NORTHERN SHAWANGUNK RIDGE FIRE MANAGEMENT PLAN

INTERAGENCY FIRE MANAGEMENT PLAN FOR MINNEWASKA STATE PARK PRESERVE, SAM'S POINT PRESERVE, MOHONK PRESERVE AND WITCH'S HOLE STATE FOREST

FEBRUARY 2011

SHAWANGUNK RIDGE BIODIVERSITY PARTNERSHIP

DEPARTMENT OF ENVIRONMENTAL CONSERVATION · NEW YORK STATE ·

OFFICE OF PARKS · RECREATION · HISTORIC PRESERVATION NEW YORK STATE

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ADOPTION OF
THE FINAL NORTHERN SHAWANGUNK RIDGE FIRE MANAGEMENT PLAN

An Interagency Fire Management Plan has been prepared for the Northern Shawangunk Ridge which includes Minnewaska State Park Preserve, Sam's Point Preserve, Mohonk Preserve and Witch's Hole State Forest located in Towns of Rosendale, Gardiner, Shawangunk, Wawarsing, Rochester and Marbletown and Village of Ellenville in Ulster County, NY.

This plan was developed on behalf of the Shawangunk Ridge Biodiversity Partnership whose members are: the Palisades Interstate Park Commission, NYS Office of Parks Recreation & Historic Preservation, NYS Department of Environmental Conservation, The Nature Conservancy, Mohonk Preserve, Open Space Institute, US Fish & Wildlife Service, NY Natural Heritage Program, Cragsmoor Association, Friends of the Shawangunks, NY State Museum, and the NY/NJ Trail Conference.

Adoption of this plan is based the Final Plan dated February 2011 and the companion environmental assessment. A Negative Declaration was issued on the plan by the co-lead agencies, NYS DEC and NYS OPRHP, in accordance with the provisions of Part 617, the regulations implementing Article 8 of Environmental Conservation Law - the State Environmental Quality Review Act.

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NYS Office of Parks, Recreation & Historic Preservation — Date: 2/25/11

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Palisades Interstate Park Commission — Date: 2/23/2011

Willie Janeway, Region 3 Director
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Tom Dooley, NY Fire Manager
The Nature Conservancy — Date: 3/7/2011

NORTHERN SHAWANGUNK RIDGE FIRE MANAGEMENT PLAN

Interagency Fire Management Plan for Minnewaska State Park Preserve, Sam's Point Preserve, Mohonk Preserve and Witch's Hole State Forest

February 2011

NYS Department of Environmental Conservation
NYS State Office of Parks, Recreation & Historic Preservation
Palisades Interstate Park Commission
The Nature Conservancy
Mohonk Preserve, Inc.
Open Space Institute

On behalf of
The Shawangunk Ridge Biodiversity Partnership

Towns of Rosendale, New Paltz, Gardiner, Shawangunk, Wawarsing, Rochester and Marbletown, and Village of Ellenville, Ulster County, New York

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Acknowledgements

The development of the *Northern Shawangunk Ridge Fire Management Plan* has been a cooperative effort involving numerous partners from the Shawangunk Ridge Biodiversity Partnership, including NYS Department of Environmental Conservation (NYS DEC), NYS Office of Parks, Recreation & Historic Preservation (NYS OPRHP), Palisades Interstate Park Commission, The Nature Conservancy, Mohonk Preserve and the Open Space Institute. The leadership and support of the NYS DEC and NYS OPRHP as lead agencies for the *Northern Shawangunk Ridge Fire Management Plan* is recognized in particular.

In addition, the following organizations and individuals have made invaluable contributions to the development and review of the *Northern Shawangunk Ridge Fire Management Plan*.

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Executive Summary

1. Introduction, Purpose & Goals

The Shawangunk Mountains—often referred to as the Shawangunk Ridge or simply the Gunks—are a long narrow mountain chain extending roughly from the confluence of the Rondout Creek and Wallkill River in Ulster County, NY to the southwest into New Jersey and Pennsylvania. The Northern Shawangunks landscape covers approximately 90,000 acres along a 20-mile stretch between the town of Rosendale and Route 52 in the towns of Wawarsing and Shawangunk. This landscape also includes portions of the towns of New Paltz, Gardiner, Rochester and Marbletown, and the village of Ellenville.

Land ownership and management in the Northern Shawangunks is varied. The Palisades Interstate Park Commission (PIPC) and NYS Office of Parks, Recreation & Historic Preservation (NYS OPRHP), Mohonk Preserve and the Open Space Conservancy[1] (OSC) own approximately 30,000 acres of land managed as Minnewaska State Park Preserve, Sam's Point Preserve, Mohonk Preserve and Witch's Hole State Forest. The Nature Conservancy (TNC) is responsible for the management of Sam's Point Preserve under agreement with NYS OPRHP/PIPC and OSC.

Purpose & Need for the Shawangunk Ridge Fire Management Plan

Purpose and Need

Much of the vegetation that exists on the Shawangunk Ridge today is highly flammable and prone to periodic wildfire. Many of the natural communities of plants and animals that now inhabit the ridge ecosystem evolved with fire over thousands of years, and depend on a regular cycle of fire in order to thrive. Over the past 50-100 years, fire has been effectively excluded from most portions of the ridge as fire suppression techniques have improved. This has led to the degradation of significant natural communities, as well as the accumulation of flammable forest debris. This abundant available fuel has now increased the potential for more intense wildfires to occur.

Members of the Shawangunk Ridge Biodiversity Partnership (SRBP)—a group of 12 public agencies and not-for-profit organizations—have long recognized the need to reintroduce fire as a key ecological management tool to support the conservation of the Shawangunk ecosystem. The SRBP's guiding management document, *Protection and Management Guidelines for the Shawangunk Mountains of New York,* highlights fire exclusion as a key threat to the ecological integrity of the Shawangunks.

[1] The Open Space Conservancy is the land acquisition affiliate of the Open Space Institute. The Open Space Institute is a member of the Shawangunk Ridge Biodiversity Partnership, and is the participatory organization in this planning effort on behalf of the Open Space Conservancy.

The *Northern Shawangunk Ridge Fire Management Plan* has been developed to address the need for a more proactive approach to fire management to protect the ecological integrity and reduce hazardous fuel loads in the highly volatile Shawangunk environment. Accordingly, the purpose of the plan is to a) provide a planning framework for implementing fire management actions in accordance with the policies of the various partner organizations; b) ensure that all fire management activities are science-based and that potential negative impacts to the environment have been assessed and mitigated for as necessary; and c) ensure that fire management is a collaborative effort focused on improving public safety and ecosystem health.

Scope

The *Northern Shawangunk Ridge Fire Management Plan* has been developed to describe and guide actions implemented by NYS DEC, NYS OPRHP, PIPC, TNC and Mohonk Preserve. The majority of these actions will occur on lands managed by these organizations at Minnewaska State Park Preserve, Sam's Point Preserve, Mohonk Preserve and Witch's Hole State Forest. These organizations may also collaborate with other SRBP members and/or nearby private landowners in order to implement fire management actions on lands outside of these park/preserve boundaries.

Environmental Review

The *Northern Shawangunk Ridge Fire Management Plan* was subject to review under the State Environmental Quality Review Act (SEQR) and NYS DEC and NYS OPRHP were co-lead agencies for the environmental review process. The plan was issued as a draft for public review and the public was invited to provide comments on the plan at two public meetings and during a comment period. A summary of the comments received and the lead agencies' responses to those comments are included in the plan (Appendix E). Based on review of the public comments and on the environmental assessment prepared for the plan (Appendix D), the co-lead agencies determined that the proposed plan will not have a significant environmental impact and have issued a Negative Declaration under SEQR (Appendix F).

Fire Management Goals

The fire management goals and associated strategies outlined below provide the guiding principles on which the actions described in the *Northern Shawangunk Ridge Fire Management Plan* will be implemented. The following goals are based on the missions and policies of the various organizations and have been developed to maintain consistency with, and be complimentary to, the other planning documents for the major parks and preserves in the Shawangunks.

- Maintain and improve firefighter and public safety
- Maintain the health and integrity of Shawangunk Ridge forests, and the wildlife and plant habitats they provide, by restoring fire as an ecological process
- Reduce the risk of damage from wildfire to wildland-urban interface (WUI) communities adjacent to managed lands in the Shawangunks

- Implement fire management activities using a science-based approach that incorporates knowledge and understanding gained through monitoring and the adaptive management process
- Conduct outreach and educational activities related to fire ecology and management to promote understanding and collaboration among stakeholders
- Maintain a cooperative, partnership-based fire management program that is consistent with New York State laws and partner organization and agency policies.

2. Fire Management Implementation

Proposed Fire Management Actions

Wildfire Suppression

Wildfire suppression will be the primary action for all unplanned wildfires on SRBP managed lands in the Shawangunks. Although management of unplanned wildfire ignitions—sometimes referred to in the past as "Wildland Fire Use"—can be beneficial in maintaining ecological communities and reducing fuel loads, the relatively poor condition of the fire management infrastructure (e.g. carriage roads, trails) and the proximity of WUI areas adjacent to managed lands make this type of action impractical to implement in the Shawangunks at this time.

Actions implemented under the *Northern Shawangunk Ridge Fire Management Plan* will focus on providing an improved infrastructure and planning framework for managing wildfire suppression incidents. This may include prescribed fire and other treatments to create buffers of reduced fuel adjacent to WUI communities, restoration of former carriage roads and other natural or constructed firebreaks, improving staff training and fireline experience and acquiring equipment resources necessary to effectively respond to wildfire incidents.

Prescribed Fire

Prescribed fire—also called prescribed or controlled burning—refers to the intentional ignition of carefully managed fires for the purpose of achieving a specific management objective. Typically, prescribed fires are used to provide ecological benefits or to reduce accumulations of forest fuels that may lead to increasingly severe wildfires. Prescribed fires are conducted in accordance with a prescribed burn unit plan which specifies, among other things, a rigid set of predefined weather and fuel conditions and required personnel and equipment resources.

Prescribed fire will be a key management strategy in the Shawangunks for achieving ecological and fire hazard reduction goals. Although prescribed fire implementation will be focused on restoring and improving the health of pine barrens and oak forests, it may also be used as a tool to achieve other management objectives including reducing fuel accumulations, maintaining open grassland and shrubland habitats, and managing invasive species infestations.

Firebreak Maintenance, Repair & Construction

The safe and effective implementation of wildfire suppression activities and prescribed burn operations requires the use of various kinds of firebreaks. Firebreaks in the Shawangunks most

often consist of hand-constructed firelines raked through leaf litter, trails, cut paths through shrub fuels, old logging roads, and carriage roads. Because they are such a valuable fire management resource, many existing carriage road firebreaks in the Shawangunks will need to be repaired and maintained to a condition that allows for the safe and efficient implementation of fire management activities. When fire management activities require the construction of new firebreaks, managers can make a determination as to whether the value of the new firebreak for future management warrants maintaining it, either permanently or for some useful period of time.

Mechanical Treatments & Forest Thinning for Fuel Reduction

In some instances cutting, mowing or grinding of vegetation may be necessary to reduce heavy fuel loads, protect sensitive resources, improve critical firebreaks or mimic fire effects where prescribed fire treatments are impractical. In the Shawangunks, widespread use of mechanical treatments and forest thinning for fuel reduction is not practical given the predominant terrain and vegetation types. As such, these treatments will be limited to relatively small scale applications to achieve specific management objectives.

Community Outreach

The effective implementation of the *Northern Shawangunk Ridge Fire Management Plan* will require extensive community outreach and education. The two main goals of outreach activities will be to 1) engage vulnerable WUI communities to reduce the risk of damage from wildfire; and 2) inform local communities and residents of the ecological role of fire to increase acceptance and support of fire management activities.

Monitoring

Monitoring is, and will continue to be, an integral part of the Shawangunk Ridge fire management program. Monitoring of ecological effects and operational implementation of fire management activities will be crucial for providing feedback into the adaptive management process, allowing managers to refine ecological objectives and evaluate the success of management actions.

Significant Roads & Trails for Fire Management

The Northern Shawangunks contain an extensive network of former carriage roads and numerous trails. This system of roads and trails provides the basic infrastructure for conducting fire management activities by providing defensible firebreaks and important access and escape routes for firefighters. Many carriage roads are in excellent condition because they receive high levels of recreational use and have been maintained over time. Other roads are minimally passable—or not passable at all—even with all-terrain or off-road utility vehicles. Table 2.2 in the text provides a list of important roads and trails that are significant for fire management at a ridgewide scale, with a general condition and repair/maintenance priority assessment for each.

Fire Management Regions & Priority Actions

Fire management regions (FMRs) are planning units that have been identified across the Shawangunk Ridge for the purposes of identifying fire management priorities. These regions do not have any inherent priority over one another; rather, they are simply a means of reducing the landscape into manageable units that are relatively similar for the purpose of identifying and describing management priorities. The various fire management regions are described in detail in Section 2.5 of the *Northern Shawangunk Ridge Fire Management Plan*, including maps, terrain and fuels, access routes and firebreaks, rare species and fire sensitive features. Section 2.5 also lists and prioritizes different management actions for each fire management region. The high priority actions identified for each region are summarized in the table below.

Summary of high priority fire management actions by fire management region (summarized from Tables 2.5, 2.7, 2.9, 2.11, 2.13, 2.15, 2.17, 2.19, 2.21, 2.23, 2.25)

FMR Code; Table #	General Description of High Priority Actions
Spring Farm-Bonticou; Table 2.5	• Conduct prescribed burns to promote oak regeneration and ecological management in areas around Spring Farm and Bonticou Crag
Trapps-Glory Hill; Table 2.7	• Conduct prescribed burns for chestnut oak forest restoration and ecological management around the Trapps cliffs, Oakwood Drive and Glory Hill areas • Conduct prescribed burns as feasible to reduce hazardous shrub fuels in the Sparkling Ridge WUI area and enhance protection for the Mohonk Mountain House property and facilities • Conduct intensive ecological monitoring in chestnut oak forest areas to assess the effectiveness of prescribed fire and other treatments in restoring degraded chestnut oak forest
Peters Kill-Jenny Lane; Table 2.9	• Work with local communities to reduce wildfire hazard in Laurel Hollow, Stony Kill Road, Raycliff Drive and Rock Hill Road WUI areas • Conduct initial test prescribed burns in the vicinity of the Jenny Lane parking area
Millbrook Ridge; Table 2.11	• Reduce fuel accumulations and improve surface condition on Gertrude's Nose Trail and Millbrook Mountain Trail
Stony Kill-Overlooks; Table 2.13	• Work with local community to reduce wildfire hazard in Decker Road WUI area • Conduct research prescribed burns in the 2008 Overlooks wildfire area to examine effects of repeated short interval burns • Continue to monitor ecological recovery following wildfire and subsequent prescribed burns
Mine Hole-Witch's Hole; Table 2.15	• Work with local community to reduce wildfire hazard in Decker Road WUI area • Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to pine barrens in the upper Mine Hole area
Castle Point-Minnewaska; Table 2.17	• Conduct test prescribed burns in the former golf course area to assess fire behavior and ecological impacts in oak forest damaged by gypsy moth • Conduct prescribed burns as feasible around fringes of region to reduce fuels and reinforce firebreaks around large area of heavy fuel • Conduct necessary repairs and manage fuels along Upper Awosting Road and Castle Point Road

Awosting; Table 2.19	• Conduct prescribed burns in the Awosting Reserve area for ecological management in chestnut oak forest • Conduct prescribed burns as feasible around Lake Awosting for ecological management in pine barrens
Badlands-Verkeerder Kill; Table 2.21	• Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to potentially sensitive Badlands area and upper Verkeerder Kill watershed • Manage adjacent vegetation and fuels along High Point Trail to improve suitability as firebreak
North Gully-Shingle Gully; Table 2.23	• Reduce fuels mechanically or by hand around the cell/radio towers to prevent damage from a wildfire or prescribed burn • Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to rare dwarf pine barrens in eastern and northern portions of region • Conduct prescribed burns along fringes of the region as feasible to reduce fuels and create buffers for managing wildfire
Maratanza-Ice Caves-South Gully; Table 2.25	• Conduct prescribed burns in oak forest in vicinity of Sam's Point Conservation Center to reduce fuels and provide buffer between volatile barrens fuels and WUI areas. • Conduct initial burns in dwarf pine barrens around Lake Maratanza to assess fire operations and fire effects in this fuel/veg. type. • Conduct additional burns as feasible for fuels reduction/ecological management in oak forest and pine barrens • Conduct substantial repairs to drainage and surface condition on Ice Caves Road • Continue to work with Cragsmoor community to maintain Firewise program • Work with local community to reduce wildfire hazard in other WUI communities, including Mt. Meenahga and Walker Valley • Conduct ecological monitoring in dwarf pine barrens to assess current condition and effectiveness of prescribed fire in achieving management objectives

Wildfire Response

Many actions described in the *Northern Shawangunk Ridge Fire Management Plan* are designed to reduce the risk of intense wildfire; however, wildfires—both human and naturally ignited—will inevitably occur. All wildfires will be reported to the Ulster County Emergency Communications Center (911) and suppressed or contained in an appropriate fashion given the nature of the individual incident. As incidents grow in size and complexity, a unified command structure should be established, including representatives from all responding agencies as well as park/preserve managers.

