical treatments may be desirable, and more effective, due to increased ease of access to conduct treatment, reduction or top killing of invasives, consumption of existing fuels, making invasive species more visible for direct treatment, and making species more vulnerable to mechanical and chemical toll impacts after the stress endured through fire. When chemical treatments are identified as a necessary tool their use is encouraged as part of a program to be used on a targeted, low volume, and specific basis and not as a wide scale broadcast independent management technique.

In summary, mechanical and chemical treatments are necessary and effective management tools, with valid and valuable situations in which they are implemented, but neither are a standalone alternative to prescribed fire. Both will have the greatest benefit to restoration and maintenance when used in concert with prescribed fire.

Wildfire

Wildfires, whether naturally or human ignited, have in the past been common on the landscape and serve as a natural alternative to management ignited prescribed burns to create needed disturbance in this fire dependent ecosystem. It can be safely said that without wildfires there would have been no significant fire disturbance in the Central Pine Barrens in the past 90 years. The Central Pine Barrens landscapes were formed and shaped by wildfire to such a degree that the health, diversity and function of this ecosystem relies upon routine and recurring fire on the landscape. The occasional fires that are high severity serve to maintain patchwork mosaic dynamic, reduce canopy, tree and understory densities and remove the organic soils exposing a mineral bed. With the crown, understory and organic matter reduced, pitch pine and other sunlight dependent species can germinate and thrive, and the cycle of fire dependent forest succession continues on. Wildfires that remain small in size due to rapid direct suppression may create small pockets of high severity impacts. However, it is important to note that these small, scattered pockets of high severity disturbance alone will not maintain the proper balance within this 106,000-acre fire dependent ecosystem. Major unsuppressed or suppressible large wildfires of 100 acres or more wildfires, have been and remain the key to maintaining this unique ecosystem.

The analysis of 1930 through 2020 Central Pine Barrens wildfire history shows a disturbing trend that has developed in the past 20 years. Multiple large fires occurred in every decade from the 1930's through the 1990's which shaped and maintained this landscape during this time period and likely for hundreds of years prior. Yet in the past two and a half decades there has only been one fire of 100 acres or larger (100 acres in timber is the national minimum size for a "large" fire). This limited large wildfire disturbance and Fire Return Interval departure is inconsistent with the fire history of these lands and deprives the forest of needed fire disturbance. The additional implication is that the lack of fire allows for a continual, unnatural increase of fuel loading and increased basal area (tree) density. This FRI

departure and the increased loading and continuity of available fuels only leads to the increased potential for more catastrophic wildfires.

Numerous factors contribute to this decline in frequency of large wildfires. The high number of volunteer fire departments in the region and their rapid and effective direct initial attack of emerging fires has virtually eliminated large landscape fires. Use of cellular phones has skyrocketed in the past 25 years, and rapid detection and reporting of fires by the public also contributes to the resulting minimal acres burned. Additionally, greatly increased fragmentation through roads and development in and around the Pine Barrens area have served as impediments to fire spread and increased access for rapid fire suppression.

Direct attack has been the initial wildfire response standard in the Central Pine Barrens area for the past few decades. While this strategic choice has resulted in quick extinguishment of wildfires and significantly reduced the fire footprint on the landscape, there are a number of inadvertent and concerning consequences.

The first, as also observed throughout the United States, is that decades of direct attack has minimized needed fire disturbance and allowed for a continued increase of fuel loading on the landscape. Direct attack minimizes fire acreage. Both nationally and in Suffolk County this has made forests more vulnerable to future fires. Another local tactic that has promoted accumulation of available fuels is sending fire suppression apparatus deep within the fire perimeter to suppress burning materials. This risky tactic to fire fighters and equipment is regularly employed even though there may be occasions where these burning fuels and fire behavior do not threaten the ability to contain or control the wildfire through more indirect suppression methodology that could be more safely and equally effectively employed at current road and fire break locations. These direct attack tactics contribute to the buildup of unburned fuels in the forest. If fuels were allowed to burn inside of fire perimeters, when they pose no threat to perimeter fire control, it would reduce overall fuel loadings and build a mosaic of burned and unburned fuels on the landscape. That outcome would be beneficial to improve forest health and reduce future wildfire threats in the.

Second, direct attack methods, especially using local brush trucks, also known as stump jumpers, have regularly been demonstrated as costly both to human safety and equipment. These vehicles frequently get stuck or impacted by trees exposing firefighters to risks of entrapment, blunt force trauma and burn over. Direct interior attack of all burning fuels deep within a wildfire has also caused firefighter exposure to other hazards including cumulative exposure to smoke. Costly apparatus damage, removal assistance, firefighter injury and adverse impacts on forest resources (i.e., erosion, non-native species invasions) can be minimized by increased use of indirect attack tactics at the discretion of the local fire professionals.

More frequent use of an indirect attack strategy can increase acres burned thereby providing desirable fire disturbance to the Pine Barrens habitat. Interior fires can be allowed to burn out and have positive ecological and fuel reduction effects when using indirect suppression can be used safely without unacceptable risk to the public. Further, by indirectly controlling fires against existing natural and man-made barriers (i.e., road/train track/ ag field) equipment-associated damage to soils and vegetation can be limited while still achieving beneficial fire effects.

Much like the alternative of mechanical and chemical treatments, to best protect public resources, prescribed burn planning and implementation work must be conducted with significant consideration of wildfire suppression. This is especially important as it is impractical to anticipate that prescribed burn

will be conducted over the entire 106,000 acres of the Central Pine Barrens due to the costs involved in planning, staffing and WUI considerations. Further, it is also impractical, due to WUI and public health and safety issues to believe that large, prescribed burns can be conducted under conditions that will mimic large fires with the resulting high severity disturbances that are needed to maintain the health and diversity of this ecosystem. Nevertheless, it is practical and prudent to proactively utilize prescribed fire in a manner that reduces wildfire risks and impacts to communities, homes, businesses, subdivisions, transportation corridors and other infrastructure before they are threatened by wildfires. It is clear that combinations of mechanical thinning and prescribed burning implemented in anticipation of future wildfires have provided key benefits by directly reducing wildland fire threats to many communities nationwide and have actually prevented loss during large wildfires.

The increased use of indirect wildfire suppression tactics and the reduction of interior suppression actions provides a number of benefits, the most important being improving firefighter safety, reducing equipment repair and recovery costs and lowering future wildfire threats. Additionally, indirect tactics would also serve the dual purpose of improving the natural condition of the Pine Barren ecosystems by increasing burned acres and increasing a mosaic of fuels on the landscape.

Utilizing a holistic fire program that includes prescribed fire, coupled with mechanical and chemical treatments, would provide a higher likelihood of successful, expedient and safer wildfire containment. Further, using prescribed fire to reduce wildfire risks creates a positive feedback loop that creates opportunities for wildfire suppression resources to adopt more indirect fire tactics, thereby allowing more and larger fires to burn on the landscape.

Collaborative training, exercises and shared post wildfire after action review “lessons learned” among Central Pine Barrens Wildfire Taskforce member agencies are suggested to further explore expanded adoption of indirect attack methods.

Combined Strategies

The ideal natural resource and fire management program for the Central Pine Barrens unifies mechanical, chemical, and prescribed fire treatments to protect communities from wildfire and improve, restore, and maintain ecological health through time. In locations where WUI protected zones have been established such operations would then allow firefighters to engage more frequently in indirect suppression methods thereby permitting wildfires to perform their valuable role more safely in maintaining the Central Pine Barrens diverse landscapes.

Section 7 will describe priorities for prescribed fire treatments and provide examples where prescribed fire, mechanical, and chemical treatments are used in concert in order to recognize synergistic effects of these collective tools to improve fire fighter and public safety, ecological health and reduced wildfire risk. Of the projects proposed, a majority are designed to reduce the threat of wildfires extending into communities and subdivisions, while providing important ecological restoration and management benefits simultaneously. As these projects are completed and maintained using both mechanical and prescribed fire treatments, they will create fire protection zones for adjacent and embedded communities. They will create fuels buffers that will allow some indirect suppression actions to be taken without creating additional hazard to firefighters and the public. They will also potentially provide safety zones for firefighters as well as anchor zones for burnout operations.

5. Legal Considerations

Law and Regulatory Requirements and Compliance

Compliance with federal and state regulatory requirements is necessary prior to advancing any management activity associated with the prescribed fire program. The following are the pertinent regulatory requirements with which compliance must be obtained prior to implementing prescribed fire and associated management treatments:

- NYS 6 NYCRR Chapter II (Lands and Forests), Part 194 (Forest Practices)

  All prescribed burn plans will comply with the New York Code of Rules and Regulations Title 6, Department of Environmental Conservation Chapter II, Lands and Forests, Part 194 Forest Practices. This regulation defines prescribed fire on State and other lands under the jurisdiction of the Department as well as non-department lands and describes the requirements of burn plans and review and approval of burn plans. It also describes permits, reporting requirements and enforcement of the regulations as well as the requirements for protection of adjoining property.

- State Environmental Quality Review Act (SEQRA) - NYS ECL Article 8 - 6 NYCRR Part 617

  In order to fully comply with Title 6 NYCRR Part 617, the New York State Environmental Quality Review Act (SEQRA), this plan and all lands not presently covered by SEQRA analysis, review and findings will undergo the required SEQRA review process with respect to the actions proposed in this Plan. The areas that will need SEQRA review for prescribed fire and fire related mechanical / chemical treatments have all been mapped and identified within the individual Fire Management Area descriptions.

  The land management plans that have already been deemed compliant with SEQRA include all the DEC lands covered by the Fire Management Plans for Rocky Point, David Sarnoff, and Peconic Headwaters Pine Barrens State Forests and Eastport Conservation Area and Pine Meadows County Park (see Table 5.1). The federal areas of Wertheim National Wildlife Refuge and Brookhaven National Lab have met federal compliance. All other DEC lands, other lands owned by New York State, lands owned by Suffolk County and the Towns will need SEQRA review.

- NYS ECL Article 57 – Long Island Pine Barrens Protection Act

  The Long Island Pine Barrens Protection Act and the Central Pine Barrens Comprehensive Land Use Plan (CLUP) both recognize the importance of and encourage the use of prescribed fire and the restoration of a fire regime to the Central Pine Barrens. Therefore, this plan conforms to the Act and the CLUP.

- Miscellaneous Laws

  The following state and federal laws may be applicable if endangered or threatened species, wetlands or cultural resources are determined either to be present on or adjacent to areas being considered for prescribed fire management during future development of an area-specific prescribed fire burn plan. In such cases, the appropriate coordination and regulatory review will be undertaken in conjunction with NYSDEC, which administers the New York State Environmental Conservation laws listed below, and the State Office of Historic Preservation, which is responsible

for conformance with the National Historic Preservation Act and New York State Historic Preservation Act.

- NYS ECL Article 11 - Endangered Species Act
- NYS ECL Article 24 - Freshwater Wetland Act
- NYS ECL Article 25 - Tidal Wetlands Act
- National Historic Preservation Act - Section 106 and NYS Historic Preservation Act – Section 14.9. Requires cultural review of management for any actions being taken that are publicly funded. As a state entity conducting management on public lands with public funding, State Historic Preservation office review will commence prior to any management action to ensure protections and conservation of any cultural resources.

Table 5.1 Brookhaven Fire Management Unit Public Land Ownership

Land Unit	Year	Agency	Management Plan
David Sarnoff Pine Barrens State Forest	1995	NYS DEC	David Sarnoff Pine Barrens State Forest Management Plan
	2005	NYSDEC	Sarnoff Demonstration Site
		CPB Comm	Land Use Ecological Services Management Plan for David Sarnoff Preserve
Peconic Headwaters Pine Barrens State Forest	2007	NYSDEC	Peconic Headwaters Management Area
Rocky Point Pine Barrens State Forest	2008	NYSDEC	Rocky Point Pine Barrens
		CPB Comm	Land Use Ecological Services Management
			Plan for Rocky Point Pine Barrens State Forest

- Air Quality Controls:

  New York Codes, Rules and Regulations, Title 6 - Environmental Conservation, Part 215 Open Fires, exempts prescribed burning done in accordance with Part 194.

  NYS Law 6NYCRR Chapter II (Lands and Forests), 194 (Forest Practices) – Section 194.9 of the regulations in regard to permits states that prescribed fires and burns for which authorization is granted by NYSDEC will not be subject to the permit requirements of Article 19 of the Environmental Conservation Law that addresses Air Pollution Control. Section 194.9 also exempts “prescribed natural fires” from this permit requirement. Prescribed Natural Fire is the obsolete NWCG term that meant the management of naturally occurring fire (e.g., lightning fires) that are allowed to continue to burn under a limited suppression strategy. NWCG now merely says that limited suppression or point protection is just a strategic option for wildfire management, just as full suppression of a naturally occurring fire is a strategic option.

- Memorandum of Understanding/Permission to Implement Management:

  The Commission aids in the protection and management of the Central Pine Barrens, but does not itself, own any of land. Accordingly, prescribed burning and pretreatment activities can only advance with permission from the landowner. The following are the permissions by agency level that are necessary to secure.

Federal Entities: Legal Commission participation on prescribed burns on federal lands must be in accordance with agreements with US Department of Energy/Brookhaven National Laboratory and US Fish and Wildlife Service for Wertheim National Wildlife Refuge.

State – NYSDEC: During the duration of the Commission's Prescribed Fire Contract, the Commission is authorized to serve as lead agency in advancing prescribed fire and other related management operations on NYSDEC lands without further permissions, as the legal authority to conduct such management on NYSDEC lands is provided under the term of the Commission's Prescribed Fire Contract. Upon expiration of this contract (expected in March 2023), a formal MOU/cooperative agreement will need to be established with NYSDEC in order to advance prescribed fire management.

New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP): While a state agency, a separate MOU/cooperative agreement is required to conduct management activities on NYSOPRHP land.

Local Agencies: For the Commission to serve as the "lead agency" in the implementation of prescribed fire management activities on Suffolk County lands and lands owned by the Towns of Riverhead, Southampton and Brookhaven lands, the Commission will need to obtain a separate MOU/cooperative agreement with each of these entities. These agreements with local agencies will also identify the legal and/or oversight roles of the Fire Marshal's Offices of Suffolk County or the respective Towns.

6. Planning and Implementation Considerations

Prescribed fire management is an involved, long term, and multi-phased process. It requires collaborative planning with landowners and managers and development of clear goals and achievable objectives. Site and monitoring inventories are conducted to provide baselines on current conditions. Where necessary pre-fire vegetation treatments such as thinning, shrub reduction, fire break and fire line construction may be undertaken in advance of prescribed fire. These pre-fire treatments are conducted and then burn plans are developed to reflect the actual conditions. Burn plans are then reviewed for appropriate approvals. It is necessary to put fire on the ground within 6 – 18 months of the treatments. Each phase is an integral component that helps ensure that prescribed fire operations are advanced in a safe and controlled manner while achieving the desired outcomes. The following details more comprehensively the components and considerations for collaborative planning as well as pre-vegetation treatment and burn plan development and implementation within the Central Pine Barrens.

6.1 Collaborative Landscape Management

Collaborative landscape management is critical to management success within the Central Pine Barrens as these lands are owned by numerous federal, state, towns, local agencies and organizations whose mission is to protect and/or help manage the lands and waters of Central Pine Barrens. Such is the case with the Commission, a State Entity that does not own any lands proper within the Central Pine Barrens but is authorized to help these public agencies in land use and ecosystem management. Advancing collaborative landscape management utilizes each agency's unique strengths, virtues, and resources to advance ecosystem management and public health protection across the Central Pine Barrens which is important as these ecosystems extend beyond political jurisdictions.

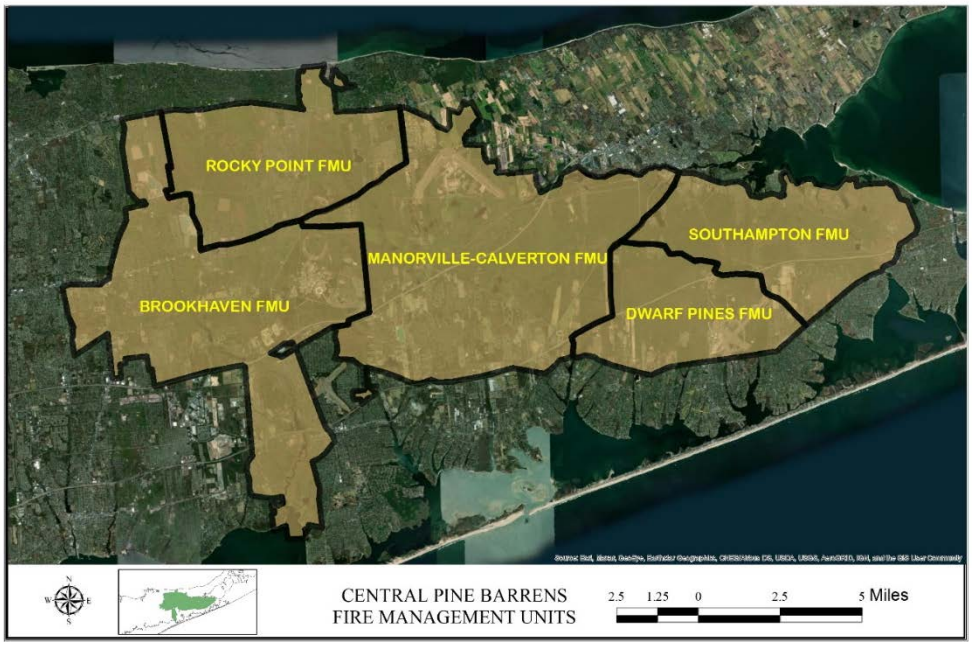


Figure 6.1 Central Pine Barrens Fire Management Units

To strategically advance fire management planning and implementation across jurisdictions in a collaborative but manageable means, the larger Central Pine Barrens has been broken into five landscape Fire Management Units (FMU's, Figure 6.1). The boundaries of these units have been delineated in consideration of vegetive communities, predominant fuel type, fire history, urban development characteristics, geographic location, and definable boundaries and closely coincide with the 12 Central Pine Barrens Stewardship Units that were established by the

Protected Lands Council's Regional Management Plan. Comprehensive information on each of the FMU's is provided in Section 9 of this plan.

6.2 Pre and Post Treatment Plans

In addition to the actual implementation of prescribed fire, a suite of additional management actions may be required to take place before and after, prescribed fire operations. Depending on the scale and scope of these actions, a pre and/or post treatment plan may be created for discussion, refinement and approval in collaboration with the landowning agency either concurrently with, or preceding the delivery of, a prescribed burn plan.

Alternatively, some of the necessary preparatory or supplementary actions may be included within the prescribed fire burn plan itself, or as an addendum, for small scale needs of limited scope. The types of additional pre- and post-management actions include, but are not limited to, monitoring, mapping, site documentation, endangered and threatened species planning, invasive species treatment, vegetation manipulation, fuels removal or manipulation, and fire break/control line installation. Generally, pre- and post-treatment plans will include a review of the spatial and temporal scale and scope of the needs, the methodologies employed, a delineation of the goals and objectives sought to accomplish, and a justifications section addressing these items.

Initial mapping, monitoring, and documentation of site and ecological conditions and rare species and vegetative communities will be necessary for the development of the prescribed fire burn plan itself, as well as in the identification of needs for pre- and post-treatment. The initial mapping, monitoring, and documentation needs will be forwarded as part of the required baseline work and included in introductory proposals for management work in specific areas with landowning agencies. These efforts will allow for documentation and the development of knowledge and understanding regarding the current and desired conditions at the site. Fundamentally, the monitoring and mapping will guide and influence the development of the prescribed burn plan itself as to where, how, and why the operations will take place in the designed, planned, and specified format. The monitoring and mapping will serve as a baseline by which to analyze the results of prescribed fire treatments in order to adapt future stages and management and to continually refine procedures and tactics. This provides the opportunity to adaptive management by maximizing ecological benefits and ensuring management objective attainment in other locations and in future burns and preparatory work.

Rare species, both floral and faunal may be present at different sites which have been identified to receive prescribed fire management treatments. Effectively and appropriately managing the habitat for these species, and in the presence of these species, may require a variety of specialized treatments, timeframes, techniques, buffers and other specifications. Examples include species like northern long-eared bat (*Myotis septentronalis),* tiger salamander (*Ambystoma tigrinum),* coastal barrens buckmoth (*Hemileuca maia* spp. 5*),* frosted elfin (*Callophyrus irus),* birds-foot violet *(Viola pedata* var. *pedata)* and many other rare and threatened plant and animal species associated with the Central Pine Barrens and Coastal Plain ponds. As part of site specific actions including identification, prioritization and planning, a thorough review of all rare and threatened species that are currently or were historically present at sites will be conducted as part of any new State Environmental Quality Reviews (SEQR) conducted for specific sites in the future as well as during pre-fire vegetation treatment and burn plan development. Specific techniques, timeframes and management considerations will be employed in the planning and implementation processes to best consider, conserve, restore, maintain and improve the populations of these species and their critical habitat as a fundamental component of the holistic monitoring and

management program including prescribed fire and associated operations. Some examples of the tools and techniques considered and potentially employed at different sites and in different scenarios include: providing buffer zones around critical habitat during specific times of year or around certain features like ponds and wetlands; placing restrictions on equipment use around certain ecological features; ensuring adequate provision and proximity of refugia for various populations; targeting appropriate fire behavior to achieve objectives consistent with species and habitat management goals and concerns, along with specific weather parameters and seasonality. The site-specific management and planning efforts will identify and consider particular species and vegetation communities and will be informed through research, site-specific environmental assessments including New York State SEQR review, tailored burn plans and pre and post management monitoring protocols, and close coordination with NYSDEC as well as potential coordination with other applicable agencies for different projects including New York Natural Heritage and United States Fish and Wildlife Service.

Within the Central Pine Barrens, pre-fire vegetation treatment is necessary as the first step of restoration as many of the focal areas have received little or no management in recent history. The baseline surveys consisting of mapping and monitoring will outline the pre-treatment requirements for vegetation and fuels as well as installation of fire breaks. This pre-treatment will often be necessary in many units in order to implement fire in a safe, prescribed and controlled manner while maximizing the ability to meet objectives.

Pre-treatment for vegetation to achieve fuels manipulation and rearrangement encompasses a wide range of activity types. Heavy or light equipment with a variety of attachments including masticators, mowers, brush hogs, rakes, and blowers may be employed to reduce, mulch, relocate, distribute and/or disburse fuels. Alternatively, handheld and walk behind power equipment or tools may be employed for some of the vegetation and fuel modification tasks as well. For particular species of concern, especially those that are fire tolerant or spread is facilitated by fire, chemical treatments may be used on occasion using best management practices to limit off target impacts.

These techniques may be used singularly and/or in combination to effectively reduce or alter the amount of smoke, heat, residence time and fire line intensity experienced during fire through conversion of particular fuel models and types to alternate, more favorable, and less extreme fire behavior producing models and configurations. These techniques can greatly increase safety, improve ability to meet ecological and fuel reduction objectives, while mitigating and reducing undesirable impacts, like smoke concentration and duration. For example, some of the more volatile and high fire intensity potential fuels, namely SH8 and SH9 (shrub) fuels models with high density, continuity, and ladder fuel presence can be reduced to more moderate timber litter and timber understory or lower-class shrub or slash/blowdown fuel models. These transitions can lead to significant differences in anticipated and actual fire behavior, safety and fire objective and goal accomplishment.

In general, certain identified management units may require some level of patch or holistic mowing or thinning to arrive at conditions where fire can adequately meet the objectives outlined for fire management in a restoration sense as well as working toward more maintenance fire management phases. In restoration phases greater emphasis is placed on structural and species type and density changes with concurrent fuel reductions, while in maintenance phases, objective emphasis is placed on controlling succession and recruitment by advancing moderate condition burns within larger acreages.

These same tools and techniques will be used to install fire breaks or fire control lines, and potentially feathering edges of burn units allowing for safe and controlled ignitions and conclusions to firing

operations. These fire breaks and control lines will be specified within pre-treatment or burn plans for individual burn units or blocks in a way that seeks to minimize environmental impact and maximize safety and controllability. These lines consist of linear segments where vegetation, and accumulated ground, surface, aerial, and ladder fuels are removed and/or reduced to assist in the containment and control of the fire. Fuel break and fire line size is dependent on adjacent fuel types and land uses and will be contextually analyzed and planned. For example, whenever possible historical fire breaks will be re-established to limit disturbance and fragmentation. Feathering edges involves the process of this fuel and vegetation thinning and reduction for more distance into the unit to deter higher intensity fire near the edges of the unit and to allow for any potential canopy spread or single tree torching that may occur within the unit's interior to be highly suppressed near the unit or block boundaries.

Preparatory management and monitoring work will allow the identification and delineation of invasive species populations. Theses populations may need either pretreatment or post treatment to effectively address, contain, and control through adequate management actions, including both mechanical and chemical methods. Some invasive species have the ability to rapidly expand and colonize sites immediately after the competitive restraints from adjacent vegetation and communities are relieved through fire. It is important in these instances to perform control, eradication, and removal efforts prior to fire ignitions in these circumstances as well as to begin follow up treatments in the near term after fire implementation. Alternatively, other species are hampered by the acute impacts from the fire and serving to record and document their reductions based on fire intensity, severity, and residence time is vital in the development of an adaptive fire management program. The pre- and post-fire treatment plans will specify needed visits, work, and intervals required for management activities and follow up aimed at controlling residual invasive species presence and germination.

Also, preparatory management of sites with special conditions may also be necessary to address a particular need in order to advance prescribed fire. An exemplative situation is the mass standing dead and downed, standing and suppressed pines that have been impacted by southern pine beetle. Prior to management, inventory and vegetation treatment may be necessary to advance management in a safe and efficient manner not only for the onsite fire crew but also to proactively reduce smoke and mop up concerns associated with ignitions in large fuel sizes.

Accordingly, effective planning and implementation before, during, and after the fire is a hallmark of effective and efficient adaptive prescribed fire and natural resource management. The plans coupled with prerequisite and subsequent monitoring form baselines and reference points for the refinement of future decision making and continuing to improve the effectiveness and the efficiency in which the natural resource goals are identified and met and the techniques employed to achieve them are analyzed and refined.

6.3 Prescribed Fire Plan Scope, Development, Coordination and Components

The burn plan development and approval process are both staff and time consuming. These investments can be magnified when holistic management requires management of target ecosystems across jurisdictional boundaries. To help mitigate these challenges and meet programmatic goals, two burn plan formats as described below will be utilized to facilitate the implementation of prescribed fire operations. Plan modification procedures are also identified below in anticipation that there will occasionally be a need to modify these long-term management plans.

Landscape Burn Plans

Landscape burn plans will be the most frequent type of burn plan developed. It is written at a landscape level where a single burn unit will be broken into multiple burn blocks instead of writing and submitting duplicate plans for small adjacent or similar habitat burn units. Upon landscape burn plan approval, specific prescribed burns will be conducted using the landscape plan criterion. A specific Incident Action Plan (IAP) will be written for each burn day that will describe staffing and all implementation aspects.

A benefit of using this landscape management approach is that within one landscape burn unit there may be multiple landowners but the planning process for the entire burn unit is consolidated and efficient (provided cooperative agreements are in place), allowing for efficient cooperative planning and implementation to take place. Incorporating this progressive landscape burn plan development approach streamlines burn plan development and directly aligns with FMU's planning strategy by prescribing cooperative landscape level management of similar fuels and features within a FMU. Prescribed Fire Enhancement Zones are an example of landscape burn plan use, and establishment of such zones in a landscape area allows for implementation flexibility to achieve both ecosystem related improvements and urban interface goals.

Target Specific Burn Plans

Target burn plans may be written for a small project when there is a new need or special issue that cannot be addressed within a larger landscape burn plan. Such burn plans can be written for special treatment needs for a specific location that cannot be amended to an existing landscape burn plan.

With both plan types, they will be written in a manner that addresses:

- Management goals and objectives especially firefighter and public safety
- A pre-planning and post-planning analysis and determination of burn complexity and requisite Burn Boss qualification level
- Current and anticipated site conditions during the active shelf life of the plan
- Descriptions of each fuel type within their designated burn unit
- Fire prescription parameters that are to be applied to the landscape by fuel types
- Predictive fire behavior runs for each of the fuel types reflecting the prescription parameters.
- Minimal staffing needs
- Pre- fire vegetation treatment and preparation work needs
- Notification requirements
- Other Prescribed Fire Plan elements required by NYS Part 194.3 or NYS Part 194.5

It is encouraged that plans are written for periods of up to 10 years in order to minimize the demands on the review process, provided that is acceptable to the reviewing and approving officials. The burn plan will include a description of pre-burn preparation work in the pre-burn considerations section of the plan, but this is limited to describing such components as pre-burn line preparation. Broadcast mechanical and chemical treatments or large-scale unit thinning projects are not components of a burn plan description and will need to be described in a separate pre-burn vegetation treatment plan as noted in the section above.

Burn Plan Development and Approval Process

The burn plan development and approval process will generally involve the following steps depending on the lead agency that is developing and implementing the plan.

- Cooperative site selection
- Landowner approval to begin planning for selected site
- Prescribed burn project file established
- Pre-treatment assessment
- Pre-treatment plan development
- Pre-treatment implementation
- Preliminary complexity determination
- Burn plan preparation in coordination with stakeholder and disciplines
- Final complexity determination
- Burn plan technical review
- Burn plan finalized with technical review incorporated
- Landowner review and approval of plan (if not NYSDEC owned lands)
- Executive Director approval (if being developed by Commission)
- Burn plan submitted to NYS-DEC for review and approval
- Approved plan with signatures provided to the Commission for storage in Central Pine Barrens management database

Central Pine Barrens Commission (CPBC) developed burn plans will be drafted by a qualified burn boss or by individuals who have completed the National Wildfire Coordinating Group (NWCG) RX-341 Prescribed Fire Plan Preparation course (or equivalent) and will seek to follow the NWCG prescribed burn plan format, as appropriate. Using this format ensures that burn plans developed for NYSDEC owned lands meet 6 NYCRR Part 194.3 requirements as NWCG plan standards meet or exceed these state requirements. For burns to be conducted on non-NYSDEC lands, the burn plans may be written to meet or exceed 6 NYCRR Part 194.5 using a modified NWCG format that reduces the required plan elements concurrent with the lesser requirements of Part 194.5.

Using the NWCG format includes the use of its burn complexity analysis system, a fundamental component of that format. This system incorporates evaluations of risk and technical difficulty for eleven elements that are completed at the preliminary and post plan phases. This process is the foundation for standardized and effectively thorough burn plan writing. The preliminary evaluation requires the plan preparer to look at the apparent risks and rate them as low, moderate, or high. As an example, when evaluating the smoke management element during the preliminary evaluation the plan preparer may describe that a large subdivision of private homes is immediately adjacent to the burn unit and that smoke issues would call for a high preliminary risk rating for the smoke management element. The goal is to then establish actions or items during the plan preparation process that mitigate and reduce this high preliminary risk rating. In this example during preparation of the plan, the preparer would include actions or elements that would reduce the smoke development and exposure risk. Actions might include items like using only backing fires with immediate and complete mop up behind the advancing backing fire flank, prescribing wind vectors that prevent smoke from entering the developed areas and having additional resources on-site during burning operations to immediately stop undesired smoke generation. With these items included in the plan during the post plan evaluation, the preparer may opt to lower this risk factor rating from high to low and document why the rating was

lowered. In essence this complexity analysis system is not just a rating system but is a fundamental blueprint identifying what needs to be incorporated into the burn plan.

Once the plan is drafted and prior to agency administrator approval, a technical review will be conducted by a qualified or previously qualified burn boss at an experience level equal to or greater than the complexity of the plan being reviewed. The purpose of this review is to provide an additional independent perspective at the burn boss level. Accordingly, the plan preparer cannot serve as the technical reviewer of their own plan. The technical reviewer should have local knowledge of the area and / or experience in burning in similar fuel types. The results of the technical review will be documented in the burn plans Appendix B, Technical Reviewer Checklist. The plan preparer will consider all comments and suggestions from the reviewer and incorporate them into the final plan as appropriate. The plan preparer must document in Appendix B what changes were made to the plan based on this review or the rationale for not accepting recommendations.

For burn plans written by the Commission, the Executive Director will be the Agency Administrator approving the plan and forwarding it into the NYS-DEC for state directed review and final approval. For plans written for non-NYS-DEC owned lands, the plan must be first reviewed and approved by the landowners designated official prior to forwarding to NYS-DEC.

At present (2020), review of all burn plans (regardless of landownership) must be completed at the NYS-DEC Region 1 office level. In accordance with 6 CRR-NY 194.6 and 194.7 plans written for non-department (non NYS-DEC) lands may be approved at the NYS-DEC Region 1 level. For burn plans on state lands under the jurisdiction of NYS-DEC, after review at the Region 1 level, plans will be forwarded to the NYS-DEC Albany HQ Central office for additional review and approval. Burn plans prepared by other cooperating agencies (such as Brookhaven National Lab and Wertheim National Wildlife Refuge) will meet their specific agency standards, requirements, and approval processes.

Modifications to the Plan

There are a variety of reasons why a previously approved plan may need to be modified. In accordance with 6 NYCRR 194.3, a person or position can be identified as having authority to review and approve modifications to the plan. For plans on non-department lands (i.e., non NYSDEC), the Region 1 Regional Forester has the authority to authorize modifications. For plans on state lands under the jurisdiction of NYSDEC, the Forest Protection Fire Management Officer in the Albany Central Office is identified as the person who can review and approve plan modifications.
Reasons for plan modifications include but are not limited to:

- Alterations in fuels due to additional treatments, preparation work or growth / increase of fuels that changes modeling.
- Modifications to prescription parameters
- Addition(s) or removal(s) of limitations or constraints
- Modifications to address new or special needs such as non-native plant invasion
- Additional acres to burn that are consistent with previously approved landscape burn plan

Prescribed Burn Plan Components

The intent of this section is to identify and elaborate on key, required components of a prescribed burn plan. The NWCG prescribed plan format includes the complexity analysis process, documentation of Test Burn and Go-No-Go day of burn decision making, and the 21 elements that describe all aspects of

the prescribed burn. The plan also encompasses appendices that allow for additional specific information and fire behavior modeling results.

- Objectives, Planning and Prescription

Objectives are developed as the first step in the planning process. The objectives establish measurable outcomes for project safety, implementation and desired fire effects results. Objectives are written to be specific, measurable, action driven, realistic and time sensitive. Generally, there will be resource-based outcome objectives as well as objectives that are more specific to implementation actions.

The planning process commences as outlined above.

Prescriptions are developed to establish high and low indices of fuels and ambient conditions for each fuel model within a burn unit in order to achieve the stated burn objectives. Common indices to include in the prescription(s) include the fuel model; fuel moistures of dead 1 hour, 10 hour and 100-hour fuels; live herbaceous and woody fuel moistures; wind speeds expressed in midflame or 20' winds; permissible wind vectors and a minimum atmospheric mixing height for smoke dispersion purposes and seasonality of burn implementation. The Keetch Byram Drought Index is a component of these prescriptions and is used as a key indicator to predict the availability of fuels for burning.

- Safety

Safety of the public and burn staff is always the highest priority on any burn project. Safety is addressed in every step of planning and implementation. Prescribed burn plans will reflect this commitment to safety. Burn bosses will also respect and ensure this safety commitment in fireline leadership; in briefings and directions and in assuring Lookouts, Communications, Escape Routes and Safety Zones are always in place and described in detail to all participants.

Safety is a commitment to the public as well, especially in this region of subdivisions, commercial developments and transportation infrastructure that make up the wildland urban interface zone. Every burn plan will consider the appropriate level of public and commercial safety precautions and level of proactive public information.

Safety endorsed in this plan also includes educational outreach regarding prescribed burning, which will continue as a function performed in part by the Commission.

- Pre-Burn Treatments

Broadcast burn unit pre-treatments are not a part of the prescribed burn plan but are dealt with in separately prepared and implemented pre-treatment plans. Tactical pre-treatments for burn implementation purposes are addressed however in the burn plans as pre-burn considerations. The pre-burn treatments addressed in the plans may include (but are not limited to) advanced preparation of holding lines or fuel breaks, ensuring vegetation management actions or special surveys or consultations have been completed prior to burning.

- Notifications

During the planning process, lists of notifications about the burn are prepared. These notifications include the public, occupants of adjacent homes and businesses, first responder agencies, and

personnel and managers of stakeholder agencies. They include notifications on the day prior to the burn, the day of the burn and post burn completion.

- Fire Weather

Fire weather is a part of the prescription parameters. The Burn Boss or Fire Program Manager will monitor the predicted weather to establish favorable burn windows of opportunity. A custom spot weather forecast is obtained from the US National Weather Service both the day before and day of burn. On burn day, A Go-No Go checklist will be completed that includes determining that all prescription parameters are in place (including weather) prior to ignitions. Plans will also direct the Burn Boss to continue monitoring the weather on at least an hourly basis and record findings in the Project File for future access for research, monitoring and future burn prescription preparation.

- Communications

The Burn Boss is responsible to ensure thorough communications are maintained throughout the Implementation. A fundamental is that all participants receive a pre-burn briefing on site that includes all safety and implementation information. Lookouts, communications, escape routes and safety zones will be identified and communicated to all participants before ignitions are commenced. Adequate radio communications will be established and maintained throughout the operations. Frequencies and a will be included in the prescribed burn plan, and a Communication Plan (ICS 205) will be part of the burn day Incident Action Plan. A span of control of three to seven (3-7) employees per supervisor shall be enforced and maintained that assures direct communications between all levels of the organization. Communications will also be maintained with off-site stakeholders and partners through the planned notification process and public information process identified in the burn plan.

- Ignitions

Ignition methods and alternatives are pre-identified in detail in the plan. Ignitions in the Central Pine Barrens will almost entirely be using hand-held devices. A test burn in representative fuels will be conducted and documented before the full burn ignitions are commenced. If the test burn is not successful, ignitions are canceled until favorable conditions return or the burn will be canceled for the day.

- Contingency

Plans will identify multiple “what if” contingencies and recommended tactical actions to resolve them successfully. Contingencies include development of serious smoke issues, dropping out of prescription parameters, medical emergencies and fire escape during operations.

The NWCG plan format also includes succinct contingency tables based on management action points to highlight contingency concerns, strategic intents, recommended resources and tactical actions and success / failure decision points.

- Smoke Management

Plans will include a smoke screening process that identifies undesired smoke receptors. The prescription wind vectors are a key part of preventing undesired smoke impacts, however firing and

holding techniques also play a major role in smoke generation and persistence and all these factors will be identified in the burn plans. The plans call for continual smoke monitoring and actions to take if undesired conditions become apparent.

- Monitoring

The burn objectives are written in a specific, measurable, realistic and time sensitive manner that allows for the use of monitoring to determine the success of meeting objectives. Day of burn monitoring will be directed and delegated by burn boss. Pre and post fire monitoring will be prioritized and advanced by the Commission and landowning agencies. Though not a part of the burn plan and burn plan process, monitoring pre-burn, immediately post burn and periodically post burn will be conducted on a frequency by which to evaluate whether burn objectives are achieved which will ultimately advance adaptive management. Standard monitoring protocols will be established and utilized pre-burn, immediate post burn and subsequent post burn as prioritized. Results, trends and reports will guide future management and made available for cooperators, academia, stakeholders and public.