While every wildfire is unique, maintaining firefighter safety and protecting human life and property in the wildand-urban interface are the highest priorities on any wildfire incident. To the extent possible, protection of ecological, recreational and aesthetic resources should also be recognized as a priority during wildfire suppression operations, and weighed against the need to minimize acreage burned.

Requirements & Guidelines for Implementation of Prescribed Fire

Prescribed Burn Unit Plans

An approved prescribed burn unit plan—often referred to simply as a ―burn plan"—is required for all prescribed burns in New York State. A burn plan is a document that describes the specific area to be burned and details the conditions under which the burn can be implemented. The minimum requirements for what information must be contained in a prescribed burn plan are described in NYS DEC Regulations, Chapter II, Part 194, and include:

- Landowner or prescribed burn manager qualifications
- Prescribed burn unit description
- Goals and objectives
- Cover and fuel loads
- Timing and weather conditions
- Intensity and duration of burn
- Logistics
- Suppression
- Notification
- Communications
- Smoke management
- Required signatures and approvals

Consistent with NYS DEC Regulations, all prescribed burn plans must be reviewed and approved by the Department of Environmental Conservation prior to implementation. Local fire departments must also be provided an opportunity to review and comment on any prescribed burns that fall within their district or jurisdiction.

Once approved, a prescribed burn plan will remain valid for a period of five years. If on-the-ground changes occur to a degree that a burn plan is no longer representative of the actual conditions in the burn unit, the burn plan must be updated and reapproved by all applicable agencies before the burn can be implemented. Section 2.7 includes specific details on appropriate fuel and weather parameters for conducting prescribed burns, as well as necessary resources, sensitive resource screening and additional requirements.

Contingency Planning

Contingency planning is an integral part of prescribed fire planning and implementation. Contingency situations can result from a variety of circumstances, such as unacceptable smoke or fire behavior, crew injuries or equipment malfunctions, or a prescribed fire escaping control of the crew. Individual prescribed burn unit plans address a variety of contingency situations by providing for redundancies in critical equipment and/or crew resources, describing adjacent fuel types and expected fire behavior, identifying key secondary fallback firelines and identifying additional suppression resources and a clear channel for notification in the event of an emergency. Guidelines for addressing serious contingencies, including an escaped prescribed fire, are included in Section 2.7.

3. Potential Environmental Impacts & Mitigation

Soil & Water

While activities such as prescribed fire can substantially affect the physical, chemical and biological processes of soil and water, these impacts are generally well within the range of natural processes that have sustained above and below ground ecosystems in the Shawangunks for millennia. Negative impacts that do occur tend to be greatest when fires are of high intensity and burn large portions of the landscape—conditions which are much more commonly associated with severe wildfire, particularly following extended periods of fire exclusion. Anticipated impacts to soil and water resources as a result of the implementation of the *Northern Shawangunk Ridge Fire Management Plan* are expected to be minimal.

Air Quality

Prescribed burning helps achieve many desired resource objectives, but it nevertheless generates particulate matter and other substances that can pollute the air. In general, the amount of smoke produced from a prescribed fire will be less than that of a wildfire, which would typically be burning under drier conditions and therefore consuming more fuel. Prescribed burns conducted regularly should reduce the potential for high intensity fires to occur, and thereby reduce the potential for concentrated impacts on air quality resulting from a large, severe wildfire. Section 3.2 provides specific actions that can be implemented by prescribed burn managers to minimize the impacts of smoke.

Plants & Animals

The plant and animal communities that exist in the Shawangunks are, in many cases, a direct result of the historical fire regime and other natural processes that have occurred here. Much of the flora and fauna found in the Shawangunks are dependent on periodic fires to maintain suitable habitat or stimulate regeneration. A primary focus of the *Northern Shawangunk Ridge Fire Management Plan* is to restore a more appropriate fire regime to benefit the unique species and natural communities that exist here.

The majority of plant species that inhabit flammable areas in the Shawangunks can quickly recover following periodic fires, particularly dominant species associated with the chestnut oak forest and pine barrens ecological communities. Physical soil disturbances or severe fires may be damaging to isolated individuals or small populations of rare plants; however, many rare species found in the Shawangunks thrive on recently disturbed sites and are often absent from more interior forest areas.

While direct exposure to fire can be lethal to virtually every animal species, the actual degree of injury and mortality sustained by various animal populations during wildland fires is typically very low. Most animal species are mobile and have the ability to avoid many of the direct physical impacts of fire. A number of the animal species in the Shawangunks depend on fire maintained habitats to thrive and they will likely benefit from fire management activities.

Timber Rattlesnakes

The timber rattlesnake is one rare animal species that may be potentially impacted by the implementation of prescribed fire due to its relatively limited mobility and low reproductive rate. In the Shawangunks, rattlesnakes tend to occur most frequently in the chestnut oak forest and pine barrens habitats with available exposed rock outcrops for gestation and basking. Periodic fire should help to improve and maintain this habitat, and it is expected that low to moderate severity prescribed fires would provide a net benefit to this species.

Minimizing Impacts to Plants & Animals

Overall, fire management activities are expected to benefit the ecology of the Shawangunks ecosystem and enhance and expand habitat for the species that have historically thrived here, including those that are rare. While many plant and animal species—including some rare species—may suffer localized mortality as a result of fire management, the continued exclusion of fire from the ecosystem poses a much greater risk. The loss of suitable habitat could lead to significant long term population declines, or even result in the extirpation of entire population from the Shawangunks.

Certain species may still be more sensitive to management activities than others, and the potential impacts of an individual action on plants and animals should be assessed and evaluated against the expected benefits. Section 3.3 provides general strategies for reducing impacts to plants and animals, as well as specific guidance for minimizing impacts to timber rattlesnakes.

Historical & Archeological Resources

The Shawangunks have a long and fascinating history of human use, dating back to early Paleo-Indians that inhabited the area as early as 10,000-12,000 years ago. Accordingly, there are numerous sites of historical and archeological significance, including American Indian sites, early European settlements, 19th century berry picker camps and several former resort hotel sites. The cultural resources in the Shawangunks will not be affected by any fire management activities given proper planning.

Recreational & Aesthetic Resources

The Shawangunk Mountains receive huge numbers of recreational visitors each year, estimated at several hundred thousand annually for Mohonk Preserve, Minnewaska State Park Preserve and Sam's Point Preserve combined. Any impacts to recreation resulting from implementation of fire management activities (e.g. trailhead closures during and/or immediately following prescribed burns) will be temporary in nature. Fire management that focuses on low to moderate intensity prescribed fires should not result in any long term degradation of recreational and aesthetic resources, and may in fact reduce the risk of high severity wildfire that could lead to extended closures and greater aesthetic impacts.

1. Introduction, Purpose & Goals

1.1 The Shawangunk Landscape

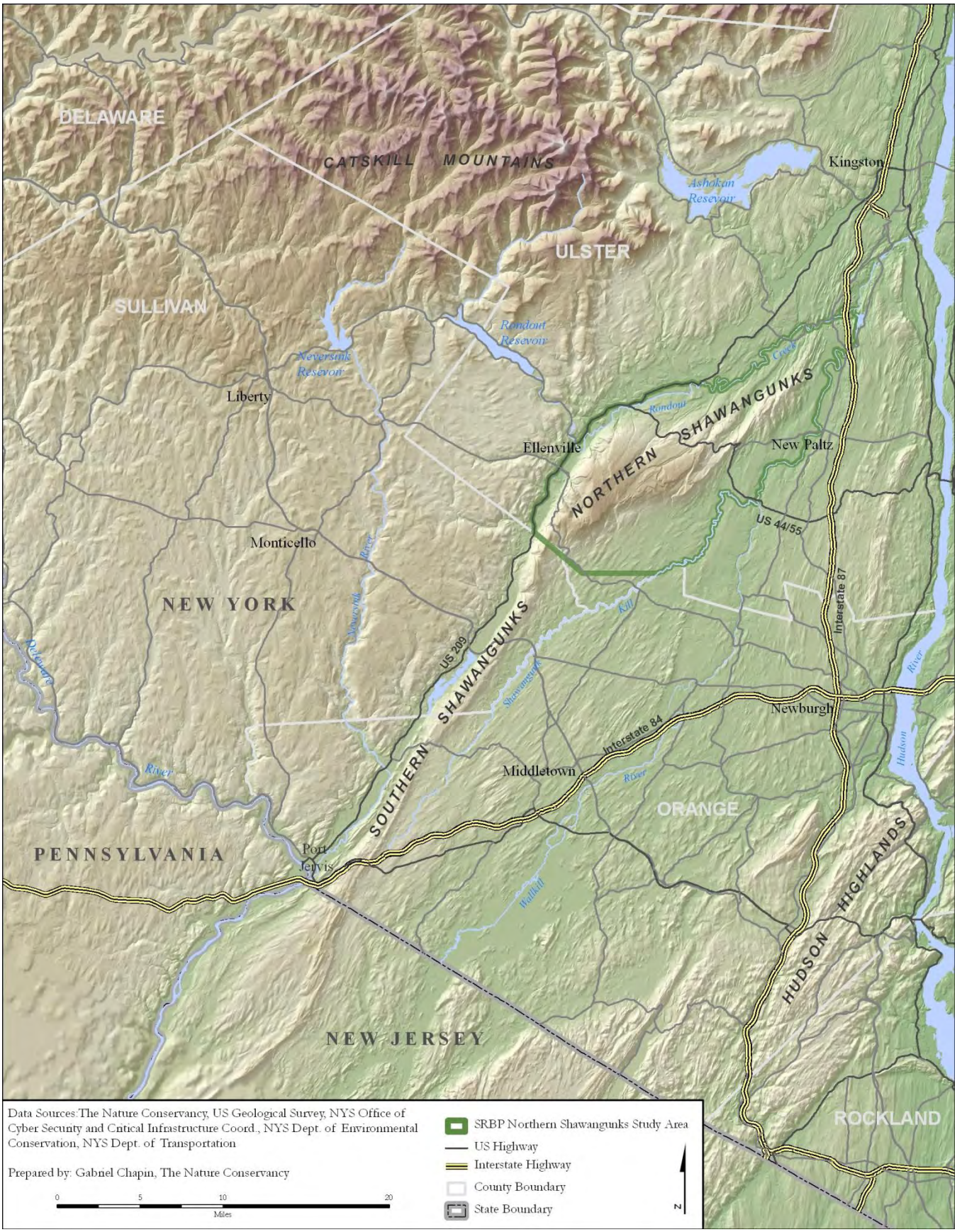
Natural History & Geology

The Shawangunk Mountains—often referred to as the Shawangunk Ridge or simply the Gunks—are a long narrow mountain chain extending roughly from the confluence of the Rondout Creek and Wallkill River in Ulster County, NY to the southwest into New Jersey and Pennsylvania (Map 1.1). The Northern Shawangunks cover approximately 90,000 acres along a 20-mile stretch between the town of Rosendale and Route 52 in the towns of Wawarsing and Shawangunk. The ridge gradually rises in elevation from north to south, reaching its highest point of 2,289 feet just south of Lake Maratanza at Sam's Point Preserve near the Hamlet of Cragsmoor. South of Sam's Point, the ridge drops in elevation and becomes a low spine that runs through High Point State Park and continues southward through New Jersey and Pennsylvania.

The eastern portions of the Northern Shawangunks consist of a series of nearly vertical cliff faces of erosion resistant quartzite conglomerate bedrock. The western flanks of the ridge are characterized by more gradually sloping flanks cut by several drainages, most notably the Stony Kill, Peters Kill, and Coxing Kill, all of which flow north and west into the Rondout Creek. Heavy glaciation and unique geology have combined to create a dramatic and unique landscape, and as a result, the Shawangunks support a rich diversity of plants and animals, including over 40 rare species (New York Natural Heritage Program 2009).

The general distribution of plant communities in the Northern Shawangunks is influenced by an environmental gradient that is related to both elevation and soil moisture (Batcher 2000, Kiviat 1988). The ridge is primarily forested, and lower elevations are characterized by shale substrate, deep, neutral, nutrient-rich soils and moderate microclimate. These generally mesic environments support relatively fire independent vegetation, including eastern hemlock (*Tsuga canadensis)* forests, successional and northern hardwood stands. Higher elevation areas are typically characterized by conglomerate bedrock—which is frequently exposed at the surface—shallow, acidic, nutrient-poor soils and harsh environmental conditions, including exposure to desiccating winds, snow and ice. These drier environments support more fire prone vegetation, including an expansive hardwood forest dominated by chestnut oak (*Quercus prinus*) and red oak (*Quercus rubra*), as well as ridgetop pitch pine (*Pinus rigida*) woodlands and shrublands.

Map 1.1. General location of Shawangunk Mountains.



Ownership & Land Use

Land ownership and management in the Northern Shawangunks is varied, with approximately 30,000 acres of protected public land and privately managed conservation land (Map 1.2) interspersed with some commercial property and private holdings. The Palisades Interstate Park Commission (PIPC) and NYS Office of Parks, Recreation & Historic Preservation (NYS OPRHP) are the largest landowners on the ridge, together owning over 21,000 acres, including the 17,000-acre Minnewaska State Park Preserve. The remaining 3,800 acres of PIPC/OPRHP land together with approximately 1,000 acres of land owned by the Open Space Conservancy[2] (OSC) are managed by The Nature Conservancy (TNC) as Sam's Point Preserve. Mohonk Preserve, Inc. owns approximately 6,600 acres and manages an additional 800 acres of OSC land as part of Mohonk Preserve. The NYS Department of Environmental Conservation (NYS DEC) owns and manages the 600-acre Witch's Hole State Forest.

The Mohonk Mountain House is an historic hotel and resort which lies on approximately 2,000 acres between Minnewaska State Park Preserve and the northern portion of Mohonk Preserve. Managed lands on the Shawangunk Ridge are primarily used for passive recreational activities—including hiking, rock climbing, biking and skiing—with the exception of the Mohonk Mountain House property which includes some intensive development immediately adjacent to the hotel and several agricultural areas on the flanks of the ridge.

The seven towns surrounding the ridge—Rosendale, New Paltz, Gardiner, Shawangunk, Wawarsing, Rochester and Marbletown—are predominantly rural, and the typical land uses are agriculture in the Wallkill and Rondout valleys with dispersed residential development. The Villages of New Paltz (population approximately 6,000) and Ellenville (population approximately 4,000) are the two largest communities in the local area. Due to the scenic landscape, relatively close proximity to New York City and abundant recreational opportunities, the Shawangunks attract approximately 500,000 visitors per year.

The Shawangunk Ridge Biodiversity Partnership

The Shawangunk Ridge Biodiversity Partnership[3] (SRBP) is a group of 12 public agencies and non-profit organizations dedicated to preserving the unique biological diversity and ecological resources of the Shawangunk Ridge. Members of the SRBP include all the major public and conservation landowners and land managers in the Shawangunks, as well as a number of smaller not-for-profit organizations. Partnership members work together to address a variety of threats that affect the entire Shawangunk ecosystem, including excessive deer browsing, invasive species infestations and fire exclusion.

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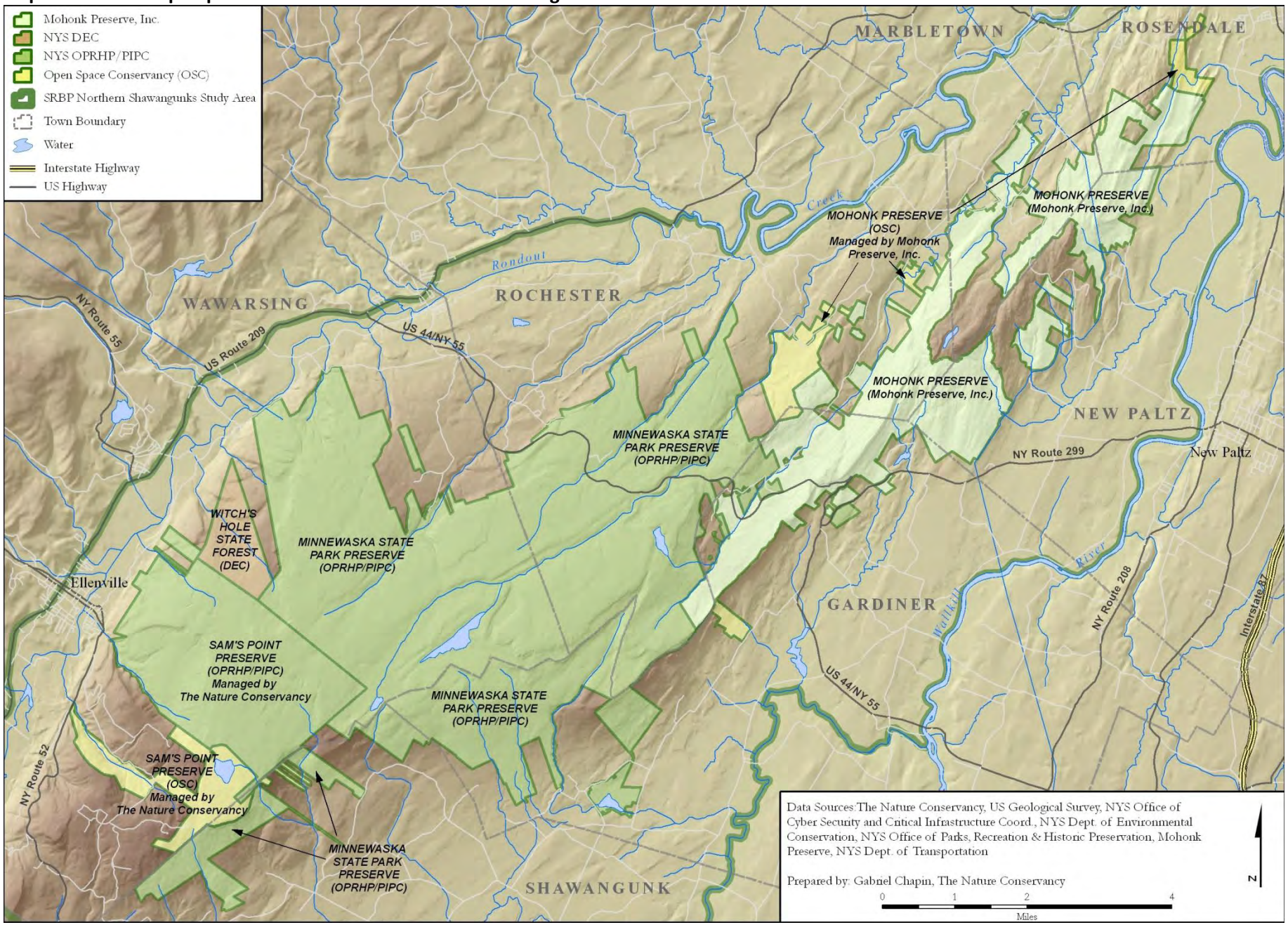
[2] The Open Space Conservancy is the land acquisition affiliate of the Open Space Institute. The Open Space Institute is a member of the Shawangunk Ridge Biodiversity Partnership, and is the participatory organization in this planning effort on behalf of the Open Space Conservancy.

[3] SRBP members are the Palisades Interstate Park Commission, NYS Office of Parks Recreation & Historic Preservation, NYS Department of Environmental Conservation, The Nature Conservancy, Mohonk Preserve, Open Space Institute, US Fish & Wildlife Service, NY Natural Heritage Program, Cragsmoor Association, Friends of the Shawangunks, NY State Museum, and the NY/NJ Trail Conference.

Map 1.2. Ownership of protected lands in the Northern Shawangunk Mountains.



In 2003, the SRBP adopted the *Protection and Management Guidelines for the Shawangunk Mountains of New York* (Shawangunk Ridge Biodiversity Partnership 2003), a series of guidelines for conservation of the Northern Shawangunks. This document identifies key ecological resources and management strategies to maintain the ecological integrity of the ridge ecosystem in the face of various threats. In the Guidelines, the SRBP recognizes alteration of historical fire regimes as one of the most significant threats to biodiversity on the Shawangunk Ridge, and the partnership now provides a critical avenue of collaboration that makes the development and implementation of the *Northern Shawangunk Ridge Fire Management Plan* possible.

1.2 Purpose & Need for the Northern Shawangunk Ridge Fire Management Plan

Much of the vegetation that exists on the Shawangunk Ridge today is highly flammable and prone to periodic wildfire. For millennia, wildfires have burned across the ridgetop landscape, resulting in a complex mosaic of forest types and habitats. Early human inhabitants of the landscape routinely set fires to enhance important food resources, improve game habitat and reduce fire hazard around settlements (Cronon 1983) and humans were likely the primary ignition source for the majority of historical fires on the ridge. Many of the natural communities of plants and animals that inhabit the ridge ecosystem evolved with fire over thousands of years, and depend on a regular cycle of fire in order to thrive.

Widespread human induced changes to the landscape during the 19th and 20th centuries—including deforestation, fire exclusion and dramatic fluctuations in deer population—caused significant alteration of the historical fire regime. As a result, the abundance of flammable fuels, particularly tall, dense shrubs, has increased across wide areas, and the health of the characteristic pine barrens and oak forests of the ridge have suffered. At the same time, the number of human communities that exist within or directly adjacent to fire prone ecosystems around the Shawangunk Ridge, often referred to as the wildland-urban interface (WUI), has expanded considerably. It is this intersection between degraded, increasingly fire prone forests and expanding development that now poses the greatest threat to local communities and the ridge ecosystem. As a result, wildland firefighters are now faced with increasingly intense fires in a more complex environment.

Purpose and Need

Members of the Shawangunk Ridge Biodiversity Partnership have long recognized the need to reintroduce fire as a key ecological management tool to support the conservation of the Shawangunk ecosystem. The *Protection and Management Guidelines for the Shawangunk Mountains of New York* highlights fire exclusion as a key threat to the ecological integrity of the Shawangunks. Current versions of the *Minnewaska State Park Preserve Master Plan*, *Sam's Point Preserve Master Plan* and *Mohonk Preserve Land Management Plan* all reference the need to address fire management in order to protect the unique ecological resources of the Shawangunks. In 2007, NYS OPRHP adopted a policy for managing wildland fire on State Park

lands, specifically to address the increased threat of severe wildfire and the need to preserve and manage fire maintained ecological communities (http://nysparks.state.ny.us/inside-our-agency/documents/OPRHPFireManagementPolicy.pdf).

In 2008, the 3,100-acre Overlooks Fire at Minnewaska State Park Preserve highlighted the need to reduce the potential wildfire hazard on ridgetop managed lands to protect human life and property and, to the extent possible, maintain fire as an ecological process that preserves rare species and significant natural communities. The 2008 fire—the largest in the Shawangunks since 1947 and the largest in New York State since 1995—burned both Minnewaska State Park Preserve lands and adjacent private lands in an area that had experienced significant fuel accumulations over the past century. The fire threatened approximately 30 homes and involved more than 400 firefighters as well as numerous other resources, including bulldozers and helicopters (R. Mecus, personal communication). While the fire did not result in any substantial property damage, it provided a glimpse at what may become an increasingly common scenario as highly flammable forest fuels mix with rural development, resulting in fires that burn hotter, threaten more homes and are costlier and more difficult to suppress.

The *Northern Shawangunk Ridge Fire Management Plan* has been developed to address the need for a more proactive approach to fire management to protect ecological integrity and reduce wildfire hazard in the highly volatile Shawangunk environment. Specifically, this plan is necessary because members of the SRBP recognize that:

- Fire is a fundamental natural process that both reduces accumulations of forest fuels and maintains the health and integrity of the natural communities that exist on the Shawangunk Ridge.
- Expansion of rural development dispersed within naturally flammable vegetation is increasingly putting homes and firefighters at risk in a more volatile and complex fire environment.
- Exclusion of fire from natural systems in the Shawangunks for the past 50 – 100 years has resulted in significant degradation of several rare ecological communities and habitat types, threatening the integrity of the entire ridge ecosystem.
- Implementation of various fire management strategies to minimize the threat of wildfire to life and property and to restore and maintain natural communities and biodiversity requires detailed and current planning.
- Fire management efforts require collaboration among various state and local partners, and all of the current partners recognize a site fire management plan as a necessary requirement for engaging in fire management activities. This planning process provides a means of promoting communication and identifying common goals and objectives among partners.

In response to this stated need, the purpose of the *Northern Shawangunk Ridge Fire Management Plan* is to:

- Provide a planning framework and guidelines for the implementation of various fire management activities aimed at reducing the threat of uncontrolled wildfire to human life

and property and restoring and maintaining the unique ecological resources and processes of the Shawangunk Ridge ecosystem.

- Develop a fire management program that maintains consistency with policies and operational standards set forth by the NYS Office of Parks, Recreation & Historic Preservation and Palisades Interstate Park Commission, the NYS Department of Environmental Conservation, The Nature Conservancy and Mohonk Preserve, Inc. In addition, all activities will be conducted in accordance with applicable state and federal laws, including the Parks, Recreation and Historic Preservation Law, Environmental Conservation Law, the State Environmental Quality Review Act and the Clean Air Act.
- Ensure that all fire management activities are properly justified using the best available science and incorporate a sound risk management process.
- Identify potential unintended impacts of any planned fire management activities to human health and environmental quality, and determine methods to minimize or mitigate these impacts.
- Ensure that the development of fire management goals and implementation of project activities are collaborative efforts among the partners involved, acknowledging that:
    - Firefighter and public safety are the highest priority during all fire management activities.
    - Wildland fire is a natural process that has played a critical role in maintaining diverse ecological system in the Shawangunks.
    - Partners will engage in fire management activities in order to a) protect people and property; b) enhance the health and viability of fire dependent natural resources and c) achieve other management objectives as appropriate.
    - All fire management activities will be conducted according to the highest standards of safety, as well as professional and technical expertise.

Scope

The *Northern Shawangunk Ridge Fire Management Plan* describes a variety of fire management actions that may be implemented by NYS OPRHP, PIPC, NYS DEC, The Nature Conservancy, Mohonk Preserve and the Open Space Conservancy. The majority of the activities described in this plan will occur on lands that are currently managed by these organizations at Minnewaska State Park Preserve, Mohonk Preserve, Sam's Point Preserve and Witch's Hole State Forest (see Map 1.2). These lands lie in the towns of Rosendale, New Paltz, Gardiner, Shawangunk, Wawarsing, Rochester and Marbletown and the village of Ellenville.

The actions described in the *Northern Shawangunk Ridge Fire Management Plan* may also be implemented on new lands within the Northern Shawangunk Ridge Study Area (see Maps 1.1 and 1.2) that are acquired or managed under agreement by any of these organizations, or to parcels that are under SRBP ownership or management but do not fall within the park or preserve boundaries mentioned above. Shawangunk Ridge Biodiversity Partnership agencies and/or organizations may also cooperate with adjacent or nearby private landowners to implement fire management activities on private lands.

While the aim of the *Northern Shawangunk Ridge Fire Management Plan* is to be inclusive and comprehensive in outlining fire management strategies in the Shawangunks, management of emergency wildland fire suppression incidents is beyond the scope of this plan. Section 2.6 of the plan provides guidance for general wildfire reporting and response; however, any emergency wildfire incident will be managed by the responding fire department or other appropriate agency based on the judgment and experience of the incident commander or incident command team. The primary intent of this plan with respect to wildland fire suppression will be to outline actions that can implemented to minimize the risks to firefighter and public safety associated with severe wildfire, and reduce the potential ecological impacts of fire suppression activities.

Environmental Review & Plan Adoption

The *Northern Shawangunk Ridge Fire Management Plan* is subject to review under the New York State Environmental Quality Review Act (SEQR) as it involves management on state lands and activities such as prescribed burning that require NYS DEC approval. NYS OPRHP and NYS DEC have agreed to be co-lead agencies for the environmental review process. A Full Environmental Assessment Form (EAF) was completed and used to guide the identification and assessment of both the potential environmental impacts and the strategies to mitigate those impacts. The Full EAF is included in Appendix D, and Section 3 describes the plan's potential environmental impacts and mitigation.

This plan was issued as a Draft to allow for public review and comment. Based on the environmental analysis conducted on the Draft Plan, the lead agencies issued a draft determination of no significant impact (i.e. Negative Declaration). Two public information meetings were held to provide the public with the opportunity to review and to provide comments on the draft plan. In addition the agencies provided a 30 day comment period. The comments received at the public meetings and during the comment period were reviewed by the lead agencies for substantive issues. Appendix E contains a summary of the comments received and the lead agencies' responses to those comments. Based on a review of all comments NYS DEC and NYS OPRHP determined that no substantive issues were raised on the plan and have issued a final Negative Declaration. The plan was adopted by the Shawangunk Ridge Biodiversity Partnership Steering Committee on January 28, 2011, conditional upon final adoption of the plan by the lead agencies.

Implementation

With the adoption of this plan, implementation can begin. The Shawangunk Ridge Biodiversity Partnership will identify an implementation team which will meet at least once every year. Using the Priority Tables for each Fire Management Region and the "Summary of High Priority Actions" table in Appendix A, this team will determine the implementation priorities for the year and report back to the Partnership. Proposed implementation projects which are consistent with this plan can go forward without any further environmental review. Projects which are not included within the scope of this plan may require additional review under SEQR.

For example, prescribed burns greater than 500 acres in size will require individual SEQR review prior to implementation due to the increased potential for adverse impacts to occur. This particular situation is described in more detail in Section 2.7.

Prescribed burns that are conducted by SRBP agencies on public or private lands in the Northern Shawangunks that are not explicitly identified in this plan are not subject to additional SEQR review, provided that they follow the guidelines for implementing prescribed burns outlined in Section 2.7. The prescribed burn planning process provides a means for identifying sensitive ecological features, historical resources and sensitive smoke receptors within any additional burn units. It can be assumed that the other potential impacts (e.g. soil and water, cultural and historical resources) from prescribed burns in the Northern Shawangunks ecosystem will not be substantially different from those evaluated in this plan.

1.3 Fire Management Goals

The fire management goals and associated strategies outlined below provide the guiding principles on which the actions described in the *Northern Shawangunk Ridge Fire Management Plan* will be implemented. These goals are based in the missions and policies of the various organizations and have been developed to maintain consistency with, and be complimentary to, the other planning documents for the major parks and preserves in the Shawangunks.

These goals and strategies provide a solid framework for fire management in the Shawangunks; however, it is also recognized that not all of these goals can be simultaneously achieved to the fullest extent. Where conflicts exist, a reasonable balance will need to be met between the various fire management goals described here and any other competing management needs and considerations.

Goal: Maintain and improve firefighter and public safety

Maintaining the safety of wildland firefighters and the public is the first priority during all fire management activities. This goal is addressed in two ways: 1) by planning and carrying out operations in a manner that puts safety considerations above all other management priorities and 2) designing and implementing specific fire management activities designed to mitigate hazardous situations before fires occur.

- Incorporate safety planning as a key element into all wildland fire activities and carry out all activities consistent with and subordinate to safety considerations.
- Continue to implement appropriate wildfire suppression actions to protect human life and property.
- Provide staff and volunteers with the training, equipment and operational guidance necessary to adequately manage risk and complete fire management activities safely.
- Utilize mechanical and/or prescribed fire treatments as appropriate to reduce hazardous fuels adjacent to residential areas and other fire-sensitive features.

- Improve the network of permanent fuel/fire breaks in the Shawangunks—focusing on historic carriage roads—in order to facilitate safe and effective suppression of wildfires and provide a solid infrastructure for conducting prescribed burns.

Goal: Maintain the health and integrity of Shawangunk Ridge forests, and the wildlife and plant habitats they provide, by restoring fire as an ecological process

Fire has played a key role in shaping and maintaining the Shawangunk Ridge ecosystem for thousands of years. Oak and pine forests have evolved with and become dependent on periodic fires to sustain them. The safe and controlled reintroduction of fire into these ecological systems is part of a suite of management actions designed to improve forest health and habitat for wildlife and plant species.