- Records Management

To achieve this a project file will created by the Commission staff for each prescribed fire project conducted. The Project File is a combination of hard copy records and digitally captured information. For example, hard copies of burn plans with original signatures will be stored manually while prescribed fire mapping records and other data can be stored digitally. Each project file will contain:

  - Prescribed fire plan and amendment modifications.
  - Monitoring data including a minimum of weather and smoke dispersal observations
  - Weather forecasts
  - Notification documentations
  - "As Worked" burn day incident action plan that document organization and participants, and any activity logs written by burn participants
  - All Go/No-Go checklists completed
  - Summary report by burn boss including actual ignition patterns and sequence
  - Final burn map including progression or accomplishment maps for multi day sequences
  - After Action Review lessons learned

7. Strategies for Prioritizing Prescribed Fire Management

The Central Pine Barrens encompasses a large and ecologically diverse land area with varying degrees of wildland interface, management staging, and disturbance. However due to a sustained fire suppression and development, there are more public lands in need of fire management for purposes of improving ecological health and reducing wildlife risk than resources currently available. This necessitates a focus on strategic planning and identification of priority areas within the Central Pine Barrens to ensure that programmatic goals are met across maximal acres and/or ecosystems in an efficient and cost-effective means. As utilized in the development of the plan and the FMU's, a holistic inventory and evaluation of current conditions, previous planning initiatives, land management and use, existing fuels, unique resource protection needs, and Fire Return Interval departure have been used to develop tactics and identify priority areas for strategic prescribed fire management as listed below. Specific recommendations reflective of the below listed prioritization considerations are identified within each individual Fire Management Units section to help further collaborative and effective prescribed fire management.

Existing Approved Management and Operational Plans

A tremendous degree of time, effort and financial resources are expended in developing and approving management and operational plans as well as conducting the necessary public outreach and SEQRA review. These plans have a shelf life, where after they need to be revisited and updated. Their value is only recognized when the plan moves from "shelf status" to active implementation. To recognize the value and investments (especially those developed within the last five years) sites for which management and especially operational plans (e.g., prescribed burn plans) have already been prepared and approved for implementation by NYS-DEC are of highest priority for implementation.

Mechanically Treated Forest Health, Fuels Treatment and Southern Pine Beetle Prevention Sites

Sites that have been proactively thinned or otherwise mechanically treated to improve forest health and resiliency, especially in the face of the recent arrival of the southern pine beetle (SPB) to the region, are high priorities for prescribed burns. In forest stands, thinning and mastication have been conducted to reduce basal areas from an average of 120 - 160 square feet per acre (sqft/ac), to 60 – 80 sqft/ac in an effort to reduce tree density. Management has also been focused on reducing the density and continuity of the shrubby understory especially those dominated by scrub oak (*Q. ilicifolia*). These practices have a number of benefits. They improve forest health by reducing competition, increasing air flow, altering stand and understory fuel continuity, and allowing sunlight to penetrate to the forest floor. Thinning and mastication also reduces susceptibility to pests and disease, especially SPB mass attack by dissipating pheromones. In addition, these treatments have reduced high fuel loads by altering the fuel load/fuel arrangement making them suitable for prescribed fire application. However, in order to advance restoration and first entry prescribed fire treatments in a safe and controlled manner requires fuel rearrangement or reduction treatments which are very costly and temporally limited as implementation of prescribed fire is necessary within the curing phase (6 to 18 months) and before regeneration of vegetation. Otherwise, desired fire behavior may not be achieved and/or specific challenges such as smoke concerns may develop. Accordingly, it is strongly encouraged that prescribed fire planning and implementation be focused on areas which have had or are scheduled to receive to such forest health treatments. After initial fire restoration treatment, these areas may also become Prescribed Fire Enhancement Zones where future prescribed burns can build upon these treated and burned acres.

Newly Installed Fire Breaks

Numerous fire breaks have recently been restored or created to strategically help reduce exposure of high-risk communities during wildfire outbreaks. To further reduce the wildfire risk to these communities, areas with these newly installed fire breaks should be evaluated for burning against these breaks. Blacklining burns conducted parallel to the firebreak or burning small patches adjacent to the firebreak can improve firebreak protections and create a more natural versus managed appearance and mosaic

Minimal Pretreatment Needs

Several sites identified in the Central Pine Barrens are in successional stages that would allow successful and impactful prescribed fire implementation without significant investment in costly pretreatment needs. Without management, these sites will continue succeed/ transition to conditions which would then reduce the positive impacts of fire without additional pretreatment. A focused effort will be made to identify sites in order to implement prescribed fire for ecological benefit and/or wildland urban interface protection where the outcomes are more aligned with maintaining current conditions. Additionally, this priority also includes sites where pre-treatment has already been conducted to maximize the long-term benefit of that treatment and to make use of the time window where fire would be most beneficial to sustain those structure and functional changes enacted by previous pretreatment. Sites having received recent wildfire can provide such an opportunity to implement maintenance management by proactively building upon the fuel reductions and ecosystem modifications. This strategic concept again ties into the desire to sustain the long-term management and positive trajectory of restoration and once established and completed through fire then arriving in suitable maintenance conditions.

Unique Ecosystem Management (e.g., coastal plain ponds, grasslands, invasive species)

Several unique and rare community types and localized biodiversity hotspots present important areas for prioritization. Prescribed fire for ecological benefit and for improvement of at-risk, threatened and endangered species population levels, and habitat conditions and habitat availability are key components of this plan and program. Many sites that represent and contain these species assemblages and habitat types are heavily reliant on disturbance and succession management centered around fire. Additionally, invasive species are a clear and present threat encroaching into these areas, which can alter habitat conditions and species interactions leading to declines in ecosystem conditions, species richness and species diversity. Prescribed fire that can be implemented as an invasive species management and prevention tool is another important priority of this plan and program.

Prescribed Fire Enhancement Zones

Prescribed Fire Enhancement Zone is a tactic which uses areas with unavailable fuels such as recently burned grasslands and other treated ecosystems, open water or wetlands as anchor points by which to advance prescribed burns in the Central Pine Barrens. Prescribed burns could be conducted adjacent to these recently burned grasslands or other non-burnable areas. Subsequently, the burn blocks adjacent to the ones which have just received prescribed fire, can then be burned more safely having reduced or limited fuels adjacent to the focal treatment area. One goal of this tactic is to reduce the number of acres that require expensive mechanical treatment in order to advance prescribed fire in a safe and controlled manner. The areas for the subsequent burns may or may not be mechanically pre-treated

prior to burning. These Prescribed Fire Enhancement Zones would be utilized in locations where annual prescribed fire operations would progressively build and expand a fire-treated mosaic to over hundreds of acres.

Wildland Urban Interface Protections

During the past 60 years, numerous subdivisions have been built adjacent to and in these forests where there is increased risk of fire due to the lack of large fire disturbance and the buildup of forest fuels. Sites to protect include subdivisions, communities and other infrastructure that may be in the path of future large fires. Prescribed fires can create a buffer to these at-risk properties by reducing adjacent fuels; maintaining a thinned understory and interface edges; improving access and defensible space and creating a mosaic in the fuel bed that will reduce wildfire rates of spread and intensity. Nationwide multiple prescribed fire projects have proven their value in protecting urban interface areas and reducing wildfire intensity.

Community Wildfire Protection Plans

In June 2016, a Community Wildfire Protection Plan (CWPP) for the Ridge / Manorville / Calverton communities was completed under contract for the Central Pine Barrens Commission. This enabled the Commission to assist homeowners within the CWPP area to assess the wildfire risks to their property and to identify actions homeowners could implement to make their property more resistant to wildfire damages. This plan also identified specific areas in which NYS-DEC would be conducting mechanical thinning and identified mechanical reduction and prescribed burn projects on the grounds of Brookhaven National Lab. Management identified as necessary within the CWPP is strongly encouraged as a priority for future management.

Recent Wildfire Sites

Proactively implementing prescribed fire against areas burned in the previous three years is an ecologically effective and cost-effective means of advancing restoration, reducing fuels and advancing public safety. This is achieved by building off the fire scars with minimal need for mechanical treatments. For example, forest areas burned in wildfires in 2020 are sites to consider for adjacent prescribed burning through 2023.

Training Priorities

Live fire exercises are a priceless component of firefighter training whether structural or wildland. Areas that are under a current prescribed burn plan are used annually by the New York Wildfire and Incident Management Academy to provide live fire training for basic and advanced firefighters, fire ignitions training, wildland fire origin and other courses. These exercises are often coordinated with multiple classes on a single day which provides a rare trainee opportunity for individuals in fire line supervisory positions such as Task Force Leader.

8. Fire Management Units

Fire Management Unit Introduction

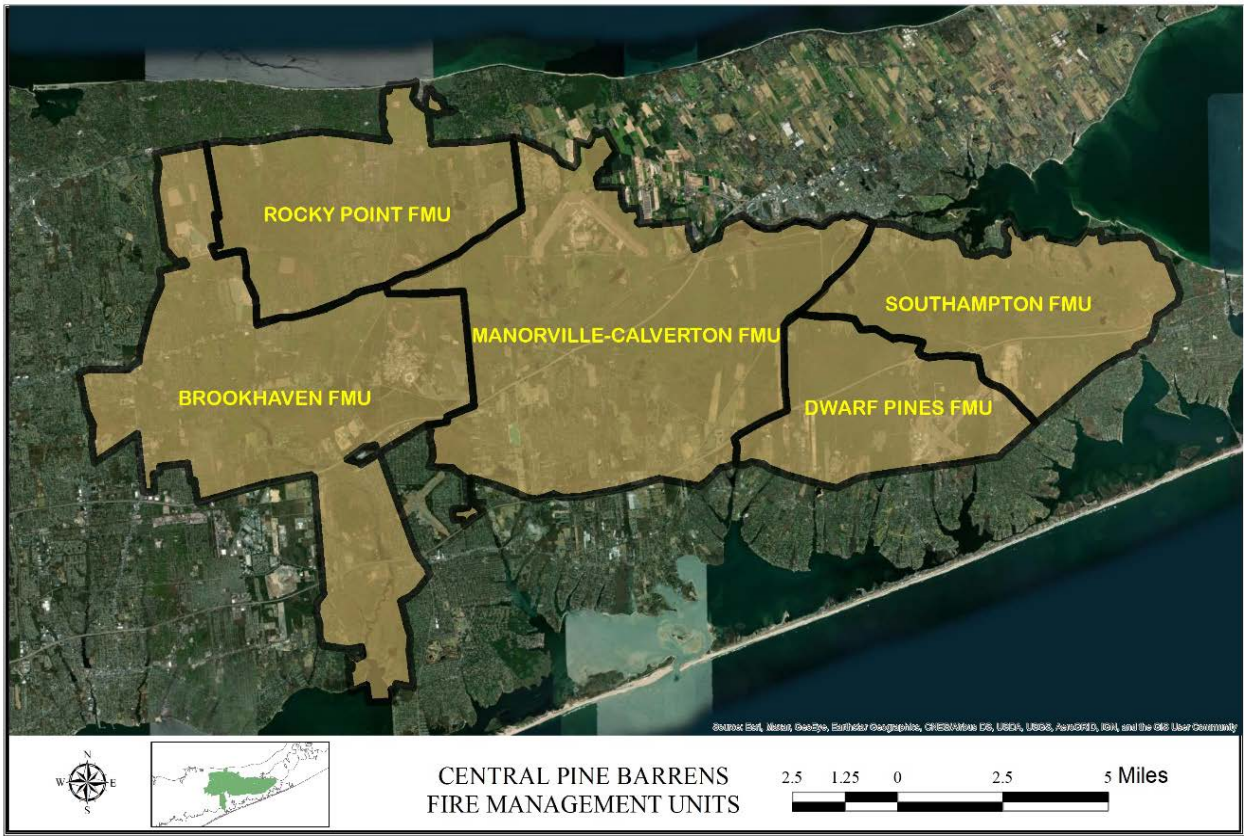


Figure 8.1 The Fire Management Units of the Central Pine Barrens

The Central Pine Barren's encompass a large land area at 106,000 plus acres, of which 57% percent is publicly owned by numerous agencies and municipalities and 54% occurs within the Core Preservation Area (Table 8.1). The Central Pine Barrens Core Preservation Area (Core) is where most of the contiguous public land ownership is and consists of the largest tracts of interconnected natural areas. The Core is where the protective zone overlay is most restrictive to development with the goal of protecting these lands in perpetuity in more natural state with function ecological structure and function and high levels of ecosystem service provision. Alternatively, the compatible growth area, or the CGA, is where development restrictions are less strict and allow some limited growth and development if it coincides with and meets legal and zoning requirements. The CGA is designed as a buffer to the core preservation area and as a more effectively planned development area that is still sensitive to environmental concerns. Predominantly, most of the prescribed fire management activities and priorities will be in the Core preservation area, but there is some potential for beneficial fire management on publicly owned tracts in the CGA.

In an effort to best advance prescribed fire planning and implementation within this sizable land area with numerous landowners and differing land use protections, the Central Pine Barrens area has been divided into five Management Units (FMU's): Rocky Point, Brookhaven, Manorville-Calverton, Dwarf Pines and Southampton (Table 8.1; Figure 8.1); effectively creating a framework for strategic landscape-based planning and implementation on public lands at a manageable scale. These units were delineated

in consideration of such factors as vegetation community, predominant fuel type, fire history, urban development, public land ownership, established management areas, geographic location and definable boundaries that are easily observed in the field. Each of these FMU's is individual in character and are each comprehensively described below within this section of this plan. It should be noted that for consistency purposes, that the Rocky Point as the first FMU described, introduces concepts/information which maybe more relevant to other the FMU's.

Table 8.1 Central Pine Barrens and Fire Management Unit Public Land Ownership and Protection Level

CENTRAL PINE BARRENS STATISTICS			
	Acres	% of CPB	
TOTAL ACRES	106372		
PUBLICLY OWNED LAND	60503	57%	
CORE PRESERVATION AREA	57892	54%	
COMPATIBLE GROWTH AREA	48480	46%	
	Acres	% of CPB	Public Land Acres
Rocky Point FMU	15714	15%	10142
Brookhaven FMU	30245	28%	15285
Manorville-Calverton FMU	34343	32%	17979
Dwarf Pines FMU	11343	11%	6654
Southampton FMU	14727	14%	10443

Unique Ecological Disturbance

Unique ecological disturbances other than wildfire is highlighted here and its impacts will be discussed within the description of each of the FMU's. Ecological disturbance is modifying forces and information about them can help explain current conditions on the landscape as well as help inform prescribed fire management.

- 2008 Mass Oak Mortality

In 2008, mass die off of oaks was experienced within the Central Pine Barrens. This was caused by a conflagration of spring outbreak and subsequent defoliation by invasive gypsy moth followed by a natural outbreak of native orange striped oak caterpillars in the fall of 2007 which then defoliated the secondary leaves generated by oaks. The second leafing out of the oaks utilized the remaining root energies of these trees and mass outbreak and second round of defoliation caused this time by the native caterpillar prevented photosynthesis and restocking of needed energies within the trees' root systems. As a result, in 2008 mass die offs of oaks (an estimated 14,166 acres) was experienced throughout the Central Pine Barrens especially from Brookhaven National Lab east to Hampton Bays (NYSDEC Forest Health). In many places these dead oaks are still standing, while those that are downed have impacted access to fire roads. Ecologically, this mass dies off has created a mosaic of vegetation communities, transition area from Oak to Pitch Pine-Oak systems and in some locations, pitch pines have recruited in dog haired stand densities (Figure 8.2).

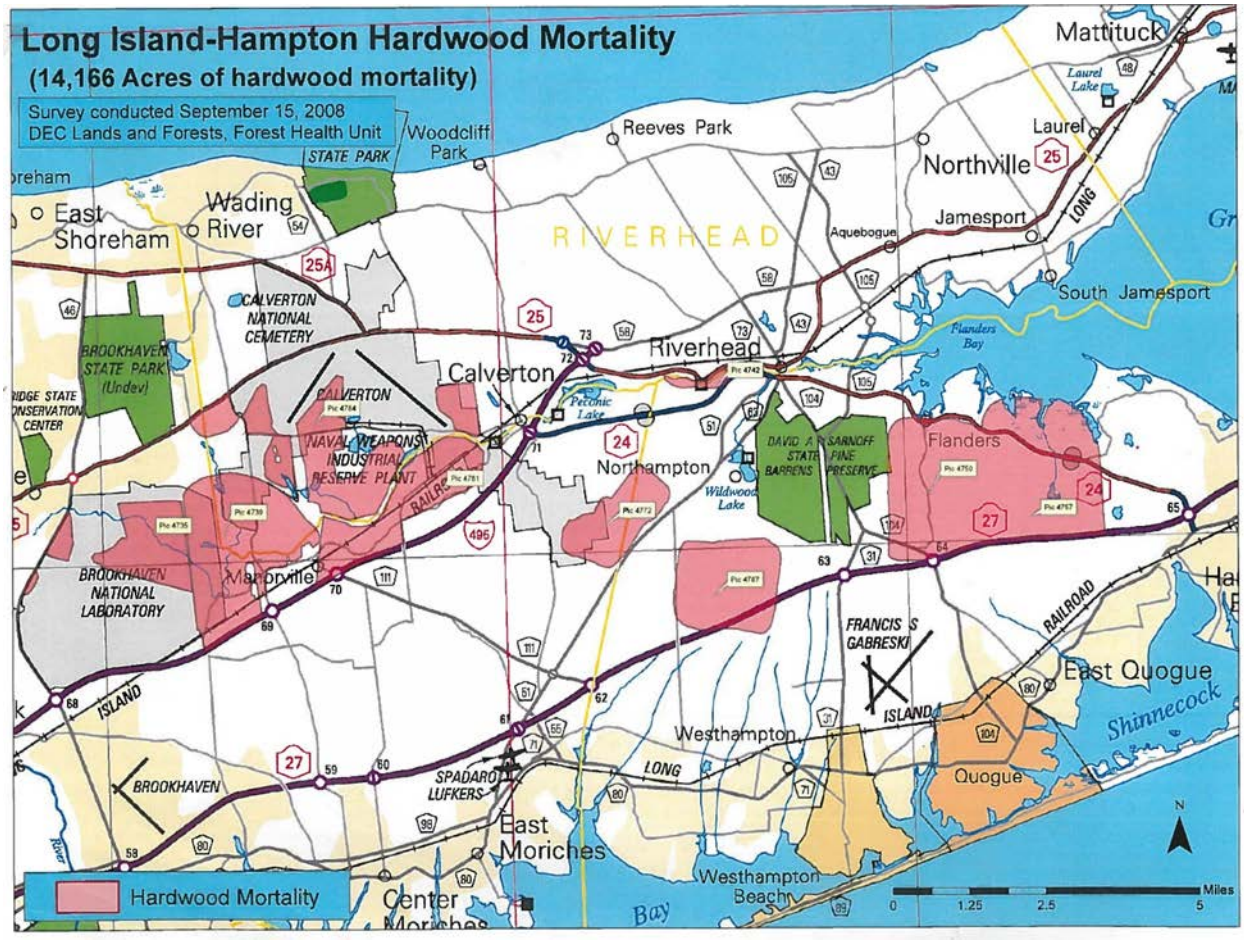


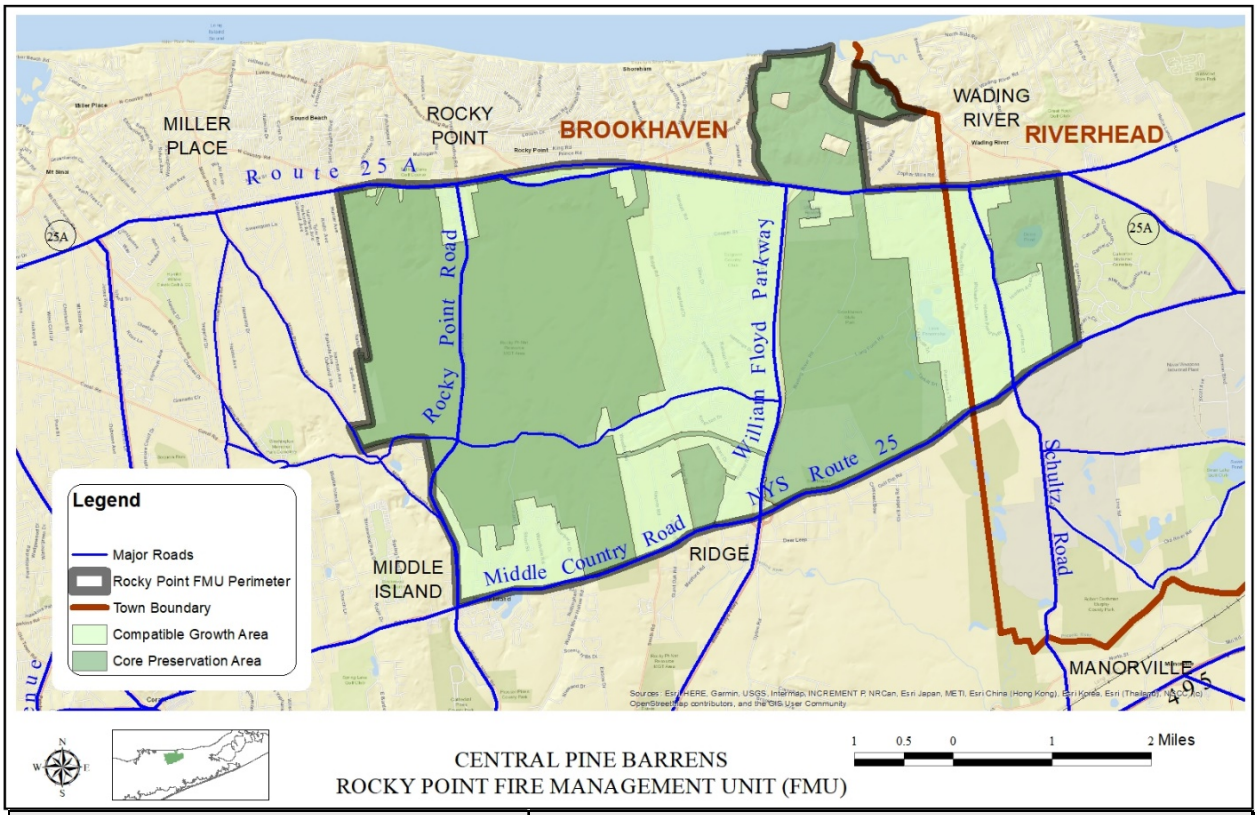
Figure 8.2 Long Island – Hampton Hardwood Mortality Aerial Survey Conducted by the NYS-DEC Division of Lands and Forests, Forest Health Unit on September 15, 2008 (NYSDEC 2008).

- Southern Pine Beetle (SPB)

In 2014, southern pine beetle was found for the first time on Long Island within Connetquot State Park, Wertheim NWR and Hampton Bays. The outbreak and its spread have been and continues to be significantly impactful resulting in the mass loss of pitch pines within many of the public lands. Cut and leave suppression has been a successful management practice which has resulted in reduction in the frequency and size of SPB outbreaks. The initial and continued decimation remains with in the forests with mass dead standing and suppressed pines within certain areas of the region especially the Central Pine Barrens. More comprehensive impact by FMU will be described below.

Rocky Point Fire Management Unit (FMU)

FMU Demographics, Land Use Protections and Ownership



ROCKY POINT FIRE MANAGEMENT UNIT	
Towns	Brookhaven, Riverhead
Fire Departments	Rocky Point, Wading River, Ridge, Middle Island
Total Acreage	15714
Core Preservation Area	9892 acres = 63% of area
Compatible Growth Area	5822 acres = 37% of area

Figure RP 8.1 Rocky Point Fire Management Unit Boundary Map with Demographic Table

The Rocky Point Fire Management Unit is located in the northwest section of the Central Pine Barrens and occurs within both the Towns of Brookhaven and Riverhead (Figure RP 8.1). It encompasses 15% of the land area of the Central Pine Barrens and is the third largest of the FMU's. The Core Preservation Area protects nearly 9900 acres (almost 2/3rds) of this FMU (Figure RP 8.1) and of this total, approximately 90% is publicly owned and dedicated State Park or Forest lands that are managed as natural areas. Compatible Growth Areas occur the more developed areas in urban corridors that occur in between the natural areas along the William Floyd Parkway and Schultz Road as well as in the southwest corner of the FMU.

Public lands account for the greater portion of the lands within this unit. The major public landowner in this FMU is New York State, which includes both NYS Department of Environmental Conservation and New York State Office of Parks, Recreation and Historic Preservation, followed by the Town of Brookhaven and Suffolk County, respectively (Figure RP 8.2; RP Table 8.1).

Table RP 8.1 Rocky Point Fire Management Unit Public Land Ownership

ROCKY POINT FIRE MANAGEMENT UNIT PUBLIC LAND OWNERSHIP = 65%	
NY State Owned Land	8142 acres = 52% of the FMU
Suffolk County Owned Land	780 acres = 5% of the FMU
Town of Brookhaven Owned Land	1220 acres = 8% of the FMU

The largest of the state-owned lands is the NYSDEC managed Rocky Point Pine Barrens State Forest (RPPBSF; 5996 acres) which is located in the western section of the FMU. Ranking second in land area in this FMU is Brookhaven State Park (BSP; 1638 acres), which is the only State Park which occurs within the Central Pine Barrens. Smaller land units occurring within the FMU are Panamoka Pine Barrens State Forest (98 acres), the Calverton Pine Barrens State Forest (191 acres), and the Brookhaven Pine Barrens State Forest (35 acres) which occur along the southeastern edge of the FMU. The NYS-DEC owned Ridge Multiple Use Area (184 acres) which located in the south-central section of the FMU dually supports of diversity of natural areas and serves as the field operations center for NYSDEC. Lastly, the Suffolk County and Town of Brookhaven owned lands generally abut these state-owned lands and collectively extend land and ecosystem protections of those occurring within the Core Preservation Area.

Natural Features

Topographically the FMU can be described as a corrugated landscape of gentle ridges and valleys. Both east/west and north/south transect lines across the FMU show maximum elevations averaging around 170 feet and minimal elevations around 70 feet. Generally, the higher elevations are in the northern portions of the Rocky Point Pine Barrens State Forest and Brookhaven State Park and the lower elevations are in the developed corridors. Slopes, both east/west and north/south, average about 5% with average maximum of 30%.

Forests are the most abundant ecosystem of this FMU and there are four main large, forested tracts covering this FMU: Rocky Point Pine Barrens State Forest on the western half, Brookhaven State Park in the center, Shoreham Central Pine Barrens Expansion Area to the north and privately owned lands at the extreme eastern edge. This fire management unit supports the one of the highest acreages in grassland habitat of all the FMUs with that majority occurring within and Rocky Point Pine Barren State Forest within the vicinity of the Rocky Point Road and Whiskey Road intersections. Currans Field just southeast of this intersection is a disjunct grassland of this complex. A Town of Brookhaven grassland also occurs on the northeastern side of Ridge Road. Aquatic ecosystems of the FMU include both maritime and freshwater systems. Tidal marsh, beaches and the outlet of Wading river discharges into Long Island Sound at the north. As compared to other FMU's, there are very few ponds and wetlands that occur in this FMU and those that due are predominantly found in the eastern section. Two large lakes: Lake Pamanoka and Deep Pond are located in the eastern third of the FMU and a series of multiple smaller ponds most frequently occur on the eastern half of the FMU while small kettle hole ponds are located throughout. In Rocky Point Pine Barrens State forest, wetlands can be found south of Currans field. A chain of ponds and wetlands occurs within the Ridge Multiple Use Area while a wetland system occurs along the powerline corridor of Brookhaven State Park. Further and more comprehensive classifications of vegetation types as it relates to wild and prescribed fire can be found within the fuels section below.

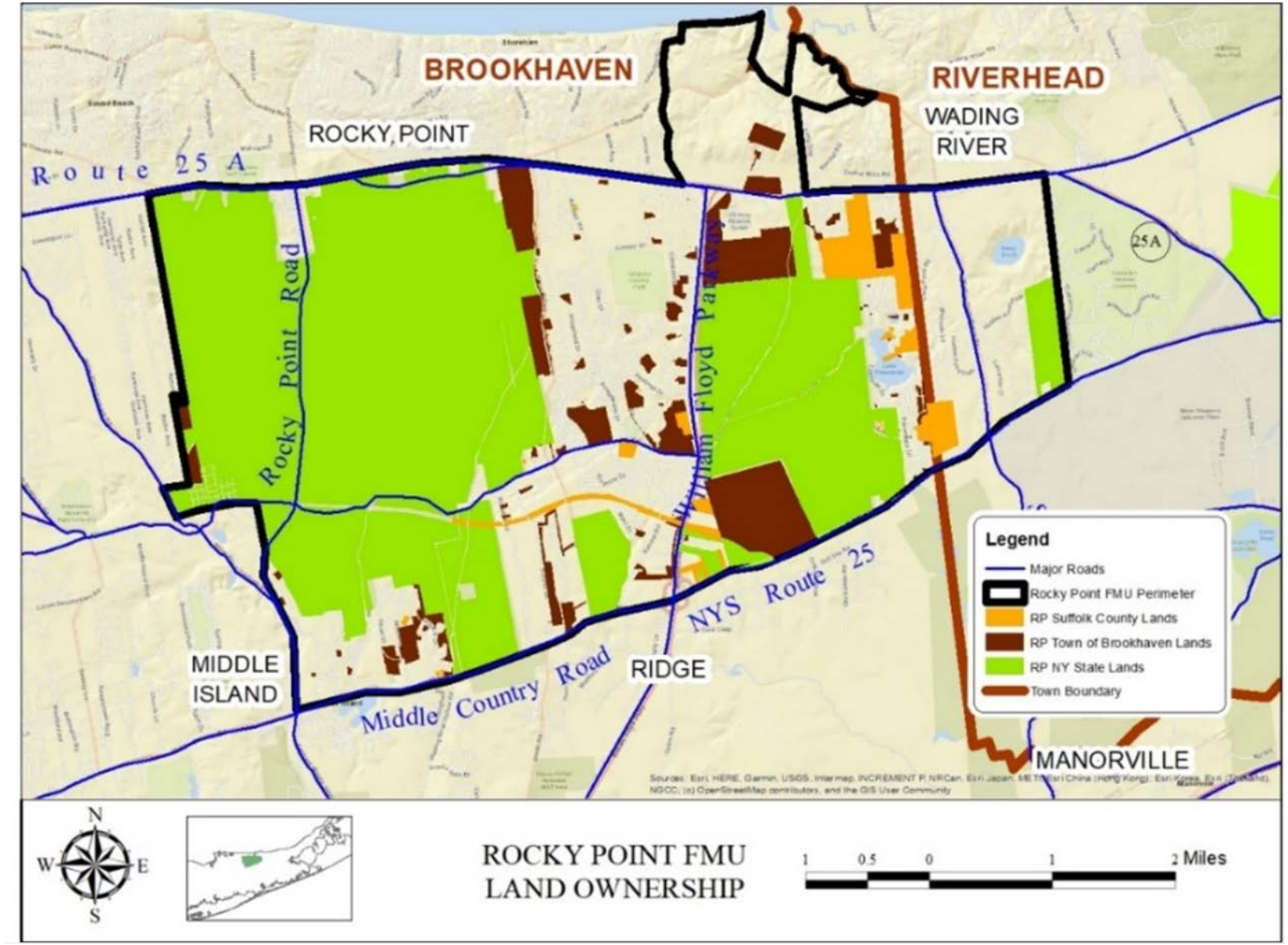


Figure RP 8.2 Public Landownership in Rocky Point Fire Management Unit

Recreation

The high abundance of public lands supports a considerable diversity of recreational usage within this FMU as exemplified by the approximately 40 miles of hiking trails; 12 miles of mountain biking trails; 20 miles of trails open to horseback riding as well as a hunting and fishing. Of note, the Paumanok Path, a 125-mile-long hiking trail begins at Rocky Point Pine Barrens State Forest and traverses through the Central Pine Barrens out to Montauk while the entire Ray Corwin Memorial trail (named for the first Executive Director of the Central Pine Barrens) is located within this FMU.

Unique Land Use History

Unique land use history as it relates to fire is highlighted in for its role in shaping and influencing the vegetation and overall ecological systems of the Central Pine Barrens. The Radio Corporation of America is an interesting and illustrative example of land use that has left its legacy within this FMU (Figure RP 8.3). In 1920, the Radio Corporation of America (RCA) began developing 6400 acres of what is presently Rocky Point Pine Barrens State Forest as the RCA Radio Central Facility. By the time this facility was dedicated in November of 1921, it was considered the largest radio transmitting station in the world. The transmitting facility was located at Rocky Point and its sister receiving facility was located within what is now David Sarnoff Pine Barrens State Forest in Riverhead, NY (Southampton FMU). There was a total of 12 transmission towers in Rocky Point covering an area of two and a half miles.

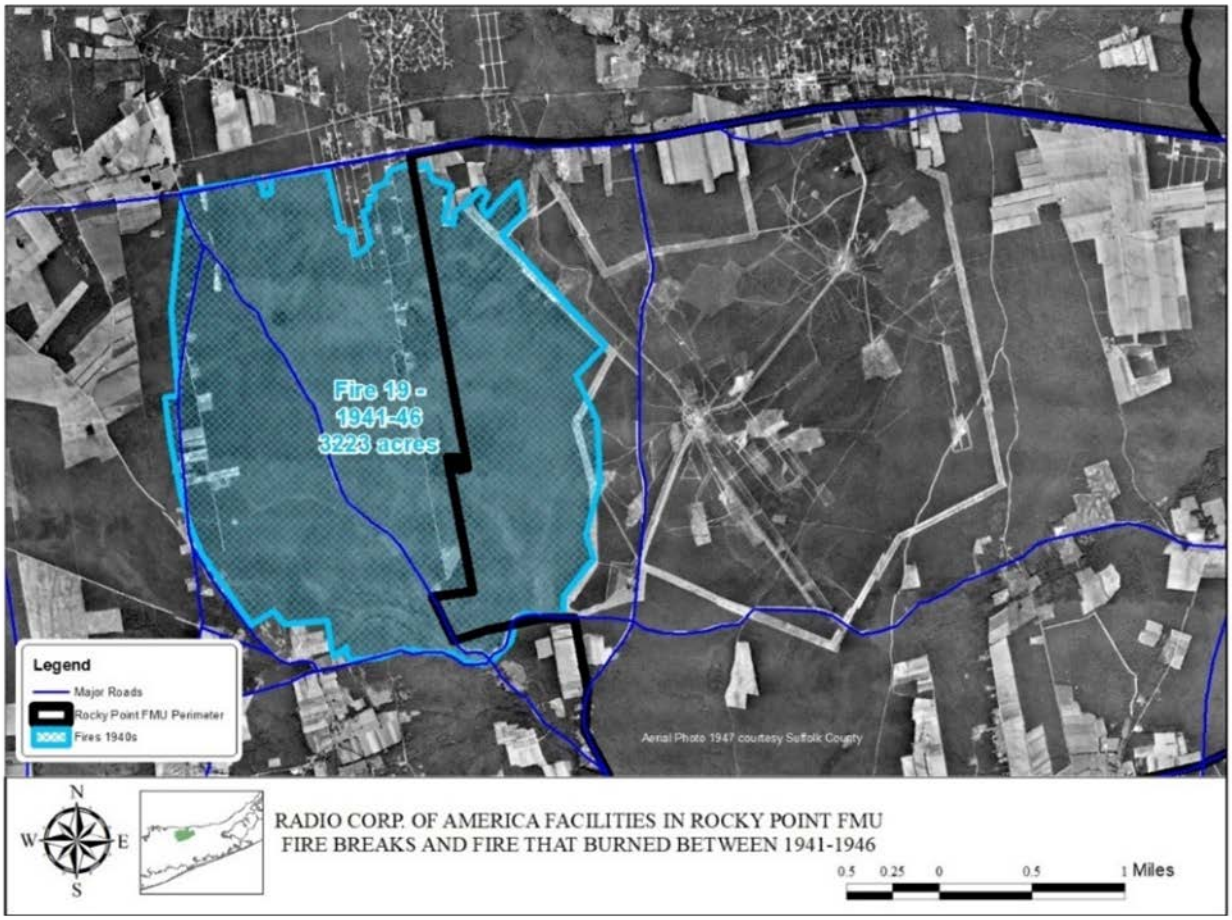


Figure RP 8.3: 1947 Aerial Photography of Radio Corporation of America Facilities in Rocky Point FMU w/ 1940's Fire History

To protect this infrastructure within a wildfire prone ecosystem, 200' wide fire breaks that were reduced to bare soil were installed around this facility as can be seen in Figure PRP 8.3. These fire breaks served their purpose, having protected the facility and lands from wildfire in the 1940's. In fact, the historic 1947 photo overlaid with the fire history (Figure RP 8.3) well identifies how the eastern perimeter of the large fire (fires) burned up to those fire breaks in the 1940's. Ultimately, both the transmitting and receiving station became obsolete due to the advent of satellite communications and were closed in 1978 (Rocky Point Historical Society). While the facility is no longer operational, 80 years later the remnants can be seen on the ground inform of poles, cables and remaining infrastructure. As it related to prescribed fire and wildland fire risk, the fire breaks no longer remain, rather pitch pine has recruited into the mineral soils of geometric remnants of fire breaks, resulting in what is now dense stands of high hazard pitch pine stands that are clearly visible in aerial photos.

Unique Ecological Disturbance

As per the aerial flight map the impact of gypsy moth and orange striped oak worm is unknown as this area was included in this survey (Figure 8.2). As of the date of publishing of this report, Rocky Point FMU has experienced minor southern pine beetle invasion with no significant outbreaks.

Fire Districts

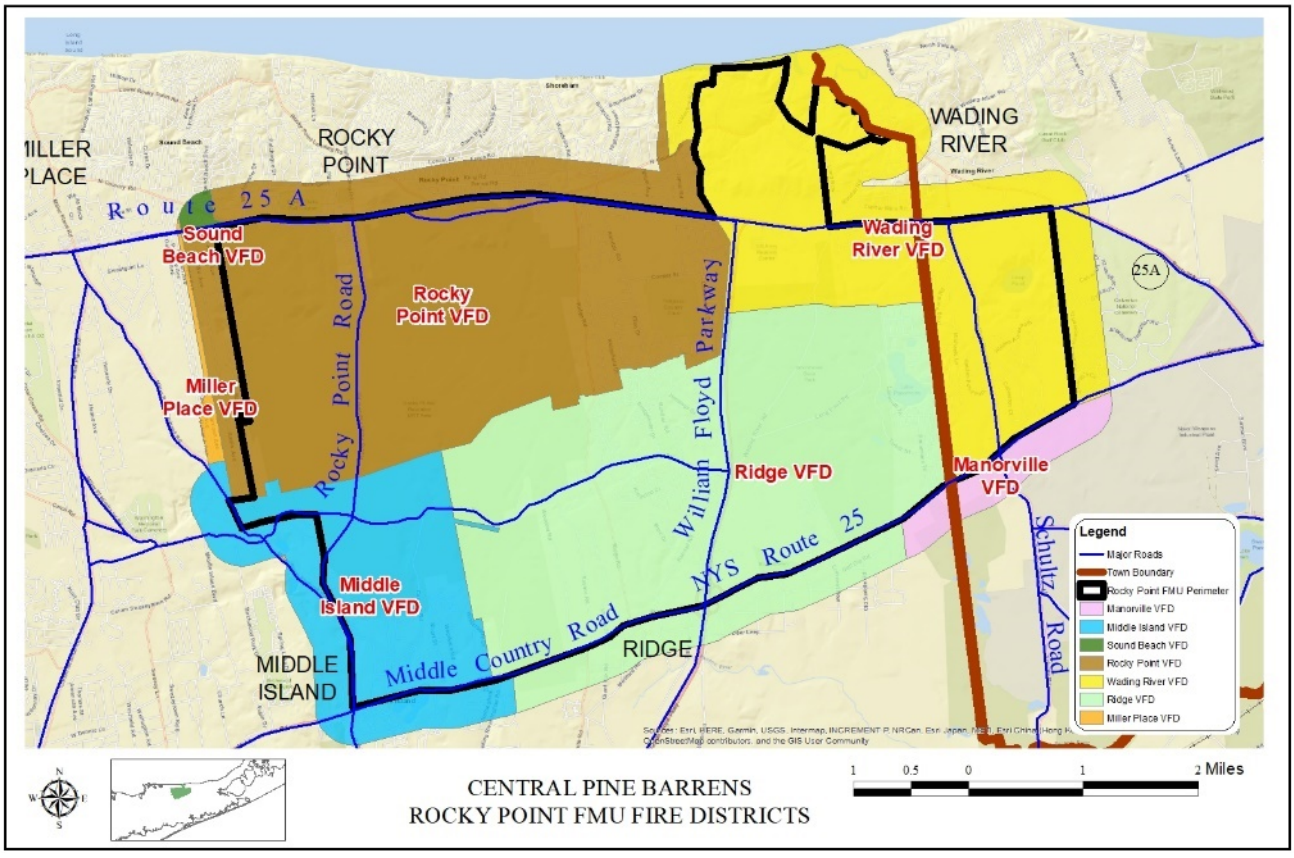


Figure RP 8.4 Fire Districts of the Rocky Point Fire Management Unit

There are four Fire Districts within this FMU (Figure RP 8.4). Clockwise from the northwest corner of the FMU they are the Rocky Point, Wading River, Ridge and the Middle Island Volunteer Fire Departments (VFD). Sound Beach, Manorville and Miller Place VFDs occur adjacent but just outside the FMU.

Wildland Urban Interface (WUI)

WUI is a zone or area between natural areas/wildland and human development and by occurring in this interface this development is at high risk of wildfire exposure and by disrupts natural ecological processes. There is considerable WUI along the edges of large tracts of public lands in this FMU (Figure RP 8.5). As noted in the weather section, the primary direction of spread of large fires has followed the prevailing wind patterns from the southwest to the northwest. Therefore, developed areas on the northeast to southeast sides of the large, forested tracts are generally the most at risk to wildfire but their risk level is also dependent on surrounding fuel types and continuity (Figure RP 8.5).

Community Wildfire Protection Plan (CWPP)

Recognizing the high WUI and high risk for wildfire, the development of the first CWPP in the Central Pine Barrens was undertaken in December 2014 for the Ridge Manorville Calverton communities under contract for the Commission. This process brought together 15 cooperating agencies/entities with the overall goals "to improve wildfire mitigation capacity and work with government agencies to identify high fire risk areas and prioritize areas for mitigation, fire suppression, and emergency preparedness". In June 2016, this CWPP was approved by the Commission, NYS-DEC, NYSOPRHP, BNL and the Ridge and Manorville Fire Districts (Figure RP 8.6; CPBC 2016).

By occurring within the CWPP boundaries, this, Brookhaven and Manorville FMU's have a series of recommendations and actions already identified and prioritized due to this planning process. Those applicable to prescribed fire management will be readily utilized to reduce wildfire risk; improve public awareness and communications; improve wildland fire fighting capability and safety; promote FIREWISE programming and educate home and business owners in prevention and making their properties fire safe. These recommendations are further referenced in the Prescribed Fire Management section below.

Fuels

The primary fuels throughout the FMU are Oak Pine forest, Oak forest, Pitch Pine Oak, Pitch Pine and Scrub Oak shrubland (Figure RP 8.7). Fuels are continuous especially in the larger less disturbed tracts such as RPPBSF and BSP. Descriptions for the dominant vegetation communities are listed below.

- Oak/Hardwood Dominated: Oak-Pitch Pine and Oak forest make up the majority of the fuels in this FMU. These oak dominated forests predominantly occur along the edges of the Unit, while the pine dominated forests tend to be more interior and overall surrounded by the oaks. Scrub Oak Shrublands most frequently occur in dense thickets of BSP and RPPBSF, which are areas that have had recent fire activity.
- Pine Dominated: Pitch Pine-Oak forest is also an abundantly distributed fuel community. These forests make up the major portion of the deep interior RPPBSF and the eastern side of BSP. Dense Pitch Pine forests occur within the unmaintained historical RCA firebreaks.
- Grasslands: Thirteen old field grasslands, totaling 270 acres occur within the FMU and are all located within or adjacent to RPPBSF. A majority of the other yellow areas identified on the associated Fuels Map (Figure RP 8.7) occur outside of Rocky Point and are agricultural areas or landscaped lawns.
- Wetlands**:** There relatively few wetlands in this FMU lie primarily in the Peconic river basin headwaters in the eastern portion of this FMU and in kettle ponds scattered throughout. They are described in the Natural Features portion above. They do not represent a significant fuels load in this FMU.

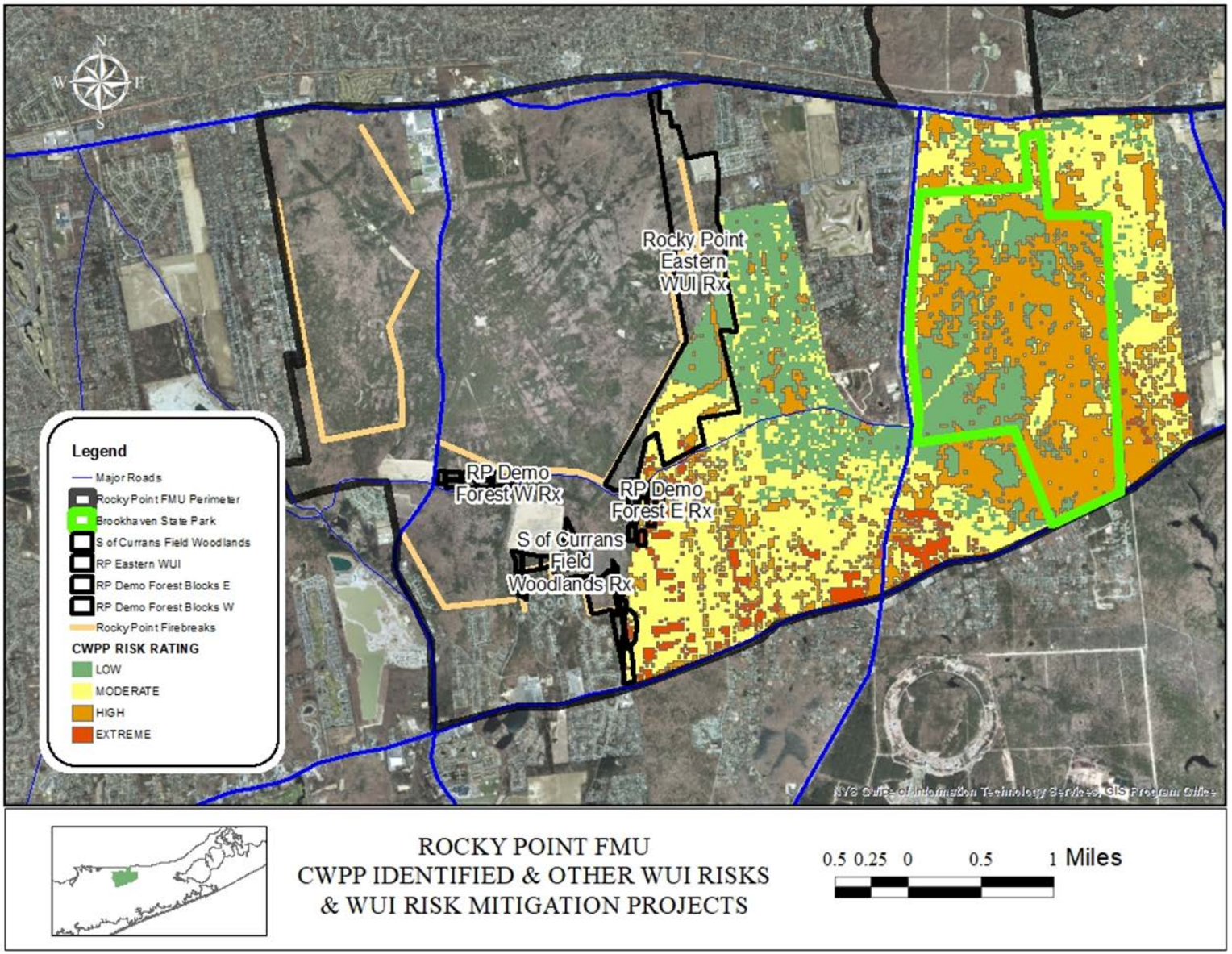


Figure RP 8.5 Rocky Point Fire Management Unit Wildfire Urban Interface Risks Identified in the Ridge Manorville Calverton CWPP

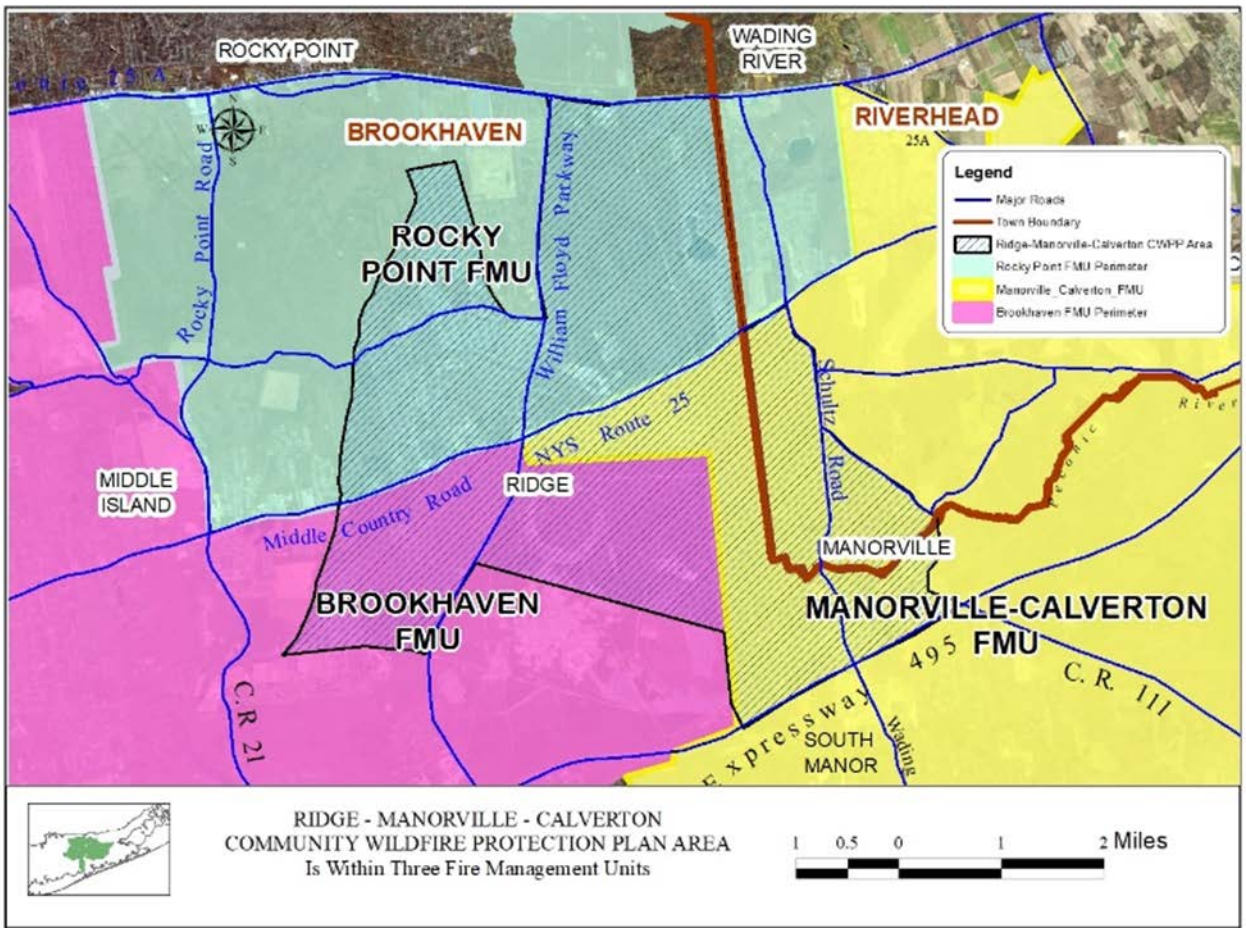


Figure RP 8.6 The Ridge Manorville Calverton Community Wildfire Protection Area within the Rocky Point, Brookhaven and Manorville- Calverton Fire Management Units

Fire History

This FMU has a rich history of frequent and large fires and due to frequent wildfires that have occurred since 1980, one of the best examples of fire ecology in the entire Central Pine Barrens is located immediately east of Currans field (Figure RP 8.8). Some of the most noteworthy fires include those of unknown dates in the 1930s that burned the southern half of BSP and fires of unknown dates in the early 1940s that burned 1000's of acres in the western edge of the FMU against RPPBSF. In the 1980s and 1990s, multiple fires were documented. The most notable being the Windisch Fire #97 that burned 625 acres within BSP in October 1985 and the Rocky Point fire that burned 1372 acres in August 1995.

An examination of fire history from 1996 to 2018, identified numerous fires (a total of 207 fires reported), however the majority were very small (99% of which were reported as 0.1 acres) and none were characterized as a large fire (100 acres or larger). No wildfire data from the period of 2018-2020 is presently available other than the fires reported to the Commission by NYS-DEC Forest Rangers in 2020. The four most noteworthy fires from 1996 thru 2020 include #NYS-2004-84 which burned 24 acres on April 29, 2004 in the northwest corner of Brookhaven State Park. The next day, fire #NYS-2004-85 burned just shy of three times the acreage of the preceding day's fire within the northwest corner of Rocky Point Pine Barrens State Forest. Ten years later, on May 15, 2014, fire #NYS-2014-0087 burned 13.8 acres near Wading River Hollow Road within the fire scar of the 1995 Rocky Point fire. The most recent and 4th most noteworthy fire burned 18 acres in Brookhaven State Park on June 12, 2020.

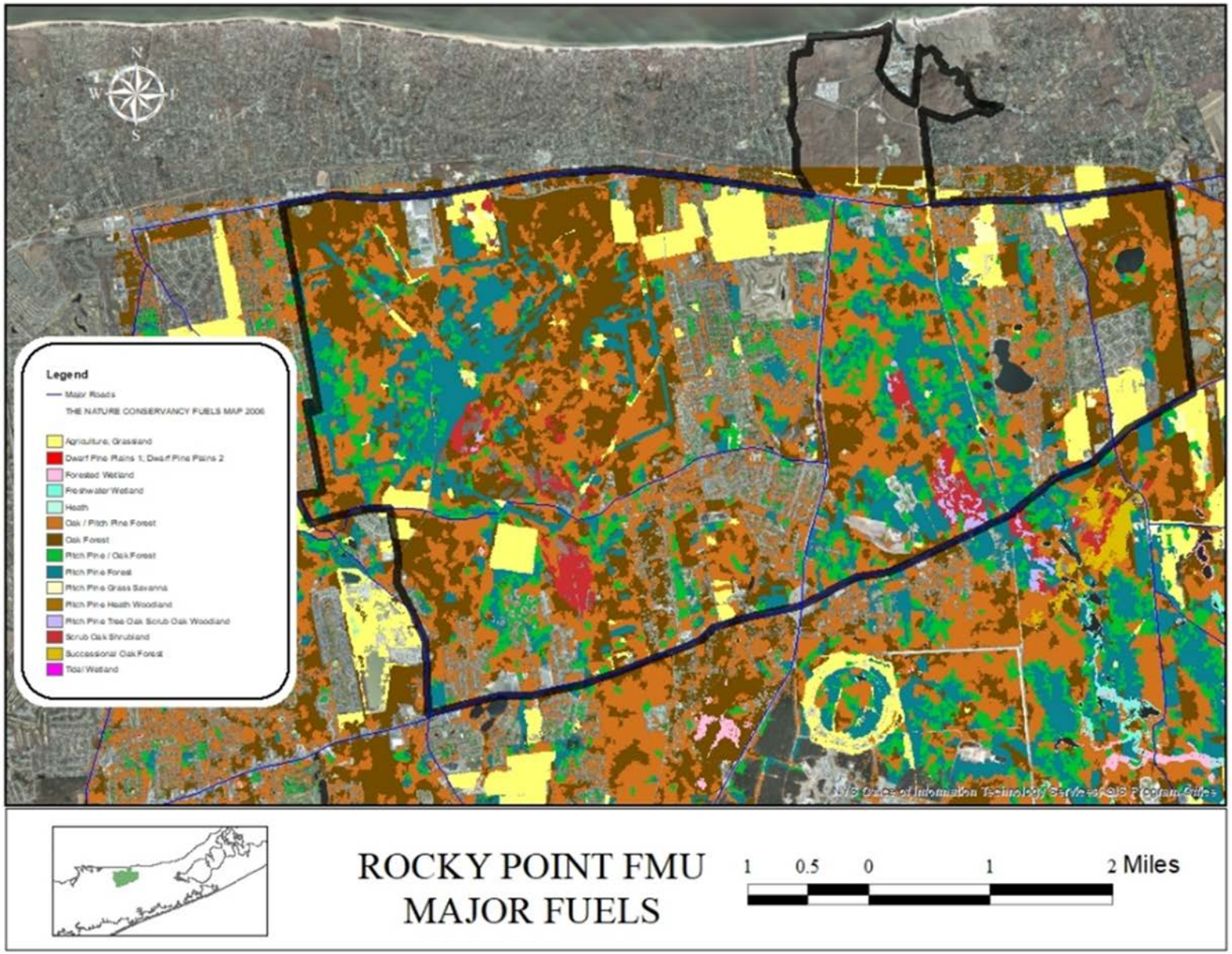


Figure RP 8.7 The Distribution of Major Fuels in the Rocky Point Fire Management Unit by Dominant Vegetative Community

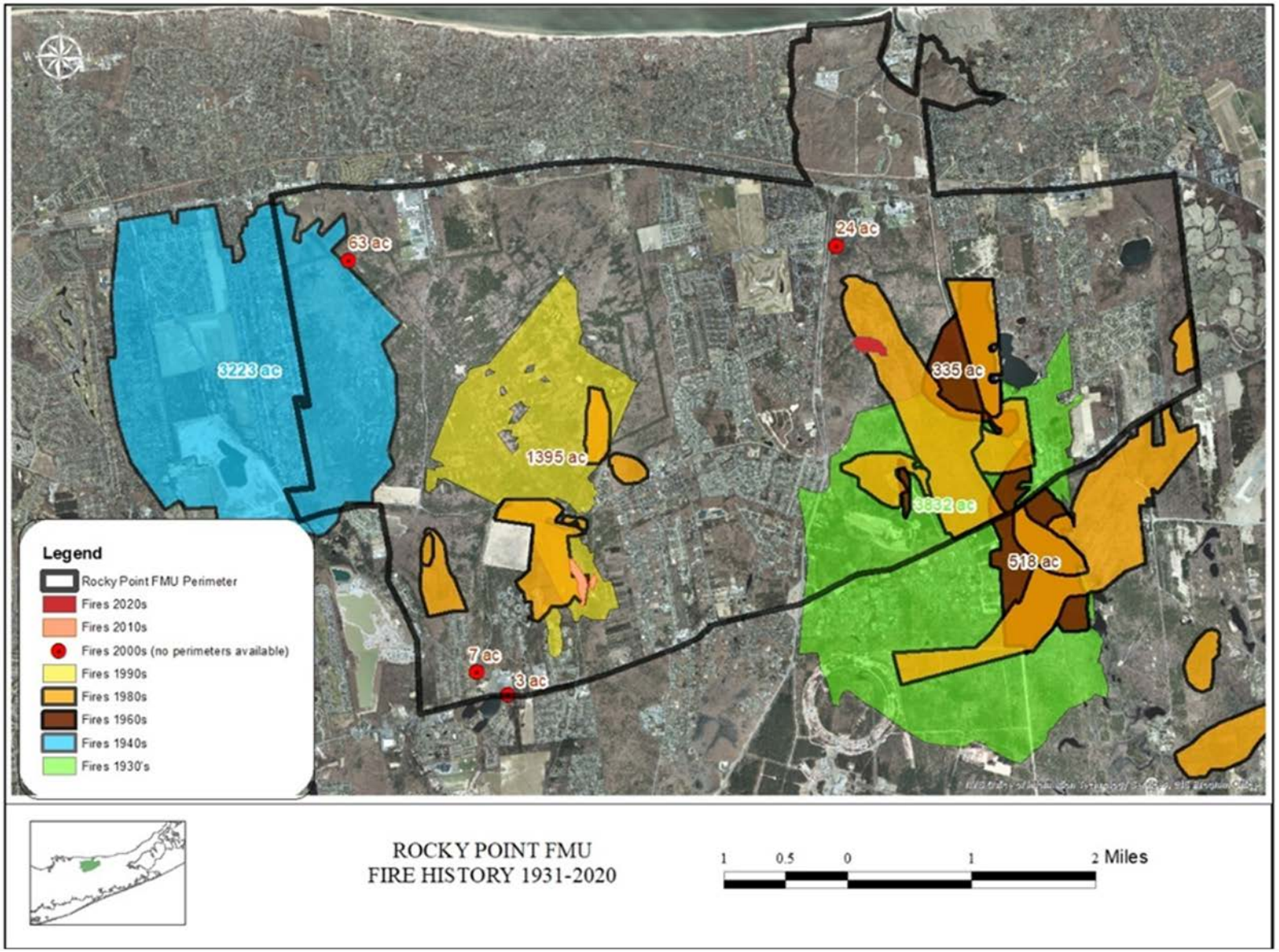


Figure RP 8.8 Rocky Point Wildfire History from 1931- 2020 (Windisch 1994 and NYSDEC)

Fire Return Interval (FRI) Departure

This FMU has an overall Fire Return Interval departure of 40-100 years based on the abundance of oak and pine vegetative communities. Documented large fires (100 acres or greater) have occurred in this FMU in the 1930's (1), 1940's (1), 1960's (2), 1980's (7) and 1990's (1). As of 2020, there have been no large fires in this FMU. It is concluded that the Rocky Point FMU is overall within the long-term FRI for its oak and pine communities. As will be discussed below, major portions of the grasslands within the FMU have been kept within a 3-7 FRI through prescribed burning, however the Bypass and Northeastern grasslands are well overdue for burning.

Prescribed Fire History

The goal of prescribed burning in this FMU is to restore and maintain healthy forests; restore and maintain native grasslands and reduce accumulations of hazardous fuels that could threaten adjacent communities during wildfire incidents.

Table RP 8.2 Grasslands within RP FMU from DEC Rocky Point Grasslands Rx Plan 2012

Unit #	Grassland Unit Names	Acres
B-7	Firebreak	7.4
D-5	Whiskey Field	32.2
D-7	Rocky Point Field	16.8
E-2	Bypass	78.9
F-8	Northeastern Grassland	34.2
L-4	Currans Field	80.6
N-1	The Hub	6.5
G-2	Arrowhead	1.9
J-7 /J-8	Northern Twin	2.3
J-7/J-8	Southern Twin	2.3
J-9	Rib-eye	2.1
J-11	Clover	3.3
H-8	Big Oak	1.8
Total Acreage of RPPBSF Grasslands		270.3

The first prescribed burn that occurred within the Central Pine Barrens was implemented on a forested patch of Rocky Point Pine Barrens State Forest in April of 1997. That catalyzed 22 years of prescribed burning within the Central Pine Barrens and since then, prescribed fire management has been focused within grasslands. Thirteen grassland burn units within the Rocky Point Pine Barren State have been repeatedly prescribed burned within this FMU since 1998 (Table RP 8.2, Figure RP 8.9, NYSDEC 2012). The Vicinity Map, taken from current prescribed burn plan, displays the locations where prescribed burning has historically been conducted (Figure RP 8.9; NYSDEC 2012).

Prescribed Burning Priorities and Goals

This final FMU section, identifies initial priorities and goals, reflective of the strategies identified in Chapter 7 of the overall plan for consideration in prescribed fire management planning and implementation. Initial prescribed fire priority projects that are approved, in review, or in development in this FMU at the time of plan development are summarized in Table RP 8.3 and described below. These projects serve as examples for applying the prioritization frameworks described in this plan to develop and identify suitable and meaningful targets for prescribed fire implementation.

Table RP 8.3 Priority Prescribed Burn Projects for the Rocky Point Fire Management Unit

Current Prescribed Fire Projects	Lead Planning Agency	Acres
NYS-DEC Demonstration Forest 1	NYS-DEC	18
NYS-DEC Demonstration Forest 2	NYS-DEC	18
South of Currans Woodlands	CPBC	123
Rocky Point Eastern WUI	CPBC	562
Rocky Point Grassland	NYS-DEC	270

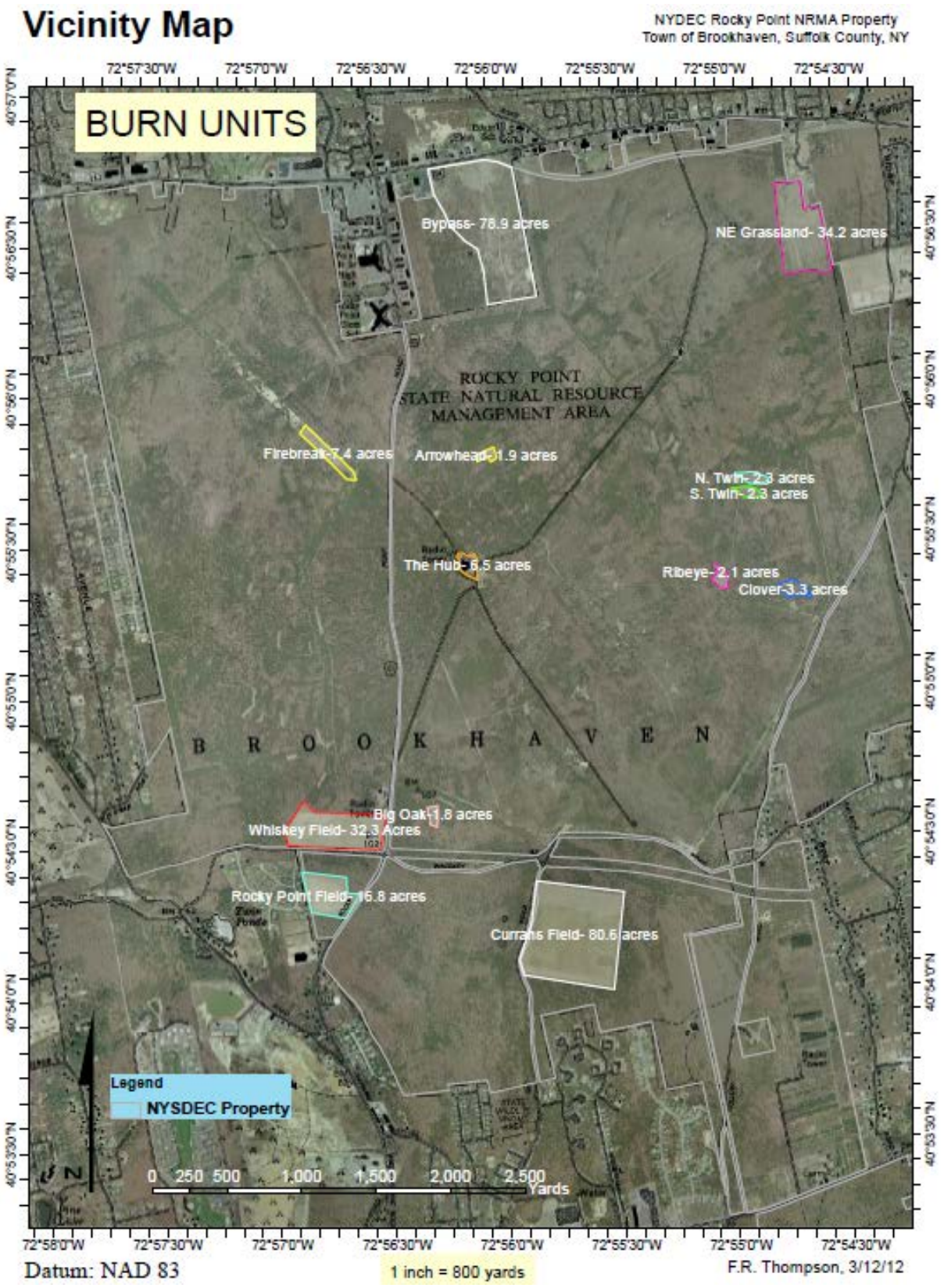


Figure RP 8.9 Vicinity Map RP FMU Grasslands (NYS-DEC Rocky Point Grassland Burn Plan 2012)

Advancing prescribed fire is especially encouraged as a high priority where approved burn plans are in place or in review currently and where fuels have already been treated to support prescribed fire operations. The NYS-DEC Demonstration Forest 1 and 2 meet both of these priorities by having existing approved burn plans and having already been mechanically treated, allowing for immediate operations when conditions are suitable (Figure RP 8.10). The Rocky Point Demonstration Forest Burn Plans (approved 2020) for the Demonstration Forest burn units authorize burns in these thinned plots. Further elevating the priority of these sites is that the fire treatments need to be implemented by no later than November 2021 to take advantage of the fuel reduction treatments. After first entry fire treatments, both units would need to be burned again before 2030 in order to provide a secondary fuels treatment.

Similarly, the Pine-Oak forests of the South Currans Field woodlands have received thinning and mastication treatments by the NYS-DEC to reduce both the risk of SPB outbreak and risk of wildfire as the forest ranked high risk for both concerns. To recognize maximal forest management and WUI projections the South of Currans Field Woodlands Landscape Burn Plan is identified as a priority for prescribed fire management. Establishing Prescribed Fire Enhancement Zone (PFEZ)on 123 acres south of Currans Field, allows for the treatment of 60 acres of Pine-Oak forest that have already been mechanically thinned followed by the burning of 63 acres without any additional thinning. This strategic treatment phasing further increases the priority for prescribed fire operations as this strategy capitalizes on the both the initial mechanical and prescribed fire treatments in order to reduce the need for future costly pre-vegetation treatments. That burn plan calls for burning small patches in the burn units initially, followed by broadcast burning in years to come. Initial burns of the treated areas need to be completed by November 2023 to take advantage of the thinned treatments. The next phase of restoration is to treat these untreated adjacent units with prescribed burning (Rocky Point Demo Forests and S of Currans Field Woodlands Rx's).

Continued management planning and implementation within the Rocky Point Eastern WUI Unit located in the southeast corner of the RPPBSF is advised in order to build upon the prioritization and planning investments that have already been advanced by the Commission, Land Use Ecological Services and NYS-DEC. Under that planning effort, site plans as well as burn and mechanical treatment plans were developed for the purposes of ecological restoration and WUI protections within 562 acres of forests, of which 485 acres are owned by NYS-DEC and 77 acres are owned by the Town of Brookhaven. This plan agrees with those previously identified conclusions and adopts the identified areas as priority areas for prescribed fire in the Rocky Point Eastern WUI (Figure RP 8.10). Increasing the priority of this site, is the recommended establishment of a PFEX within this large land unit as this phasing technique would more efficiently and expeditiously advance fuels management and met management objectives.

From 2019 to 2020, NYS-DEC re-established many of the former RCA firebreaks within RPPBSF by clearing vegetation within the historic 20 feet wide fire breaks down to mineral soil. During the era of RCA, the firebreaks were intended to exclude fires from the facility, now these breaks will serve to contain fires ignited with forest stands that have since succeeded within the center of what is now RPPBSF. Prescribed fire operations benefit from such infrastructure as a contingency safety measure. In many cases areas that have installed firebreaks are also areas that have greater potential to be priority areas for WUI protection and buffering through prescribed fire operations. Additionally, the investment required to implement prescribed fire is lessened at locations with installed firebreaks as that is part of necessary pretreatment for new prescribed fire units. Implementing the above-mentioned prescribed fire projects within the RPPBSF provides additional strategic opportunities to achieve programmatic goals and objectives most readily. For example, in the South of Currans Woodland, the landscape prescribed burn would anchor off the recently cleared firebreak and create a much wider buffer to the subdivisions to the east and southeast.

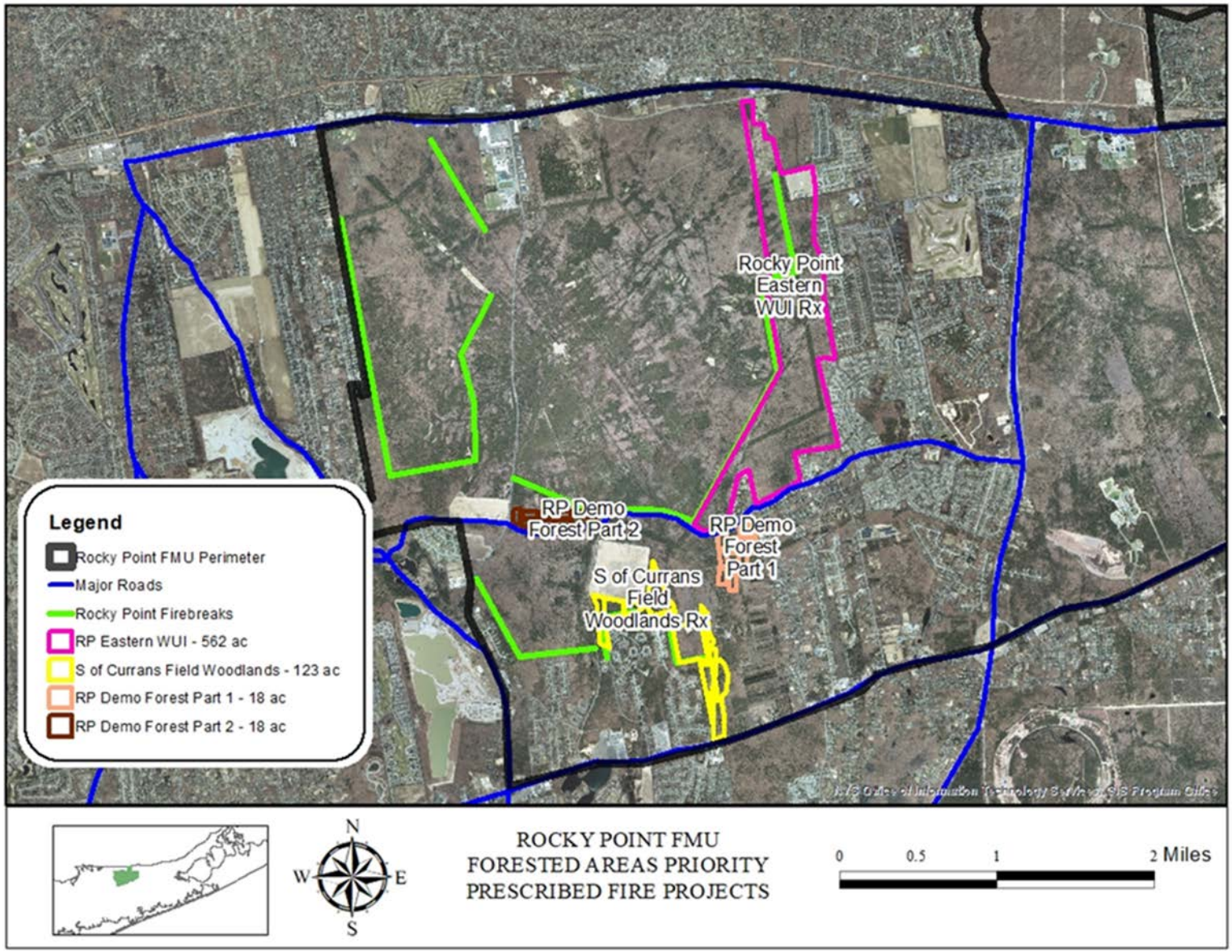


Figure RP 8.10 Active Prescribed Fire Projects within Rocky Point Pine Barrens State Forest as of 2020

Priority prescribed burns in this FMU include continuing to burn the 13 grasslands identified in the existing Rocky Point Grassland Burn Plan (2012) and displayed in Figure 8.9 in accordance with the NYS-DEC burn rotation schedule. For future planning the Town of Brookhaven grassland which is currently being overtaken by pitch pine is recommended as high priority for restoration in order to maintain grassland habitat.

In addition, these above mentioned and other grasslands as well as non-burnable maintained areas throughout this FMU that are directly adjacent to State or County owned forested areas could proactively be established as future Prescribed Fire Enhancement Zones. These are places where fire could be applied either in conjunction with grassland burns or against non-burnable areas. Examples include forests adjacent to Whiskey Field, west of the Rocky Point public high school campus, adjacent to Bypass and NE grasslands as well numerous pocket grasslands embedded within the FMU. These are areas prime for future prescribed fire projects.

A large volume of valuable information to assist in prioritization for WUI protection is available within the Ridge Manorville and Calverton Community Wildfire Protection Plan (CWPP). The CWPP compiles wealth of information about wildfire prevention actions and prescribed fire management planning in this FMU. The CWPP was consulted when developing and identifying initial priorities within the FMUs and will continue to serve in the identification and delineation of successive sequential priorities into the future. One particular area of note within the CWWP is the Brookhaven State Park, which is the second largest block of contiguous forested natural area in this FMU. For the purposes of future planning, there are areas within the park boundaries that would be important to consider as targets for ecologically beneficial prescribed fire. In regard to WUI protection focused prescribed fire operations, the western urban interface of this State Park is generally protected from wildfire by two factors. The first is that the prevailing winds are predominantly from the west while easterly winds are rare. Therefore, if wildfire does ignite, the fires are not likely to come from adjacent forested areas into the subdivisions. Secondly, the four lane William Floyd Parkway helps provide a fuel break which divides the forests from the homes. The CWPP Risk analysis identifies that most of the eastern boundary as low to moderate wildfire risk as there is a mosaic of oak and pine forests as well as open areas and lakes that break up fuel continuity. Future analysis will be performed to determine if there are protection project needs against the high and extreme risk areas on the southeast corner.