- Where appropriate, implement prescribed fire treatments to restore, improve and/or maintain the health of fire dependent ecological systems—primarily pitch pine barrens and chestnut oak forest—by achieving specific management objectives, including promoting the regeneration and vigor of desirable species including rare plants, improving wildlife habitat and reducing competing native and non-native vegetation.
- Incorporate ecological considerations and potential negative ecological impacts of various activities into tactical plans during wildfire suppression incidents. When safe and practical, prioritize minimum impact suppression tactics that focus on utilization of existing firebreaks over minimizing area burned.
- Where prescribed fire implementation is not possible or practical, evaluate and/or implement other types of treatments (e.g. silvicultural treatments, mowing shrubs) in order to mimic the effects of fire, achieve similar management objectives and/or create a less flammable fuelbed to facilitate the safe implementation of prescribed fire.
- When planning landscape scale implementation of fire management activities, incorporate actions that will reduce the potential for large contiguous areas or significant proportions of individual ecological communities to be severely impacted during a single fire event.
- Fully integrate fire management treatments with other management activities, such as silvicultural forest management, recreation management and management of deer and invasive species.
- Utilize fire where appropriate as a management tool to achieve other specific management objectives, such as maintaining cultural landscape features and scenic views, managing for specific wildlife habitat (e.g. fields, forest openings) or controlling invasive species.

Goal: Reduce the risk of damage from wildfire to wildland-urban interface (WUI) communities adjacent to managed lands in the Shawangunks

Expansion of rural development adjacent to managed lands that support flammable vegetation (i.e. the WUI) increases the probability of human life and property being threatened during a wildfire event. Specific actions can be planned and implemented to reduce the risk to WUI communities around the Shawangunk Ridge.

- Work with local communities to educate homeowners and develop specific plans to reduce the chances of homes being damaged from wildfire (e.g. Firewise or similar programs).
- Prioritize fire management activities (including prescribed fire, mechanical treatments and fire/fuel break restoration or construction) that reduce the risk of wildfire to nearby WUI communities.

Goal: Implement fire management activities using a science-based approach that incorporates knowledge and understanding gained through monitoring and the adaptive management process

Implementation of all fire management activities should be based on the best and most current available scientific knowledge and operational understanding. Ongoing monitoring of the ecological and operational effectiveness of fire management activities is crucial in maintaining a flexible and adaptive management approach.

- Develop and implement a science-based monitoring plan in order to evaluate the effectiveness of fire management activities in achieving ecological and operational objectives.
- Incorporate evolving scientific and operational understanding into the planning and implementation of future management activities.
- Conduct fire management activities in accordance with the highest operational standards and most current implementation techniques.

Goal: Conduct outreach and educational activities related to fire ecology and management to promote understanding and collaboration among stakeholders

Due to the proximity of the Shawangunk Ridge to developed areas and the high level of recreational use that occurs on the ridge, fire management activities have the potential to impact the public in several ways, including closure of areas for recreation while fire management activities are implemented and various issues related to smoke production from prescribed fires and/or wildfires. Continued outreach and education activities are necessary to inform various stakeholders regarding the need for fire management and the implementation of management activities.

- Provide general educational opportunities for the public to learn about fire ecology and management, such as publications lectures, guided hikes, and other education/prevention programs.
- Incorporate emergency services, municipalities, adjacent landowners and other stakeholders into the fire management planning process and keep various stakeholders and the public informed when fire management activities are taking place (e.g. prescribed burns, wildfires, mechanical treatments, and significant fire/fuel break work).

Goal: Maintain a cooperative, partnership-based fire management program that is consistent with New York State laws and partner organization and agency policies.

The success of a fire management program in a landscape with such diverse ownerships and management responsibilities as Shawangunk Ridge will depend upon the engagement of numerous public and private partners. In addition, fire management activities conducted as part of the *Northern Shawangunk Ridge Fire Management Plan* will need to be consistent with the policies and requirements of the various partner agencies and organizations covered by this plan. Similarly, activities will necessarily comply with all applicable NY State laws.

- Work cooperatively within the Shawangunk Ridge Biodiversity Partnership to identify management priorities and address various management challenges, resource limitations, and training needs.
- Develop and maintain written agreements between partner organizations as necessary to facilitate cooperation and maintain consistency with various agency and organizational policies.
- Engage external partners as necessary to facilitate cooperation and support for fire management activities (e.g. emergency services and local volunteer fire departments, other state or federal agencies, research institutions).
- Ensure that all activities implemented as part of this plan follow applicable NY State Codes, Rules & Regulations, including any regulations regarding forest management, wildfire control, prescribed burning and environmental quality review.
- Conduct all fire management activities in accordance with the various policies and requirements of the different partner organizations.

1.4 Fire Ecology & History

Fire Ecology of Oak Forests & Pine Barrens

Historically, wildfires were a common occurrence on the Shawangunk Ridge. The rich mosaic of plant communities and habitat types that have flourished on the ridge for the past several thousand years are the result of these periodic fires and other disturbances (e.g. ice storms, insect and disease outbreaks) interacting with unique geologic, topographic and hydrologic conditions. As a result, many of the dominant plant communities on the ridge are adapted to and even require periodic fires in order to persist and flourish. The drier flanks of the ridge support over 25,000 acres of chestnut oak forest, making this one of the largest occurrences of this significant ecological community in the state. At the higher elevations in Minnewaska State Park Preserve and Sam's Point Preserve, the chestnut oak forest gives way to nearly 6,000 acres of open pitch pine woodlands, collectively referred to as the pitch pine-oak-heath rocky summit ecological community. On the highest most exposed portions of the ridge top at Sam's Point Preserve, pitch pines become more stunted and form a dense 2,000 acre shrubland including abundant blueberry (*Vaccinium spp.*), black huckleberry (*Gaylusaccia baccata*) and sheep laurel (*Kalmia angustifolia*). This globally rare pine shrubland is known as the dwarf pine ridge ecological

community (Edinger et al. 2002). These pitch pine woodlands and shrublands are collectively referred to as pine barrens.

Both pitch pine barrens and oak forests in the Shawangunks depend on periodic fire to maintain their health and vigor. Fires create forest openings and reduce accumulations of leaf litter and other forest floor debris, conditions that favor the reproduction and growth of pitch pine and oak (*Quercus spp*.). Both oak and pitch pine also possess various adaptations that allow them to survive and/or recover quickly following fires, including thick, insulating bark and the ability to resprout from tissues in the tree crown and around the base of the trunk. Some dwarf pitch pines also possess serotinous cones (G. Chapin, unpublished data), which are sealed shut by a hard coating of resin. The cones may remain closed on the tree for many years until the resin is melted by the heat of a fire, allowing the cones to open and release seeds at an opportune time for germination and growth.

Regular fires also remove competing fire-sensitive vegetation, maintaining a more open canopy and forest structure which provides habitat for a wide diversity of understory plants. In the absence of fire, relatively shade-tolerant trees and shrubs—including red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), white pine (*Pinus strobus)*, black gum (*Nyssa sylvatica*), ironwood (*Ostrya virginiana*), and mountain laurel (*Kalmia latifolia*)—begin to invade oak forests and pine barrens creating a denser, shadier and more mesic forest that can no longer support oak and pitch pine reproduction.

Fire History

Although no detailed fire history exists for the area prior to widespread European settlement, research has confirmed that fire has been a significant part of this landscape for approximately 9,000 years (Laing 1994). Fires at relatively regular intervals favored oak and pitch pine, the dominant species on the ridge top for the last several thousand years. Although lightning caused fires did occur, the primary ignition source for the majority of historical fires was humans, who frequently burned landscapes across the region to clear land, improve habitat for wild game, and promote important food bearing plant species such as oaks, American chestnut (*Castanea dentata*), blueberries and huckleberries (Cronon 1983).

Attempts to analyze the more recent fire history of the Shawangunks have documented 95 wildfires in the Northern Shawangunks between 1842 and 1995 (Hubbs 1995). From 1842 to 1976 (the year of the last significant fire during the record) a total of 19 fires burned more than 100 acres, meaning that, on average, a large (>100 acre) fire occurred somewhere on the ridge approximately every seven years (Table 1.1). During this same period, fires greater than 500 acres in size occurred every 15 years on average. It should be noted that the reliability of this record decreases during the earlier part of the reporting period, and there are likely numerous fires, both small and large, that occurred prior to the early 1900s but were not documented. Some fires were also documented without firm estimates of size, but sufficient evidence exists to classify them as greater than 100 acres.

Although oak forest dominance on the ridge is well documented prior to European settlement and corresponds with periods of increased fire occurrence, the present day chestnut oak forest in

the Shawangunks did not regenerate from fire. Rather, these forests consist of oaks that regenerated following widespread land clearing for various industries in the mid-19th century, including charcoal, barrel hoop making and tanning (Russell 2001, J. Thompson, personal communication). Oaks resprout vigorously following cutting, as well as fire, and the forest regenerated quickly following cessation of widespread land clearing efforts.

Since that time, much of the oak forest has not burned at all and, as a result, many areas of chestnut oak forest on the ridge have gone substantially more than 100 years without fire. This is in stark contrast to historical fire return intervals of 1-15 years that are reported for the oak forests that dominated eastern landscapes prior to European settlement (Dey 2002 and references therein). In 2008, the largest wildfire in the Shawangunks since 1947 burned a 3,100 acre swath of oak forest and some smaller patches of pitch pine woodland at Minnewaska State Park Preserve, as well as some adjacent private lands. The 2008 Overlooks Fire at Minnewaska, the 1947 fire and possibly the 1923 fire are the only major documented fires since the late 19th century that appear to have burned substantial areas of oak forest (Hubbs 1995, Batcher 2000).

Table 1.1. Documented fires greater than 100 acres in the Northern Shawangunks between 1842 and 1995 (data from Hubbs 1995).

Year	Month	Approx. Size (acres)	Approximate Location
1864	July	300	Mohonk Mountain House area
1872	April	No estimate	Ellenville to Sam's Point overlook area
1890	April	1,400	Sam's Point Preserve area
1890	April	1,000	Walker Valley to Sam's Point overlook
1893	August	4,000	Sam's Point/Minnewaska area
1896	May	No estimate	Minnewaska/Witch's Hole area
1904	April	2,000 – 3,000	Ellenville to Sam's Point Preserve area
1906	May	3,500 – 4,000	Sam's Point Preserve area
1907	August	No estimate	Sam's Point Preserve area
1922	April	No estimate	Sam's Point/Minnewaska area
1923	April	400 – 500	Mohonk Preserve area
1923	July	6,000 – 8,000	Sam's Point/Minnewaska area
1939	July	720	Sam's Point Preserve area
1939	July	680	Minnewaska State Park Preserve area
1947	October	7,500 – 9,000	Sam's Point/Minnewaska Area
1947	October	380	Minnewaska State Park Preserve area
1953	July	600	Sam's Point Preserve area
1964	August – November	1,350	Minnewaska/Sam's Point area
1976	April	120	Minnewaska State Park Preserve area

In contrast to the lack of fire in most Shawangunk oak forests over the past 100-150 years, the core area of pine barrens that exists at Sam's Point Preserve and the southern portion of Minnewaska State Park Preserve has been impacted by numerous fires during this time. These pitch pine dominated woodlands and shrublands were never cleared for timber and have likely been associated with relatively frequent fires throughout their existence. An examination of rough fire locations described by Hubbs (1995) indicates that at least 10 significant fires burned some portion of this area between 1890 and 1964. However, with the exception of several small patches that burned in the 2008 Overlooks fire, most pine barrens in the Shawangunks have been fire free for 46 – 71 years (major pine barrens fires occurred in 1964, 1947, and 1939). Jordan et al. (2003) reference various studies that report historical fire return intervals of 7-30 years for shrub type pine barrens similar to those found in the Shawangunks. Despite having experienced fires regularly during the late 1800s and early 1900s, the vast majority of pine barrens in the Shawangunks have more than doubled the maximum historical fire return interval.

Impacts of Fire Exclusion

Over the second half of the 20th century several factors combined to limit the extent and occurrence of wildfires in the Shawangunks, including the loss of the local berry picking industry, improvements in fire detection and suppression capability and more dispersed human settlement into rural areas. Fire suppression was, and still is, necessary to protect homes and property that exist in close proximity to flammable vegetation around the ridge. However, the substantial decrease in fire frequency and extent has had several significant negative impacts on the ridge, from both an ecological and fire hazard perspective.

The absence of fire coupled with other significant disturbance events—including several gypsy moth outbreaks and a significant rise in the deer population—has led to a widespread expansion of tall shrub fuels (primarily mountain laurel) within the chestnut oak forest. These highly flammable, long lived evergreen shrubs can exceed ten feet in height and support very aggressive fire behavior under dry conditions. Tall mountain laurel was the dominant fuel type over much of the area that burned in the 2008 Overlooks Fire.

Many significant ecological changes have occurred during the long fire free interval as well. In the chestnut oak forest, the expansion of mountain laurel coupled with significant invasion by shade tolerant, fire sensitive species (e.g. red maple) has substantially reduced and, in some cases, eliminated oak regeneration. Pitch pines, which rely heavily on basal sprouts following fire as a mode of regeneration, are aging and decreasing in their ability to produce vigorous sprouts. Red maple, white pine and black gum are also invading large areas of pine barrens, further inhibiting pitch pine regeneration through increased shading. The continued absence of fire from these ecosystems will likely result in a shift away from these ecological community types into a more shade tolerant hardwood dominated forest with the consequent loss of many rare plant species. Numerous rare plants—including clustered sedge (*Carex cumulata*), Appalachian sandwort (*Minuartia glabra*), black-edge sedge (*Carex nigromarginata*) and Rhodora (*Rhododendron canadense*)—rely on open habitats in pitch pine-oak-heath and oak-heath rocky summit communities that are maintained by fire.

Loss of oak and pine barrens systems could result in significant impacts to numerous wildlife species as well. Open pine barrens and chestnut oak forest in the Shawangunks provide habitat for timber rattlesnakes (*Crotalus horridus*) and support four rare moth species and one rare tiger beetle (New York Natural Heritage Program 2010). Acorns are perhaps the single most important wildlife food source in eastern forests. It has been estimated that 49 species of birds and mammals in the eastern US directly rely on acorns as a part of their diet (Miller and Lamb 1985), many of which in turn are prey for other species. Consequently, a significant decline in oak forest habitat in the Shawangunks would likely result in considerable impacts to wildlife species at all levels in the forest food chain.

1.5 The Fire Environment—Weather, Fuels & Topography

Climate & Weather

In general, the climate of New York and the northeast is described as humid continental, but the annual weather patterns on the Shawangunk Ridge are highly variable. The average annual temperature between 1896 and 2008 was 48.3 degrees F., with the highest average monthly temperature in July (70.8° F). Average annual precipitation is 47.85 inches, also peaking in July (4.49 inches) (Huth and Thompson 2008). Although average precipitation tends to be very evenly distributed among months of the year, month to month variations in rainfall and temperature may fluctuate widely within any given year (New York State Climate Office 2008).

As a result, fires can occur virtually anytime between March and November in the Shawangunks, with a peak in fire activity tending to occur in April and early May. Prior to leafout, exposed fuels dry rapidly in the sun as daylength and solar radiation increase. Large high pressure systems moving from the northern interior of the continent can bring warm, dry air masses to the northeastern US at this time of year (US Forest Service 2005), sometimes resulting in temperatures as high as 75 to 80 degrees and relative humidities near or below 20% (G. Chapin, unpublished data). These very dry weather conditions—coupled with low live fuel moistures in pitch pine and mountain laurel prior to spring –green-up"—tend to result in hot, fast moving fires during this time of the year, despite fairly regular precipitation events.

In contrast, summer and fall fires in the Shawangunks tend to be associated with extended periods without rain, and large fires between July and November can be loosely correlated with indices of soil drought (Batcher 2000). During the late 19th and early 20th centuries, summer fires were fairly common and probably corresponded with periods of increased activity on the ridge by seasonal berry pickers (Hubbs 1995). Due to higher live fuel moistures in the most flammable fuel types (e.g. pitch pine and mountain laurel), higher relative humidities and increased shading of fuels, fires during the summer months—often referred to as the growing season fires—typically move more slowly and burn less intensely than spring (dormant season) fires. Under severe drought conditions, summer and fall fires can burn very intensely and can also burn deeply into the soil and into rock crevices if sufficient fuel has accumulated. Such fires may smolder for weeks or possibly months in the absence of sufficient rainfall. Large intense

fires more characteristic of the spring dormant season can also occur in October and November under certain large scale weather patterns (US Forest Service 2005).