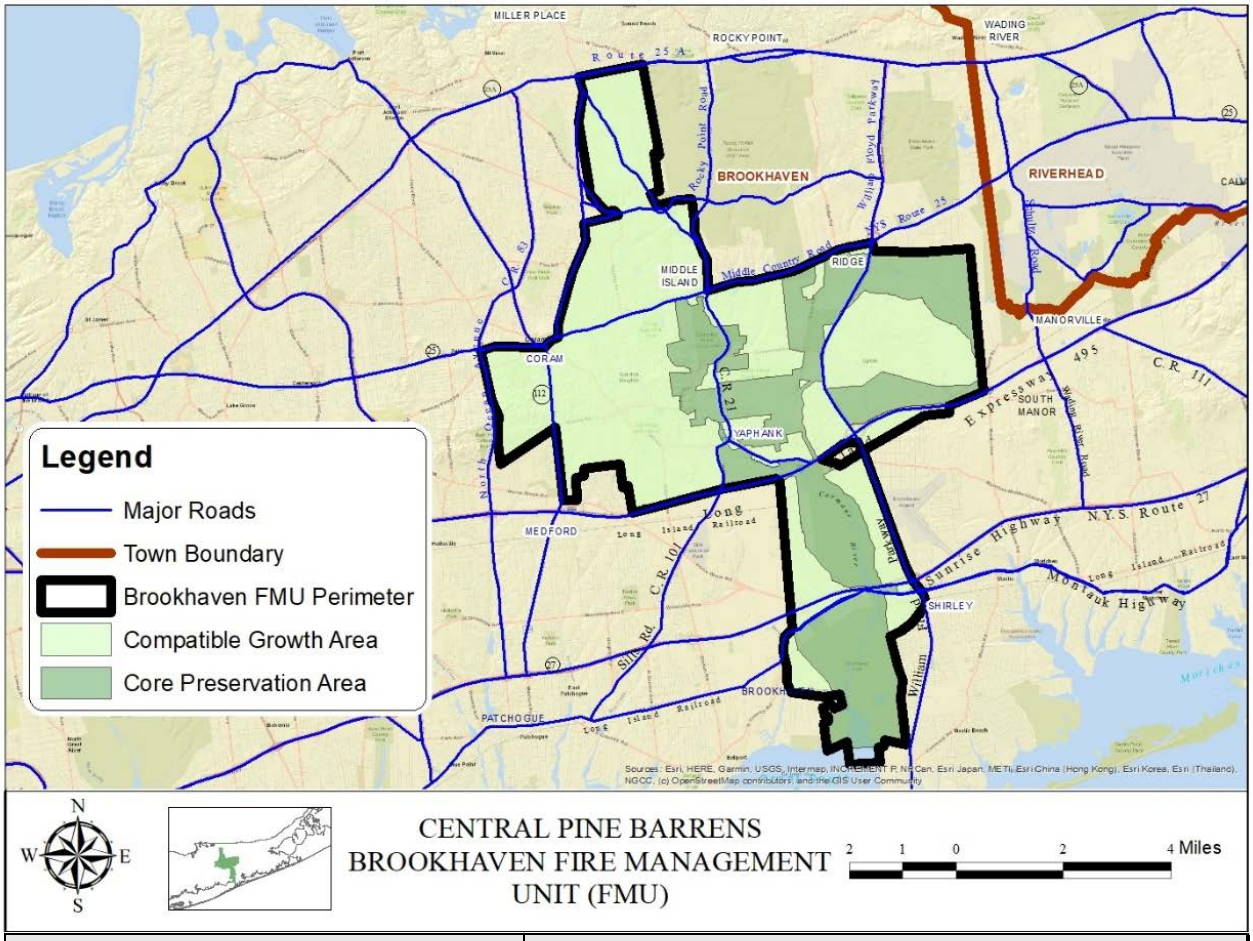
These projects and identified locations demonstrate operationalization of the priority framework through the process of targeting and planning prescribed fire projects. Countless other projects exist across the landscape, and in this FMU, that hold benefit potential for many of the priority objectives identified. This plan recommends continuing to identify and develop prescribed fire projects that meet objectives for implementation as time and resources allow.

Environmental Compliance

NYSDEC determined that the proposed Prescribed Fire and Mechanical Treatments in the Rocky Point Natural Resource Management Area Fire Management Plan (NYSDEC 2007) were permitted when it issued Negative Declaration # 2008-SLM-1-252 (December 9, 2008), determining that these would not result in any significant adverse environmental impacts. SEQRA compliance will be achieved for lands scheduled for management treatment that have not already been reviewed for environmental compliance.

Brookhaven FMU

FMU Demographics, Land Use Protections and Ownership



BROOKHAVEN FIRE MANAGEMENT UNIT	
Towns	Brookhaven
Fire Departments	Yaphank, Rocky Point, Farmingville, Mastic
	Miller Place, Coram, Selden, Gordan Heights, Medford,
	Brookhaven, Ridge, Brookhaven NL, Middle Island,
Total Acreage	30245
Core Preservation Area	10417 acres = 34% of area
Compatible Growth Area	19828 acres = 66% of area

Figure B 8.1 Brookhaven Fire Management Unit with Demographic Table

The Brookhaven Fire Management Unit is located in the western most half of the Central Pine Barrens and extends from Miller Place to the Great South Bay in Wertheim Wildlife Refuge in Shirley and from Route 83 to the eastern fire break at BNL (Figure B 8.1). It is the second largest of the FMU units (Figure 8.1; Table B 8.1) and 50% of the lands are in public land ownership. Of these, 34% of the land area is classified as Core Preservation Area. The larger percentage of Compatible Growth Area reflects the large amount of development occurs in this FMU. A majority of the Core Preservation Area is public parklands

with more half occurring within Southaven County Park and in US Fish and Wildlife Service (USFWS) managed Wertheim National Wildlife Refuge (NWR). The western half of this Unit is highly developed, and the fuel blocks are fragmented. As a result of this development this FMU has had significantly less wildland fire issues than other FMU's.

The major landowners in this FMU are US Department of Energy - Brookhaven National Laboratory, Suffolk County, US Fish and Wildlife Service, Town of Brookhaven and NYS-DEC (Table B 8.1; Figure B 8.2). Federal lands account 25% of this FMU (7536 acres). The campus of the US Department of Energy managed Brookhaven National Laboratory (BNL) is the largest publicly owned land that is located in the eastern section of this FMU. BNL encompasses intensely developed land but also has large, forested tracts with over 2800 acres of forest and wetlands. Suffolk County owned lands in this FMU include the Southaven County Park (1356 acres), Dennis Puleston Warbler Woods Preserve (648 acres), Cathedral Pines County Park (320 acres), Prosser Pines Nature Preserve (50 acres). In total the County owns over 4500 acres making up 15% of the lands of this FMU.

The 2550-acre USFWS Wertheim NWR is located at the south end of the FMU was established in 1947 primarily as an estuary for migratory birds. This diverse ecosystem is located at the mouth of the Carmans river which discharges into the Great South Bay.

The Town of Brookhaven owns 2818 acres (9% of the FMU) including protected lands that border the Carmans river corridor and Southaven County Park, as well as those that support cultural history such as the Longwood Estate (35 acres) which is adjacent to Longwood Pine Barrens State Forest. Other Town lands are those that support town infrastructure or recreational / athletic parks.

While NYS-DEC is a large landowner by comparison in a majority of the FMU's, the state-owned lands in this FMU total only 1% of the acres within it. These lands include the East Bartlett Pine Barrens State Forest (100 acres) and the Longwood Pine Barrens State Forest (165 acres).

Table B 8.1 Brookhaven Fire Management Unit Public Land Ownership

BROOKHAVEN FIRE MANAGEMENT UNIT PUBLIC LAND OWNERSHIP = 50%	
Federally Owned Land	7536 acres = 25% of the FMU
NY State Owned Land	402 acres = 1% of the FMU
Suffolk County Owned Land	4529 acres = 15% of the FMU
Town of Brookhaven Owned Land	2818 acres = 9% of the FMU

Natural Features

Topographically the FMU has the high ground ridgetop formed by the Ronkonkoma Moraine running west to east through the center of the FMU. The highest ground is located at the west central boundary of the FMU at Bald Hill near the Brookhaven Town Hall campus with an elevation of over 300 feet. The higher ground of the western half of this FMU drops to the east in the central portion. Public land ownership primarily follows the topographic features described. Most public lands are along the ridge line of the Ronkonkoma Moraine east to west or is along the Carmans River drainage.

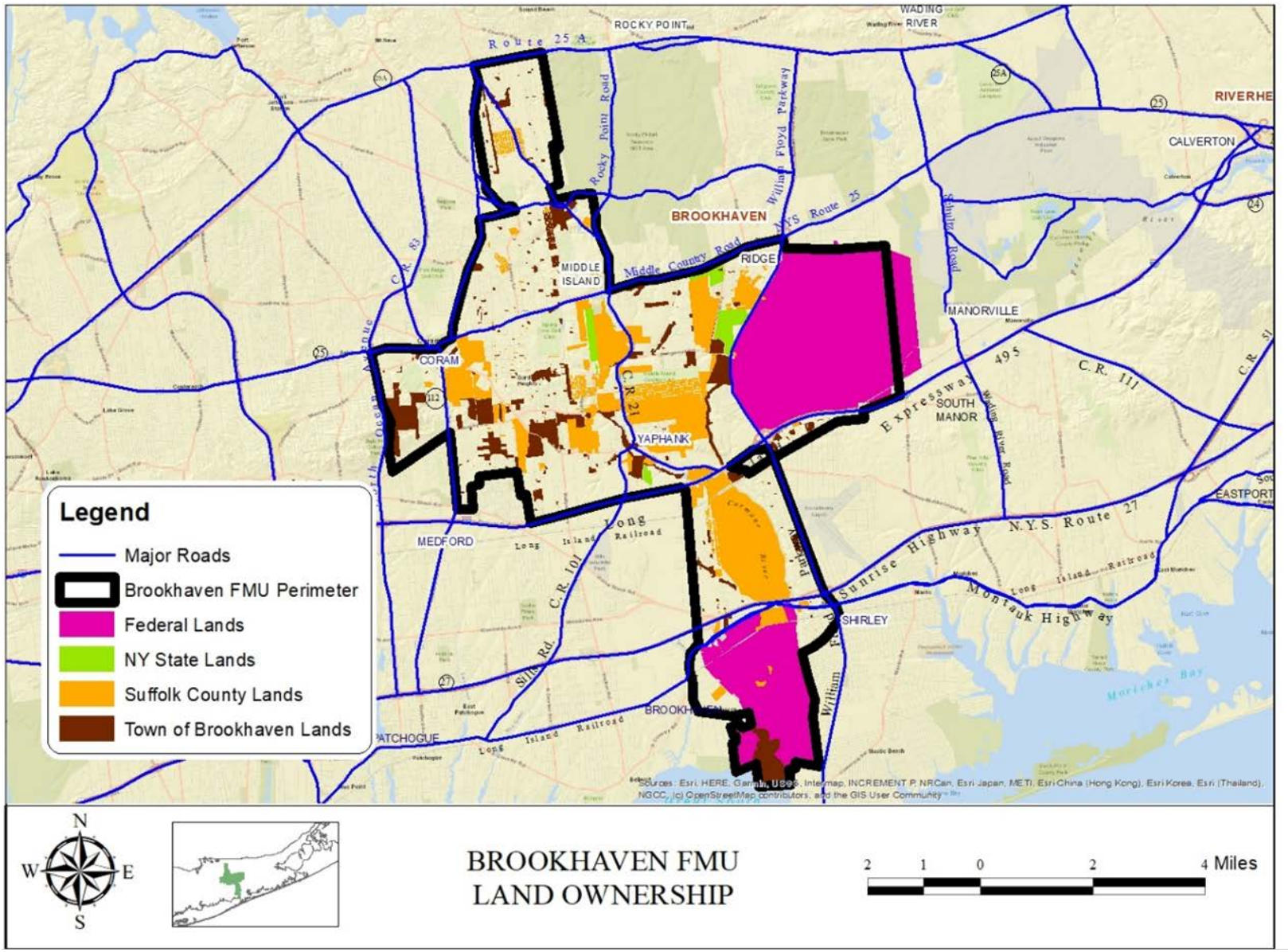


Figure B 8.2 Public Landownership in the Brookhaven Fire Management Unit

The Carmans River watershed is the dominant feature of the central core of this FMU. The river system travels from its northern headwaters in Middle Island south and discharges into the tidal waters of Bellport Bay (which is the northeastern portion of the larger Great South Bay). The Carmans river is a freshwater stream that is fed by groundwater for its first eight miles and transitions into a tidal estuary for its last two miles. All of the Carmans river is designated as Scenic River or Recreational River by New York State (NYSDEC) and is classified as a Class 1 Trout Stream. East of the Carmans River the topography is much like the corrugated terrain described in the Rocky Point FMU with alternating highs of about 120 feet and lows about 70 feet in elevation along both east / west and north / south transects. The average slope is 6% with maximums of 35%.

The northern section of the unit is dominated by Oak Pine and Pitch Pine Oak Forest (Warbler Woods), old field grasslands, the headwaters of the Carmans River and white pine (*Pinus strobus*) plantations (Prosser Pines Preserve and Cathedral Pines County Park). Forested tracts of Oak-Pine Forest and Coastal Oak forests are scattered in the center of this unit starting in the northeast corner on Brookhaven National Lab (BNL) lands then snaking down toward Shirley. The southern half of the Carmans River runs through two public land management areas, the Southaven County Park and the Wertheim National Wildlife Refuge which are separated by Sunrise highway. This large ecosystem hosts a variety of habitats including Pitch Pine, Pitch – Pine Oak and Oak-pine woodlands; old field grasslands and fresh, brackish and saltwater impoundments and wetlands making this FMU one of only three that support saltwater ecosystems. Further and more comprehensive classifications of vegetation types as it relates to wild and prescribed fire can be found within the fuels section below.

Recreation

There is a considerable amount of recreational use of the lands and waters in public lands of this FMU. Hiking, biking fishing, hunting for both for white tailed deer and waterfowl, boating, picnicking, camping, bird watching, and other wildlife viewing are extremely popular in this FMU.

Wertheim NWR uniquely offers nature trails and river access with Southaven County Park immediately to the north featuring a large campground, extensive picnic areas, bridle paths, hiking trails, waterfowl hunting, fishing (especially for trout) and boating. It also provides the unique opportunity for skeet shooting or to hop a ride on mini steamer train. Cathedral Pines County Park which is sited along the headwaters of the Carmans River also provides campsites and picnicking for youth groups, clubs and family camping and its mountain bike trails are heralded and extensive. Warbler Woods, as its name suggests is renowned for bird watching, especially for warblers due to the number of species that inhabit and migrate through this preserve.

Unique Land Use History

Brookhaven is a culturally rich area with a variety of land uses, the most renowned is the history associated with Brookhaven National Laboratory (BNL). BNL is located on the eastmost portion of this FMU in the hamlet of Upton, New York and was (originally) established in 1947 to explore the peaceful applications of atomic energy. Its most historic and notable use was as Camp Upton, a WWI army camp. It was also used as Civilian Conservation Corp camps; a WWII internment center for Americans of Japanese descent; a military convalescent and rehabilitation hospital and briefly from 1925 to 1927 this site was known as Reserve National Forest as established and rescinded by the US Forest Service. An interesting research experiment initiated in 1961 at BNL, the BNL Radiation Ecology Project, examined the effects of 20 hours per day of doses of a 9500-curie gamma source of Cesium-137 on the growth of 50 acres of forest in the northeast of BNL (BNL 1962). The long-term effects of massive doses of gamma

radiation within what is now referred to as the Gamma Forest, are dead zones and stunted vegetation which can still be observed today (Statler and Kincaid 2009).

Brookhaven National Laboratory is one of 10 national laboratories. It is primarily supported by the U.S. Department of Energy's (DOE) Office of Science. It is also a partnership with multiple universities and has a staff of over 2500 people. In addition to its research and support facilities, the Lab campus is presently home to the US National Weather Service (NOAA) Forecast Office New York, New York which provides NWS forecast services for the New York City Metro area, northern New Jersey, Connecticut as well as Long Island and southeast New York area.

These historic and current land use and management decisions have shaped the lands, the vegetation, and natural communities of what is now BNL. As a result, the campus also currently supports an abundance of natural areas such as woodlands, grasslands, and wetland habitats which includes white pine plantations. To the east, large fire breaks have been maintained to protect powerlines and railroad. The "Gamma Forest" remains dwarfed from years of gamma radiation research, while the areas above the Collider support a health vegetation community. The extensive research has been focused on these diverse and unique ecosystems which is reflected in the inventories that documented over 230 plant species, including two New York State Threatened and two New York State Rare species, 15 animal species, and approximately 85 nesting bird species observed on site. Because of its location within the Atlantic Flyway, more than 200 transitory bird species have also been documented.

Another interesting and historic land use that can be observed in vegetation community is the majestic stand of white pines that were planted in 1812 within Prosser Pines Nature Preserve. This unique and rare forest is one of the oldest surviving White Pine Plantations to exist on the eastern seaboard of the United States.

Unique Ecological Disturbance

In 2008, mass oak mortality was reported was documented by NYSDEC Division of Lands and Forests within this FMU. Two small sections in the western section of BNL along William Floyd Parkway were impacted, however the greatest mortality within this FMU occurred in the mid to northeastern section of BNL (Figure 8.1).

The next major ecological disturbance, southern pine beetle outbreaks were detected in 2014. Wertheim NWR as well as Connetquot State Park and Hampton Bays experienced the first significant and expansive outbreaks of SPB. The Beetle quickly eliminated the majority of the pines from Wertheim NWR from 2014-2016 and progressed north into Southaven County Park where it continues to be active and has caused mass loss of pines starting in 2016 and 2017. Uncountable mass dead standing and downed pines as well as 10,000 individual infested pines were cut during suppressed and hazard tree elimination lay in the wake of the SPB outbreak. As of the publishing of this report, SPB remains active in Southaven County Park and while suppression management continues. The beetle swiftly and significantly reduced the abundance of especially large heritage pines within this ecosystem and eliminated a majority within Wertheim NWR effectively advancing succession to Oak dominant systems. The mass die off of pitch pines has also resulted in increased hazards, canopy closure and fuel loading especially of 1000-to-10,000-hour fuels within this system.

Fire Districts

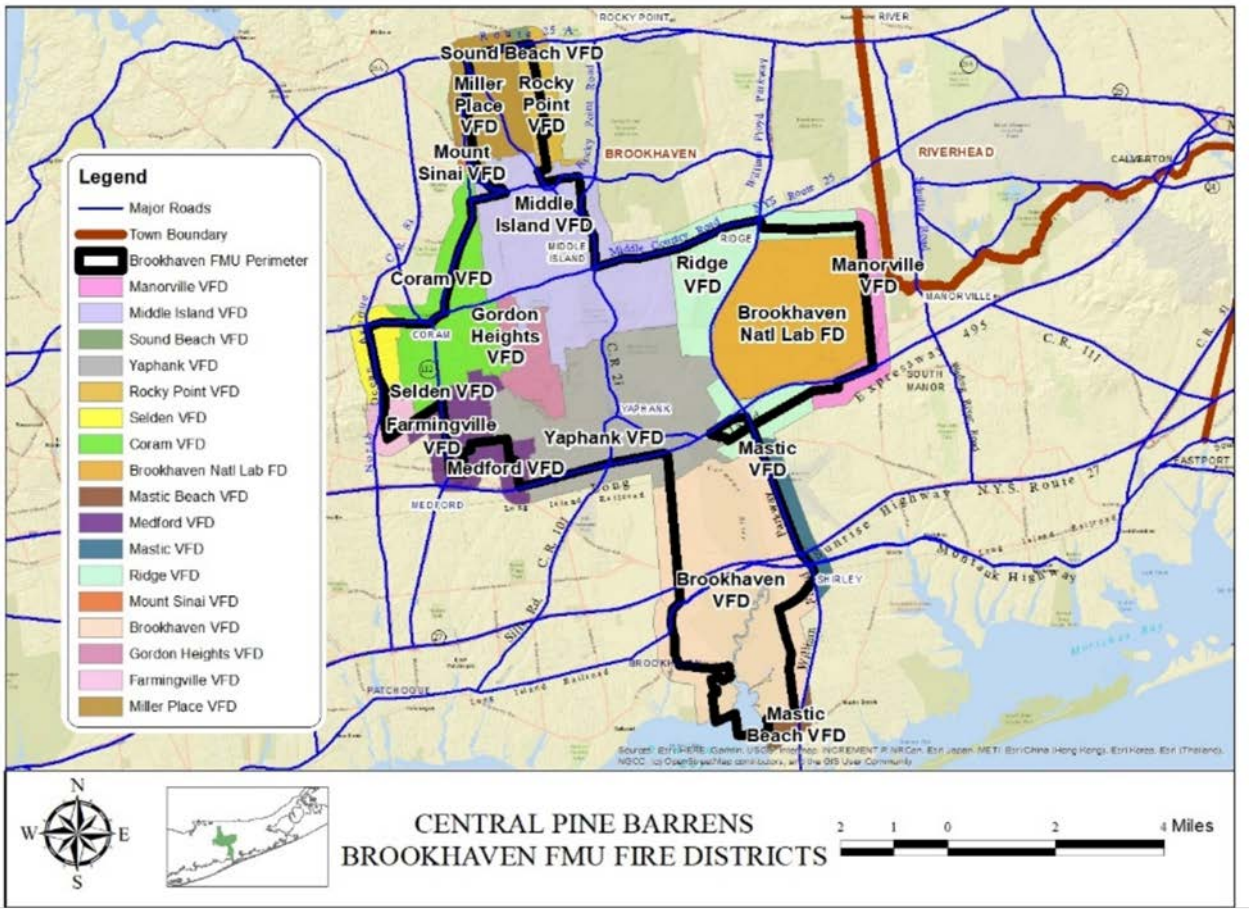


Figure B 8.3 Fire Districts within the Brookhaven Fire Management Unit

There are 18 fire departments either are within or immediately about this FMU (Figure B 8.3).

Wildland Urban Interface

Wildland Urban Interface concerns in this FMU are primarily subdivisions and developments adjacent to large, forested tracts of Suffolk County and Town of Brookhaven owned lands, including County Parks. These mostly follow the Central Pine Barrens Core lands in the center and southern areas of this FMU. The Wildfire Risk Rating map excerpted from the Ridge Manorville Calverton Community Wildfire Protection Plan (discussed more comprehensively below) identified that the vast majority of WUI risk in the northern the portions of this FMU was classified as low to moderate. The predominance of oak forest communities throughout most of this FMU and lack of large fire history indicate there is no significant WUI issues in this FMU (Figure B 8.5).

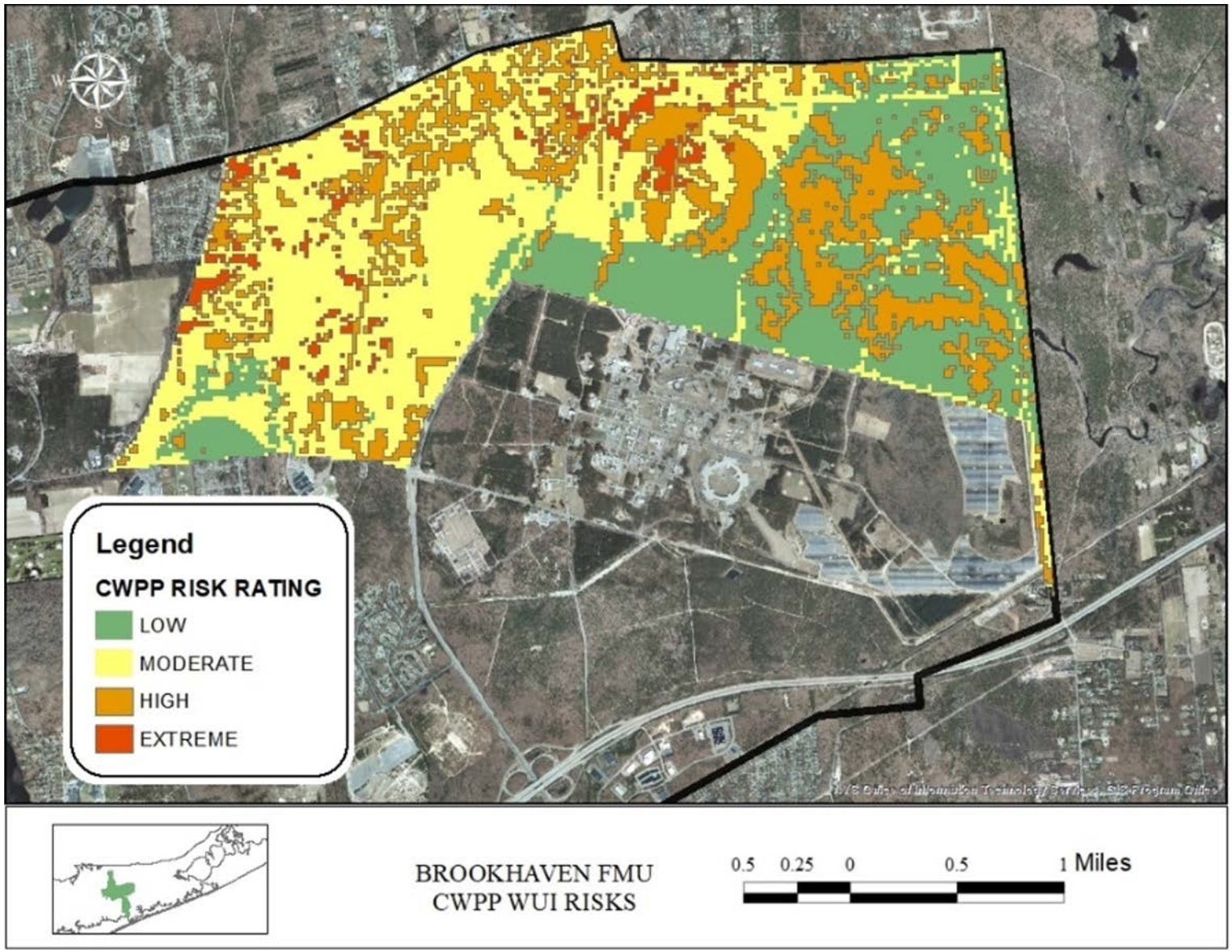


Figure B 8.4 Brookhaven Management Unit Wildfire Urban Interface Risks Identified in the Ridge Manorville Calverton Community Wildfire Protection Plan

Community Wildfire Protection Plan (CWPP)

The Central Pine Barrens Commission sponsored Ridge/ Manorville/ Calverton CWPP that was discussed comprehensively in the Rocky Point FMU also covers the areas of Ridge east to BNL within this FMU (Figure RP 8.6 and B 8.4). Mechanical fuels reduction and prescribed burn projects outlined in that plan are recommended on the grounds of Brookhaven National Laboratory and in the prescribed fire management recommendations section below. A map showing the community risk analysis for the Brookhaven FMU portion of the CWPP is detailed the wildland urban interface section (Figure B 8.4).

Fuels

The fuels within the Brookhaven FMU are primarily Oak forest, Oak Pine forests and Pitch Pine forests (Figure B 8.5). Due to development, these fuels predominantly occur within the remaining contiguous forests including those immediately north and south of Yaphank and southwest of Middle Island as well as Southaven County Park, Brookhaven National Lab and Wertheim NWR. Below are a series of summary descriptions of fuel types by the dominant vegetation communities (Figure 8.5).

- Oak Communities: The primary forest fuel types in this FMU are Oak Pitch Pine and Oak forest. The Oak Pine forests are the most dominant and are scattered throughout the FMU while the Oak forests are primarily located in the western and central portions of the FMU as well as in the southern portion in Wertheim NWR.
- Pine Communities: The dominant vegetation of Pine communities within this FMU are Pitch Pine Pitch Pine Oak forest which are most commonly found within B and Southaven County Park.
- Grasslands: Grasslands occur in low frequency and size within this FMU although the fuels map indicates a high potential for grasslands, agricultural lands or turfgrass accounts for the greater portion. The largest old field grassland is County owned and located on East Bartlett Road in Middle Island. Wertheim NWR and Southaven County Park also support old field grasslands.
- Wetlands: Wetlands and riparian areas are abundant in this FMU as predominantly associated with the Carmans river corridor. They are also found dispersed but a lesser degree throughout the FMU as well. Tidal wetlands occur within Wertheim NWR being the transition zone of the Carmans river and Great South Bay.

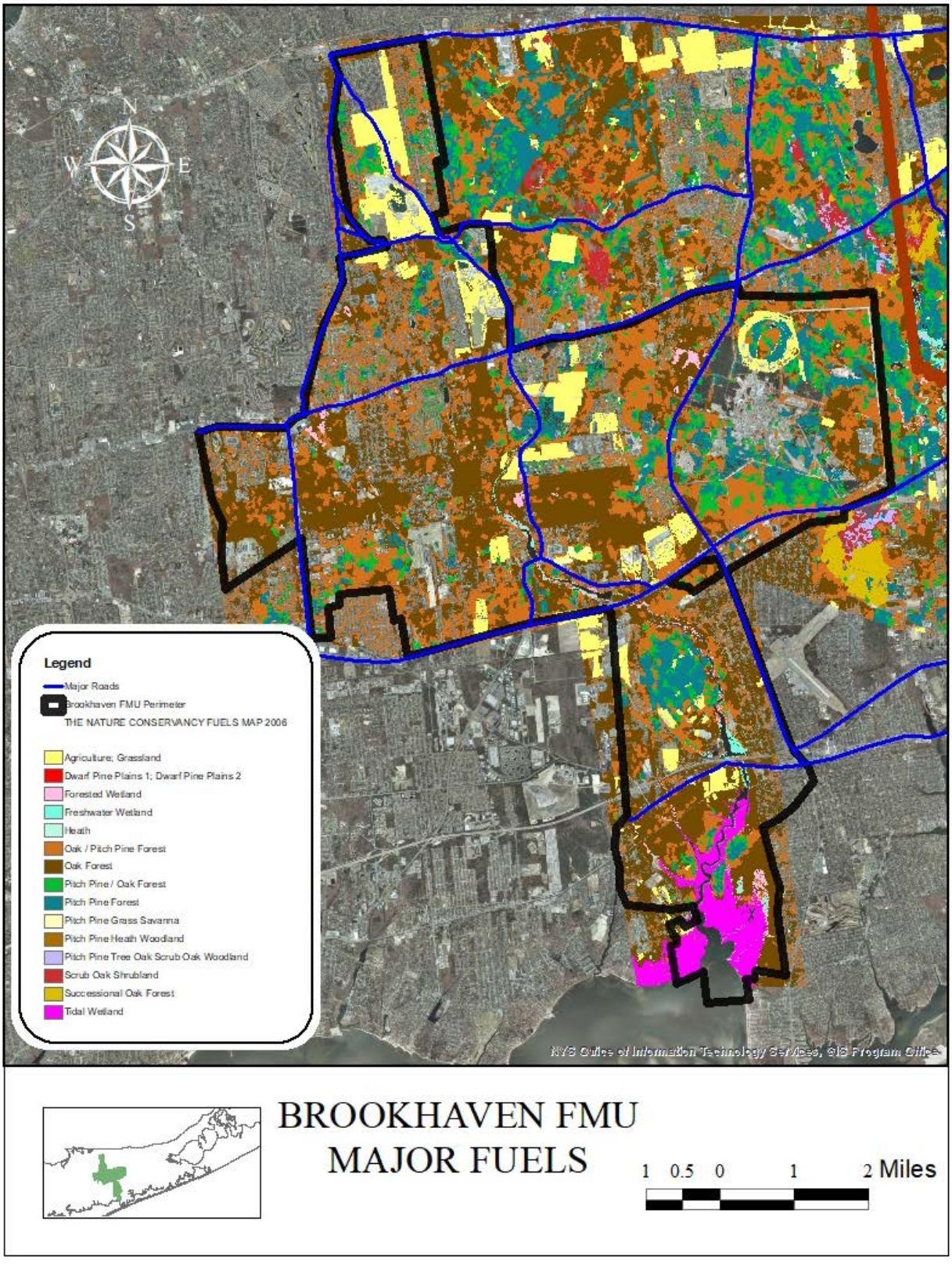


Figure B 8.5 Major Fuels by Dominant Vegetation Community of Brookhaven Management Unit

Fire History

From 1931 to 2020, the most active and largest fire history in this FMU was documented in extreme northern portion and the eastern Unit. The northernmost prong of this Unit (abutting Rocky Point FMU which is immediately east) had some large fires of unknown dates in the 1940s, but due to development on that land and subsequent elimination of fuels, wildfire will never occur again at this location. In the east, a large fire in the 1930s occurred both within this and Rocky Point FMU. This location has experienced two wildfires since 1960s. A fire in late August 1963 burned 375 acres just off of BNL and just touched the northeast corner this FMU. In the same area on April 9, 2012, the Crescent Bow Fire ignited on the northern boundary of BNL and burned 1100 plus acres in an easterly direction into the Manorville-Calverton FMU. Along the southern boundary of BNL, two large fires were documented in the 1930's and the 1960's. A total of 50% of these burned areas occurred outside of the BNL boundary and have since been developed.

Due to long established development, large fire history is notably lacking in the western section of the FMU. It is highlighted that formal fire history for the southern section of the FMU (e.g., Southaven and Wertheim NWR) has not been documented or discussed as land area were not part of Central Pine Barrens Boundary which was delineating boundary used within Windisch's 1930 - 1994 fire history inventory. This does not mean that fire did not occur in these locations, only that has yet to be formally documented.

An overall evaluation of modern fire history (including Southaven and Wertheim land areas, identifies that 653 fires have occurred in this FMU between 1995 and 2018. With the exception of the Crescent Bow Fire of April 2012, none of the fires were significant.

Fire Return Interval (FRI) Departure

The fire return intervals for the Oak and Pine dominated vegetative communities is 40-100 years while grasslands have a significantly lower FRI at 3-7 years. Fire history analysis performed as part of this Plan identifies that large, major fires (in excess of 100 acres) occurred in this FMU in the 1930's (2 large fires), in the 1940's (1 large fire) and 2010's (180 acres of the 1124-acre Crescent Bow fire). During the period from 1930 to 2020 this FMU followed the established FRI with a total of 4 large fires. It can be argued that this FMU is very reasonably within its FRI, but large woodland tracts in the center of the FMU and in Southaven County Park are overdue for fire.

Prescribed Fire History

The majority of prescribed burning that has been implemented within this FMU has been conducted by the US Fish and Wildlife Service at the Wertheim NWR. Their burning was utilized to primarily control Phragmites within tidal marsh in 2000's.

More recently, BNL Prescribed burning has accomplished prescribed fire operations in the Pine Oak and Oak Pine forests at Brookhaven National Lab in 2004-2005 (22 acres) and in 2017-2018 (39 acres). Additional prescribed burning operations are planned at BNL as noted below in Table B 8.2.

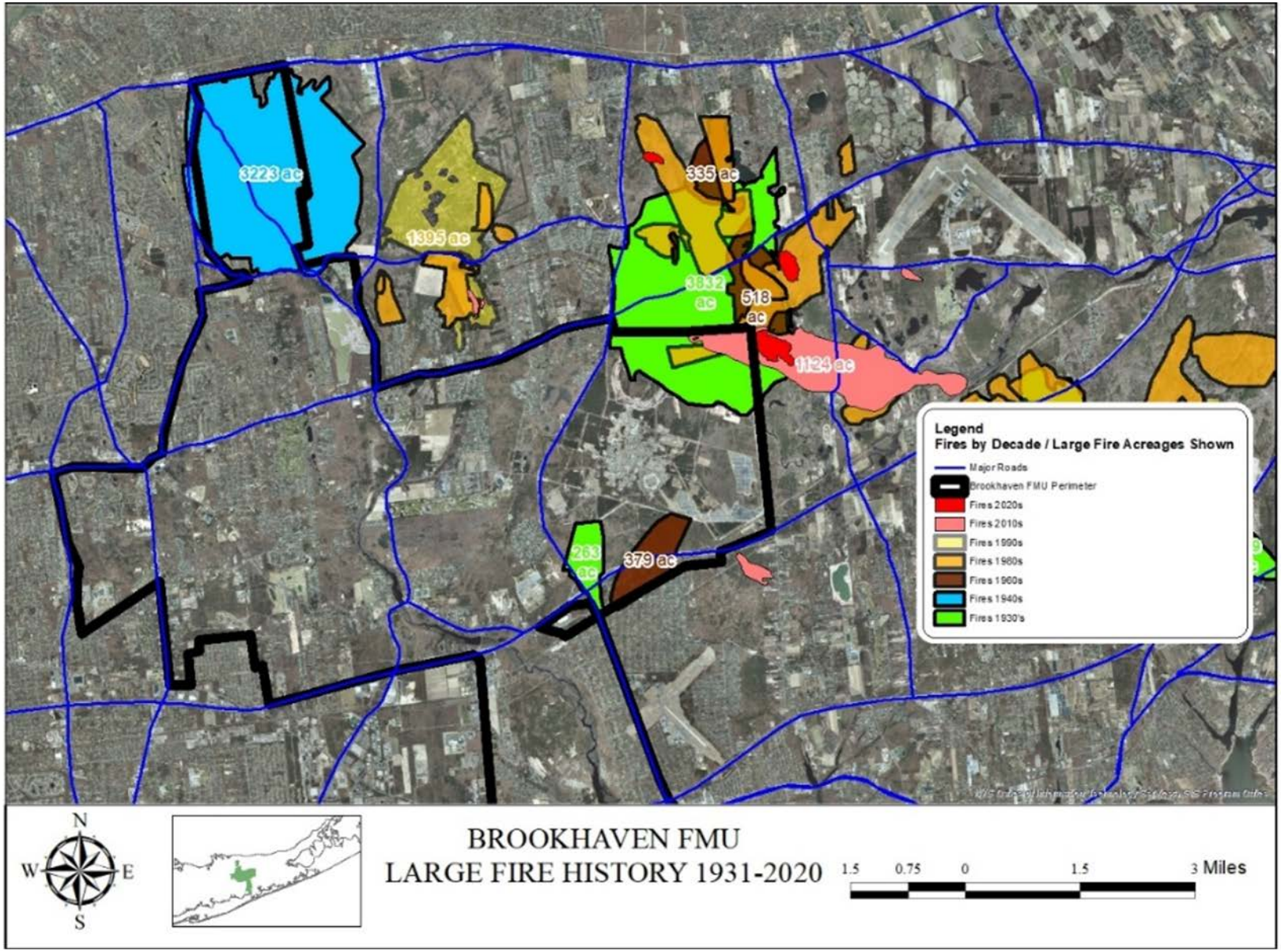


Figure B 8.6 Fire History Map from 1931 to 2020 within the Brookhaven Fire Management Unit

Prescribed Burning Priorities and Goals

Initial prescribed fire priority projects that are approved, in review, or in development in this FMU that at the time of Plan development are summarized in Table B 8.2 and described below. As this plan is intended to promote and expand prescribed burning in the Central Pine Barrens, the identification and establishment of additional projects is strongly encouraged that over time.

Table B 8.2 Brookhaven Fire Management Unit Active Prescribed Fire Management

Current Prescribed Fire Projects	Lead Planning Agency	Acres
North Complex	Brookhaven National Lab	111.2
East Complex	Brookhaven National Lab	58.8
Saddle East	Brookhaven National Lab	13.6

Brookhaven National Lab currently has the most active prescribed fire programming within this FMU with burn plans approved for the treatment of a total of 186.3 forested acres on the northeast side of the BNL. As noted above, 39 acres within this plan have already been treated, and the additional subunits within each of these complexes are scheduled for future fuels treatment and retreatment for purposes of wildfire risk reduction and restoring fire to maintain the ecological condition of the forests.

Similar forest health improvement and WUI risk reduction have been identified as priorities within Southaven County Park by Suffolk County Department of Parks and the Commission. This park has been significantly impacted by southern pine beetle invasion and subsequent cut and leave suppression. Burning as a follow up treatment will be pursued between Suffolk County Parks and the Commission. This burn would also provide WUI protection to the large public campground in this Park and the adjacent neighborhoods to the east. There are ample opportunities within the park to utilize Prescribed Fire Enhancement Zone for the safe and effective treatment of fuels following first entry mechanical and prescribed fire treatments.

Additional future prescribed fire priority project areas and potential Prescribed Fire Enhancement Zones occur in this FMU on Suffolk County parklands, including Cathedral Pines, Warbler Woods and possibly some fire protection for the Davis Meeting House site. The Town of Brookhaven, County and State lands in the vicinity of the Longwood Estate also hold high potential for meeting various management objectives through prescribed fire implementation.

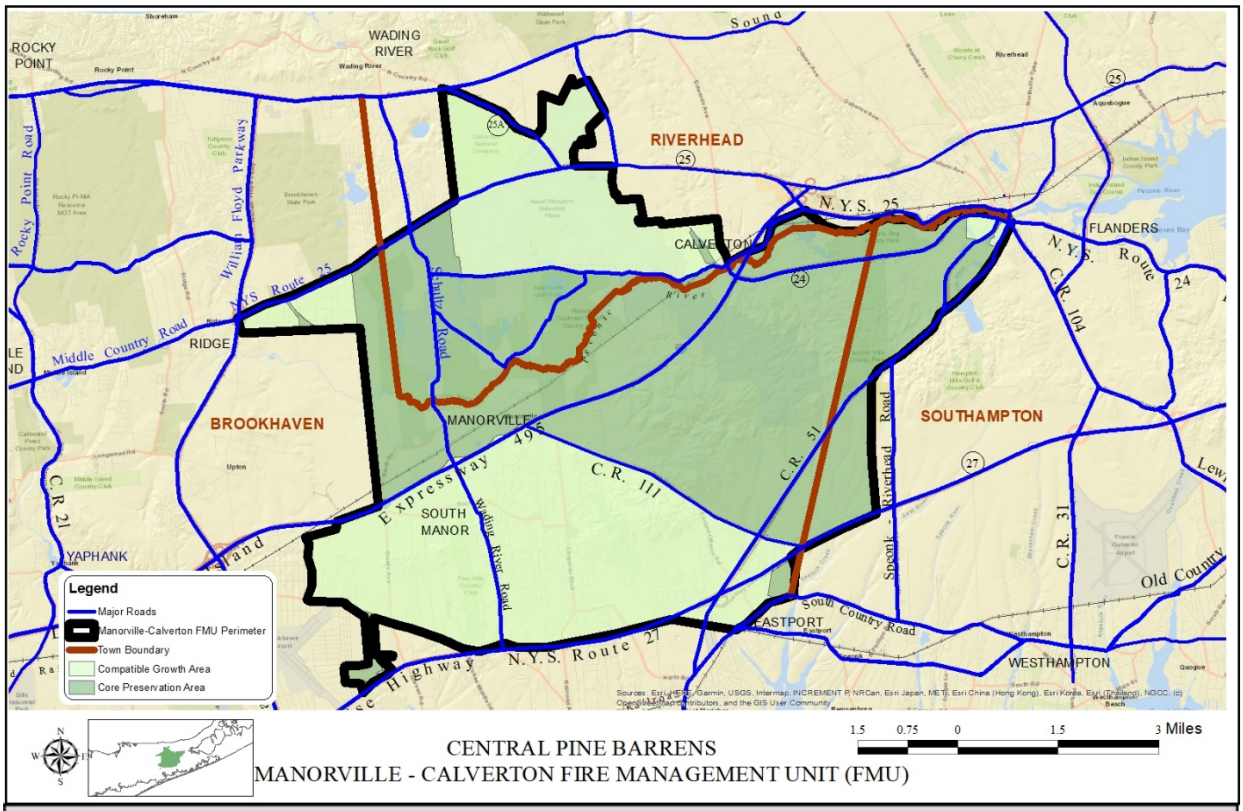
Wertheim National Wildlife Refuge is also planning for additional prescribed burns in the future that would benefit from interagency collaboration and support for planning and implementation.

Environmental Compliance

Brookhaven National Lab and Wertheim National Wildlife Refuge both have completed federal compliance to prescribe burn.

Manorville - Calverton FMU

FMU Demographics, Land Use Protections and Ownership



MANORVILLE-CALVERTON FIRE MANAGEMENT UNIT	
Towns	Brookhaven, Riverhead, Southampton
Fire Departments	Manorville, Riverhead, Eastport, Flanders, Wading River, Ridge, Mastic, Center Moriches, East Moriches
Total Acreage	34343
Core Preservation Area	19192 acres = 56% of area
Compatible Growth Area	15151 acres = 44% of area

Figure MC 8.1 Manorville Calverton Fire Management Unit Map and Demographic Table

The Manorville Calverton Fire Management unit is the largest of all the Central Pine Barrens FMU's and is very representative of the natural character of the Central Pine Barrens as it abounds with a diverse natural ecosystem and has the most robust fire history and active prescribed fire management (Figure 8.1; Table MC 8.1). The greater portion of the FMU is protected as part of the Core Preservation Area which traverses the center of this FMU (Figure MC 8.1).

Suffolk County is the largest landowner within this FMU with lands of New York State and the Towns of Brookhaven, Riverhead and Southampton interspersed (Table MC 8.1; Figure MC 8.2). Robert Cushman Murphy County Park (2200 acres), Manorville Hills County Park (2,018 acres), Peconic River County Park (601 acres), Peconic Bog County Park (368 Acres) and Cranberry Bog County Park(436 acres) and Pine Meadows County Park (156 acres) are all located in this FMU.

Otis Pike Pine Barrens State Forest (5,400) is intertwined within the Robert Cushman Murphy County Park Boundaries and extends east to the Fresh Ponds complex north of this unit. Both of these public lands as well as Eastport Pine Barrens State Forest (800 acres) occur completely within this FMU. The Federally owned lands consist of the Calverton National Cemetery (1058 acres), small areas on Grumman Road in in Enterprise Park at Calverton (EPCAL) and Brookhaven National Laboratory (593 acres) lands east of Princeton Road and the powerline on the eastern side of the BNL campus.

The Town of Brookhaven owns 4% of the lands within this FMU which, while dispersed throughout the western and central half of the FMU, are most sizable and occur just east of River Road near the northern section of Southaven County Park and within the Manorville-Eastport area. In the Town of Riverhead, Town owned lands occur within and between the 2900-acre Enterprise Park (EPCAL). Southampton Town accounts for the smallest land acreage of the FMU west of Speonk-Riverhead Road.

Table MC 8.1 Manorville Calverton Fire Management Unit Public Land Ownership

MANORVILLE - CALVERTON FIRE MANAGEMENT UNIT PUBLIC LAND OWNERSHIP = 52%	
Federally Owned Land	1829 acres = 5% of the FMU
NY State Owned Land	4379 acres = 13% of area
Suffolk County Owned Land	9887 acres = 29% of the FMU
Town of Brookhaven Owned Land	1408 acres = 4% of the FMU
Town of Southampton Owned Land	194 acres = 0.6% of the FMU
Town of Riverhead Owned Land	282 acres = 0.8% of the FMU

Natural Features

The Peconic River and its tributaries run from north to south in the central portion of this FMU and then make a turn to the east as the river widens before reaching Riverhead then discharges into Peconic Bay. The headwaters occur in the western section ,adjacent Rocky Point and Brookhaven FMUs and are 50' above sea level. The watershed encompasses the land to the north at the base the Harbor Hills Moraine and grades southward. South of the river, lands slope northward as elevations climb in association with the Ronkonkoma moraine. Just south of I495 within Manorville Hills, the Ronkonkoma moraine reaches is highest elevations of 260 feet and some of the Central Pine Barrens most striking topography.

This FMU has the greatest diversity of vegetative communities which supports forests, wetlands, rivers and ponds, as well as the highest number and largest grassland acreage (Figure MC 8.7). On the north to mid-western side, BNL lands, Robert Cushman Murphy County Park and Otis Pike Pine Barrens State Forest support not only Pitch Pine and Pitch Pine Oak forests but also the chain of coastal plain ponds that are part of the headwaters of the Peconic River. Both sides of the riverine system are bordered by these forests as it moves eastward. This unit is dotted with a plentiful number of forest ponds and small freshwater marshes. The central (especially on the moraines) and the south-central area of this Unit consists of large, forested tracts mostly of Oak-Pine communities which transition to Pitch Pine-Oak and Pitch Pine forest to the east. In the north, northeast and southeast, grasslands are most frequently found. In the northern area is the largest grassland in the Central Pine Barrens, those on EPCAL which is the former Grumman aircraft facility which now contains an industrial park, an enterprise zone owned and managed by the Town of Riverhead, town recreational facilities, a business incubator, a private addiction rehabilitation facility, a privately-owned future water park and Town-owned forested open space. Additional grasslands of Otis Pike Pine Barrens State Forest and Calverton National Cemetery surround EPCAL grassland. The Fresh Ponds tract of Otis Pike Pine Barrens State Forest encompasses both grassland and Oak Pine forests.

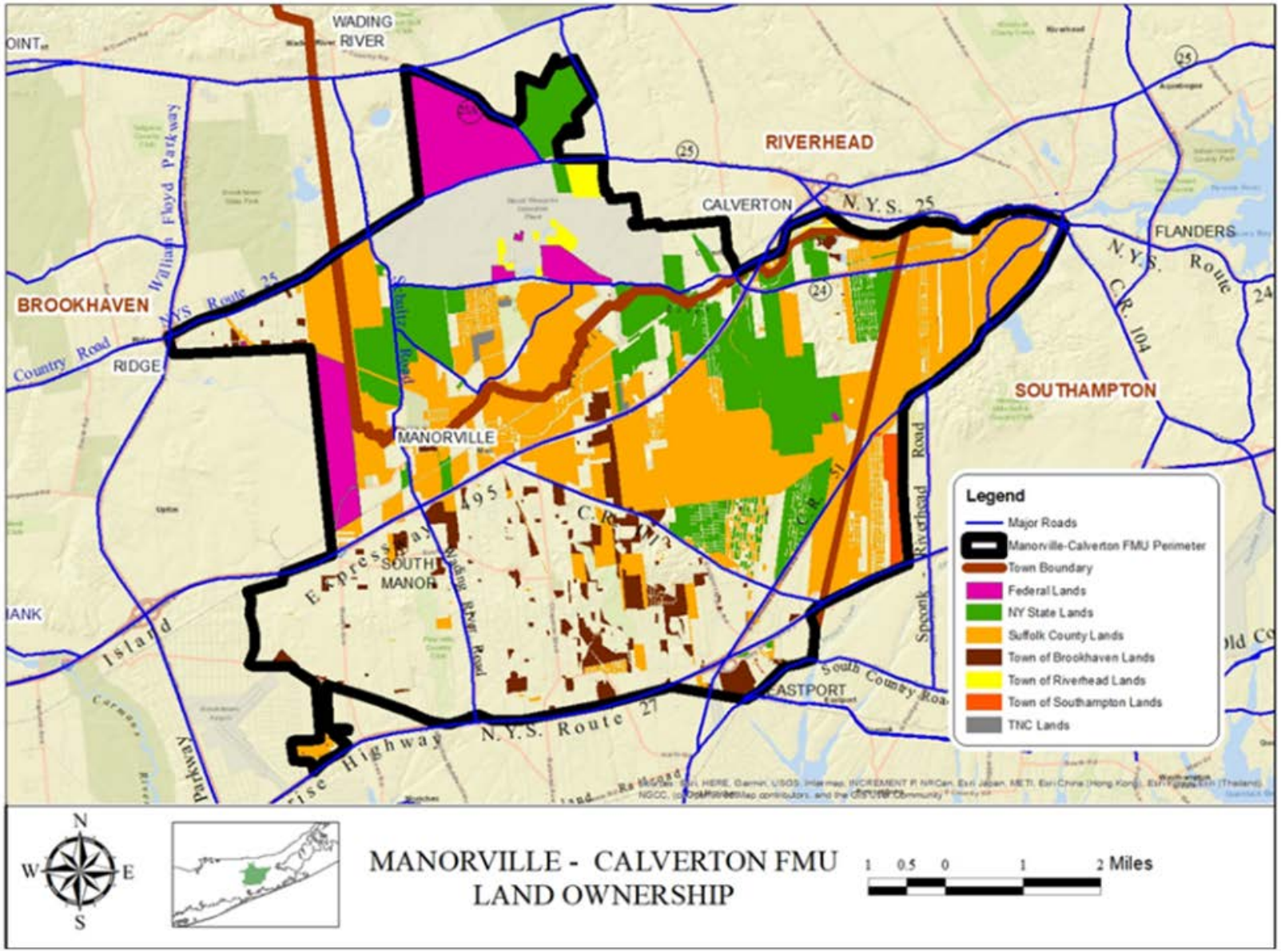


Figure MC 8.2 Land Ownership Map for Manorville – Calverton Fire Management Unit

Recreation

This FMU, being largest and most ecologically diverse FMU also supports a wealth of recreational activities similar to the other FMU's such as hiking, hunting, fishing, bicycling and boating. The hilly terrain make Manorville Hills is a popular and more difficult mountain biking destination. The Peconic River draws bird watchers, anglers and boaters alike. The grasslands in Calverton and Eastport, draw a diversity of hunters including those that use raptors and dogs. Horseback riding is also popular in this FMU and the unique floristic diversity of bogs and coastal plain ponds uniquely attract botanists.

Unique Land Use History

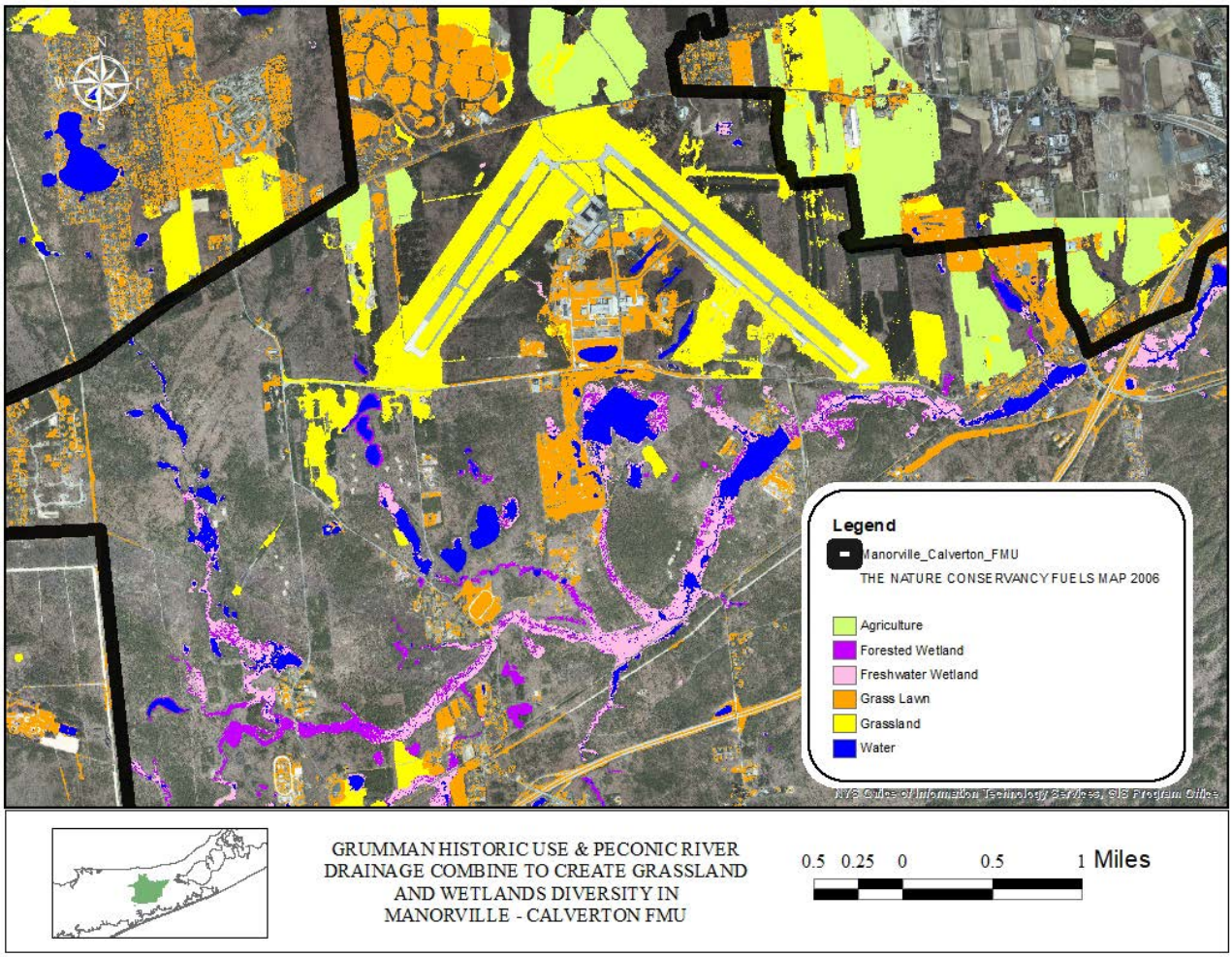


Figure MC 8.3 Grumman Land Use History Contributions to Biodiversity in Manorville – Calverton

In the 1950's the US Navy purchased approximately 6000 acres north and south of New York State Route 25 in Calverton and subsequently established the Naval Weapons Industrial Reserve Plant, which was a government owned, but contractor operated facility (citation: information provided by John Pavacic, Executive Director CPBC; Figure 8.3). The Navy constructed two runways totaling 7000 and 10000 feet long and mowed the cleared areas around them for purposes of safety. The Grumman Aircraft Engineering Corporation was the contracted company that managed this facility from 1956 to 1996. At this site Grumman tested, assembled and retrofitted a wide variety of military jet aircraft, including the F-14 Tomcat. Grumman was also a chief contractor for the Apollo Lunar Module and this site was used

to test the Lunar Roving Vehicle that became part of the lunar missions. In 1965, the runways were proposed by then-New York Governor Rockefeller to become an addition New York metropolitan area airport, but that proposal was dashed by both Grumman and by local residents. In 1974 and 2000, the Navy donated a total of 1045 acres of these lands to establish (and later expand) the Calverton National Cemetery, which is notably the largest national cemetery in the US, located north of Route 25A and the airport runways.

In 1992, the Suffolk County Department of Planning commenced a study to investigate the feasibility of establishing an air freight cargo facility at EPCAL, but the effort was subsequently abandoned. Grumman Corporation left the facility, and the site was transferred by the federal government to Riverhead Town in 1998 for economic redevelopment. The site was subsequently renamed and today is known as Enterprise Park at Calverton (EPCAL). The portion south of the two runways contains a now privately-owned industrial and commercial development complex, including adaptively reused buildings previously constructed by Grumman. This includes the new Wellbridge at Calverton addiction treatment center on 96 acres.

Stony Brook University operates the Calverton Business Incubator on 50 acres of the EPCAL site along the south side of State Route 25, adjacent to which is Grumman Memorial Park which displays several aircraft Grumman built at the site. Located in the northwest portion of EPCAL is Riverhead's 62-acre Veterans Memorial Park which contains softball and baseball fields, a dog park and picnic area. Adjacent to this park is Island Water Park, a proposed, privately-owned indoor and outdoor, water-based recreational complex which is currently undergoing development. The site contains a man-made lake. A paved bike path rings the perimeter of the EPCAL property. Additional development has been proposed for a large portion of the remaining vacant portion of the property, which is dominated by grassland.

Unique Ecological Conditions

Large, forested areas across the core of this FMU, especially west and south of EPCAL and within the vicinity of Peconic Hills County Park, experienced mass oak mortality in 2008 due to outbreaks of the invasive gypsy moth and native orange stripped oak caterpillar (Figure 8.2). Southern pine beetle has been more recently active within this fire management Unit, which small outbreaks observed west of Route 111 in 2016. These outbreaks have remained small but have continued to spread into previously unaffected parklands with outbreaks occurring within Robert Cushman Murphy County Park, Peconic Hills County Park, Otis Pike Pine Barrens State Forest and Eastport Pine Barrens State Forest in 2018-2020. Surveying and suppression continue to be advanced in these prior public lands to maintain SPB in low abundance and prevent mass attack.

Fire Districts

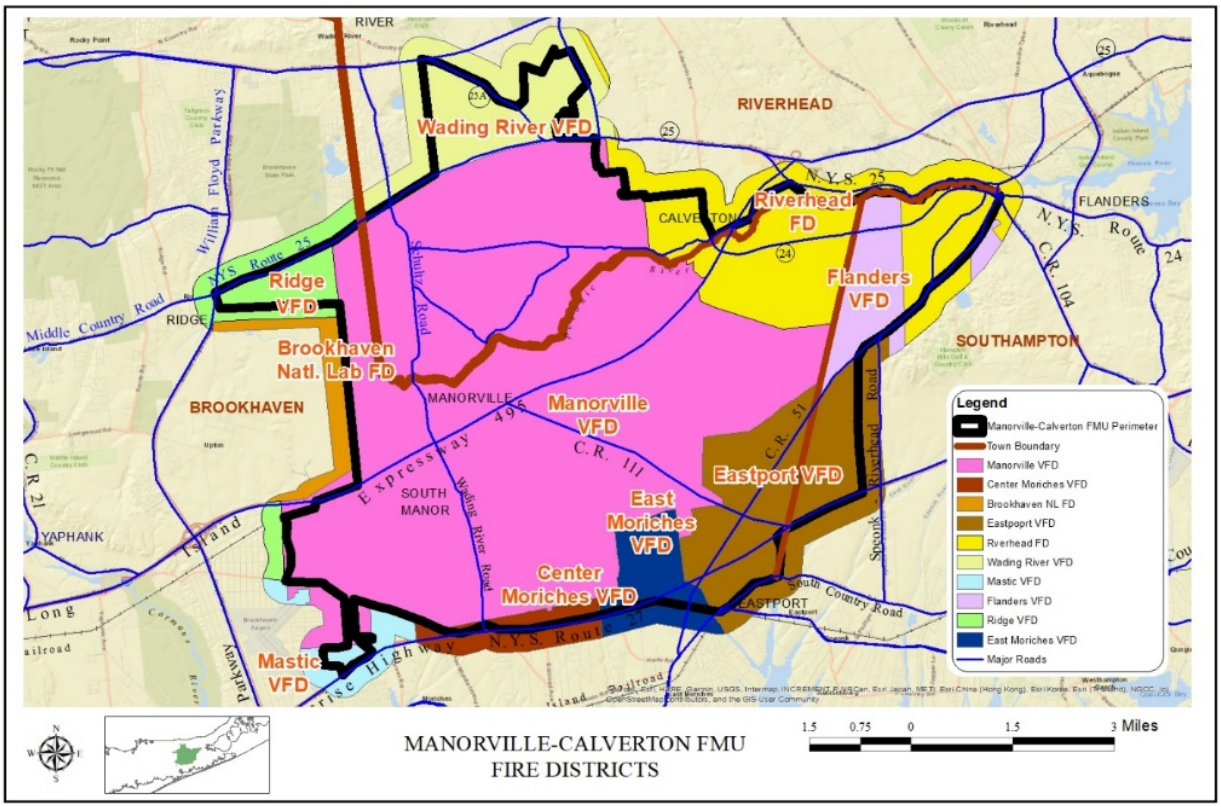


Figure MC 8.4 Fire Districts of Manorville Calverton Fire Management Unit

Manorville VFD covers most of this FMU, but eight other departments also have jurisdiction including Ridge VFD, Wading River VFD, Riverhead FD, Flanders VFD, Eastport VPD, East Moriches VFD, Center Moriches VFD, and Mastic VFD.

Wildland Urban Interface (WUI)

Wildland Urban Interface areas are primarily located within the southern half of this FMU (Figure MC 8.5). These urbanized areas are predominantly adjacent to smaller blocks of forests that are private, county or state-owned lands. This pattern of land use and vegetation collectively defining the wildland urban interface are depicted in the continuity of dark green pine forests that are broken up with the orange-colored lawn areas and the light green agricultural areas. There are no densely developed urban areas in the central core and eastern half of this FMU, therefore again only scattered isolated WUI concerns. To the north, fire history analysis also shows that the wetlands and open water of the Peconic river drainage have impacted large fire spread in the northwestern portion of this FMU which also helps reduce WUI threats. Further discussion on WUI risks is detailed below within the CWPP section.

Community Wildfire Protection Plan (CWPP)

The Ridge Manorville Calverton CWPP extends east within this FMU from the northern Peconic river drainage; north and east of the BNL to Wading River Manor Road, David Terry Road, and Line Road (Figure MC 8.6). With the exception of the subdivisions north of BNL in Ridge, these areas are the least developed portions of the CWPP. Accordingly, the wildfire risk is low to moderate with some patches of high and extreme. There are no special wildland interface projects identified in this FMU in the CWPP.

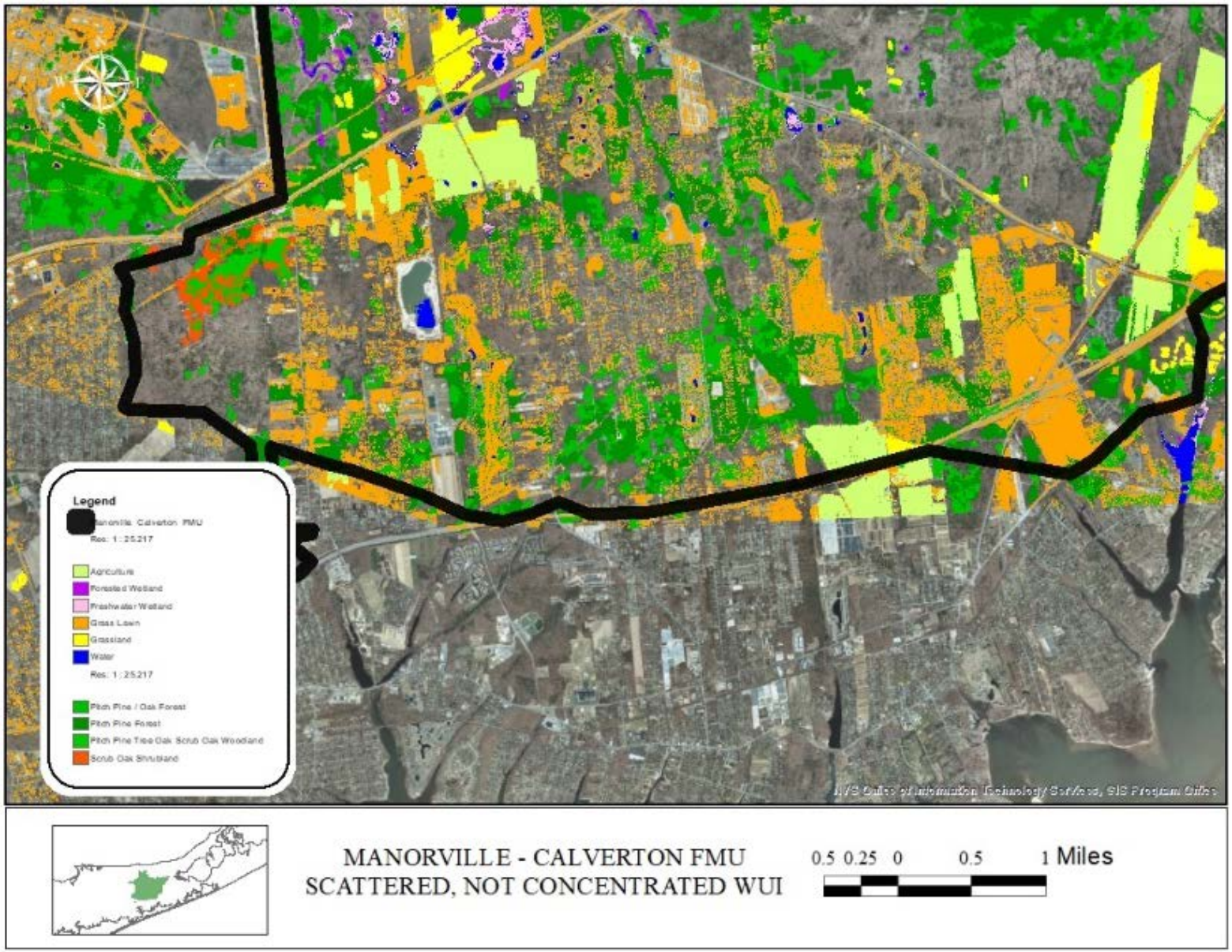


Figure MC 8.5 Wildland Urban Interface Map for the Southwestern Area of the Manorville Calverton

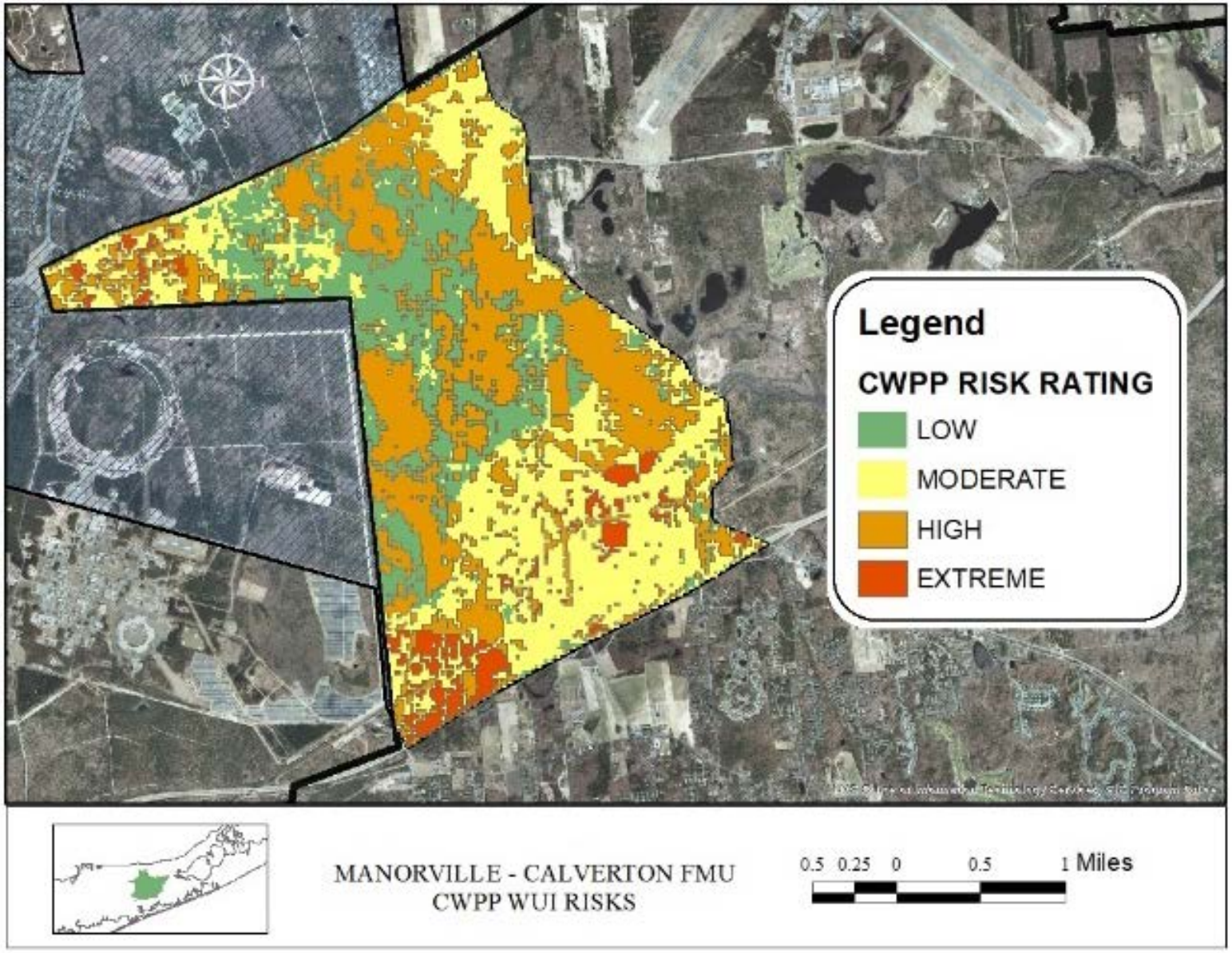


Figure MC 8.6 Risk Rating from the Ridge Manorville Calverton CWPP in Manorville Calverton Fire Management Unit

Fuels

The primary forest types in this unit consist of Oak-Pine and Pine-Oak forests. Due to the large volume of State or County owned lands inside of this unit, these forests are mostly continuous throughout the core of this unit. This unit also has a relatively large number of grasslands, especially in the northwest and southeast corner of this unit (Figure MC 8.7). Below are a series of summary descriptions of fuel types by the dominant vegetation communities.

- Oak Communities: Oak communities are the major fuel type in this FMU in most of the forested areas in all but the northeast corner. The Oak-Pitch Pine is the most prevalent fuel type in the area. In the southwest corner there is an area of approximately 800 acres that is Successional Oak forest embedded with volatile Scrub Oak Shrubland and Pitch Pine / Tree Oak / Scrub Oak fuels. In the southeast corner there is also a volatile Scrub Oak Shrubland community near Eastport.
- Pine Communities: Pitch Pine forest has a few dense areas especially in the northeastern corner and south and southwest of EPCAL in the Otis Pike Pine Barrens State Forest. Pitch Pine – Oak forests are scattered throughout the FMU, interspersed with Oak-Pine forests.
- Grasslands: There are significant old field grasslands in the northern portion of the FMU on and adjacent to the EPCAL and in Otis Pike Pine Barrens State Forest. In the southeastern corner, there are also sizable old field grasslands in Eastport Pine Barrens State Forest and county owned Pine Meadows.
- Wetlands: The northern half of this FMU has considerable wetland areas along the Peconic River headwaters and drainage which carves its way through this FMU from the northwest to the east. There are also many scattered ponds formed on this glacial landscape that have wetland fuels shorelines. It is hard to say how much of them are available fuels. They have component species that are fire dependent, so fire does play a role at times, likely during drought years. They have also served as barriers to fire spread as seen in fire history.

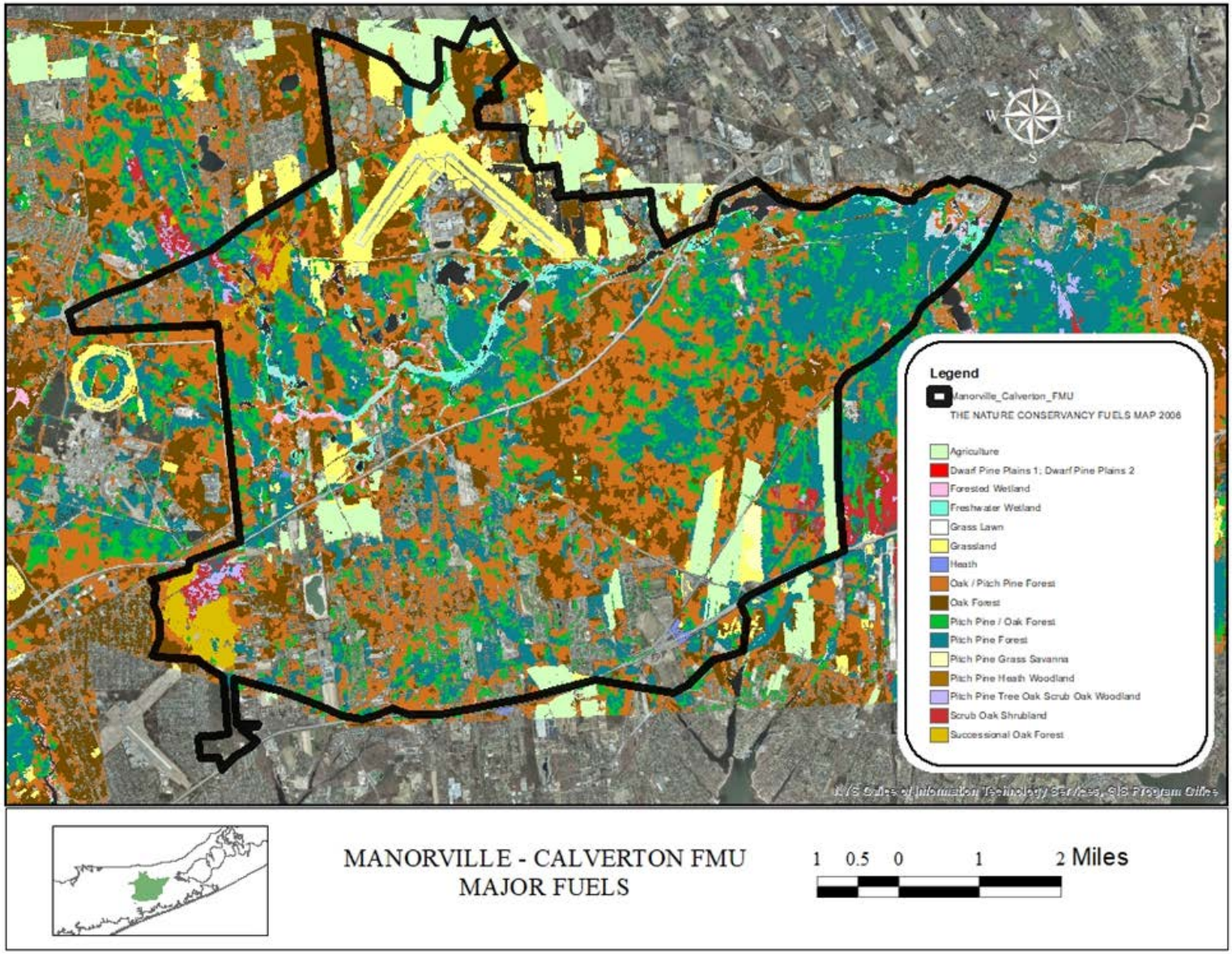


Figure MC 8.7 Major Fuels by Dominant Vegetation Community of the Manorville-Calverton Management Unit

Fire History

This area has a robust fire history with large fires occurring every decade from 1930 to the 1990's. Coupled with this large fire history, this FMU has received the most prescribed fire treatments (within grasslands) than any other Central Pine Barrens FMU.

As can be observed in Figure MC 8.8 these historic large fires burned throughout the central core of this unit, the home of large and contiguous forests both in the past as well as today. The Crescent Bow fire (Pink Polygon in Figure MC 8.8) started in the Brookhaven FMU and burned through the western central section of this FMU. This fire was a particularly notable event, being the only fire in the Central Pine Barrens to exceed 100 acres since the 1995 fires. A 59-acre fire in the southwest corner of this FMU occurred eight days after the Crescent Bow Fire. Other than these two fires, there were 361 fires in this FMU that occurred between 1996 and 2018. Of those within this modern fire history, only two reached 15 acres with a majority of the remainder equally 1 acre or less in size.