Winds in the Shawangunks tend to be strong and gusty on the ridgetop and decrease in strength at lower elevations with increased ground surface friction and sheltering from topography and vegetative cover. The prevailing winds generally blow from the southwest to northwest and winds blow consistently throughout the fire season on the ridge. Weather station data from Sam's Point Preserve show general winds from 3-10 miles per hour between April and November, with gusts often exceeding 10-20 miles per hour on the ridgetop (G. Chapin unpublished data). Local wind strength and direction can be heavily modified on the ridge based on vegetation height and topography and are thus highly variable across the landscape at any given time.

Topography

The topography of the Northern Shawangunks is likewise highly variable. Moderate to steep slopes (i.e. 30-100% or more) rise out of the Rondout and Wallkill valleys, from elevations of 200-300 feet in the valley bottoms to over 2000 feet on the ridgetop. The eastern slopes of the ridge are characterized by several large cliff formations—the Trapps, Near Trapps, Millbrook Mountain, Castle Point, Gertrude's Nose and Sam's Point—and numerous smaller escarpments and rock outcrops occur throughout the landscape. The broader western flank of the Northern Shawangunks is somewhat more moderate with respect to slope, although very steep slopes do occur in some areas. In addition to significant glacial activity, several moderate to high gradient streams have modified the landscape, creating steep gullies and ravines.

In general, the Shawangunk landscape includes a wide diversity of large landforms and finer scale features that will influence fire behavior at any given location. Certain features, such as cliff and talus fields, can serve as barriers to fire spread, while other features—including steep slopes and narrow ravines that create a chimney effect—can dramatically increase fire intensity and spread rates under favorable conditions. Because of this wide variety of topographic features and landforms, the impacts of topography on fire behavior will be highly localized and dependent on a number of factors including slope steepness, slope position, landform shape and aspect.

More important than the impacts of topography alone on fire behavior, are the interactions between topography and fuels. Slopes in the Shawangunks range from flat to vertical; however the most significant vegetation/fuel types (chestnut oak forest and pitch pine barrens) tend to occur on relatively flatter to moderately steep slopes, with the most flammable fuel types (dwarf pine barrens and shrublands) occurring on the flattest slopes at the highest elevations (Batcher 2000). Aside from vertical cliff faces, the steepest slopes—which occur in deeply cut stream drainages—typically support hemlock forests with heavy shade and sparse surface fuels. Similarly, the effect of other topographic variables such as aspect and slope position—which influence sunlight availability (for drying and preheating fuels), daytime temperature and relative humidity—will be heavily modified by the density and shading characteristics of the dominant vegetation type. Therefore, assumptions about the impacts of topography on fire behavior—e.g.

that fire activity will increase with increasing slope and south aspects will be drier than north—may not be valid unless the influence of vegetation/fuel type is accounted for as well.

Fuels

Fuel types on the Shawangunk Ridge vary dramatically between and within different vegetation types, and it is therefore difficult to accurately assess fuel types spatially across the entire ridge based on existing vegetation maps (Map 1.3). Table 1.2 lists the dominant fuel types in the Shawangunks and relates them to ecological communities described by Thompson (1996) and Edinger et al. (2002). For the purposes of describing the wide range of fuel conditions that can occur in the Shawangunks, fuel types were broken out into four major groups which are described in more detail below: Chestnut Oak Forest, Barrens, Other Forest, and Grass. Table 1.3 includes descriptions of various ecological communities that are either devoid of fuel or will only support active or spreading fire under abnormal conditions (e.g. prolonged drought, very high winds).

For each fuel type described in Table 1.2, a standard fuel model for predicting fire behavior was selected that best represents the general conditions found within the fuel type. These fuel models can be used for various fire behavior modeling applications. Anderson (1982) described a set of 13 standard fuel models for this purpose; however these models do not accurately represent northeastern fuel types and tend to perform very poorly in making predictions of fire behavior. Therefore, Table 1.2 references a set of new fuel models developed by Scott and Burgan (2005). To provide a reference, the most applicable fuel model from Anderson (1982) is listed in parentheses.

In order to provide some relative reference for the variability in fire behavior that can be observed across the fuel types described, Table 1.2 also includes a range of predicted estimates of flame length and rate of spread for each fuel type under both a moderate moisture/moderate wind scenario and a very dry/high wind scenario. These ranges were intended to serve as a general reference for fire behavior for the vast majority of fuel moisture/weather situations that may occur. Extremely dry or drought conditions, very high winds and/or steep slopes could result in actual fire behavior that substantially exceeds the fire behavior predictions listed below. In addition, certain vegetation types—particularly pine barrens types—may support crown/canopy fire or other forms of extreme fire behavior. These scenarios were not accounted for in the predictions of fire behavior in Table 1.2, but are discussed in more detail in the fuel type descriptions that follow.

While the fuel models and fire behavior predictions described in this section provide a useful guide for planning purposes, they are not meant to replace more specific fire behavior calculations developed as part of the prescribed burn unit planning process. The fuel model selections for various vegetation types described in Table 1.2 are also largely unverified, and may also need to be modified over time based on actual observations of fire behavior in the different vegetation types.

Map 1.3. Ecological communities in the Northern Shawangunk Mountains.

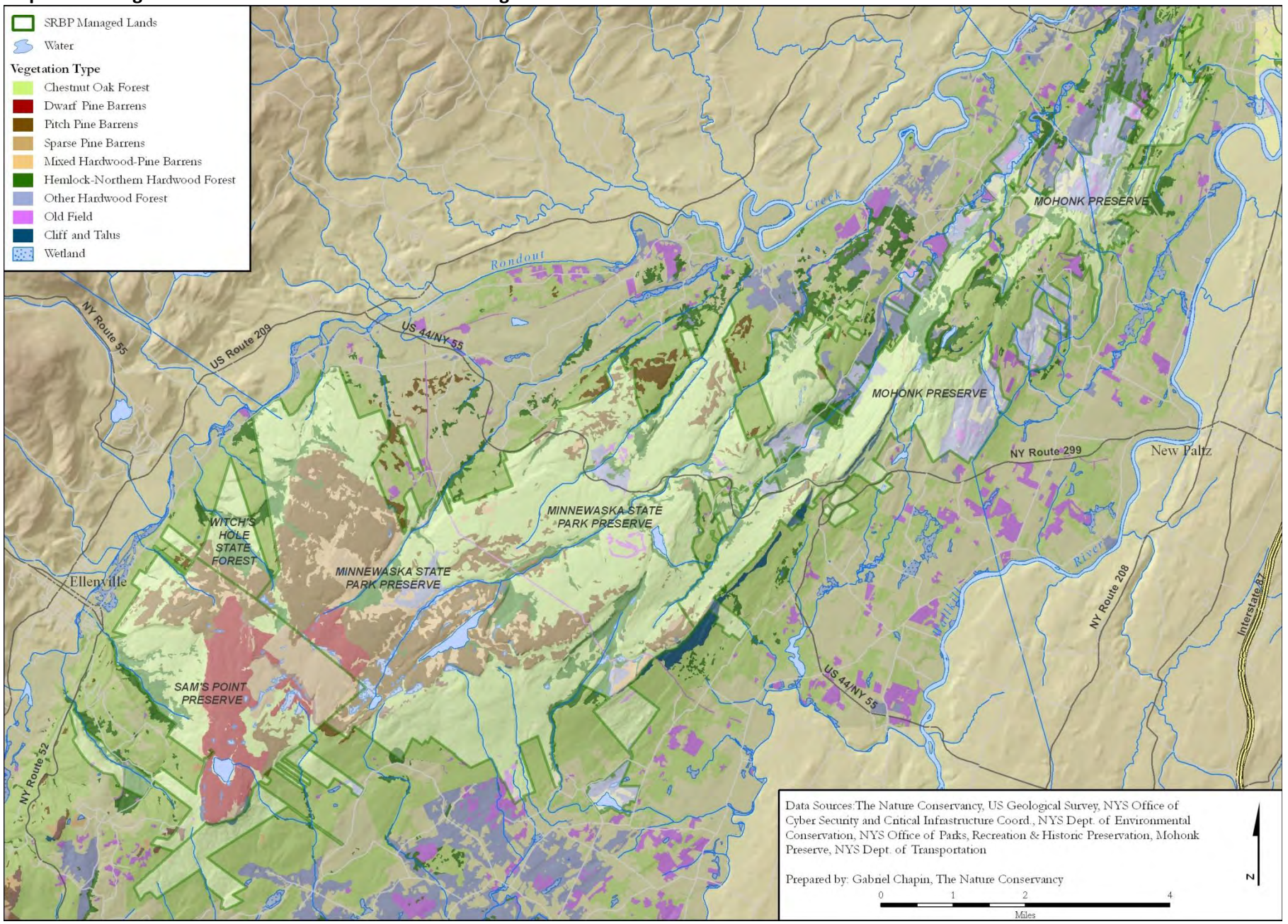


Table 1.2 Description of fuel types for ecological communities found in the Northern Shawangunks, including fire behavior prediction fuel models and range of expected fire behavior.

Fuel Type	Description	Fire Behavior Fuel Model[1]	General Fire Behavior[2]
Chestnut Oak Forest Group (includes chestnut oak forest ecological community with various understory types)			
Chestnut Oak Forest – Leaf Litter	Chestnut oak and/or red oak dominated forest with few or no shrubs in the understory. Fire burns primarily through uncompacted oak leaf litter.	TL6 (9)	Low – Moderate intensity fire Flame Length: 2 – 5 feet Rate of Spread: 5 – 24 ft./min.
Chestnut Oak Forest – Low Shrub	Chestnut oak and/or red oak dominated forest with blueberry/huckleberry/low mountain laurel understory (avg. shrub height <1.5 feet).	TU2 (9, 6)	Low – Moderate intensity fire Flame Length: 3 – 7 feet Rate of Spread: 10 – 49 ft./min.
Chestnut Oak Forest – Moderate Shrub	Chestnut oak and/or red oak dominated forest with tall huckleberry and/or moderately tall mountain laurel understory (avg. shrub height 1.5 – 3 feet).	SH4 (5, 6)	Low – High intensity fire Flame Length: 2 – 15 feet Rate of Spread: 8 – 134 ft./min.
Chestnut Oak Forest – High Shrub	Chestnut oak and/or red oak dominated forest with dense, tall mountain laurel understory (avg. shrub height 3 – 4.5 feet).	SH8 (5, 6)	Moderate – Very High intensity fire Flame Length: 8 – 19 feet Rate of Spread: 17 – 87 ft./min.
Chestnut Oak Forest – Very High Shrub	Chestnut oak and/or red oak dominated forest with dense, tall mountain laurel understory (avg. shrub height > 4.5 feet).	SH9 (4)	High – Very High intensity fire Flame Length: 15 – 32 feet Rate of Spread: 34 – 161 ft./min.
Barrens Group (includes dwarf pine ridge, sparse dwarf pine ridge, pitch pine-oak-heath rocky summit, sparse pitch pine-oak-heath rocky summit, pitch pine-heath rocky summit, heath rocky summit, scrub oak rocky summit and red maple-hardwood heath ecological communities). NOTE: Canopy fire in these fuel types may result in fire behavior that dramatically exceeds predictions.			
Barrens –Needle Litter	All barrens types with few or no shrubs in understory where continuous pitch pine needle litter is the primary carrier of fire.	TL8 (9)	Low – moderate intensity fire Flame Length: 3 – 6 feet Rate of Spread: 5 – 22 ft./min.
Barrens – Low Shrub	Includes all barrens communities with huckleberry/blueberry/mountain laurel understory (avg. shrub height <1.5 feet tall).	TU2 (9, 6)	Low - Moderate intensity fire Flame Length: 3 – 7 feet Rate of Spread: 10 – 49 ft./min.

Fuel Type	Description	Fire Behavior Fuel Model[1]	General Fire Behavior[2]
Barrens – Moderate Shrub	Includes barrens communities with tall huckleberry, moderately tall mountain laurel and/or scrub oak understory (avg. shrub height 1.5 – 3 feet).	SH4 (5, 6)	Low – Very High intensity fire Flame Length: 2 – 15 feet Rate of Spread: 8 – 134 ft./min.
Barrens – Tall Shrub	Includes all barrens communities with tall mountain laurel and/or scrub oak understory (avg. shrub height 3 – 4.5 feet).	SH8 (5, 6)	Moderate – Very High intensity fire Flame Length: 8 – 19 feet Rate of Spread: 17 – 87 ft./min.
Barrens – Very High Shrub Understory	Includes dwarf pine ridge communities < 6 feet tall and other barrens communities (typically red maple-hardwood heath or scrub oak rocky summit) with dense, tall mountain laurel or scrub oak understory (avg. shrub height 4.5. – 6 feet).	SH9 (4)	High – Very High intensity fire Flame Length: 15 – 32 feet Rate of Spread: 34 – 161 ft./min.
Barrens – Dwarf Pine Ridge > 6 feet tall with shrubs and/or ladder fuels	Includes taller dwarf pine barrens (> 6 feet in height) where there are abundant surface and ladder fuels present. Canopy fire is likely and not adequately represented by available fuel models.	NA	Very High intensity to extreme fire behavior likely. Fire behavior may exceed fuel model SH9 under very dry conditions.
Other Forests Group (includes Appalachian oak-hickory forest, Appalachian oak-pine forest, northern hardwood forest, beech-maple mesic forest, successional northern hardwood forest, successional southern hardwood forest, hemlock-northern hardwood forest, white pine forest)			
Oak, Oak-Hickory or Oak-Pine Forest Litter	Includes oak dominated forest types where uncompacted oak leaf litter is the primary carrier of fire.	TL6 (9)	Low – Moderate intensity fire Flame Length: 2 – 5 feet Rate of Spread: 5 – 24 ft./min.
Hardwood Forest Litter	Includes non-oak hardwood forest types (beech-maple mesic forest, northern hardwood, successional hardwood) where compacted leaf litter is the primary carrier of fire.	TL2 (8)	Very Low intensity fire Flame Length: 1 – 1 feet Rate of Spread: 1 – 4 ft./min.
Hemlock-Northern Hardwood Forest Litter	Includes hemlock dominated and mixed hemlock-northern hardwood forests with a fuelbed of highly compacted short needled conifer litter; will not sustain spreading fire under many conditions. (NOTE: not necessarily representative of hemlock stands impacted by hemlock wooly adelgid and/or elongate hemlock scale)	TL1 (8)	Very Low intensity fire Flame Length: 0.5 – 1 feet Rate of Spread: 1 – 2 ft./min.

Fuel Type	Description	Fire Behavior Fuel Model[1]	General Fire Behavior[2]
White Pine Forest	Includes white pine dominated forests where the fuelbed is compact conifer litter with a small to moderate amount of small woody debris.	TL3 (8)	Very Low intensity fire Flame Length: 1 – 2 feet Rate of Spread: 2 – 6 ft./min.
Logging Slash/Forest Blowdown	Includes a wide range of relatively uncommon conditions including slash from logging activity, blowdown or insect disease outbreak that has resulted in significant coarse woody fuels. Appropriate fuel model selection will depend on fuel loading and other conditions.	SB1, SB2, SB3, SB4 (11, 12, 13)	Low – Very High intensity fire Flame Length: 3 – 25 feet Rate of Spread: 6 – 213 ft./min.
Grass Group (Includes successional fields and other culturally modified landscapes, e.g. former orchard and golf course at Minnewaska State Park Preserve, old agricultural fields at Mohonk Preserve, etc.)			
Successional Field	Includes former agricultural fields and/or other cultural fuel types that are dominated by standing grasses and perennial forbs averaging 2 feet tall.	GR3 (2)	Low – High intensity fire Flame Length: 4 – 14 feet Rate of Spread: 23 – 233 ft./min.
Mowed Field	Includes recently mowed field with a low, patchy fuelbed consisting predominantly of grass/forb litter from mowing; standing fuels typically < 0.5 feet tall.	GR1 (1)	Low intensity fire Flame Length: 1 – 3 feet Rate of Spread: 5 – 30 ft./min.

[1]Fire behavior fuel models shown are from Scott & Burgan (2005), with applicable fuel model from Anderson (1982) in parentheses. Fuel models were selected using field observations, information from the Shawangunk Ridge Biodiversity Partnership (2003), and data and information from Brose (2008) as a guide.

[2]Estimates of flame length and rate of spread are based on BehavePlus5 fire behavior simulations. Range of fire behavior is calculated using a moderate fuel moisture (FM) scenario (1-hr FM = 9%, 10-hr FM = 10%, 100-hr FM = 11%, live herbaceous FM = 90%, live woody FM = 120%, mid-flame wind = 5mph) and a very dry scenario (1-hr FM = 3%, 10-hr FM = 4%, 100-hr FM = 5%, live herbaceous FM = 30%, live woody FM = 60%, mid-flame wind = 10mph) on level ground. Fuel moisture parameters are taken from Scott & Burgan (2005).

Table 1.3. Description of ecological communities that support non-burnable or very low intensity fuel types or fuels that will only sustain active fire behavior under abnormally dry conditions.

Fuel/Vegetation Type	Ecological Community/Description	Comments
Hemlock-Northern Hardwood Forest	Hemlock-northern hardwood forests with a dense canopy and highly compacted needle/leaf litter.	This fuel type will often not support active fire spread except under very dry conditions. Suitability as a barrier to fire spread dependent on various factors, including season, drought status, species composition, slope and canopy closure. Hemlock wooly adelgid and/or elongate hemlock scale infestations may increase the flammability of this fuel type.
Sparse Barrens	Portions of sparse dwarf pine ridge and sparse pitch pine-oak-heath rocky summit communities with large patches of exposed bedrock.	At the typical patch size scale, these communities have abundant shrub fuels and will support active fire behavior. Larger exposed rock outcrops exist in certain areas and may be localized barriers to fire spread.
Barrens Shrub Wetlands	High bush blueberry bog thicket, perched bog/dwarf shrub bog, pitch pine-blueberry peat swamp communities under non-drought conditions.	These wetland types will typically not support active fire spread, although drought conditions and/or high winds may make shrub fuels available. Under these conditions, these community types could burn similarly to low, moderate and/or high shrub fuel types (TU2, SH4, SH8) depending on shrub stature and density.
Other Wetlands	Sedge meadow, shallow emergent marsh, vernal pool, red maple-hardwood swamp, hemlock swamp under non-drought conditions.	These wetland types are unlikely to burn except under extreme drought conditions and most will only support low intensity fire. Hemlock swamps may support dense stands of rhododendron which could burn similarly to high and very high shrub fuels under extreme drought conditions (SH8, SH9).
Cliff, Talus & Ice Caves	Includes cliffs, acidic talus slope woodlands, exposed bedrock/talus and ice cave talus communities with very sparse or no vegetation.	Very little to no fuel present. These types generally serve as barriers to fire spread. Under drought conditions, litter accumulated in talus slopes and rock crevices may ignite and smolder for extended periods of time.

Chestnut Oak Forest Fuels Group

Chestnut oak forest is the dominant vegetation type in the Shawangunks and is often referred to as the ―matrix" forest type in which other ecological communities are embedded. Correspondingly, chestnut oak forest fuel types are among the most common found on the ridge. Conditions within the mapped chestnut oak forest in the Shawangunks vary widely, with the various shrub understory types occurring as a result of differences in site condition, disturbance history and deer browse pressure.

The leaf litter fuel type occurs on sites where there are few or no understory shrubs and typically supports low to moderate fire intensity; however fires may move quickly through this fuel type on steeper slopes. The various shrub understory fuel types within chestnut oak forest can support a wide variety of fire behavior, and are broken out into four types based on field observations of fire behavior and data collected on fire behavior in similar oak forests in Pennsylvania and New Jersey (Brose 2008).

The low shrub type is characterized by a relatively open canopy of chestnut oak with an understory layer of moderately dense blueberry and huckleberry—sometimes mixed with low mountain laurel—with an average total shrub height of less than approximately 1.5 feet tall. The moderate shrub type is similar, but the shrub layer is generally dominated by dense huckleberry and/or mountain laurel with a total average height of 1.5 – 3 feet. With sustained high winds and dry conditions, fire behavior in the moderate shrub understory can move quickly and burn intensely (flame lengths 10-15 feet).

The high and very high shrub types in the chestnut oak forest represent some of the most significant fuel types in the Shawangunks. While these types typically occur in smaller patches, they can occur over larger areas. The high shrub fuel type is typically found on more mesic sites and consists of a chestnut oak or red oak overstory with a dense and continuous understory of tall mountain laurel (average total shrub height 3 – 4.5 feet). The very high shrub type is similar but shrub height ranges from 4.5 – 6 feet tall. In its most extreme expression, the very high shrub type can have mountain laurel in excess of 8-10 feet tall. Wildfires occurring in these fuel types under very dry conditions can be extremely difficult to control. Flame lengths can exceed 20-30 feet and significant spotting—ignitions in advance of the main fire front from lofted embers—can occur resulting in rapid and unpredictable fire spread. Under more moderate conditions, these fuel types could experience low intensity fire, which burns through the leaf litter without igniting the shrub layer.

Barrens Fuels Group

Barrens fuels are more common towards the southern end of the Northern Shawangunks at Sam's Point Preserve and the southern portion of Minnewaska State Park Preserve, and they represent some of the most volatile fuels in the entire ridge ecosystem. Barrens vegetation types in the Shawangunks consist primarily of the dwarf pine ridge and pitch pine-oak-heath rocky summit communities along with a variety of less common heath (huckleberry/blueberry) and scrub oak (*Quercus ilicifolia*) dominated sub-communities.

Barrens fuel types in the Shawaungunks consist primarily of flammable shrubs of varying stature and mirror the fuel structure and fire behavior characteristics of the low, moderate, high and very

high shrub types within the chestnut oak forest. Typical examples of the low and moderate barrens shrub types include blueberry and huckleberry in open canopy pitch pine-oak-heath rocky summit woodlands, open heath rocky summit communities with dense tall huckleberry or red maple-hardwood heath communities with a continuous huckleberry understory. High and very high shrub types are typically associated with patchy scrub oak rocky summit communities, tall mountain laurel understories in pitch pine-oak-heath rocky summit and red maple-hardwood heath communities and shrub form dwarf pine ridge communities.

The primary distinction between barrens and chestnut oak forest fuel types is that several barrens types—particularly denser pitch pine-oak-heath rocky summit woodlands and taller dwarf pine ridges—are prone to experiencing canopy fire. Canopy fire can consist of individual tree crowns or groups of trees igniting (single tree or group torching) or the entire tree canopy becoming engaged by the fire (active canopy fire). This type of extreme fire behavior is typically associated with very dry conditions and/or very high winds, and can dramatically exceed the fire behavior predictions listed in Table 1.2.

The dwarf pine ridge ecological community is somewhat more difficult to define with respect to fuel structure. For the purposes of describing fuel types and determining appropriate fuel models, this ecological community can be thought of as having three fuel types: needle litter, high shrub and dwarf pine barrens > 6 feet in height. The shrub form of this community occurs on shallow rocky soils and consists of a very dense, continuous shrub canopy less than six feet in height. The fuelbed structure consists of pine litter and foliage mixed with some low shrubs, forming a vertically continuous shrub layer with no or very little separation between surface and aerial fuels. This fuel structure should behave similarly to other very high shrub types (i.e. mountain laurel, scrub oak).

In other areas of the dwarf pine ridge, trees are less stunted and grow relatively taller (up to 16 feet), in some cases resulting is separation of surface fuels—which consist primarily of long needled pine litter—and the aerial fuels (i.e. pitch pine foliage in canopy). This type of fuel structure can result in surface fires that burn beneath the canopy of pines without igniting the canopy foliage, and thus it is characterized as the barrens needle litter fuel type. Where this type of growth form occurs with moderate to heavy surface fuels, shrubs and/or other ladder fuels present, canopy fire is very likely to occur. This situation is not adequately represented by any available fuel models and fire behavior in many circumstances may exceed that predicted by any of the shrub models.

Despite the distinction between various dwarf pine barrens fuel types, there is a continuum of growth forms and fuel structures that can occur, ranging from short stature shrub forms to taller pines with a distinct canopy. In any given situation, the propensity for a surface fire to transition into a canopy fire in dwarf pine stands will depend on a variety of factors, including the growth form of the pines, wind and weather conditions, the vertical continuity of fuels beneath the pine canopy and the overall height of the pine canopy. As such, any fire behavior predictions using standard fuel models in any dwarf pine fuel types should be applied with some caution.

Other Forests Fuels Group

Other forest types in the Shawangunks are not particularly fire prone and do not typically support high intensity or fast moving fires. Various oak dominated forest types, including Appalachian oak-hickory and Appalachian oak-pine, can have a relatively flammable leaf litter layer but generally lack shrub fuels. Other hardwood types (e.g. successional hardwoods and northern hardwoods) tend to be dominated by species with less flammable litter, including red maple, sugar maple, ash (*Fraxinus spp.*) and ironwood. These forest types typically support low intensity fire and active fire spread is limited under most conditions.

There are several conifer forest types in the Shawangunks, including white pine forests and hemlock-northern hardwood forests. White pine forests are not common and occur only in small patches. Despite having long needles, white pine litter is relatively compact and fire intensity in this type is usually very low to low. Hemlock dominated forests occur most frequently in narrow ravines and along stream banks, and they are characterized by extremely compact, short needled litter and heavy shade. As a result the fuelbed tends to retain moisture and fire spread is often significantly limited in these areas. In many cases, hemlock forests can serve as barriers to fire spread. Expansion of hemlock wooly adelgid (*Adelges tsugae*) and elongate hemlock scale (*Fiorinia externa*) infestations are changing the structure of many hemlock forests by opening the canopy and increasing the amount of standing dead fuel and surface fuel available. Heavily damaged hemlock forests may be significantly more flammable and as such, may need to be classified as a different fuel type depending on the amount and type of fuels that are available.

Forest management activities, blowdown, ice damage and insect/disease outbreaks can significantly alter forest fuel structure. Areas with abundant coarse woody fuel resulting from tree damage or management activities should be characterized using one of the slash/blowdown fuel models listed in Table 1.2. Which fuel model is selected will depend on the amount and size of available fuels, and will need to be determined from site observations.

Grass Fuels Group

While limited in extent, several grass fuel types do exist in the Shawangunks. They are typically associated with cultural land uses, including former agricultural fields and the old orchard/golf course area at Minnewaska State Park Preserve. These are referred to as successional old fields and typically consist of a mixture of grasses and tall perennial forbs, including goldenrod, and have a fuel bed depth of approximately two feet. Fire behavior in these fuel types can be highly variable depending on weather conditions, the depth of standing fuels and the proportion of grass and goldenrod relative to shrubs and other less flammable forb species. Recently mowed fields typically have a patchy fuelbed 0 – 0.5 feet or less in height, and fuels consist of litter laying flat on the ground—as opposed to the vertical orientation of standing vegetation—significantly limiting fire spread and intensity.

Non-burnable, Limited Availability and Low Intensity Fuel Types

Certain ecological communities in the Shawangunks have very sparse or no fuels, or fuels that are only available to burn under certain conditions, such as drought. Examples of areas with sparse or no fuels include cliffs, exposed rock outcrops and talus slopes. In some cases, these features may be large (e.g. talus fields, cliff faces) and may significantly limit or stop the spread of fire. Sparse variants of the dwarf pine ridge and pitch pine-oak-heath rocky summit

communities can incorporate numerous patches of exposed bedrock. At the scale of a typical patch size in these communities, there are abundant shrub fuels that will support active fire behavior. However, larger exposed rock outcrops exist in certain areas and may be localized barriers to fire spread.

2. Fire Management Implementation

Achieving the fire management goals outlined in Section 1.3 of the *Northern Shawangunk Ridge Fire Management Plan* will require detailed planning, on-the-ground management and public outreach and education. This purpose of this chapter is to describe the range of planned actions and list priority treatments for various fire management planning regions. Other sections provide guidance and detail on special situations—including prescribed fire, and wildfire response —that will require additional consideration.

Implementing the actions described in this chapter will require a coordinated effort among the Shawangunk Ridge Biodiversity Partnership (SRBP) members, as described in detail is Section 1.2. While this chapter outlines general priority actions, ongoing communication and planning will be necessary to effectively implement specific management actions. Partner organizations will need to meet regularly to collaboratively identify fire management priorities and determine the most effective means of implementing priority actions. The various subcommittees and working groups of the SRBP provide an ideal forum for such discussions.

2.1 Ecological Basis For Actions

Current Condition

A primary focus of all fire management activities is to restore, improve and maintain the ecological communities and associated biodiversity that exist in the Shawangunks. Section 1.4 provides background information on the fire history and ecology of various ecological communities found in the Shawangunks, particularly fire dependent oak forests and pine barrens. The removal of fire as an ecosystem process has resulted in the disruption of key forest processes—such as tree regeneration and the creation of forest canopy openings—and has allowed fire sensitive species to become increasingly dominant.

Since 1948, the extent of pine barrens in particular has decreased by about 30%, from approximately 10,000 acres in 1948 to 7,000 in 1994 (Russell 2001)—at least partly as a result of effective fire exclusion during this time. While chestnut oak forests are still widely distributed in the Shawangunks, evidence suggests a shift towards more mesic, shade-tolerant species is occurring, with a particular increase in the abundance and importance of red maple in both smaller and larger size classes (Russell 2001, Thompson and Sarro 2007). The continued exclusion of fire from oak and pine barrens communities—particularly when coupled with additional threats such as overabundant deer, invasive species infestations and climate change—will likely result in significant losses of habitat and biodiversity.

Ecological Targets and Management Goals

Ecologically based fire management actions will focus primarily on two major management targets, pine barrens and chestnut oak forest. The pine barrens target is made up of two existing ecological communities, dwarf pine ridge and pitch pine-oak-heath rocky summit, along with numerous associated sub-community types including sparse dwarf pine ridge, sparse pitch pine-oak-heath rocky summit, heath rocky summit, scrub oak rocky summit, red maple-hardwood heath, and others (Thompson 1996). The dwarf pine ridge, pitch pine-oak-heath rocky summit and chestnut oak forest ecological communities—along with their embedded sub-communities—have also been identified as priority conservation targets by the Shawangunk Ridge Biodiversity Partnership (2003) due to their significant contribution to the biodiversity of the ridge ecosystem.

Secondary targets represent lower ecological priorities and they are not as widely distributed as the primary targets. However, these secondary targets are fire maintained and may be valuable as small-patch habitat types, habitat for rare species, or as recreational, historical, or aesthetic resources. Desired fire frequencies and ecological fire management goals for pine barrens, chestnut oak forest and secondary management targets are described in Table 2.1.

It is important to note that desired fire return intervals are generally based on historical averages that can vary considerably across a landscape over time. Past fire return intervals can only serve as a guide for managers and, in the case of prescribed burns, the frequency of treatments should be based on the management objectives at an individual location. For example, treatments aimed at restoring degraded ecological targets may require substantial deviation from the desired long term fire return interval. In addition, some targets may be effectively maintained in good condition with fire frequencies that are substantially lower than historical averages.

In implementing fire management activities and monitoring efforts, it is also important to recognize that changes in climate are already becoming evident in the Shawangunks and impacting the plants and animals that exist here (Cook et al. 2008). As general climatic changes become more pronounced, increasing minimum and maximum temperatures and changes in precipitation patterns may begin to influence the distribution and relative dominance of certain species, as well as the fire regime itself. While it is difficult to predict exactly how these changes will unfold, it is imperative that ongoing fire management goals and objectives incorporate flexibility and evolving scientific understanding with respect to changing climate and other variable ecological influences.

Table 2.1. List of primary and secondary fire management targets, desired fire frequency and management goals.

	Management Target	Desired Fire Frequency[1]	Ecological Fire Management Goals
Primary Targets	Pine Barrens	15 – 25 years	• Promote pitch pine regeneration via multiple modes, including seeding after and between fire events, basal sprouting and serotinous cones • Minimize abundance of shade tolerant species (red maple, white pine, black gum) • Maintain diversity of habitat structure, ranging from dense shrubland to open woodland
	Chestnut Oak Forest	15 – 35 years	• Maintain abundant small and advanced oak regeneration via basal sprouting and seedlings • Promote oak dominance over other species (particularly red maple) in all size/age classes • Maintain open forest canopy structure with small to moderate sized canopy gaps • Prevent development of extensive tall (>3 feet) shrub layer dominated by mountain laurel
Secondary Targets	Other upland oak forests	15 – 35 years	• Maintain abundant small and advanced oak regeneration via basal sprouting and seedlings • Promote oak dominated or mixed species composition (e.g. oak-hickory, oak-pine) in all size/age classes • Maintain open forest canopy structure with small to moderate sized canopy gaps
	Successional Grasslands	1 – 3 years[2]	• Maintain low levels of shrubs and tree regeneration • Maintain low levels of non-native species cover

[1]Desired fire frequency represents a range of mean fire return interval (MFRI) needed to maintain the long term ecological viability of management target. MFRIs listed here are taken from the Shawangunk Ridge Conservation Action Plan (The Nature Conservancy 2008) and were developed using various data sources.