FRI Departure

The FRI for this FMU is 40-100 years based on the of oak and pine habitats. The grassland habitats have a significantly lower FRI at 3-7 years. Fire history analysis identifies that large, major fires (in excess of 100 acres) occurred in the 1930's (3 large fires), in the 1940's (1 large fire), in the 1950's (2 large fires), in the 1960's (2 large fires), in the 1970's (1 large fire), in the 1980's (5 large fires) and in the 2010's (1 large fire). This identifies that fires historically occurred frequently each decade and sometimes within the decades up to the 2010's and as such during the period from 1930 to 2010, this FMU followed the established FRI with a total of 15 large fires.

The grasslands of the Otis Pike Pine Barrens State Forest have also received routinely conducted prescribed burns which has maintained them at or close to a 3-7-year FRI. The grasslands of Eastport Pine Barrens State Forest and Pine Meadows County Park are well overdue for fire, however.

It can be reasoned that this FMU is very reasonably within its FRI.

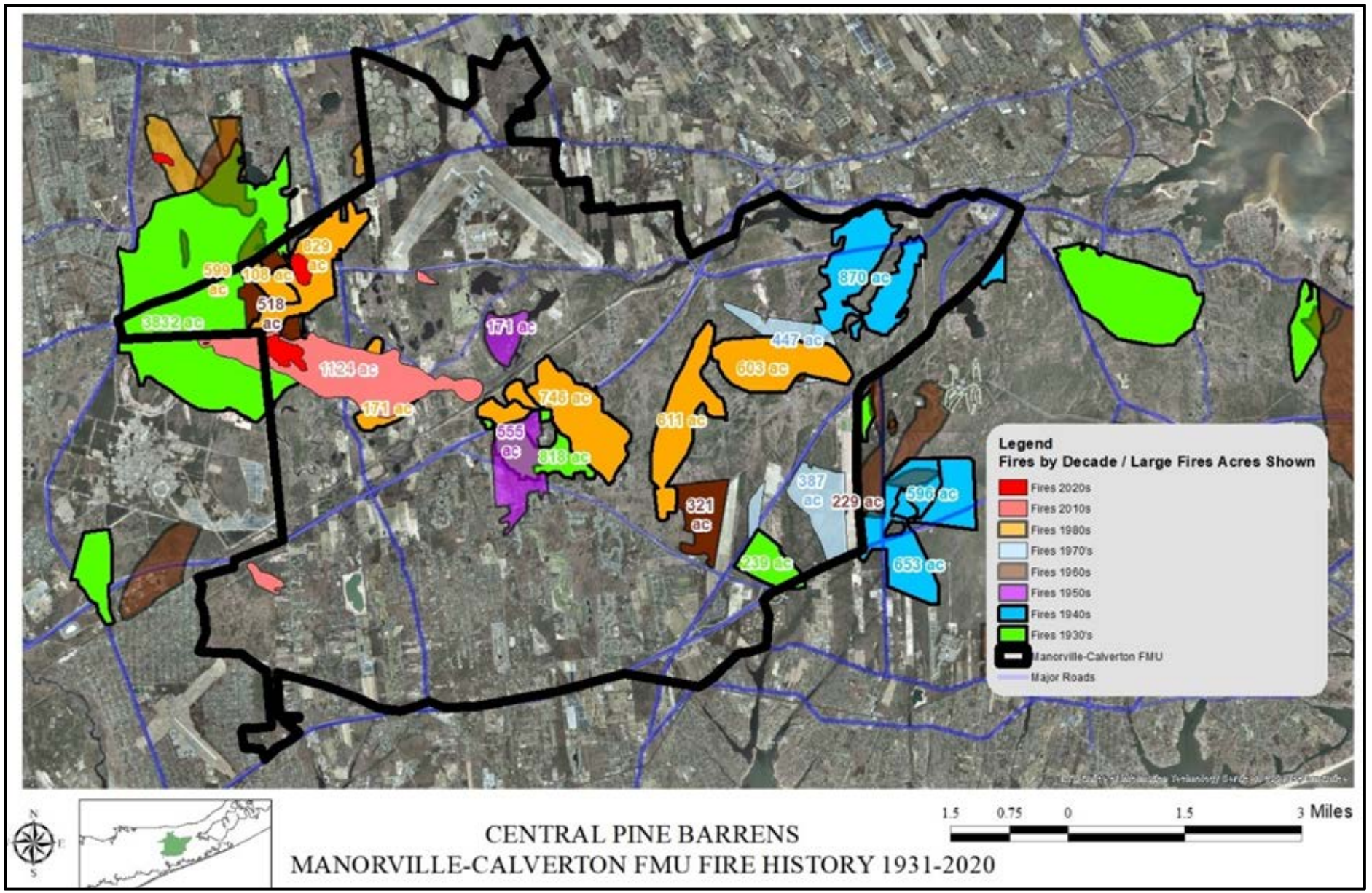


Figure MC 8.8 Fire History Map from 1931 – 2020 in the Manorville-Calverton Fire Management Unit

Prescribed Fire History

Prescribed fire has been actively implemented within this FMU for the purposes of grassland management and public health improvement and more recently for prescribed fire training associated with New York Incident and Management Academy and as recommended by the Peconic Headwaters Natural Resource Management Area Unit Management Plan (NYSDEC 2006) .

Table MC 8.2 Unit Name and Acreage of the Grasslands within the NYS-DEC Active Prescribed Burn Plans for the Manorville Calverton FMU.

NYSDEC Burn Plan Name	Unit #	Unit Name	Acres
Fresh Pond		Fresh Pond North	44
		Fresh Pond Central	45
		Fresh Pond South	55
Otis Pike Preserve	B-2	Line Road East	9.9
	B-2	Line Road West	13
	B-2	Prestons Pond	5.4
	B-2	Big Field North	8
	B-2	Big Field South	8.8
	B-2	Wellhead Pond	20
	B-3	Linus Pond	1.6
	B-5	River Road	27.5

There are two current NYSDEC grassland prescribed burn plans for this FMU: Fresh Ponds (NYSDEC 2012 Figure MC 8.10) and Otis Pike Preserve Grasslands Burn Plans (2017; Figure MC 8.9). The grasslands of these management units have been burned repeatedly since the 1990's (Table MC 8.2) for the purposes of ecological maintenance and especially to support game bird hunting.

Prescribed Burning Priorities and Goals

Initial prescribed fire priority projects that are approved, in review, or in development in this FMU at the time of this Plan development are summarized in this table and described below. As this Plan is intended to promote and expand prescribed burning in the Central Pine Barrens, it strongly encourages the identification and establishment of additional projects over time.

This FMU has had the greatest prescribed fire operation activity which is attributed to grassland restoration and management. Grasslands occur in comparatively low frequency within the Central Pine Barrens and require regular management to abate invasive species and woody encroachment as well as maintain the diversity and vitality of desirable graminoids and forbs (Table MC 8.3). As such, continued prescribed burning of grasslands is encouraged to remain a high focal priority within this FMU.

Table MC 8.3 Active Prescribed Fire Projects within the Manorville Calverton Fire Management Unit

Current Prescribed Fire Projects	Lead Planning Agency	Acres
Fresh Pond Grassland Prescribed Fire Plan	NYSDEC	144
Fresh Pond Wildfire Drill Zone	CPBC	9
Eastport/Pine Meadows Rx Enhancement Zone	CPBC	784
Otis Pike Prescribed Fire Plan RX Enhancement Zone	CPBC	2087
Otis Pike Preserve Grasslands Burn Plan	NYSDEC	95

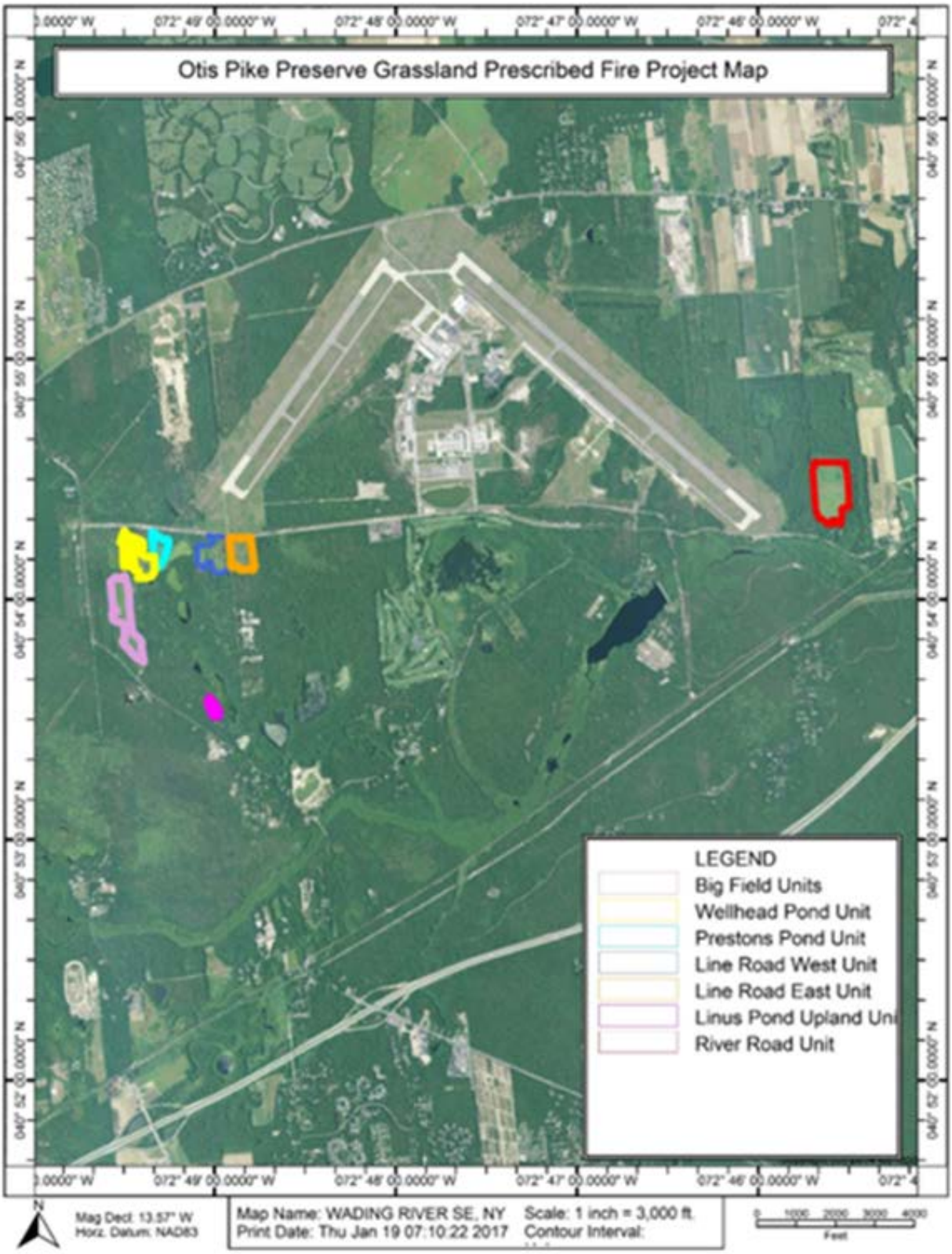


Figure MC 8.9 Otis Pike Grassland Prescribed Fire Location Map Excerpted from the Otis Pike Grassland Prescribed Fire Plan

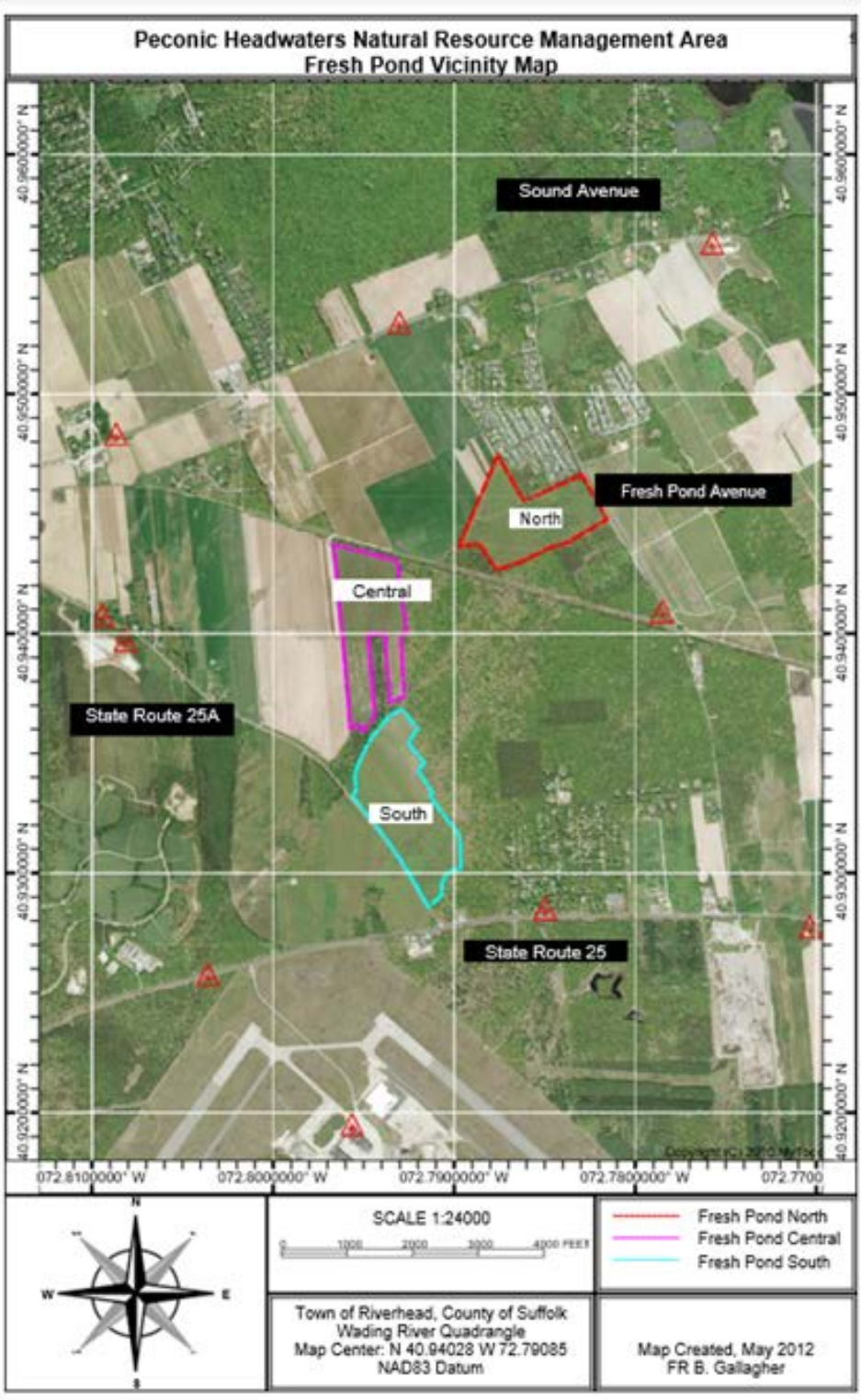


Figure MC 8.10 Vicinity Maps from Current NYS-DEC Fresh Ponds Burn Plan (NYSDEC 2012)

Additional projects include using the Fresh Pond Wildfire Drill Zone for training purposes on an ongoing basis. The Fresh Pond Wildfire Drill Zone is a nine-acre forested island surrounded by the prescribed burned grasslands of the Fresh Pond Grasslands Prescribed Burn Plan. The grassland burns create a barrier for fire escape from this forested island. This area will be used to create wildfires to provide real time training opportunities for wildland firefighters in wildfire size up, tactical suppression plan development and communications. This allows for trainees to receive valid training assignments on a scheduled basis and can eliminate the need for trainees to obtain out of state assignments for these types of training opportunities.

Capitalizing on grassland areas already being prescribed burned by expanding prescribed burns into the immediately adjacent forest area is a fundamental concept of a Prescribed Fire Enhancement Zone (PFEZ). Such a PFEZ is proposed in Otis Pike Pine Barrens State Forest and Suffolk County owned lands in the northwest corner of this FMU. There are numerous large grasslands, which are already part of the burn plans listed, which provide the opportunity to build the foundation of such a protective yet enhancing zone. There are also numerous lakes, wetlands and recent (2020) wildfire scars to allow for a successive progression of burning adjacent forests without having to perform a large volume of mechanical thinning pre-treatment.

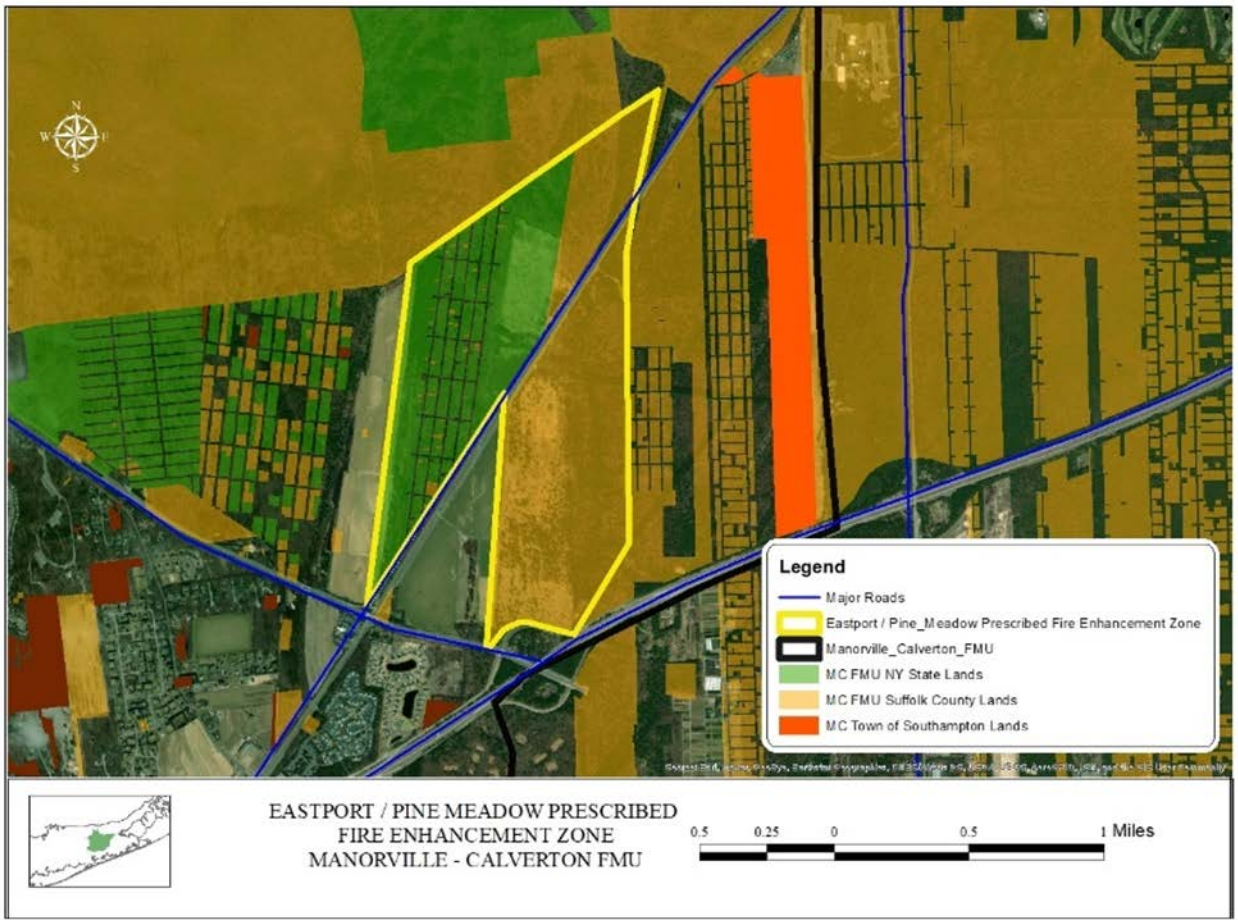


Figure MC 8.11 Proposed Eastport Pine Meadows Prescribed Fire Enhancement Zone

Another area where a Prescribed Fire Enhancement Zone could be utilized is in the southeast corner of this FMU in the NYS-DEC Eastport Pine Barrens State Forest and the adjacent Pine Meadows County Park grassland (Figure MC 8.11). This location consists of a combination of public owned lands with forest / grassland communities that have not received necessary treatments. Utilizing this location as a prescribed fire management zone may initiate and allow for the additional benefit of continued use of fire within the forested lands in strategic and progressive way.

Several other large contiguous forest blocks have many priority objective parameters that could be accomplished through prescribed fire management implementation. These areas include woodlands in the northeast of the New York State Fresh Pond Site as part of the Otis Pike complex. Manorville Hills County Park affords another large contiguous forest area which could provide opportunities for prescribed fire management to meet goals toward providing significant ecological benefits and wildfire risk and fuels reduction.

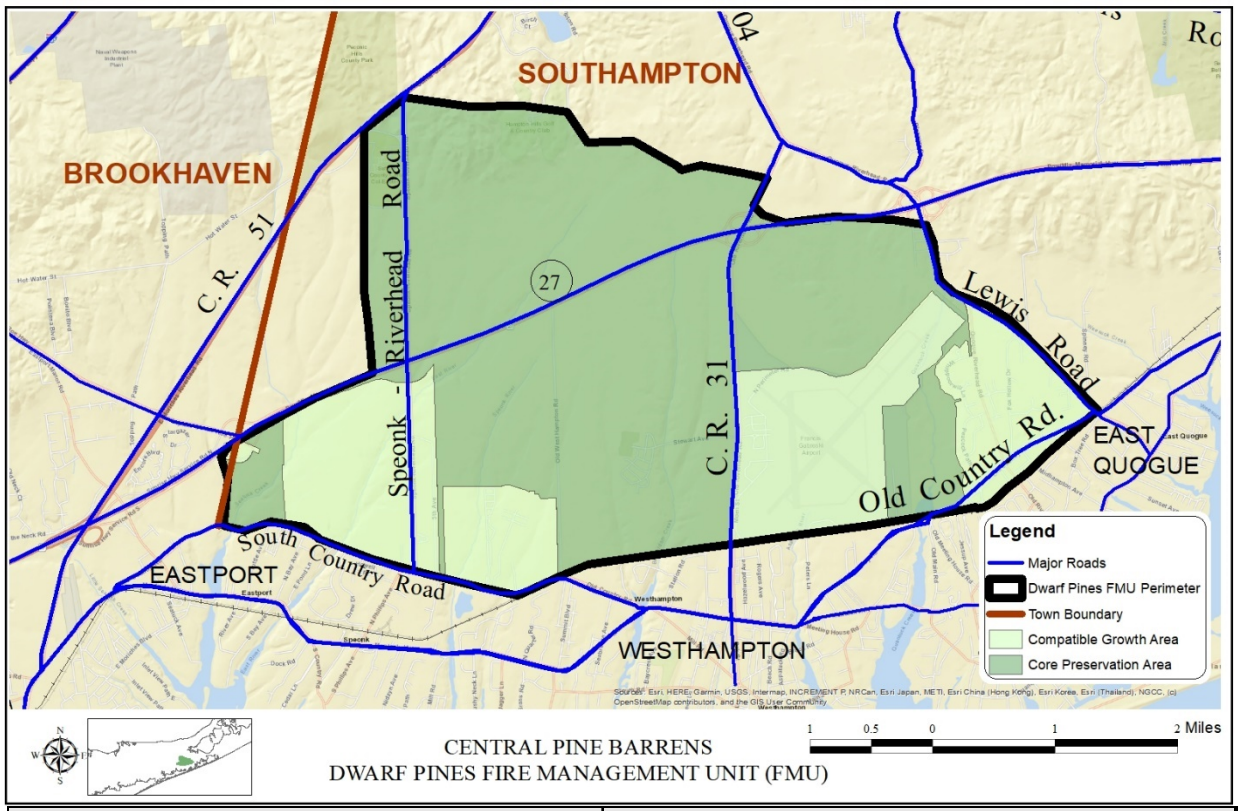
The Coastal Plain ponds on both County and State lands are ecosystems which support the highest number of rare and endangered species. These systems are being invaded with Common reed (*Phragmites austrailis*) and without eradication are at a significant risk of habitat loss and species decline. Management plans to facilitate the eradication of this invasive grass are proposed and/or ready for implementation. The use of prescribed fire as a tool to most proactively reduce the leafy and dense stemmed biomass is supported under this plan in order to thereafter allow best access to facilitate chosen management treatments.

Environmental Compliance

The Peconic Headlands Management Plan completed SEQRA compliance for the Otis Pike Pine Barrens State Forest and for the Eastport Pine Barrens Pine Barrens State Forest in this FMU. No other areas have had prescribed burn compliance conducted.

Dwarf Pines FMU

FMU Demographics, Land Use Protections and Ownership



DWARF PINES FIRE MANAGEMENT UNIT	
Towns	Southampton, Brookhaven
Fire Departments	Westhampton Beach, Gabreski Airbase, Eastport
	East Quogue, Quogue, Riverhead,
Total Acreage	11343
Core Preservation Area	7787 acres = 69% of area
Compatible Growth Area	3556 acres = 31% of area

Figure DP 8.1 Dwarf Pine Fire Management Unit and Demographics Table

The Dwarf Pines FMU is located in the southeastern section of the Central Pine Barrens east of Manorville Calverton FMU and southwest of the Southampton FMU (Figure DP 8.1). The smallest of the FMU's encompasses 11% of the land area and is largely located within the Town of Southampton with exception of a small corner on the western edge of the unit (Table DP 8.1 ; Figure DP 8.2). Approximately 58% of the lands are publicly owned and a high percentage (69%) occur within the Core Preservation Area in the center, far west and east of this unit (Figure DP 8.1).

Suffolk County is by far the major public landowner within this FMU, the Dwarf Plains Preserve and protected natural lands from just west of Speonk – Riverhead Road to Route 104 east of Hampton Hills Golf Course (Figure DP 8.2). Interspersed within this large section of natural area, which is also where the Sunrise Fire burned in 1995 are numerous small privately-owned out parcels that were originally given away as prizes in the 1950's to people who sold a quota of magazine subscriptions or similar activities. Suffolk County and The Nature Conservancy have led the way in taking measures to protect

these lands, starting in the 1980's, by contacting the landowners to encourage the donation of these private tracts to the county in addition to seeking acquisition through purchase.

The County also owns Francis S. Gabreski Airport, part of which is utilized by the 106th Rescue Wing of the US Air National Guard and the Hampton Business District. The NYSDEC is the second largest landowner, with approximately 727 acres located predominantly just east of CR 31 (Old Riverhead Road) of the Dwarf Pine Plains and western section of the Quogue Wildlife Refuge.

The CR 31 Corridor including Stewart Avenue as well as well as the eastern and southern section of the Unit is mostly developed with the Airport, subdivisions, industrial areas and housing. The southwest corner of the unit is also developed with subdivisions, county buildings and other industrial areas north of County Road 71 (Old Country Road) in the Remsenburg-Speonk area.

Table DP 8.1 Dwarf Pines Fire Management Unit Public Land Ownership

DWARF PINES FIRE MANAGEMENT UNIT PUBLIC LAND OWNERSHIP = 59%	
NY State Owned Land	727 acres = 6% of area
Suffolk County Owned Land	5805 acres = 51% of the FMU
Town of Southampton Owned Land	122 acres = 1% of the FMU

Natural Features:

The Dwarf Pines FMU summit on the Ronkonkoma glacial moraine of the Hampton Hills (elevation 260 feet) at the northwest corner of the FMU and slopes to the southeast across a deep glacial outwash plain to 40-60 feet above sea level. This outwash plain is a 3% single slope with a southeast aspect. In the upper elevations to the north and west of the forests consist of Oak, Oak-Pine, Pine-Oak and Pitch Pine stands. As the elevation drops to the east and south, the forests become classic Dwarf Pitch Pine stands with mixes of Dwarf Pine Plains and Pitch Pine-Scrub Oak woodland/shrubland.

The key natural and most abundant feature of this FMU is its namesake, the Dwarf Pines. This is a globally imperiled ecosystem that exists only in one other location in the world on coastal sands, in the New Jersey Pinelands, which formed on a similar glacial outwash plain. Although the Sunrise Highway and County Routes 88 and 31 bisect the plaints, the natural areas immediately adjacent to the roads are essentially a vast sea wilderness with densely spaced pitch pines standing at heights of thirty feet or less with a scrub oak, heath and/or barren understory. Except for old roads and trails, it is a very difficult terrain to travel through due to the density and intermingling of the squat, scraggly trees. From a forest fire perspective, this is a stand replacement forest with a very short FRI in which, after the ecosystem appears to have been catastrophically laid to waste by wildfire, it restores itself again in a 20-year cycle. About half of the FMU interior was burned in the severe 1995 Sunrise Fire; and it has been 25 years since the last major fire. The stand is now renewed and waiting for its next timely disturbance.

Most grasslands within the FMU support a high diversity of common and rare sandplain grassland species which surround the runways of the Gabreski Airport with a few small, scattered grasslands dispersed throughout the unit. There are few ponds and wetlands in this FMU as the soils of the glacial outwash plain are exceptionally well drained. The impoundments are North Pond and Old Ice Pond, both located on the grounds of the not-for-profit Quogue Wildlife Refuge in the southeast corner of the FMU. The only other waterbodies are three man-made water features on the fairways of the Hampton Hills Golf and Country Club in the northwest corner of the FMU. Wetlands are restricted to the upper freshwater reaches of tidal creeks, one associated with the two ponds on site at the Quoque Wildlife Refuge and the other two crossing north under County Road 71 into the FMU in the southwest corner.

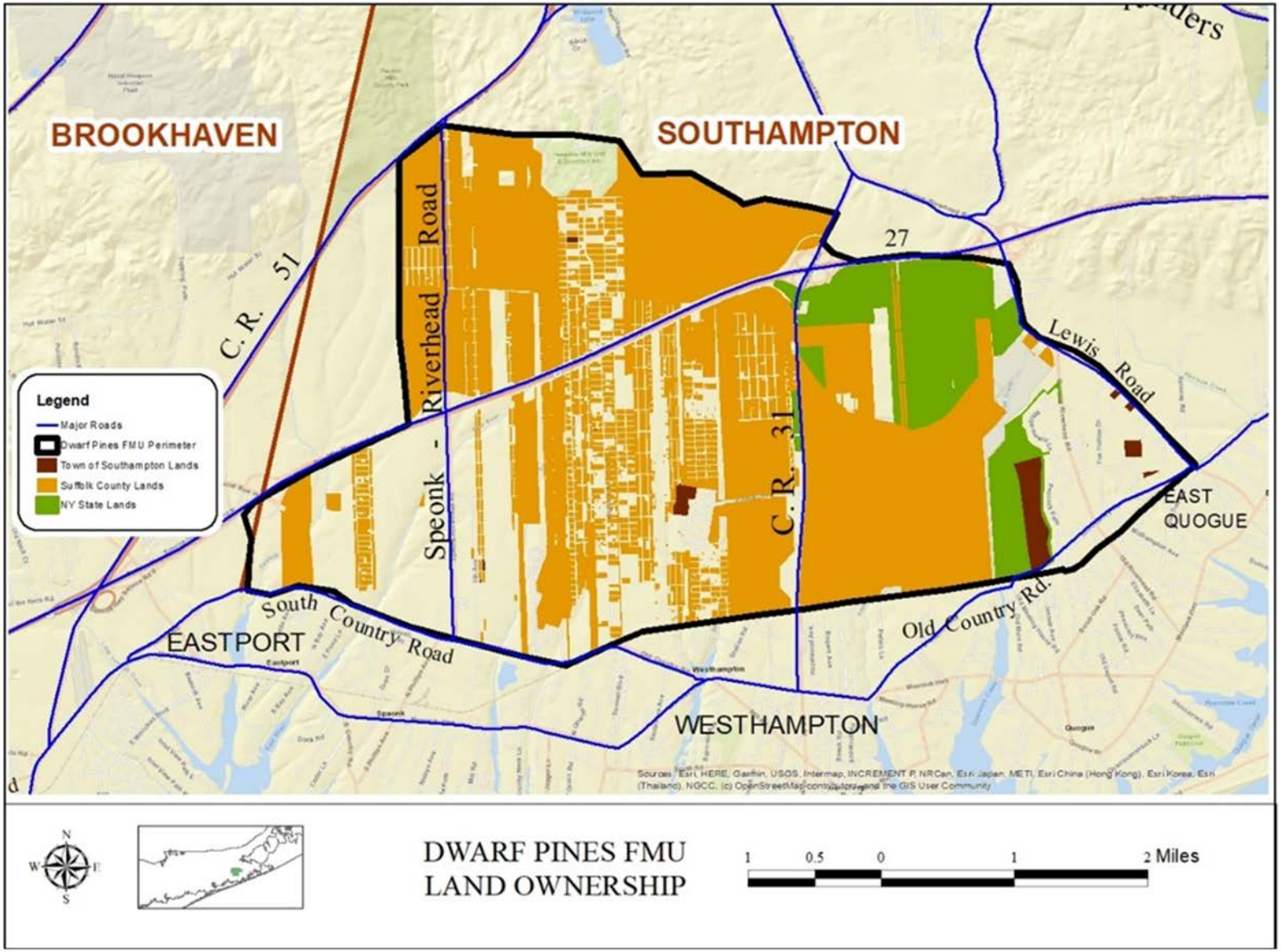


Figure DP 8.2 Public Lands Ownership in the Dwarf Pines Fire Management Unit

Recreation

The greatest recreational draws of this FMU are the Quogue Wildlife Refuge, the Dwarf Pine Plains trail and Hampton Hills Golf Course. The Refuge hosts wildlife viewing, a trail network, education exhibits and programs, bird watching, botanizing and cross-country skiing. The roads around Gabreski Airport are used recreationally for running especially by the Westhampton Brewing Company's Monday night Running Club. With the exception of the Dwarf Pine Barrens Trail, for the larger public lands to the north, public access is open but limited to old roads and paths utilized for hiking, hunting, birdwatching and especially for mushroom hunting.

Unique Land Use History

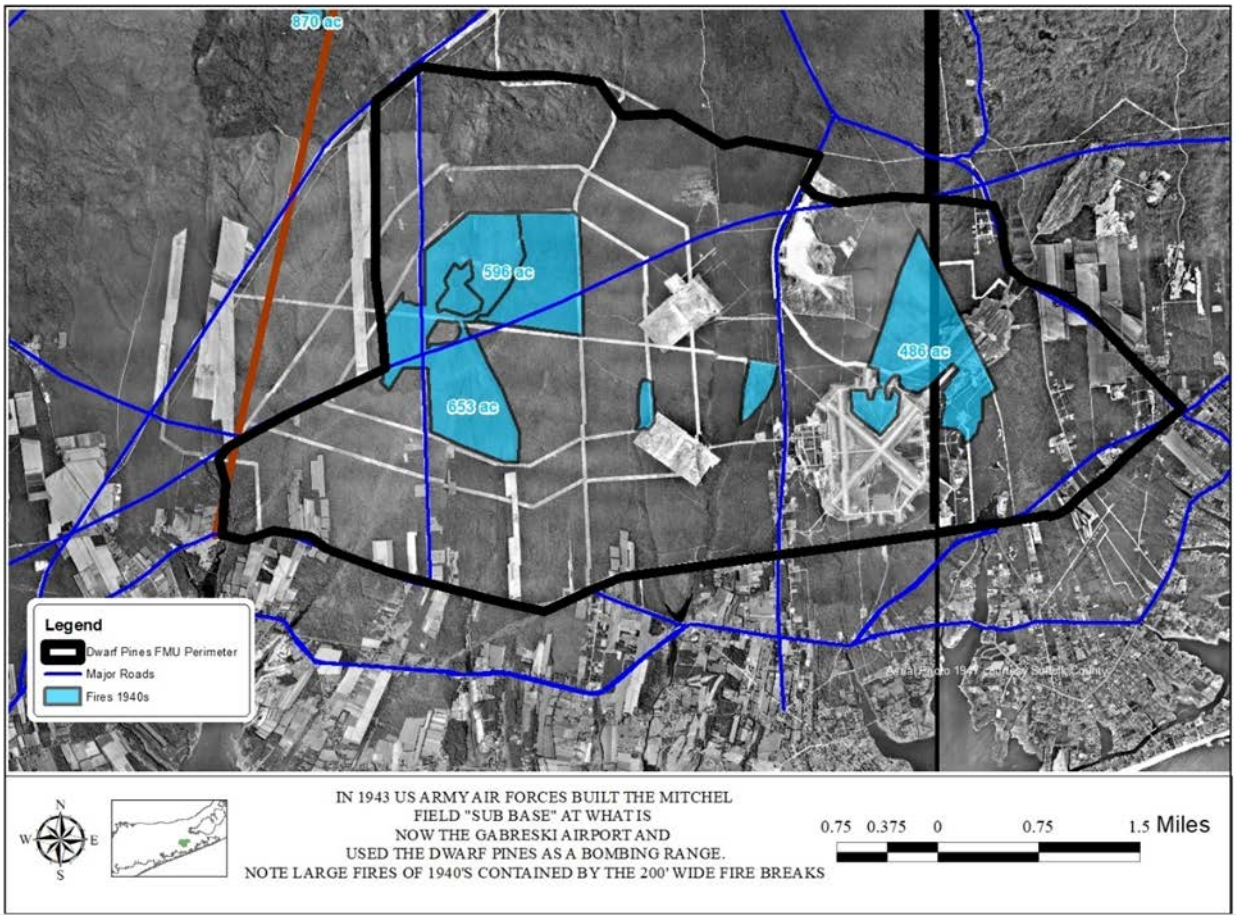


Figure DP 8.3 WWII Bombing Range, Firebreaks and Large Fires of 1940's in Dwarf Pines Fire Management Unit

An interesting piece of land use history in this FMU is that a large portion of the core of the dwarf pine stand was used during WWII as an aerial bombing range (Figure DP 8.3). It is hard to picture that this area was once a grid of concentric, wide fire breaks all leading into the X of the military airstrip that was using the range. Although swept for unexploded ordinance by the US Army, post war, in 1946 the area will once again be surveyed for unexploded ordinances by the Army Corps of Engineers and US Army in the next few years in order to comply with current standards. This survey will involve some clearing of

transects to allow for proper surveying. CPBC is part of the planning process for this project, and it is hoped that some of the vegetative clearings may serve dual duty as firebreaks for future management.

Unique Ecological Disturbance

While research has been conducted, it remains unknown why the pines are dwarfed within this ecosystem. One hypothesis is that evolution in deep and significantly coarse and droughty soils has caused the species to genetically develop small stature and growth as a means to adapt to and thrive within the xeric and fire-prone conditions. The second hypothesis is that these trees are phenotypically short in stature due to environmental factors rather than genetics (Fang 2006). As it relates to wildfire, this ecosystem is highly influenced by its unique soil conditions creating a volatile fire-prone ecosystem.

Mass oak mortality occurred with in the north central section of this FMU just north of Sunrise Highway as part of the greater outbreak of gypsy moth and orange striped oak caterpillar (Figure 8.2). Southern pine beetle infestation has been evident to a minor level north of Sunrise Highway, where the pitch pines are not dwarfed. It is anticipated that due to SPB's demonstrated preference for larger diameter trees, that the SPB outbreaks will remain limited within the core of the FMU.

Fire Districts

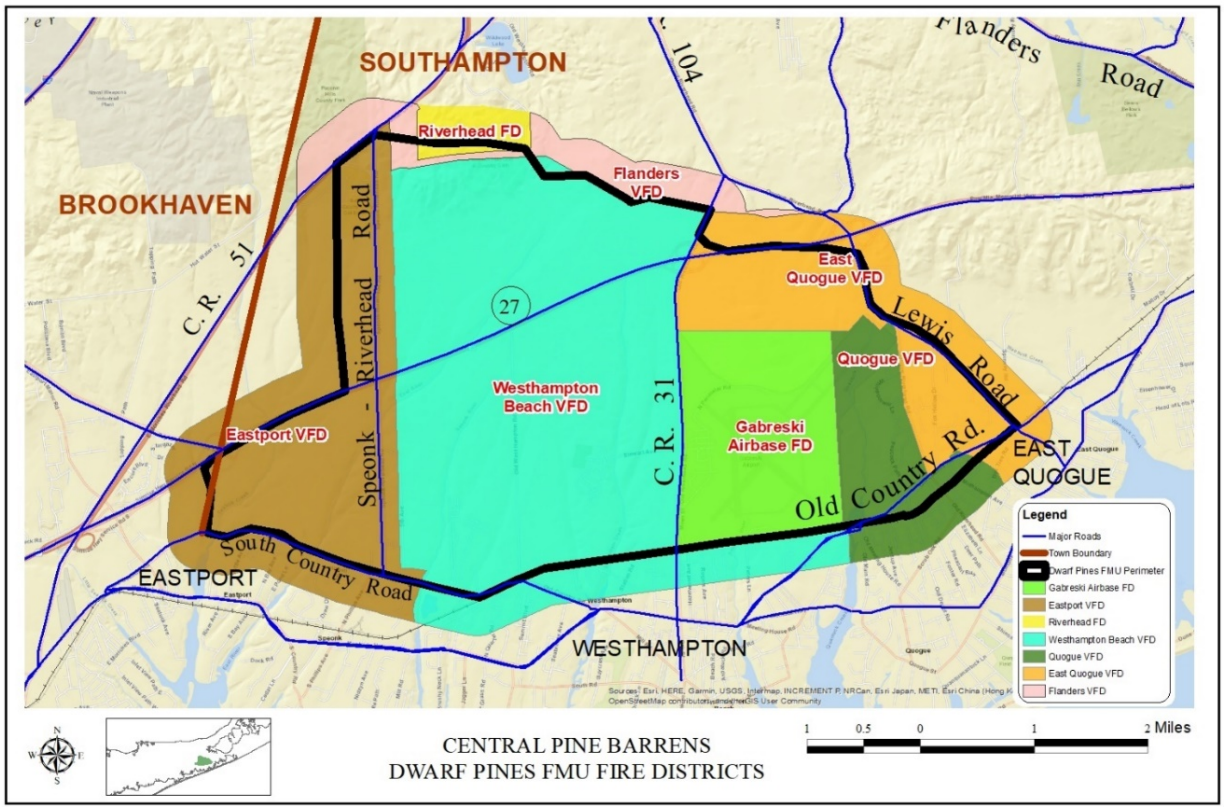


Figure DP 8.4: Fire Districts within the Dwarf Pines Fire Management Unit

Seven fire departments have direct jurisdiction in this FMU. The major portion is part of Westhampton Beach VFD, followed by Eastport VFD, East Quoque VFD, Gabreski Airbase FD, Quoque VFD, Flanders VFD and Riverhead FD (Figure DP 8.4).

Wildland Urban Interface

The primary wildland urban interface threats are at the businesses, subdivisions and government campus to the south and southeast edges of the FMU. In the northeast corner, the Oakville subdivision is another area of concern. The Steward Ave subdivision in the south center of the FMU is a remnant from bombing range usage. That area is a virtual urban island in a sea of dwarf pines which was successfully protected during the 1995 Sunrise fire but remains exposed to future fires. The Sunrise Fire did however damage 12 homes, businesses and structures along the southern boundary of the FMU.

Community Wildfire Protection Plan

There is no Community Wildfire Protection Plan with this FMU.

Fuels

The most dominant fuel types in this FMU are highly volatile fuels of the Dwarf Pines, Scrub Oak shrubland (covering most of the Sunrise Fire area) and Dwarf Pine plains covering the dwarf pine region east and northeast of the Sunrise fire scar. The Nature Conservancy Fuels map was published in 2006, 14 years before the date of this Plan and the fuels are now likely more dwarf pitch pine since map creation (Figure DP 8.5). Regardless these are both highly flammable and volatile habitats. Below are a series of summary descriptions of fuel types by the dominant vegetation communities.

- Oak Communities: The oak dominated communities in this FMU are in the extreme corners, the west, the northwest and the east of the FMU and are a combination of Oak-Pine forests and Coastal Oak forests.
- Pine Communities: The pine communities dominate this FMU. The majority of FMU core consists of Pitch Pine Plains Dwarf Pine forests. Pitch Pine forests surround the Dwarf Pines, with Pitch Pine – Oak forests scattered slightly further along the perimeters. The fuels are contiguous. The dwarfed trees do not self-prune and the shrubbery is dense providing ample opportunity for crowning and stand replacement fires.
- Grasslands: A majority of the grasslands within the FMU surround the runways of the Gabreski Airport and roadsides of the FMU. Otherwise, there are a few small, scattered grassland pockets. The herbaceous vegetation reaches a maximum height of 3-4 feet but mowing regularly reduces the fuels within the transportation corridor grasslands.
- Wetlands: The wetlands in this FMU are a tiny fraction and would not significantly contribute to fire behavior and fire acreage.

Fire History

This FMU has had significant fire history (Figure DP 8.6). There were multiple large fires in the 1940s followed by one large fire in the 1950s in the northeast corner of the unit. There were multiple large fires in the 1960's, then absence of fire in the 1970s to the 1980s. Then 28 years later in August 1995, the 3198-acre Sunrise Fire became the third largest fire in the 1930-2020 fire records. The Sunrise Fire started in the northwest corner of the FMU just south of Suffolk County Community Colleges Eastern

Campus was driven to the southeast by northwest winds where it jumped the divided four-lane Sunrise Highway as the fire crowned through the Dwarf Pitch Pine - Scrub Oak woodlands / shrublands. The Sunrise Fire ignited in the same area that the fires burned in the 1940's and 1960's. It crowned through the 28-year-old rough of fires #61, #62, #63 and #60 (the 1960's fires in this unit).

The modern fire history (1996 to 2018) for this FMU identifies 35 reported fires. There were no significant fires, the largest being fire #NY5279-2015-163 which was a five-acre fire that occurred on 08/10/2015 east of County Road 31 and just south of the Sunrise Highway interchange.

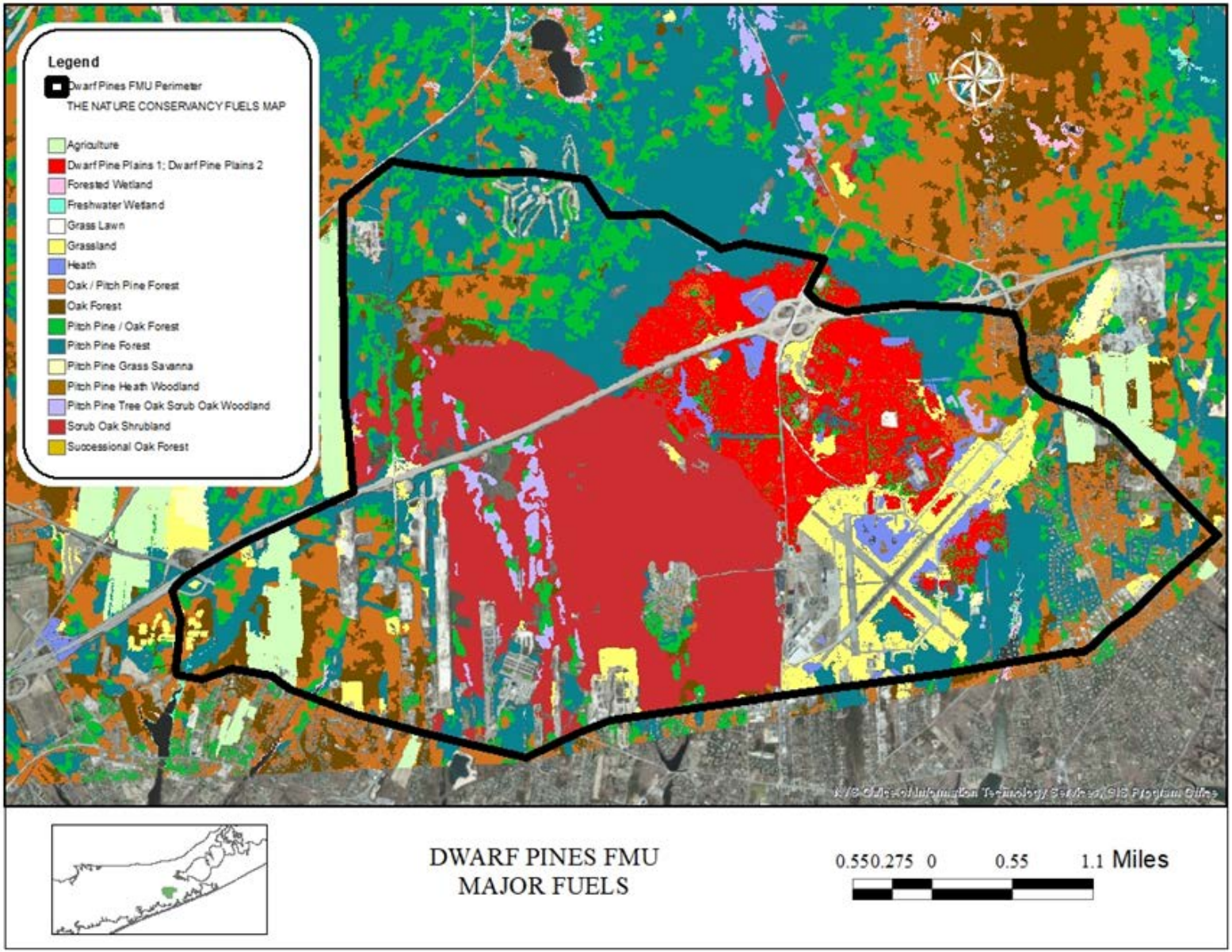


Figure DP 8.5 Major Fuels by Dominant Vegetation Community of Dwarf Pines Fire

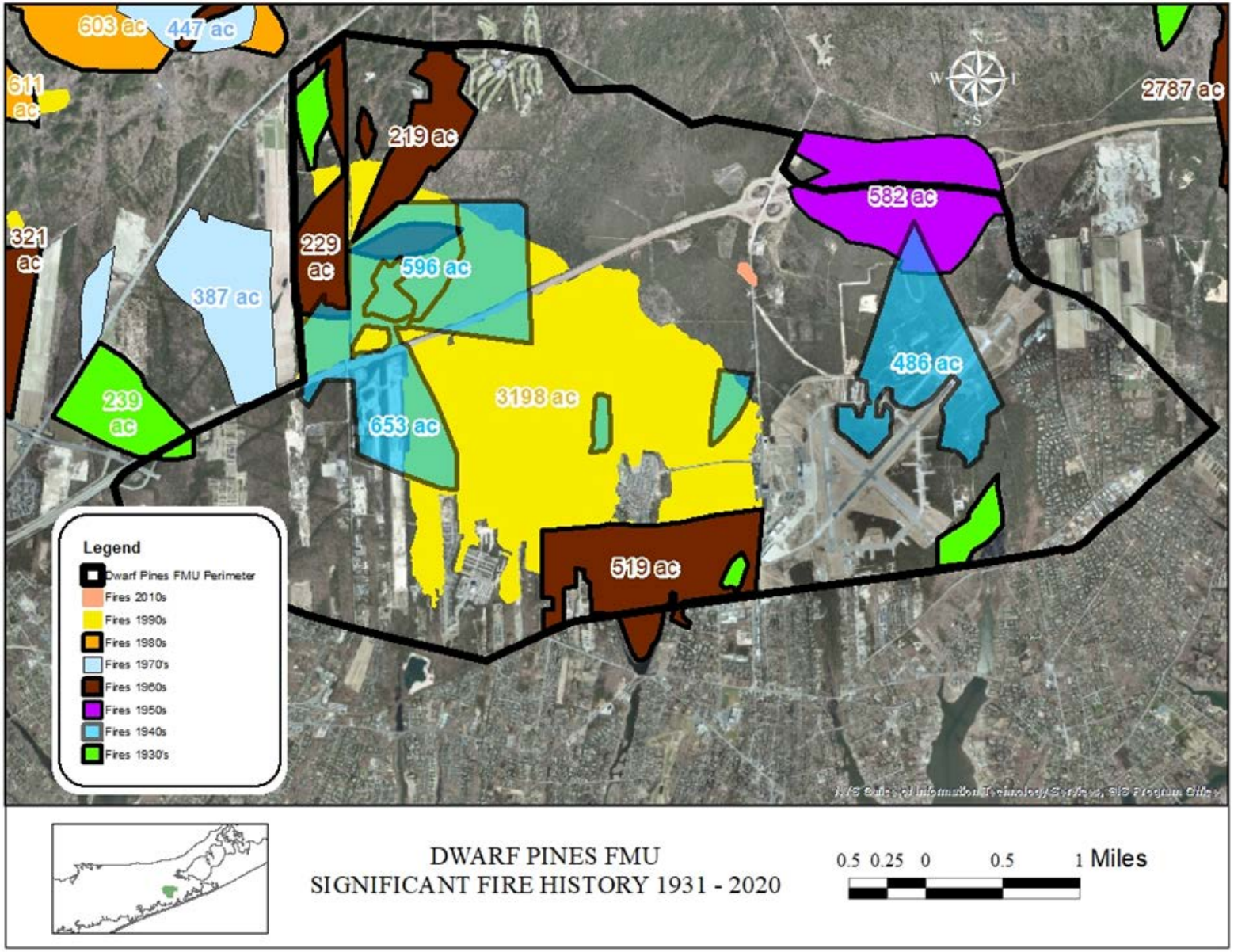


Figure DP 8.6 Fire History Map from 1931 to 2020 within the Dwarf Pines Fire Management Unit

Fire Return Interval (FRI) Departure

The fire return interval for the Dwarf Pine Barrens, the dominant ecosystem of this FMU is established as 7 to 20 years. Fire history analysis performed in the development of this Plan identifies that large, major fires (in excess of 100 acres) occurred in this FMU in the 1940's (3 large fires), 1950's (1 large fire), 1960's (3 large fires) and 1990's (1 large fire). During the period from 1930 to 2000 this FMU followed the established FRI with a total of 8 large fires. There was no large fire in this FMU in 2000 or 2020, in fact none since 1995. It can be reasoned that this FMU is now due or slightly overdue for a large fire or fires.

Prescribed Fire History

There is no history of prescribed fire in this FMU.

Prescribed Burning Priorities and Goals

At time of plan development there were no initial prescribed fire priority projects that were approved, in review, or in development in this FMU. However, as this FMU has highly volatile fuels and, as its fire history indicates, it is overdue for wildfire, three prescribed burn projects are suggested as examples of priorities in this FMU. They are identified with the primary goal of protecting adjacent subdivisions and developed areas from wildfire, while simultaneously establishing burned areas with reduced fuels that prescribed fire management can build from.

Future prescribed burn projects may include extending the Dwarf Pines Prescribed Fire Enhancement Zone to the east to include protections for the Hampton West / Coast Guard Housing subdivision and the commercial corridor on the west side of CR 31 opposite Gabreski Airport. This may include coordination with the US Army Corps of Engineers as it engages on an upcoming project to survey this area for latent unexploded ordinance from 1940's military bombing range use.

The Oakville Subdivision WUI is identified as a leading priority project where prescribed burns would be conducted on NYS-DEC lands that are west and south of the Oakville subdivision which is southeast of Sunrise Highway Exit 64 (Figure DP 8.7). The purpose of the burn is to provide WUI protection to the subdivision by reducing wildland fuels in the Oak forest immediately adjacent to the subdivision. The dwarf pitch pines due west of this subdivision have not burned since the 1950's putting those dwarf pines in as much as a 50-year FRI deficit. The primary wind vectors for large fires have historically been southwest to northwest. Burning this Oak forest will create a buffer of fire protection from the dwarf pines just west of them reducing the wildfire exposure risk. With the long FRI for the Oak forest this prescribed fire treatment would provide many years of protection thereafter to this community.

A second and equally important benefit of advancing prescribed fire in the Oakville Subdivision is that thereafter it facilitates the opportunity to establish a Prescribed Fire Enhancement Zone to the west of the Oak forest. The operational goals for treating this area would be two-fold: continue to expand on WUI protection and to begin to build a fire mosaic within the dwarf pines for ecological improvement Such a mosaic could later be expanded to include more treatments on larger acres.

As it has been cited that this FMU is overdue for large wildfire(s), it is critical to create buffer protection to the subdivisions and other developed areas north of South Country Road and the Stewart Avenue housing complex. These areas were the highest risk to a large fire driven by northwest winds and while the Stewart Avenue area was spared, the southern section experienced property damage as a result of

the Sunrise fire of 1995. These projects could possibly be linked with a US Army Corps of Engineers unexploded ordinance survey project that is scheduled to commence in the next few years.

With the high volatility of the fuels throughout this FMU and the short duration fire return interval as discussed, there are numerous areas within this FMU that are important priorities for prescribed fire management on routine intervals. Many burn projects have multiple benefits in fuel reduction, wildfire risk reduction, and numerous important ecological benefits. Establishing and building successive priorities through continued prescribed fire management with fires building upon previous fires to create a safe and sustainable maintenance burn program is strongly encouraged and highly needed.

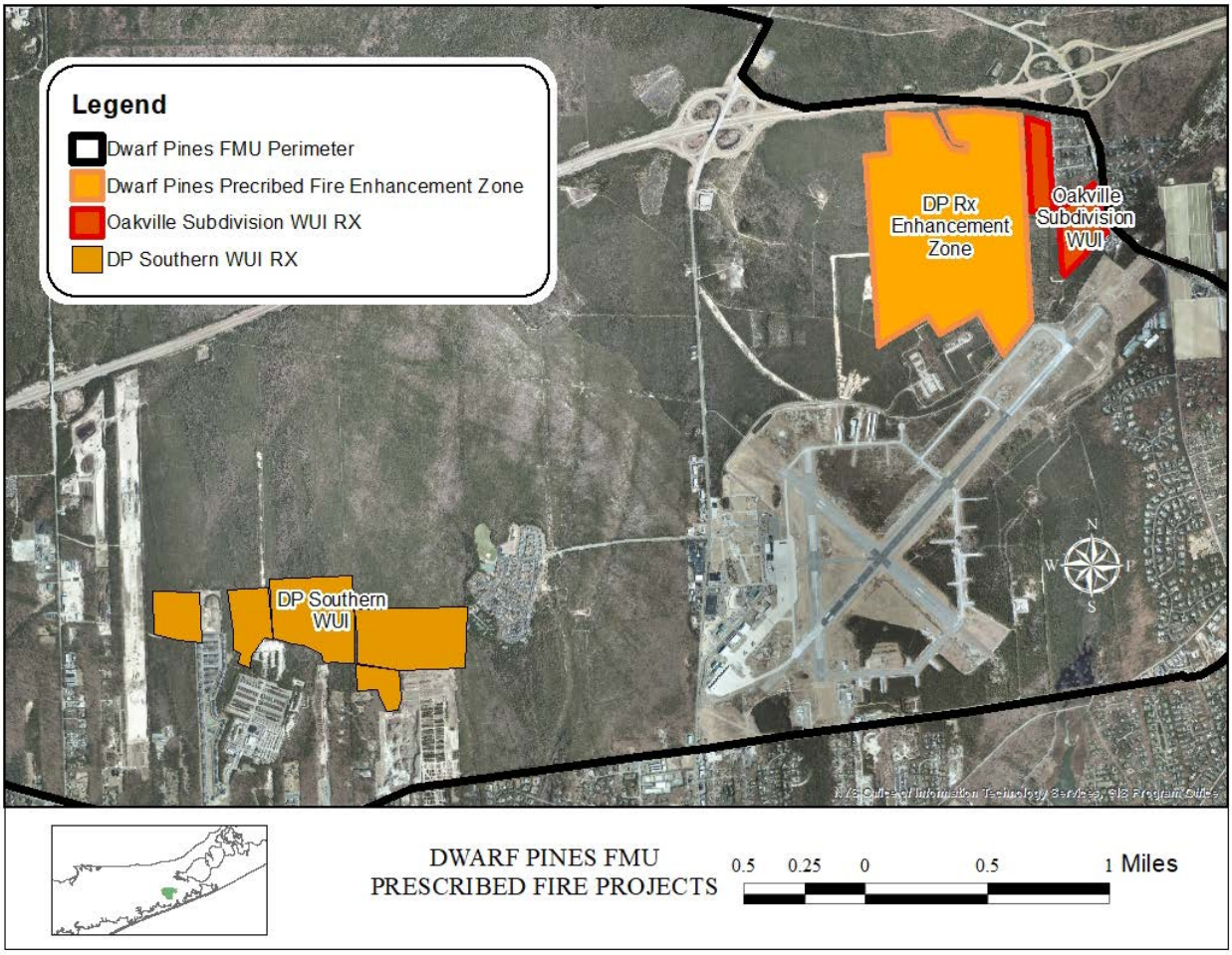


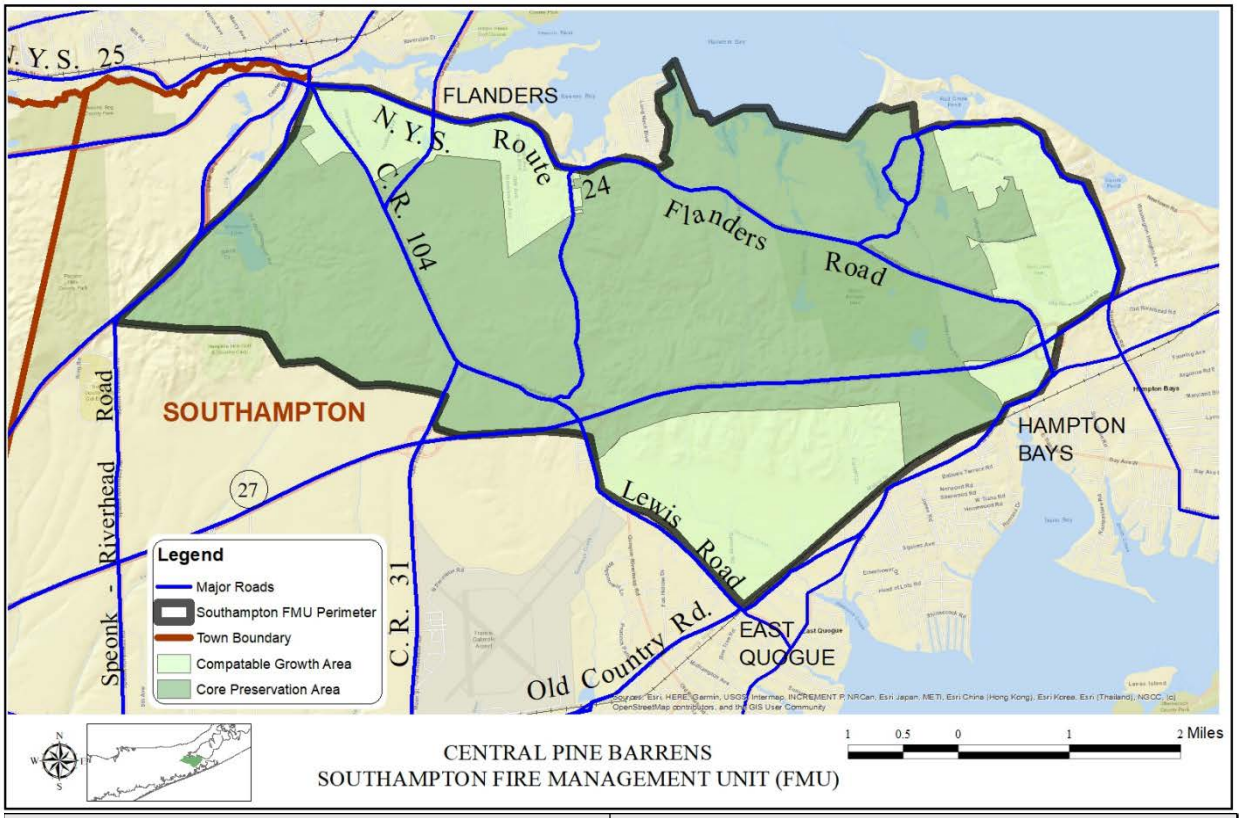
Figure DP 8.7 Prescribed Fire Management Projects for Consideration within the Dwarf Pines Fire Management Unit

Environmental Compliance

None of the public lands in this FMU have had prior environmental compliance conducted for prescribed burning.

Southampton FMU

FMU Demographics, Land Use Protections and Ownership



SOUTHAMPTON FIRE MANAGEMENT UNIT	
Towns	Southampton
Fire Departments	Flanders, East Quogue
	East Quogue, Quogue, Riverhead,
Total Acreage	14727
Core Preservation Area	10604 acres = 69% of area
Compatible Growth Area	4123 acres = 31% of area

Figure S 8.1 Southampton Fire Management Unit and Demographic Table

The Southampton FMU is the eastern most unit and falls entirely within the Town of Southampton. While the second smallest, it is in comparable size to the Rocky Point FMU. The Southampton FMU has the highest acreage of publicly owned lands 71% of any FMU and 69% of total land acres are protected under the Core Preservation Area (Figure S 8.1).

Suffolk County is the largest owner of public lands in this FMU followed by NYSDEC and the Town of Southampton (Figure S 8.2; Table S 8.1). Suffolk County owns lands in the western most section of the FMU. The largest and most contiguous section of parkland occurs just east of Pleasure Drive and encompasses the following Suffolk County Parks from west to east: Maple Swamp (801 acres), Birch Creek Owl Pond (818 acres), Hubbard (1800 acres), Sears Bellows (830 acres) and Munn's Pond (38.8 acres). County lands also abut State lands in David Sarnoff Pine Barrens State Forest (2324 acres) which extends on either side of CR 31. Just south of Sunrise Highway, Henry's Hollow Pine Barrens State Forest

(272 acres) extends west from Munn's Pond County Park. Town of Southampton lands are interspersed within County lands on the east side of the FMU and Hubbard County Park as well as throughout the southern section of the FMU. Developed areas from west to east include the Wildwood Lake subdivisions in the far west corner; the Riverside community and Flanders community along the northern edge, a developed corridor from Flanders south to Quogue that transects the FMU; and finally, subdivisions and municipal buildings campus of the Town of Southampton in the far east and subdivisions north of Montauk Highway in East Quogue. The southern area in East Quogue also has a 400-acre area that is open agricultural fields and a sand quarry that is an unburnable area.

Table S 8.1 Public Land Ownership in the Southampton Fire Management Unit

SOUTHAMPTON FIRE MANAGEMENT UNIT PUBLIC LAND OWNERSHIP = 59%	
NY State Owned Land	3106 acres 21% of area
Suffolk County Owned Land	5801 acres = 31% of the FMU
Town of Southampton Owned Land	1536 acres = 10% of the FMU

Natural Features

The topography in the unit has its highest ground in the center following the Ronkonkoma glacial moraine ridgeline from the Hampton Hills east to Sears Bellows County Park. The highest ground is approximately 260 feet above sea level and the lowest elevations are at sea level adjacent to Flanders Bay in Hubbard County Park.

The diversity of ecosystems within this FMU is outstanding and is attributed to its extremely extensive tracts of public lands that are diversified by both fresh and saltwater ecosystems, numerous terrestrial habitats and the terminal moraine. Large tracts of Pitch Pine, Pitch Pine Oak and Oak Pine forests extend from the Sarnoff preserve across this area to Hubbard and Munn's County Park. Small pockets of grasslands also are interspersed through this FMU and a Pitch Pine Grass savanna, a unique pine grassland habitat is located on New York State lands in the south / center of the FMU. Along the north shore, expansive tidal marshes of Flanders Bay buffer the Coastal Oak forests. A complex of large coastal plain ponds and many scattered kettle ponds, forested wetlands and freshwater wetlands are interspersed within the forested areas. In the County Parkland Complex of Flanders and Hampton Bays numerous ponds including Mill, Sears, Bellows, Penny and House, Division ponds, Hubbard Creek, Grass Creek and Birch Creek support rare Atlantic White Cedar forests and stream systems that discharge into Flanders Bay. Munn's Pond is the exception as it is located on the south shore's Tiana Bay.

Recreation

There is wealth of recreational use in this FMU given how a majority of it is comprised of publicly owned land and as how it supports both fresh and saltwater access. Hunting (deer, waterfowl, small game), hiking, fishing, boating, and bird watching are permitted in most of the County Parks and State Forests. Sears Bellows offers camping and Ducks Unlimited provides waterfowl hunting educational programs in Hubbard County Park. Additionally, portions of the Sarnoff Preserve are actively used for hunting dog training.

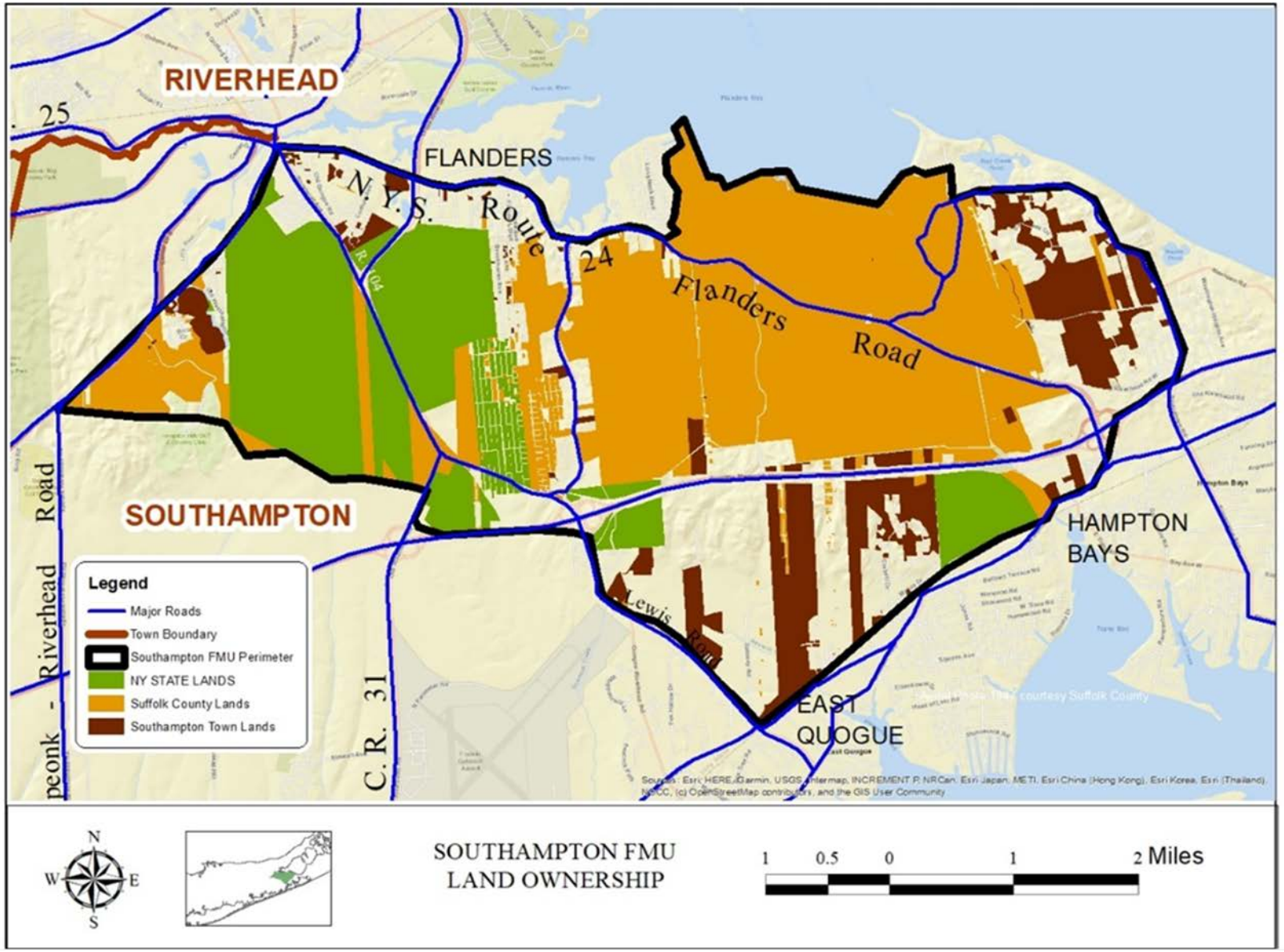


Figure S 8.2 Public Land Ownership in the Southampton Fire Management Unit

Unique Land Use History

From the 1920's through the 1970's the Radio Corporation of America operated the "receiving station" that was a sister facility to the RCA Radio Central transmission facility in Rocky Point (Figure S 8.3). The receiver was located south of Riverside and west of Flanders on what is now Sarnoff Pine Barrens State Forest. This area, known as the "House" portion of Sarnoff west of CR 104 and south of Riverside, was where the receiver operational facility "House" was located. Besides the large linear cleared paths for antenna wire systems and connecting equipment there was a 200' wide rectangular firebreak surrounding the western facility. The firebreak is visible today by the differences in fuels composition from the surrounding areas (grassy strips, pitch pine regeneration) and the presence of concrete stays, cables, poles and gear winches which still remain on site.

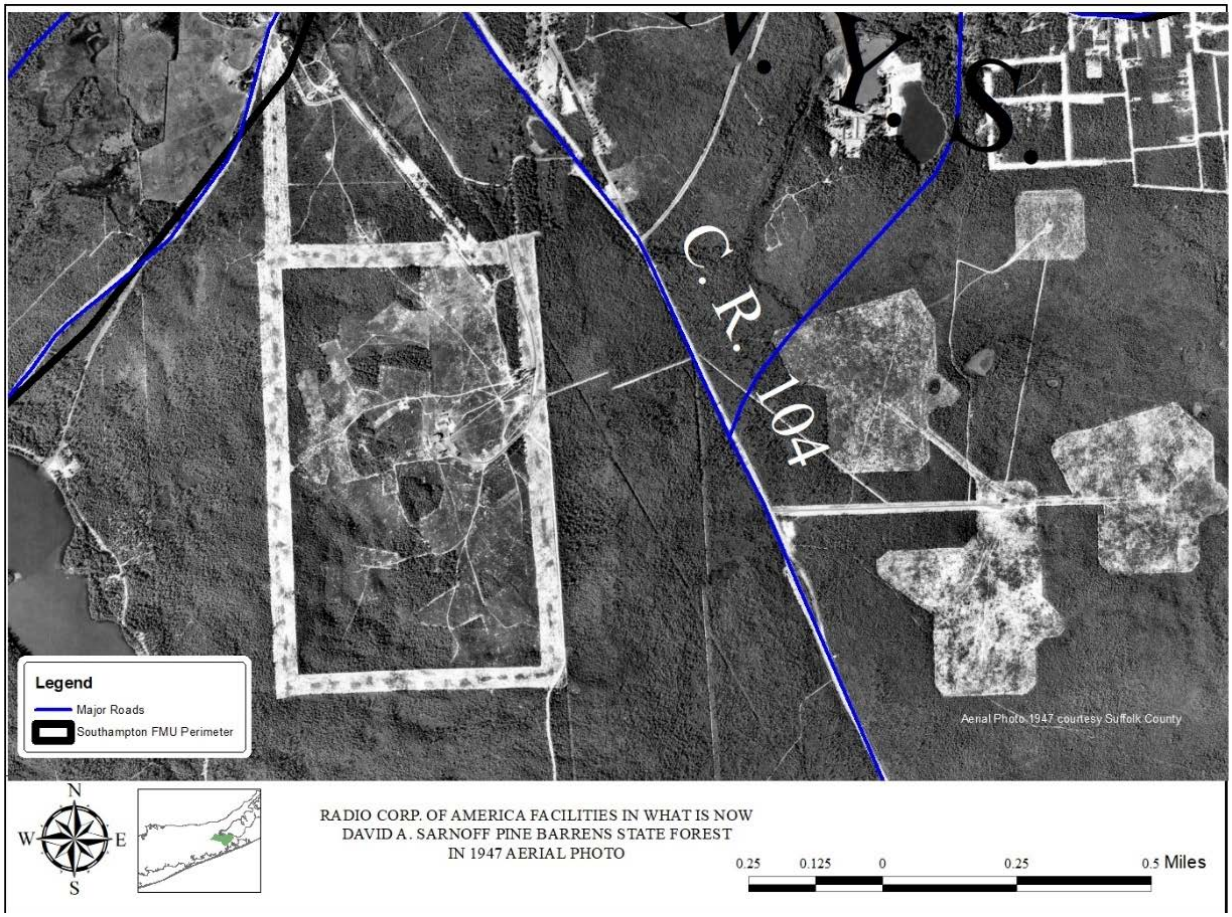


Figure S 8.3 1947 Historical Aerial Photo of Radio Corporation of American Facilities Located on what is now David A. Sarnoff Pine Barrens State Forest.

Unique Ecological Features

Mass oak mortality was prominent in this FMU especially just east of the Sarnoff Pine Barrens State Forest to Sears Bellows County parks eastern border (Figure 8.2). In some of these affected areas, dense "dog haired" pitch pines are regenerating among the remnants of the dead standing oaks.

Of all of the areas affected in the Central Pine Barrens, the southern and eastern section of the FMU has been one of the most heavily impacted. An estimated 15,554 infested southern pine beetle trees have

been cut as part of suppression and hazard removal efforts in Hubbard, Sears Bellows, and Munn's Pond County Parks as well as Henry's Hollow State Forest. This, however, does not account for the mass dead standing and downed trees that have been affected by this swiftly moving and ravenous beetle. The East Quogue area it is estimated that over 160 acres of pines had been affected. Since 2019, outbreaks of the beetle have been smaller and in lower frequency and while southern pine beetle is too abundant and dispersed to be eradicated, these declining trends indicate the suppression efforts are having a desirable effect on the insect. As it relates to prescribed fire, numerous pitch pines have been lost from these forests, which will become oak dominant without further intervention. The large amount of downed and standing organic materials require mitigation in order to advance restoration.