[2]Maintaining necessary grassland disturbance regime will likely require alternative methods in addition to fire, e.g. mowing.

2.2 Wildland-Urban Interface

As important as the ecological basis for conducting fire management activities is the need to protect the human communities that exist adjacent to flammable ecosystems in the Shawangunks. The zone or area where human development meets or mixes with hazardous wildland fuels is known as the wildland-urban interface (WUI). These areas hold the greatest potential for wildland fires to threaten human life and property.

Protection of WUI communities is a national level priority for fire managers. Every year, homes and property are damaged by wildfire and wildland firefighters are increasingly put at risk as they work to suppress fire in an increasingly complex fire environment that involves additional

hazards such as power lines, limited access and escape routes and the presence of hazardous materials that may ignite (e.g. building materials, fuel tanks).

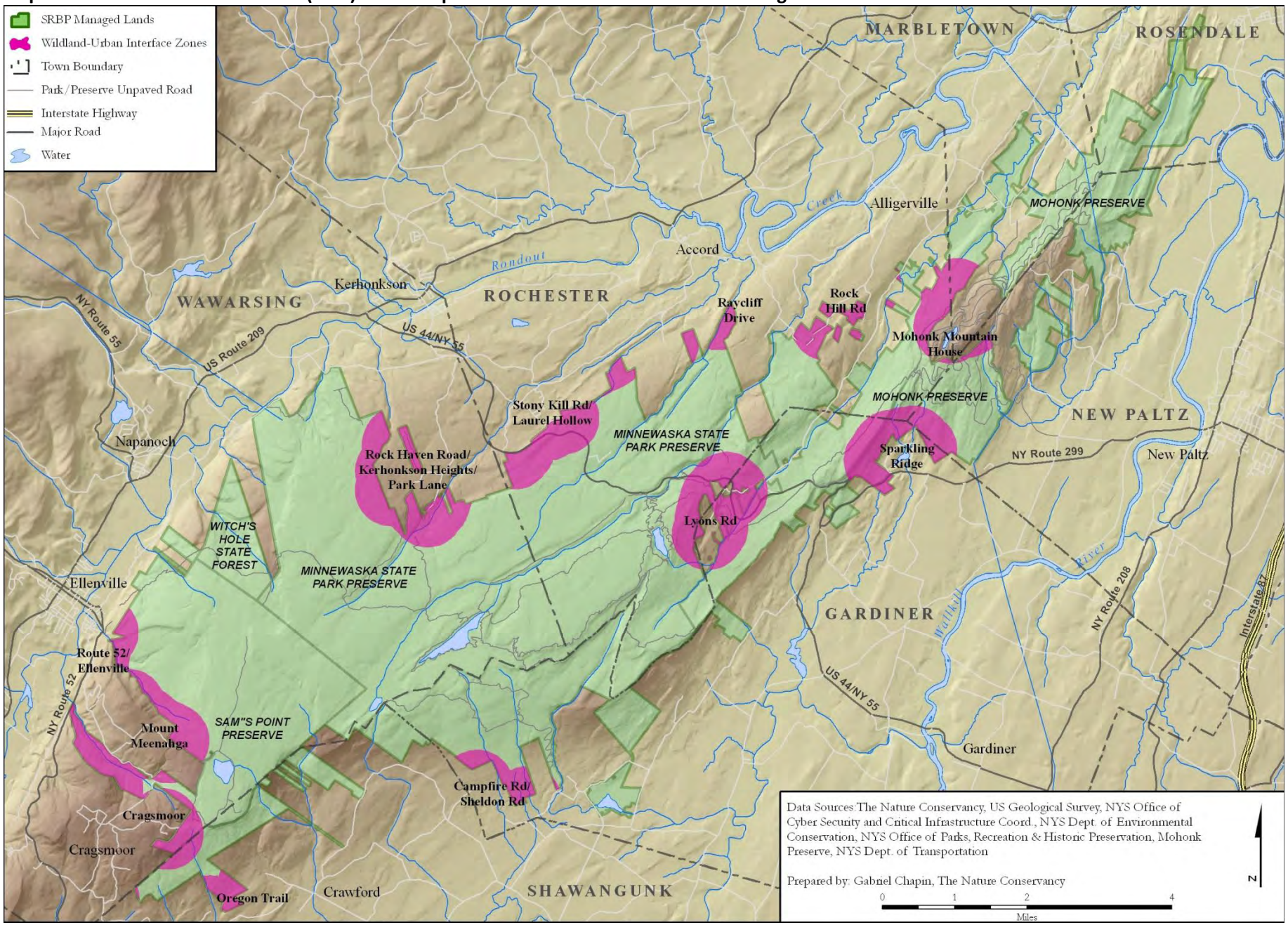
Towns in the Shawangunk region are continuing to experience significant growth and expansion of rural development into fire prone areas that have experienced significant accumulations of wildland fuels over the past 50-100 years. Map 2.1 depicts where WUI zones in the Shawangunks extend onto lands managed by SRBP partners, based on a 2009 field assessment of rural roads that surround the Shawangunk Ridge. The WUI zone in the Shawangunks is defined as a ½ mile radius around each of these residential areas.

In total, there are over 4,400 acres of existing WUI that lie on lands managed by SRBP partners. The majority of this WUI zone falls in the towns of Wawarsing, Rochester and Gardiner. Smaller WUI areas lie in the towns of Shawangunk and New Paltz. Particularly vulnerable areas have been identified in the communities of Alligerville, Accord, Kerhonkson Heights, Walker Valley, Crawford and Sparkling Ridge.

While the risk of home ignition can be substantially mitigated by actions that occur directly adjacent to the structure, strategic management in the WUI zones on SRBP lands will help to protect communities that are potentially at risk by reducing the potential for extreme fire behavior. Reducing the potential for high intensity fire will also benefit firefighters engaging in suppression activities in these areas. Priority actions for various fire management regions in the Shawangunks are discussed in more detail in Section 2.5. Some general strategies for management in WUI areas include:

- working with local communities and/or home owners to assist them in implementing programs that reduce the potential for home ignitions during a wildfire;
- maintaining key firebreaks, shaded fuel breaks or other natural or constructed barriers to fire that exist in the WUI zone; and
- reducing hazardous fuel loads in WUI zones using prescribed fire, mechanical treatments or combinations of both to moderate the intensity of future wildfires in and around vulnerable communities.

Map 2.1. Wildland-urban interface (WUI) zones on protected land in the Northern Shawangunk Mountains.



2.3 Proposed Fire Management Actions

Wildfire Suppression

Wildfire suppression will be the primary action for all unplanned wildfire ignitions on SRBP managed lands in the Shawangunks. Although management of unplanned wildfire ignitions—sometimes referred to in the past as "Wildland Fire Use"—can be beneficial in maintaining ecological communities and reducing fuel loads, the relatively poor conditions of the fire management infrastructure (e.g. carriage roads, trails) and the proximity of WUI areas adjacent to managed lands make this type of action impractical to implement in the Shawangunks at this time.

Section 2.6 provides some additional guidance on wildfire response; however the management of individual wildfire incidents—including the development and implementation of specific strategies and tactics—will be the responsibility of the incident command team in charge of suppression operations. Resource managers should be incorporated into incident command teams and, minimizing the ecological impacts of suppression activities should be prioritized over simply minimizing the total area burned on wildland fires managed by SRBP agencies.

Actions implemented under the *Northern Shawangunk Ridge Fire Management Plan* will focus on providing an improved infrastructure and suppression environment for managing wildfire suppression incidents. This may include prescribed fire and other treatments to create buffers of reduced fuel adjacent to WUI communities, restoration of former carriage roads and other natural or constructed firebreaks, improving staff training and fireline experience and acquiring equipment resources necessary to effectively respond to wildfire incidents.

Prescribed Fire

Prescribed fire—also called prescribed or controlled burning—refers to the intentional ignition of carefully managed fires for the purpose of achieving a specific management objective. Typically, prescribed fires are used to provide ecological benefits or to reduce accumulations of forest fuels that may lead to increasingly severe wildfires. Prescribed fires are conducted in accordance with a prescribed burn unit plan which specifies, among other things, a rigid set of predefined weather and fuel conditions and required personnel and equipment resources. Prescribed burns are implemented regularly throughout all regions of the US. Between 1998 and 2009, federal agencies burned nearly 20 million acres in the US, and state agencies and other organizations contributed an additional 6 million acres (National Interagency Fire Center 2010). The Nature Conservancy—a leader in the implementation of prescribed burns among non-governmental organizations (NGOs)—burned a total of nearly 250,000 acres nationwide in 2008 and 2009 (The Nature Conservancy, unpublished data).

The first modern prescribed burns in the Shawangunks were conducted in 1978 and 1979 by Dan Smiley at Mohonk Preserve to investigate the response of oak forest and pitch pine communities (John Thompson, personal communication). In 2005, the SRBP began implementing prescribed burns at Mohonk Preserve, the first to occur since Smiley's 1978-79 burns. Since that time, the Partnership has burned a total of 102 acres, including 66 acres of successional fields and 36 acres

of chestnut oak forest. These burns have thus far focused on demonstrating the effective use of prescribed burning as a management technique, providing staff training opportunities and conducting research on the ecological effects of the burns.

Prescribed fire will be a key management strategy in the Shawangunks for achieving ecological and fire hazard reduction goals. Although prescribed fire implementation will be focused on restoring and improving the health of pine barrens and oak forests, it may also be used as a tool to achieve other management objectives including reducing fuel accumulations, maintaining open grassland and shrubland habitats, and managing invasive species infestations.

Implementing prescribed burns requires careful planning, trained crews and adequate equipment resources. Section 2.7 provides guidance on how prescribed burns will be implemented in the Shawangunks, including requirements for prescribed burn unit planning and operational standards.

Firebreak Maintenance, Repair & Construction

The safe and effective implementation of wildfire suppression activities and prescribed burn operations requires the use of various kinds of firebreaks. Although there is some ambiguity surrounding the term firebreak and various related terms—fuel break, fireline, control line, etc.—the term firebreak in this plan refers generically to constructed linear features that can be used to limit or manage the spread of fire. Firebreaks may vary in width—typically ranging from approximately 2-14 feet in the Shawangunks—and most often consist of hand-constructed firelines raked through leaf litter, trails, cut paths through shrub fuels, old logging roads, or carriage roads. Other existing features such as paved roads, cliffs or rock outcrops, lake and streams can also be used effectively as barriers to fire, but in some cases—particularly with smaller streams—they may require some additional work to remove fuels or make a passable route for firefighters.

The suitability of any given firebreak will depend on the adjacent fuel conditions, the burning conditions on a given day and the tactics being employed to manage or suppress the fire. For example, in light fuels such as leaf litter, narrow raked lines may be an adequate firebreak. In heavier shrub fuels, the same firebreak may be inadequate unless other tactics are employed, such as wetting down adjacent fuels with water or foam. In addition, small firebreaks such as raked hand lines or trails may be suitable for indirect attack methods on a wildfire—intentionally setting backfires to burn out fuels between the main fire and the firebreak—while larger firebreaks created by bulldozer may be needed to directly attack the flaming front of the same fire.

Another key feature of firebreaks is that they often serve as access routes for firefighters to reach remote areas, either by vehicle or foot. Similarly, they provide the only efficient route of escape should conditions change during a fire incident requiring firefighters to leave the area for their safety.

Because they are such a valuable fire management resource, many existing carriage road firebreaks in the Shawangunks will need to be repaired and maintained to a condition that allows

for the safe and efficient implementation of fire management activities, primarily fire suppression and prescribed fire. Improvement of existing firebreaks may involve two major components, reducing/removing heavy fuels adjacent to the road or trail when necessary, and making improvements to the surface and drainage. A restoration and maintenance plan was recently developed by the Palisades Interstate Park Commission (PIPC), NYS Office of Parks, Recreation & Historic Preservation (NYS OPRHP) and Mohonk Preserve (Palisades Interstate Park Commission 2010). This manual includes a detailed inventory of condition and maintenance needs for all major carriage roads at Mohonk Preserve and Minnewaska State Park Preserve, and can be used as a guide for repairs and maintenance to existing carriage road firebreaks.

Existing firebreaks—including both carriage roads and trails—should be prioritized for restoration (see sections 2.4 and 2.5). In general, firebreaks should only be restored or maintained to the minimum width/conditions given a) the general surrounding fuel conditions; and b) the types of tactics expected to be employed. Whenever possible, managers should utilize existing permanent firebreaks for fire suppression and prescribed fire activities; however these types of activities will inevitably require the construction of new temporary, semi-permanent or permanent firebreaks.

When the creation of new firebreaks is necessary, they should be kept to the minimum width necessary to safely support the planned activity and they should be located in areas where expected fire behavior will be moderated by terrain or fuel conditions (e.g. tops of slopes, areas of low fuel). Firebreaks should also be planned to avoid disturbing sensitive resources and utilize natural barriers to fire to the greatest extent possible. Whenever practical natural vegetation of low stature and/or low flammability should be retained in and adjacent to new temporary or semi-permanent firebreaks and soil exposure/disturbance should be minimized. Maintaining some vegetative cover and reducing soil disturbance will also help prevent invasive plants from establishing and spreading along firebreaks.

When fire management activities require the construction of new firebreaks, managers can make a determination as to whether the value of the new firebreak for future management warrants maintaining it, either permanently or for some useful period of time. This is most likely to occur where a firebreak is necessary as a primary or secondary control line for multiple anticipated prescribed burns, or when a firebreak installed during an emergency wildfire suppression operation has significant value for future fire management efforts. In determining whether or not the new firebreak should be maintained over time, managers should consider the following:

- the proximity of the new firebreak to any sensitive resources;
- ecological impacts of the new firebreak as a fragmenting feature;
- the potential for undesirable secondary impacts (e.g. erosion, invasive species invasion) or human uses (e.g. social trail, ATV trail);
- the spatial arrangement of the firebreak in relation to other constructed or natural firebreaks;
- long term maintenance requirements; and

- the anticipated useful lifespan of the firebreak.

Mechanical Treatments & Forest Thinning for Fuel Reduction

In some instances cutting, mowing or grinding of vegetation may be necessary to reduce heavy fuel loads, protect sensitive resources, improve critical firebreaks or mimic fire effects where prescribed fire treatments are impractical. These types of actions—generally referred to as mechanical treatments—involve the manipulation of fuels or other vegetation with mechanized equipment such as a brush-hog, hydro-axe, flail mower or similar implement.

While mechanical treatments are typically considered a less desirable management alternative than prescribed burning, these treatments may be the only effective strategy for achieving targeted management objectives, particularly in situations where fire has been suppressed over time and fuel or other conditions make the implementation of prescribed fire impractical. These objectives could include:

- reducing fuels to protect highly sensitive resources that could be severely damaged by wildfire (e.g. WUI residences, cell/radio towers, park/preserve facilities);
- removing shrubs and/or small trees to partially mimic the ecological effects of fire; and
- constructing or improving firebreaks by mowing or thinning heavy fuels adjacent to or near the break.

Mechanical treatments are widely used throughout the Northeast as a tool for restoring pine barrens and oak forests that have suffered extensive degradation from fire suppression. These treatments typically involve mowing or grinding scrub oak, mountain laurel and/or small diameter trees either in combination with or to facilitate the use of prescribed fire treatments.

In the Shawangunks, these types of methods are currently used to maintain carriage road shoulders. Implementation of mechanical treatments over large areas is not practical given the predominant terrain and vegetation types. As such, mechanical treatments will be limited to relatively small scale applications to achieve specific management objectives. The primary focus of mechanical treatments will be to protect vulnerable facilities, reduce or thin fuels along priority firebreaks or to achieve other specific fuel reduction goals in the WUI zone.

Forest thinning treatments are also widely implemented by fire managers in many parts of the country to reduce the potential for extremely high intensity canopy fire. Thinning involves the removal of canopy trees to reduce forest density to a specified level. Thinning reduces the total amount of canopy fuels while increasing the spacing between tree crowns, effectively reducing the potential for fire to move through the tree canopy. In the Shawangunks, these types of treatments would be implemented by hand or mechanized equipment and will again be used as a targeted tool for reducing canopy fuels along critical firebreaks or in particularly vulnerable areas in the WUI zone.

Community Outreach

The effective implementation of the *Northern Shawangunk Ridge Fire Management Plan* will require extensive community outreach and education. The two main goals of outreach activities

will be to a) engage vulnerable WUI communities to reduce the risk of damage from wildfire and b) inform local communities and residents of the ecological role of fire to increase acceptance and support of fire management activities.