Fire Districts

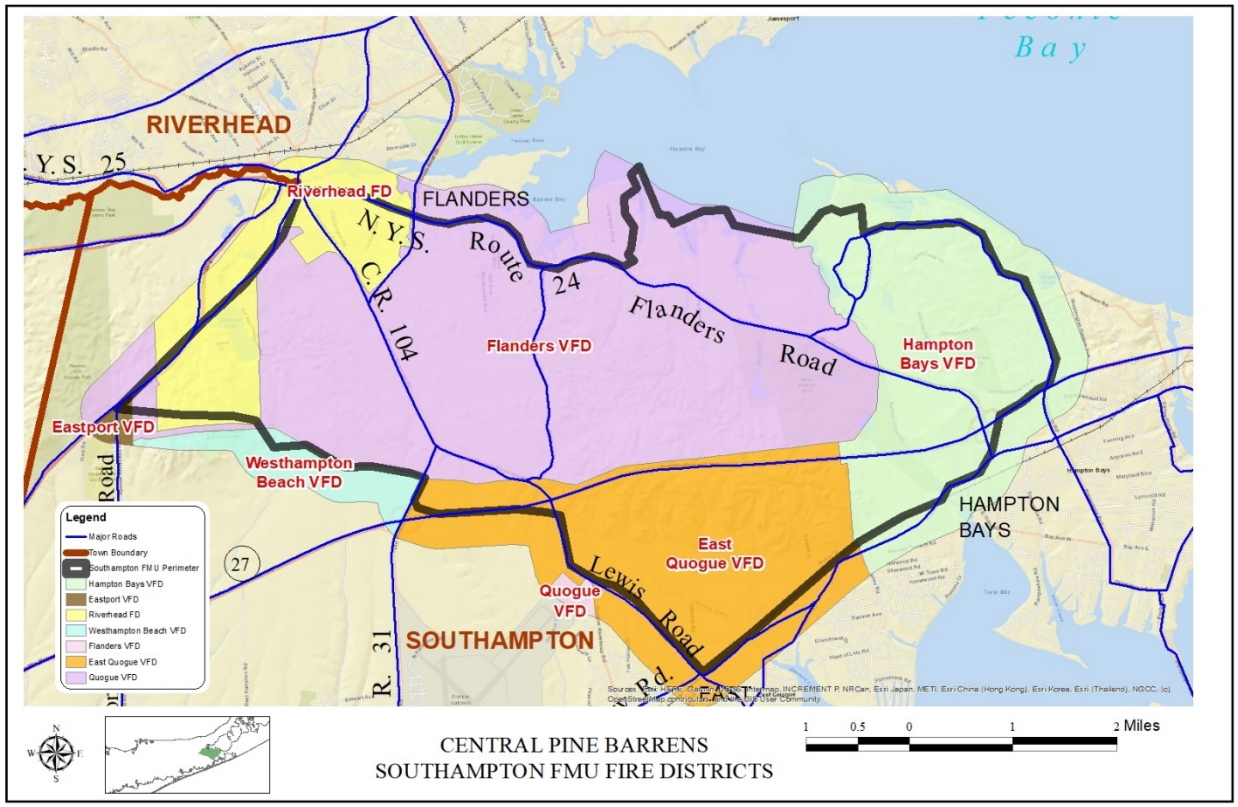


Figure S 8.4 Fire Districts of the Southampton Fire Management Unit

A total of six fire departments have jurisdiction in the Southampton FMU. The largest coverage is provided by Flanders VFD, followed by East Quoque VFD, Hampton Bays VFD, Riverhead FD, Westhampton Beach VFD, and Eastport VFD (Figure s 8.4).

Community Wildfire Protection Plan

There is no Community Wildfire Protection Plans developed within this FMU.

Wildland Urban Interface

There are significant wildland urban interface concerns in this FMU. On the public land ownership map (Figure S 8.2), the areas that are not identified as public lands are private lands with home subdivision or

other private infrastructure directly adjacent to heavily forested areas. Additionally, public facilities and utilities are also embedded in the wildland interface. An additional concern is in regard to public transportation in this area as two very important highways travel through this FMU from west to east (Sunrise Highway and CR24- Flanders Road). These are important corridors to the communities further east on the south fork (Hamptons, et. al.). They are very busy roads not only during the summer season but are also known for the daily weekday "Trade Parade" of service, construction, landscaping, and other support industry staff traveling daily to and from the Hamptons throughout the year and are the main escape route as needed. These important transportation corridors are a significant part of the urban interface in this FMU. There is a combination of sand quarry and agricultural fields east of CR 104 and south of the Sunrise Highway. To some extent this area would shelter some of the East Quogue subdivisions north of the Montauk Highway from a large-scale wildfire approaching from the northwest. With the exception of that same cluster of subdivisions (the area they are presently in was burned over by a huge fire in July of 1964) most of the developed areas have been spared from large fires.

Fuels

There is a wide diversity of fuels in this FMU (Figure S 8.5). The western and eastern portions are made up of large tracts of pitch pine forests interspersed with pine-oak forests. The central portion is dominated by oak forests, primarily oak-pine but large tracts of pure oak stands. The marine coastal wetlands on the north are mostly covered with invasive phragmites. Below are a series of fuel type summary descriptions by the dominant vegetation communities.

- Oak Communities: Large continuous areas of Oak – Pine forest and Oak forest dominate the center of this FMU. They are also the primary fuels in the eastern side and southeastern corner.
- Pine Communities: The pine communities in this FMU are dominated by Pitch Pine forests with second in abundance being Pine-Oak forests. There is also a considerable amount of Pitch Pine Heath forest in this FMU especially in the Sarnoff Pine Barrens State Forest.
- Grasslands: The Pitch Pine Grass savanna (700 acre) is a unique Pine - Grassland habitat that uniquely occurs within this FMU that is located on NYS-DEC lands in the south / center of the FMU. This area is immediately south of the Sunrise Highway, has Oak forested state land to its west, agricultural lands in Quoque to its south and a large sand and gravel pit to its east. Otherwise, there are only small pockets of grasslands in the rest of the FMU.
- Wetlands: There are abundant and diverse wetland habitats in this FMU, but many of them would not likely be available fuels. There are forested wetlands near the shorelines of several ponds including Wildwood Lake, Penny Pond, the creek drainage flowing north from Grass Pond and in Maple Swamp County Park. There are freshwater wetlands in most of those same areas, particularly between Sears Pond and the Division Pond / House Pond areas. It is very likely the forested wetlands never burned. In the tidal marshes along the south shore of Flanders Bay it is likely that some of these marshes were burned as part of agricultural practices in the past, though there is nothing in fire history about that, but fire scars exist on fence posts and trees. That is a moot point now since these marshes have mostly been invaded by non-native phragmites which is a species and habitat that supports fire.

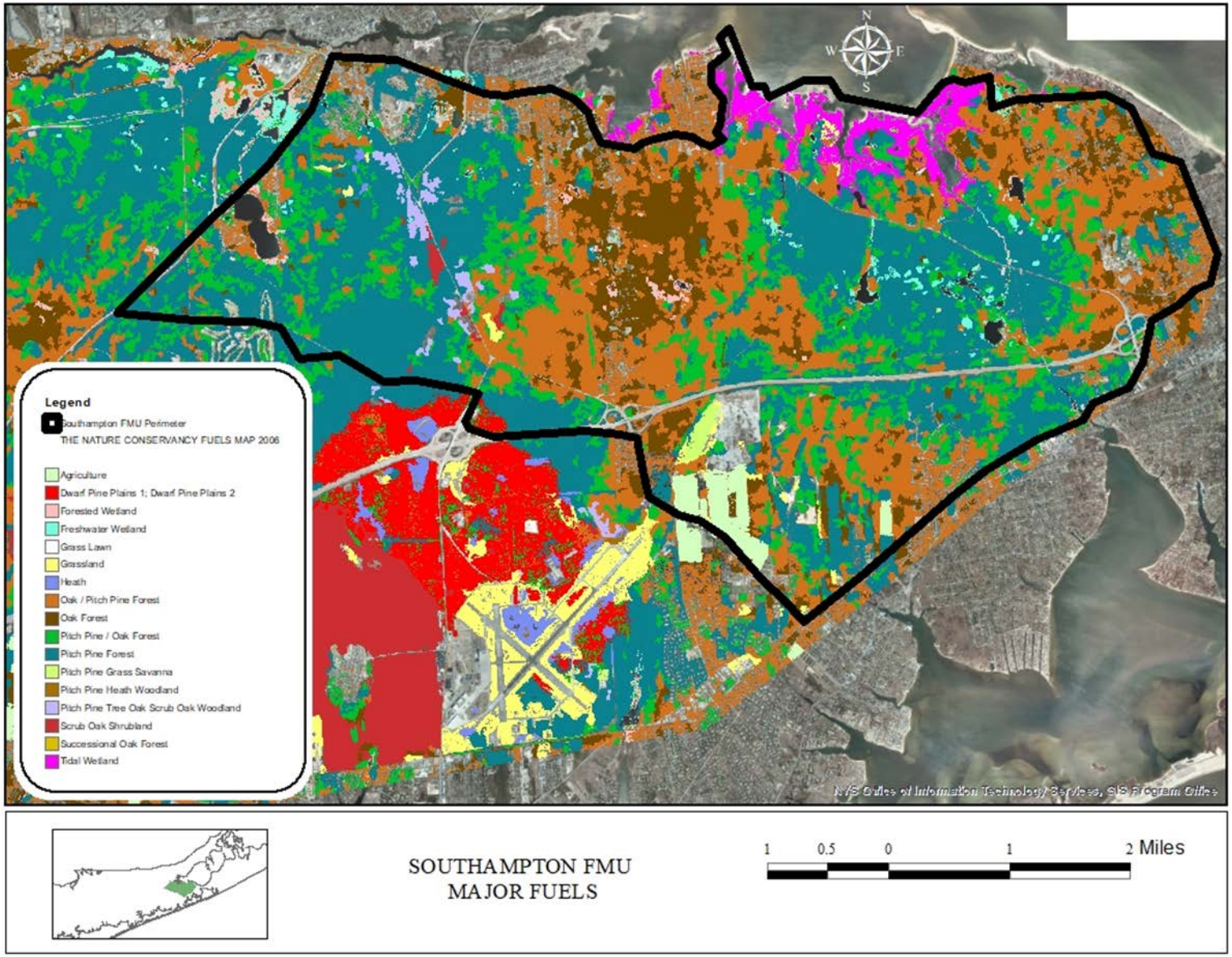


Figure S 8.5 Major Fuels by Dominant Vegetation Community for the Southampton Fire Management Unit

Fire History

A total of six large fires burned in the FMU decades ago, with no large fires since the mid-1960's (Figure S 8.6). One of the largest fires on record in the Central Pine Barrens, Fire #58 occurred on July 1-2, 1964 and burned 2,787 acres. However, Windisch estimates the fire could have burned as much as 6000 acres. That fire occurred across the eastern section of Hubbard County Park, the extent of Sears Bellows County Park, Henry's Hollow and Munns' Pond and into East Quogue. The fire burned over the entire area that is now a subdivision south of the Sunrise Highway. Based on crown run strips Windisch said the winds were mostly southwest and west by southwest but also included other directions. Another noteworthy fire was Fire #15 that burned nearly 1000 acres in the late 1930's/40's. That fire burned from Riverside to Flanders and burned much of the future Sarnoff Preserve. That fire was the last major fire to have burned in the eastern half of Sarnoff / Pleasure Drive subdivision. From 1995 thru 2018 only 107 wildfires were reported, none of them of significant acreage. That particular area is shown as having burned during the large July 1964 Fire #58, but it is unknown whether these wetlands burned or if the fire bypassed them.

FRI Departure

The majority of this FMU is Pitch Pine Oak – Pine habitat with a FRI of 40 to 60 years. Large, major fires (in excess of 100 acres) occurred in this FMU in the 1930's (2 fires), 1940's (1 fires), 1950's (2 fires), 1960's (1 fire) and there have been no large fires since the 1960's. During the period from 1930 to 1970 there were six large fires. The largest occurred in 1964 (2787 acres) and was the fourth largest fire in the 1930-2020 fire data (Windisch 1994). It can be reasoned that this FMU is about at the outer limit of the FRI. There are significant acres of the Sarnoff Pine Barrens State Forest that have not had large fire on them in at least nine decades, which is an up to 50-year FRI departure.

Prescribed Fire History

Since 2005 there have been considerable efforts made to establish prescribed burning in the David A. Sarnoff Pine Barrens Preserve, especially that portion east of CR 104. Some burning was completed there in 2006 by a joint project between TNC and NYSDEC. Several units were burned, and some were treated by blacklining. In those years, a large area east CR 104 in Sarnoff was also mechanically thinned.

Prescribed Burning Priorities and Goals

At time of plan development there were no initial prescribed fire priority projects that were approved or in review for this FMU. In 2019 and 2020 NYS-DEC conducted a large mechanical thinning project on both sides of CR105 to reduce susceptibility to southern pine beetle. As a result, portions of the areas designated on the map Figure S 8.7 are now ready for follow-up prescribed fire treatments. Additionally, the Commission will be contracting additional mechanical reduction work to continue these pre-burn treatments in the eastern portion of the Sarnoff. These additional treatments will enable WUI reduction burning for the subdivisions in Flanders. This project is described below.

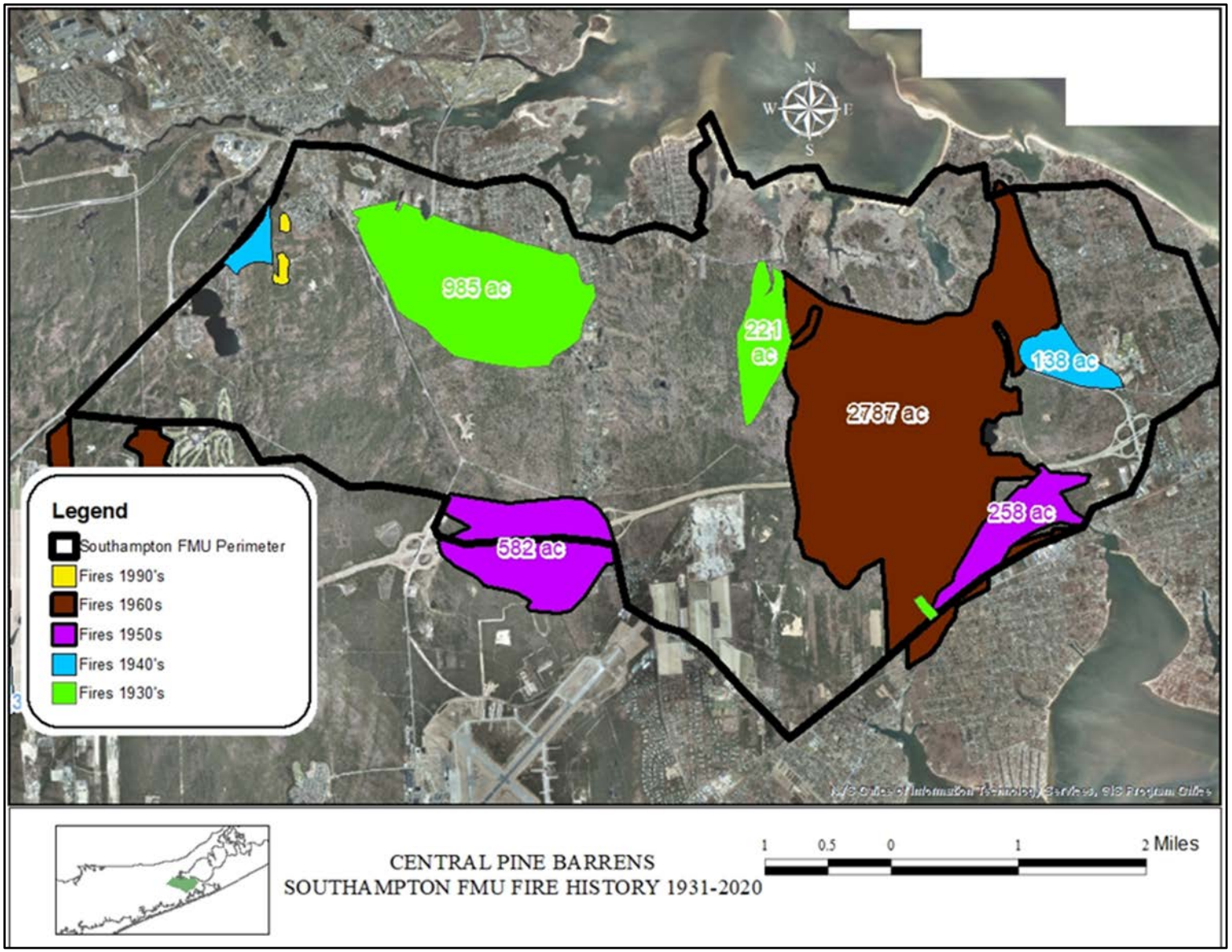


Figure S 8.6 1931-2020 Fire History of the Southampton Fire Management Unit

As this Plan is intended to promote and expand prescribed burning in the Central Pine Barrens, it encourages the establishment of additional projects as needed in the future. In this accord, three large, prescribed fire projects are identified which would facilitate ecological restoration and WUI risk reduction. Similar to the forest management activities advanced in South of Currans Woodlands, 75 acres of the David Sarnoff Pine Barrens State Forest have received forest management treatments in 2019 and 2020 in an effort to improve forest health and reduce susceptibility to southern pine beetle (Figure S 8.7) . To capitalize on these fuel treatments most readily and holistically recognize the above-mentioned goals, prescribed fire and the establishment of a Prescribed Fire Enhancement Zone on the western half of Sarnoff Pine Barrens State Forest is being established at the time of this plan's publication. The Commission has initiated burn plan development for this "Sarnoff West" area that will become the basis of the greater enhancement zone. The area cleared is in the "House" area in the center of what was the RCA facility. Prescribed burning would be slated to begin on the mechanically treated areas, and then untreated adjacent forests can be burned into the new blackened areas. Prescribed fire needs to follow up between 6 and 18 months post mechanical treatment to take advantage of the fuel reduction and enhance future prescribed burn maintenance.

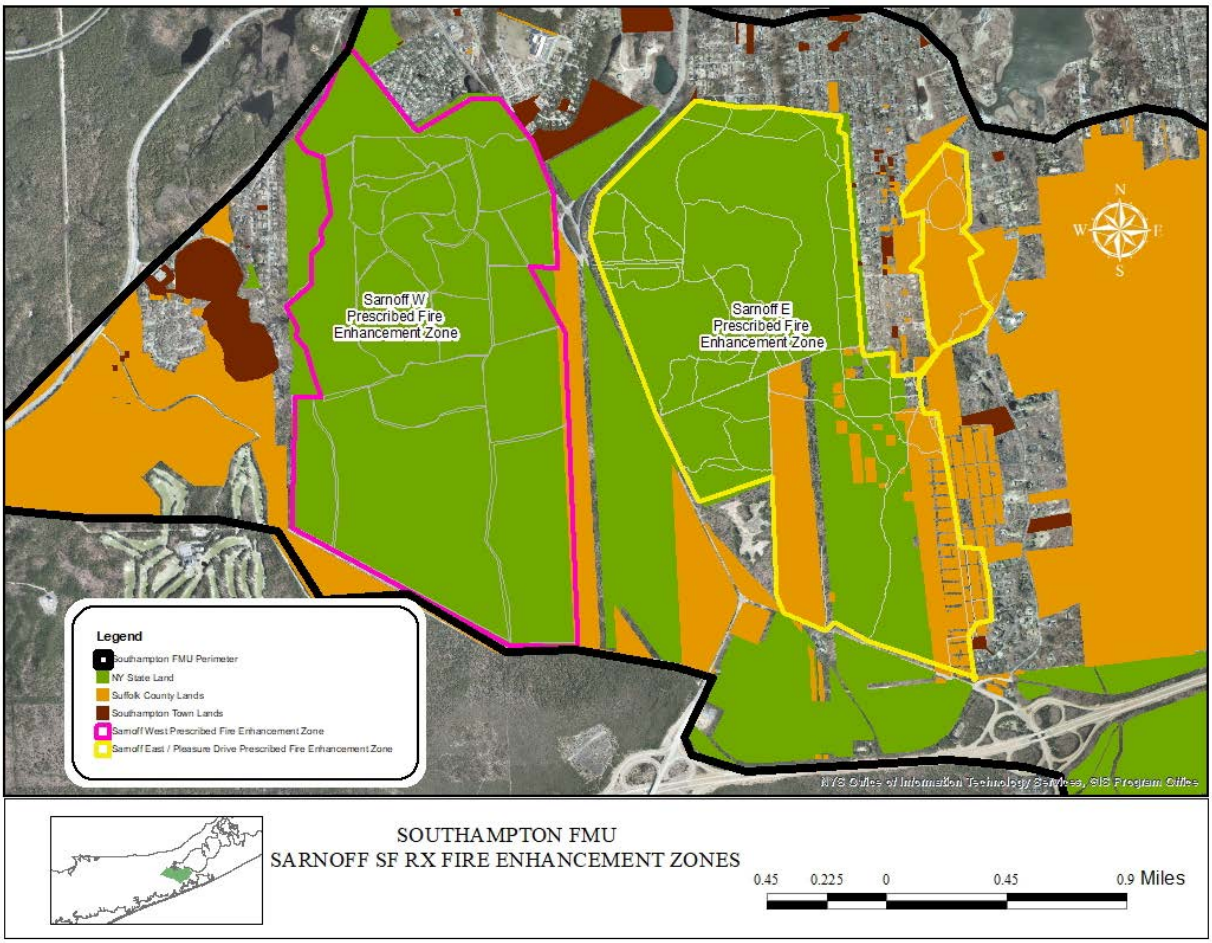


Figure S 8.7 Prescribed Pire Priorities for the Sarnoff Pine Barrens State Forest

A second management recommendation includes prescribed fire management and establishment of a Prescribed Fire Enhancement Zone on the 1209 acres of the eastern half of Sarnoff Pine Barrens State Forest east of 104 and adjoining Suffolk County-owned lands and the "Pleasure Drive" community urban interface. This large project would expand upon the previously conducted mechanical and fire plans and

treatments that were developed and/or advanced by The Nature Conservancy and Land Use Ecological Services under contract with CPBC from 2005- 2017. NYSDEC will be conducting mechanical treatments in Sarnoff Pine Barrens State Forest in this project zone starting in fall of 2020.

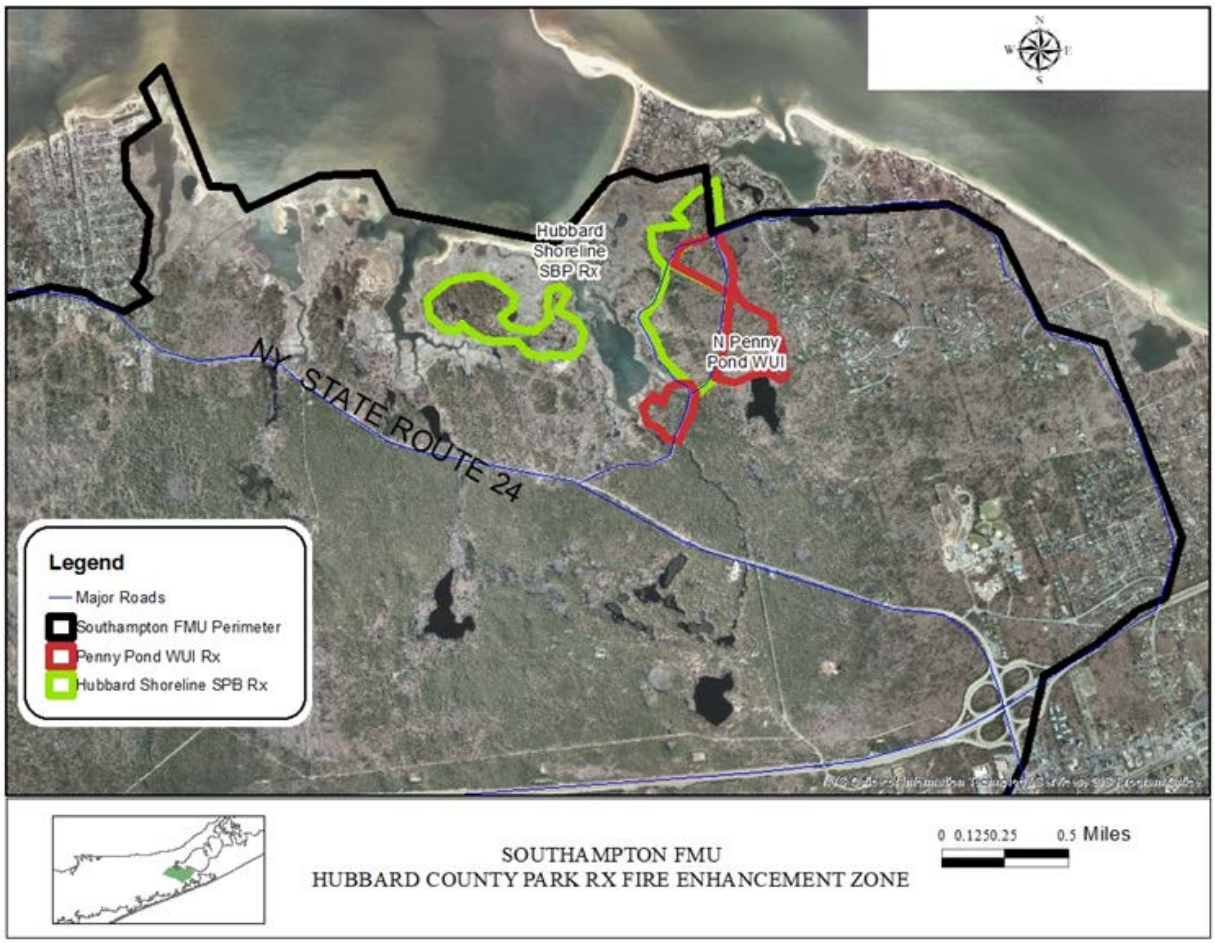


Figure S 8.8 Prescribed Fire Proposed Priorities for the Hubbard County Park within the Southampton FMU

The third recommendation for prescribed fire treatment occurs within Hubbard County Park in Hampton Bays. A Prescribed Fire Enhancement Zone is recommended along the eastern edge of this FMU by using pretreatments and prescribed fire to eliminate fuels (figure S 8.8). This area would then be used to and build a foundation by which a Prescribed Fire Enhancement Zone can be established and can facilitate future prescribed fire within this ecologically valuable parkland.

The first burns to be initiated in this area would be a series of burns called N. Penny Pond WUI. The purpose of the three burns in this project would be to protect the subdivisions just to the east of Hubbard County Park from a large fire approaching from the southwest. These three burn blocks would total 79 acres.

The next burns recommended would be located immediately west of these WUI burns and would build upon the buffer they provide. Additionally, after these subsequent burns, the Hubbard Shoreline Southern Pine Beetle prescribed burn, is recommended on the 142-acre peninsula in order to help restored the Pitch Pine forests which experienced significant southern pine beetle damage. These burns

would be a follow up to suppression and hazard tree removal activities performed in this area since 2016 in an effort to suppress future south pine beetle outbreaks.

As noted in the Manorville-Calverton FMU prescribed fire recommendations, the Coastal Plain Ponds and creeks are experiencing significant Common reed invasion that is threatening these unique ecosystems and species which they support. The planning for the use of prescribed fire within these systems is recommended and supported to help facilitate the restoration and maintenance of these ecologically valued systems.

Significant land area within the Southampton FMU has a justifiable need for prescribed fire management to meet a variety of goals and objectives relating to ecology, WUI protections, and wildland fuel reductions. These lands include state, county, and town lands. Of particular note for future project potential include more areas of Hubbard County Park, Sears Bellows County Park, and the New York State Henry's Hollow property. The plan recommendation is to continue to identify and develop prescribed fire projects collaboratively with the landowning partners to cumulatively build upon continuing and sustaining prescribed fire management efforts.

Environmental Compliance

None of the public lands in this FMU have had prior environmental compliance conducted for prescribed burning.

9. Monitoring and Research

Monitoring

At many stages in the adaptive comprehensive prescribed fire management program, monitoring will be a core and fundamental ongoing aspect. Monitoring is central to the goals of administering and maintaining an adaptive management program. In this program, monitoring is the collection of data and observation on a variety of site conditions relating to vegetation, species, and fuels. Monitoring in this context is effectively routine and detailed surveillance of particular aspects and conditions in the environment. At the initial stages, monitoring helps to inform and guide the development of priorities regarding where, when, and how prescribed fire should be implemented. Defining what realistic and achievable goals for fire at a particular site is also made possible through detailed monitoring. Monitoring data assists in establishing a baseline understanding of status and conditions to communicate and share with partners and landowners, as well as the public, when initially identifying particular landscapes and tracts for treatment. This baseline monitoring data is what facilitates comparative analysis to identify and monitor changes that take place through management actions enabling adaptive management to refine and improve techniques to meet pre-established objectives and goals. Without thorough and robust monitoring protocols and practices an adaptive management and prescribed fire program is not possible.

This program will employ monitoring protocols that have been tested and adopted by several land management organizations and agencies. Using consistent protocols that are widely accepted and implemented allows some universality in being able to compare the resultant data within similar systems across jurisdictional and regional boundaries more expediently. These comparative powers also help to adapt the local management program based on the results of implementation in a variety of landscapes and conditions in similar habitats in the region.

Research

While monitoring data can be used in research fundamentally, monitoring and research are distinct, although there are significant areas of overlap. In research, the scientific method is usually employed to develop inquiry and test hypotheses. In the adaptive prescribed fire program, the scientific method is employed to continually ask questions, especially related to achieving the desired outcomes, if different techniques better meet different objectives and how to refine practices. This is one core area of research that will be conducted and made possible by robust monitoring.

In 2005 and 2006 the Foundation for Ecological Research in the Northeast (FERN) conducted a baseline study of the forest ecology of the Long Island Pine Barrens Core Preservation Area. In this study 91 permanent vegetation plots were established throughout the Central Pine Barrens Core Preservation Area by field crews supported by the Brookhaven National Laboratory Natural Resource Management Program.

In 2019 and in 2020 field crews once again monitored these plots. The comparison analysis of forest health changes and dynamics is a valuable process to evaluate the results of fire on this ecosystem. Some of these plots have had wildfires on them since the first round of installation (Crescent Bow Fire April 2012). Some of these plots are also located within the boundaries of the Sunrise Fire (1995) and comparison of the changes in those burn areas since 2005/2006 will produce important information regarding fire effects in the pine barrens.

Similar efforts will be made to collaborate with partners in other agencies and academia to develop and conduct a variety of additional research projects related to natural resource management and restoration that will be of benefit directly and indirectly to the comprehensive prescribed fire management program. Cooperation on grant and contract writing to secure funding to enable and facilitate research will be an ongoing effort closely tied to implementation and improvement of the comprehensive fire management program. This research will be guided by the desire to improve and increase understanding about the Central Pine Barrens and create new knowledge with the goals of documenting, sharing, distributing that knowledge.

10. Education and Outreach

A significant and a necessary element for this plan to succeed and for prescribed fire to develop widespread acceptance as an important, routine, and necessary component of Central Pine Barrens land and forest management is public education and outreach. Compared to some regions of the country, the Central Pine Barrens region has had little exposure to, or familiarity with, any kind of prescribed fire and/or forestry management practices, especially relating to fire in woodland environments. Developing and building a culture of prescribed fire that facilitates understanding, comfort, acceptance, and ultimately support takes significant investment in diverse and ongoing public education and outreach activities. To reach this goal it will be necessary invest in, conduct, and facilitate, to the greatest extent possible, a holistic, evolving, adaptive and collaborative public education and outreach program regarding prescribed fire use and its larger relationships to ecological and forest health, as well as wildfire risk reduction. A diverse set of tools, materials, and communication and engagement methodologies will be employed to reach and connect with the public and to develop and sustain a positive and productive culture of prescribed fire on Long Island and in the Central Pine Barrens.

Recognizing the importance of such public education and outreach, efforts to improve and increase public education about wildfire, the role of prescribed burning in ecological health, active forest management, and wildfire fuel and risk reduction, along with actions property owners can perform to improve wildfire protection to their properties have already been initiated. Additional and future desirable, general public education and outreach projects include (but are not limited to):

- Developing and offering presentations to various civic groups, organizations, homeowners associations, volunteer fire departments, neighborhood and community groups, and other interested parties
- Creating and making available, both in digital form and in print, additional materials about the Central Pine Barrens and the role of fire in the ecosystem and the benefits and justifications of prescribed fire as a management tool
- Implementing recommendations from the Ridge – Manorville – Calverton Community Wildfire Protection Plan (2016) including assisting property owners in performing protection assessments, and working with the State, County and Town governments in creating and distribution of fire educational materials.
- Creating and distributing a “Homeowner’s Guide” that provides a thorough review and reference about living in and around a fire adapted ecosystems, land and prescribed fire management, wildfire awareness and preparedness, and associated additional topics.
- Website development to have an access portal for the public, as well as firefighters and other agencies to access materials, general information about fire ecology, prescribed burning, and more specific information like planning, calendars, maps, etc.
- Expanding topical coverage of prescribed fire and fire ecology in current educational programming for school children and reaching out to develop curriculum development partnerships for additional K-12 outlets.

For specific prescribed burns, pre-burn and day of burn targeted community / subdivision educational outreach actions include an assortment of public information processes that may be undertaken. These potential actions include (but are not limited to):

- Public fire educational events
- Fire protection / awareness / CWPP information distribution
- Distributing prescribed fire information at community locations (e.g., fire information trap lines)

- Distributing burn schedule(s) to adjacent neighborhoods and posting on CPBC website
- Public day of burn notifications as specified in a prescribed burn plan
- Providing on-site information in the community or subdivision on day of burn

All the holistic and ongoing education and outreach activities, as well as the specific pre-burn and day of burn targeted activities require significant effort. The population size on Long Island, both near the Central Pine Barrens and within the region, exponentially increases the time, expertise, staff, and resource investment and allocation.

That said, education and outreach, and investment in it, is vital for initiating and sustaining prescribed fire management and developing the culture of fire in the region. Without the understanding and support of the public, the process and continuance of initiating and sustaining a prescribed fire program is far less likely to be successful in the short and long term. The public in general, as well as public organizations and groups, must have a significant level of buy-in and support of this project and program, which is garnered and achieved through consistent, high quality education and outreach materials and operations. Developing the culture and support of fire use, and all that comes with using fire as a management tool, from the benefits to the challenges is possibly one of the most significant and important aspect of the plan. Therefore, it is integral to recognize that the public landowning agencies and land managers will be stronger and more effective in conveying this information collectively and as such it is a recommendation of this plan is that this effort be an interagency and collaborative as is prescribed fire and land management in general.

11. Conclusion

Nearly 25 years have passed since the need to develop and implement a prescribed fire management plan and land management practice was identified and recommended by the Central Pine Barrens Comprehensive Land Use Plan and by the Wildfire Task Force in its Fire Management Plan. Other interested individuals and organizations have provided additional encouragement over this period and even earlier in time. This has especially been the case with the support offered by other entities which have been successfully implementing prescribed fire as a management tool with great ecological and wildfire risk reduction benefits in similar habitats for decades. This plan seeks to answer these calls and proposes to develop a foundational framework for catalyzing a holistic and sustained land management program using prescribed fire as the justified primary tool to meet many goals and objectives.

The Central Pine Barrens is an enormously valuable ecological system, but it is suffering from continual degradation through a lack of routine and impactful restoration and maintenance-based successional management. This plan develops and presents a systematic approach to restoring and maintaining the Central Pine Barrens in an ecologically appropriate manner through prescribed fire use. It truly is the responsible stewardship decision to manage the ecosystem to sustain it over time while reducing wildfire risk and prescribed fire is the most ecologically appropriate, economically feasible, and beneficial tool available.

The land use protections afforded this system have safeguarded an important natural resource in the sense of its boundaries, but a lack of management induces the system to erode and deteriorate from the inside in several ways. Declines in ecosystem health and in rare, threatened and endangered species populations are occurring and a progression continues toward a transition to wholly different ecosystem types and species presence. Reductions in ecosystem services through reduced ability to filter and percolate water into the aquifer are manifesting themselves. The continuing development of wildfire fuel in the system is additive over time, resulting in increasing wildfire risk, a reduction in the ability to achieve successful wildfire containment and control and leading to the greatly increasing probability of catastrophic wildfire when environmental conditions align which threaten life, property, and fire fighter safety.

It has been observed in most of the remaining geographical areas that have resident Pine Barrens and associated rare species habitat, that the use of active management and prescribed fire has been the standard, is widely accepted and has been in use for decades already. Prescribed fire in other locales has been used to successfully meet management goals and objectives and remedy the declines observed in ecosystem health, respond to pest and disease pressures, reduce wildfire risk, build up defensive wildfire capacity in the wildland urban interface and restore ecosystem services through restoration and maintenance of the system. These examples of effective prescribed fire program implementation give more credence to the justifications for implementing prescribed fire and the likely benefits it will confer when employed as a management tool in the Central Pine Barrens.

This plan is presented in an earnest effort to encourage, establish, build, and participate in a cohesive and collaborative prescribed fire-based land management structure that seeks to forge partnerships enabling the ongoing restoration and maintenance of the important Central Pine Barrens natural resource. The costs to manage this system properly and effectively to improve its health and service provision, be good stewards of the land and keep the people and property of Long Island safe is a larger effort than any one agency can bear in oversight, planning, implementation, and in human or financial capital. New York State has provided initial seed money to initiate this prescribed fire program, but the amount of effort and resources required to continue to build and sustain the program at the necessary

scale will involve a long-term funding allocation and the cooperation of various landowning partners and cooperating organizations. This plan helps to create the outline and provides the rationale for this program's existence and value. The continued investments through time in this management program will pay dividends that have multiple benefits which collectively far outweigh the costs. This plan contends that this investment should be made and maintained over the long term and receive a perpetual allocation to allow for restoration in the short term and the maintenance needs of the system in the long term.

The significant size of the Central Pine Barrens and the fire return intervals involved in maintaining these systems requires a program that is routine and administered on a continuous basis. This routine effectively manifests as a program that is burning small to moderate sized acreages throughout the entire year, when environmental conditions allow, to meet a variety of restoration and maintenance objectives. Prescribed fire management needs to become a very regular and recurring effort with burning happening nearly every week and multiple days per week. This plan encourages development, staffing, and funding of regular burn staff through mutual interagency support that has the capacity to focus consistently on prescribed fire as well as additional trained personnel who can fill in or add to capacity for some specific projects or times of the year.

The fire program outlined herein is designed to start and then continue very conservatively and safely. Integrated into this plan is the goal of significant public outreach and education, research, and monitoring. There is substantial work entailed in developing a culture of acceptance, advocacy, and support for prescribed fire use on Long Island that is paramount to the success of the program. There is a wealth of information to be learned through initial program inception and implementation with associated research and monitoring that will allow improvements through an adaptive process which will continue to refine and grow the program to best meet goals and objectives.

This plan is put forth with great appreciation for the land protection efforts that led to the designation of the Central Pine Barrens and a strong desire to facilitate the management of the Central Pine Barrens in a way that encourages its strength, health, and resiliency through generations. With high hopes, this plan has been created and is offered to be a guiding framework and tool to help establish the management program needed to conserve this precious resource, and all it contains and offers while also providing for public safety.

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