Firewise and similar programs focus on reducing the risk to homes and other structures by addressing the most common causes of home ignition during a wildfire, and they can be tailored to meet the specific needs of the local community. Efforts to implement *Firewise* and similar programs are already underway in the Shawangunks, and in 2006 the hamlet of Cragsmoor became the first officially designated Firewise community in NY.

The scope of these programs can vary greatly, and be as simple as individual homeowners taking simple steps such as removing flammable debris around their homes, using building and landscaping techniques that reduce flammability and creating space around their home for firefighters to operate. These programs not only benefit the community, but provide a safer and more flexible environment for conducting wildfire suppression and prescribed fire operations.

Other outreach efforts will be focused on providing educational opportunities for the public to learn about fire ecology and the need for proactive fire management in the Shawangunks. This includes publications, lectures, guided hikes, and other educational and interpretive programming.

Monitoring

Monitoring is, and will continue to be, an integral part of the fire management program. Monitoring of ecological targets will be crucial for providing feedback into the adaptive management process, allowing managers to refine ecological objectives and evaluate the success of management actions. Monitoring the operational aspects of fire management—including elements of safety, smoke management, weather conditions, fire behavior, etc.—will also provide important feedback for ensuring that activities are carried out safely and efficiently.

The Shawangunks have a long history of ecological monitoring and observation that continues today. Ecological fire monitoring efforts are already underway in several prescribed burn units and in the Overlooks Fire area at Minnewaska State Park Preserve. A coordinated monitoring approach that incorporates both short and long term strategies is required to effectively evaluate the condition of the ridge ecosystem, and the ecological effects of individual management actions.

It is important to note that effective monitoring can be resource intensive. Consequently, monitoring should be focused on identifying key elements of the biological and operational environments that provide the most meaningful feedback into the adaptive management cycle and are most relevant to management objectives. Monitoring related to fire management activities should also include maintaining detailed records of fire management actions that are implemented over time in a spatial database. Fire management monitoring efforts should also be integrated with other management efforts, including deer and invasive species management.

2.4 Significant Roads & Trails for Fire Management

The Northern Shawangunks contain an extensive network of former carriage roads and numerous trails. This system of roads and trails provides the basic infrastructure for conducting fire management activities by providing defensible firebreaks and important access and escape routes for firefighters.

Several criteria were applied to identify significant roads and trails that are important to ridgewide fire management efforts. These significant features are described in Table 2.2 and depicted on Map 2.2. Features were selected as important firebreaks if they:

- provide the only or most defensible firebreak in close proximity to adjacent private lands;
- provide the only or most defensible firebreak in a large expanse of heavy fuels; and/or
- provide the only or most efficient access to remote areas or to other fire management infrastructure that is otherwise difficult to reach.

Numerous other trails and roads are also clearly important for fire management activities at smaller scales. These features of secondary importance are included under the fire management region descriptions in Section 2.5.

Significant firebreaks range from carriage roads in excellent condition to degraded former roads to foot paths, and the long term restoration/maintenance needs are dependent not only on the current condition but the primary intended future use. As such, each priority feature will need to be individually evaluated in more detail to identify repair/maintenance needs based on:

- current condition and needs;
- anticipated long-term uses for fire management; and
- resources available for repairs and maintenance

Efforts to repair and maintain existing carriage road firebreaks should be consistent with the Restoration and Maintenance Manual for the Shawangunk Carriage Road Systems that has been developed for Minnewaska State Park Preserve and Mohonk Preserve (Palisades Interstate Park Commission 2010). This manual provides both a current inventory of maintenance needs along with detailed specifications to adequately repair and maintain existing roadways.

Repairs and maintenance on roads and trails to enhance their functionality for fire management will require a substantial investment of resources. Some roads in poor condition may require excavation and installation of new culverts and drainage, while others may only require periodic superficial maintenance (e.g. spot surface repairs and mowing of adjacent fuels) to keep the road in good condition. On important trails, the focus will generally be on maintaining low stature, light fuels adjacent to the trail while maintaining the trail surface to prevent erosion and provide easier foot access. To the extent possible, SRBP partners should consider the value of improving priority fire management features when trying to identify and/or allocate available resources.

Table 2.2. Summary table of significant roads and trails important to ridgewide fire management efforts in the Shawangunks.

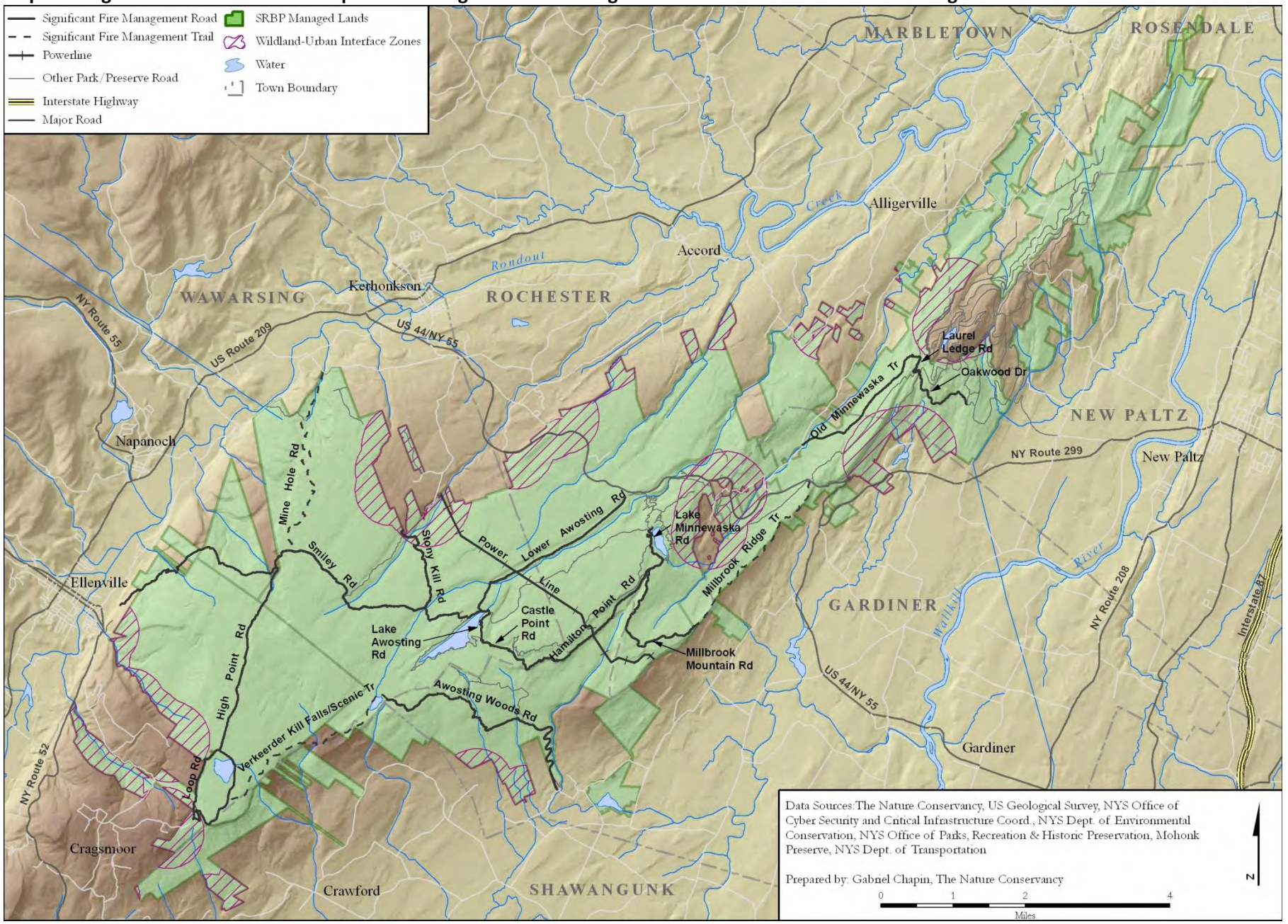
Name	Location	Length (mi.)	Reason for Significance	Condition & Repair/Maintenance Needs	5-year Priority [1]
Smiley Rd.	Sam's Point Preserve and Minnewaska State Park Preserve, from Village of Ellenville E to Lake Awosting Rd.	6.7	Only major existing east/west oriented firebreak south of Route 44/55 Major firebreak between vast areas of heavy fuels Provides access to otherwise remote areas	Poor condition Needs significant management of fuels/veg. except where bulldozed during 2008 wildfire Needs major drainage and surface repairs from Ellenville to Lake Awosting Rd.	High
Loop Rd.	Sam's Point Preserve from Conservation Center, N to High Point Rd., SE to Ice Caves Rd. and back to Conservation Center	3.0	Only major firebreak in heavy dwarf pine fuels around L. Maratanza Protects adjacent WUI community of Cragsmoor Key access route to High Point & Smiley Rds.	Moderate condition West side of Loop Rd. requires maintenance and improved drainage East side of Loop Rd. up to Sam's Point less critical but needs urgent drainage and surface repairs	High
High Point Rd.	Sam's Point Preserve from Loop Rd. north to Smiley Rd.	2.8	Only major firebreak in very large patch of dwarf pine fuels Only major access route N to Smiley Rd. and to N. Gully and upper Verkeerder Kill basin	Moderate condition From Loop Rd. to High Point needs some repairs to drainage & surface Significant veg./fuels management needed adjacent to roadway N of High Point, becomes ATV accessible path. Needs veg. management & periodic maintenance to remain passable	High
Verkeerder Kill Falls Trail/ Scenic Trail	Sam's Point Preserve, from Ice Caves Rd. N to Mud Pond; short section of trail crosses private land	3.2	Only existing firebreak and access route along eastern flank of Sam's Point Preserve and N into Minnewaska State Park Preserve	Poor condition Currently a rough foot path that runs through several fuel types Needs some improvements including fuel/veg. management adjacent to trail	High
Old Minnewaska Trail	Mohonk Preserve, from Clove Valley Rd. northeast to Laurel Ledge Rd.	2.3	Major existing firebreak in large area of oak forest below Overcliff Rd, adjacent to private land	Poor condition Former road needs significant restoration of surface and drainage and fuel/veg. management along trail	Moderate

Name	Location	Length (mi.)	Reason for Significance	Condition & Repair/Maintenance Needs	5-year Priority [1]
Hamilton Point Rd.	Minnewaska State Park Preserve, from Lake Minnewaska Rd. SW to Lake Awosting Rd.	2.9	Major firebreak adjacent to large patch of oak forest S of Upper Awosting Rd. Provides access to areas above Palmaghatt Ravine	Moderate condition Some restoration began in 2009, with removal of vegetation Additional work needed to improve road surface and drainage	Moderate
Mine Hole Rd.	Minnewaska State Park Preserve, from Smiley Rd. N to Foordmore Rd.	3.5	Primary access route to entire Mine Hole area of Minnewaska State Park Preserve	Poor condition Needs significant veg. management to reduce adjacent fuels Drainage/surface repairs needed to improve access by foot	Moderate
Awosting Reserve Access/Woods Rds.	Minnewaska State Park Preserve, from Mud Pond SE to parking area off Aumick Rd.	4.2	Protection for several WUI communities Primary access route to remote Mud Pond/Badlands area.	Moderate Condition Some surface and drainage maintenance needed to maintain vehicle access	Moderate
Stony Kill Rd.	Minnewaska State Park Preserve, from Smiley Road N to Stony Kill Falls	1.5	Significant firebreak in large expanse of oak forest Most efficient access route into remote area Provides protection to adjacent WUI communities	Poor condition Needs some fuels/veg. management and major repairs to drainage and surface Large portion of road was damaged by bulldozers during 2008 wildfire	Moderate
Millbrook Ridge Trail	Mohonk Preserve, from Millbrook Mt. Rd. NE to Rt. 44/55	3.0	Only existing firebreak/access route along top of Millbrook Ridge N to Route 44/55	Moderate Condition Needs some fuels/veg. management along trail	Moderate
Millbrook Mountain Rd.	Minnewaska State Park Preserve from Lake Minnewaska Rd. S to Gertrude's Nose	2.5	Access route to remote Gertrude's Nose and Millbrook Ridge areas	Moderate condition Needs repairs to surface and drainage to maintain vehicle access Some veg./fuels management needed adjacent to roadway	Moderate

Name	Location	Length (mi.)	Reason for Significance	Condition & Repair/Maintenance Needs	5-year Priority [1]
Powerlines	Minnewaska State Park Preserve from slopes east of Gertrude's Nose NW to Shaft 2A Rd	4.2	Major N/S oriented firebreak in large area of oak forest between Route 44/55 and Smiley Rd Provides foot and limited vehicle access to otherwise inaccessible areas with heavy wildland fuels	Moderate condition Needs continued and/or enhanced fuels management in powerline ROW to improve defensibility Needs maintenance to maintain foot access, and improve or expand ATV/UTV access where feasible	Moderate
Castle Point Rd.	Minnewaska State Park Preserve from west end of Hamilton Point Rd. NW to Lake Awosting Rd.	0.6	Completes Hamilton Point Rd. firebreak and connects to Lake Awosting Rd.	Good condition Maintenance and upkeep needed to maintain drainage, surface and adjacent fuels	Low
Lower Awosting Rd.	Minnewaska State Park Preserve, from Lower Awosting parking area S to Lake Awosting Rd.	2.7	Major firebreak in large patch of oak forest to N and W Most efficient access route to interior of Minnewaska State Park Preserve	Good condition Maintenance and upkeep needed to maintain drainage, surface and adjacent fuels	Low
Lake Minnewaska Rd.	Minnewaska State Park Preserve, from Lake Minnewaska parking area S to Millbrook Mountain Rd.	0.7	Key access route to two major priority firebreaks (Millbrook Mountain Rd., Hamilton Point Rd.)	Good condition Maintenance and upkeep needed to maintain drainage, surface and adjacent fuels	Low
Lake Awosting Rd.	Minnewaska State Park Preserve, from Smiley Road E and S to Castle Point Rd.	0.8	Access route between several priority firebreaks (Smiley, Lower Awosting, Hamilton Point/Castle Point)	Good condition Maintenance and upkeep needed to maintain drainage, surface and adjacent fuels.	Low
Laurel Ledge Rd./Oakwood Drive	Mohonk Preserve, from Old Minnewaska Trail S and E to Glory Hill Trail	1.6	Major access route/ firebreak in large area of oak forest Protection for adjacent Sparkling Ridge WUI	Good condition Maintenance and upkeep needed to maintain drainage, surface and adjacent fuels	Low

[1]Priority rating indicates the urgency of repairs and/or maintenance to road or trail in the next five years to support anticipated fire management activities. High indicates the feature is in urgent need of repairs to prevent significant degradation and is critical to the success of priority fire management activities. Moderate indicates that feature is in relatively stable condition (even if overall condition is poor) and will likely be able to support most planned fire management activities in the next five years. Low indicates that feature is very stable and in adequate conditions to support all anticipated fire management uses in the next five years.

Map 2.2. Significant roads and trails important to ridgewide fire management efforts in the Northern Shawangunk Mountains.



In total, there are approximately 42 miles of significant fire management roads and trails that have been identified in the Shawangunks. Table 2.3 summarizes the total miles of roads and trails in Poor, Moderate and Good condition and miles of High, Moderate and Low priority for repairs/maintenance in the next five years.

Table 2.3. Summary of miles of priority roads and trail by condition rating and priority.

	Condition Rating			
Feature Type	**Good**	**Moderate**	**Poor**	**Total**
Road/Former Road (miles)	6.4	15.4	10.5	32.3
Trail/Footpath/Other (miles)	-	7.2	6.7	13.9
	5-year Priority Rating			
	High	**Moderate**	**Low**	**Total**
Road/Former Road (miles)	12.5	13.4	6.4	32.3
Trail/Footpath/Other (miles)	3.2	10.7	-	13.9

2.5 Fire Management Regions & Priority Actions

Fire Management Regions

Fire management regions (FMRs) are planning units that have been identified across the Shawangunk Ridge for the purposes of identifying fire management priorities. These regions do not have any inherent priority over one another, rather they are simply a means of reducing the landscape into manageable planning units that are relatively similar for the purpose of identifying and describing management needs. Specific priority actions are included in the tables presented with the description of each Fire Management Region in the following subsections. While prescribed burning is a major component of the priority fire management actions, difficulties related to existing terrain and limited vehicle access may be significant enough to make prescribed burning difficult, if not impractical, in certain situations.

A total of 11 FMRs were identified for the Northern Shawangunks (see Table 2.4) based on several key criteria.

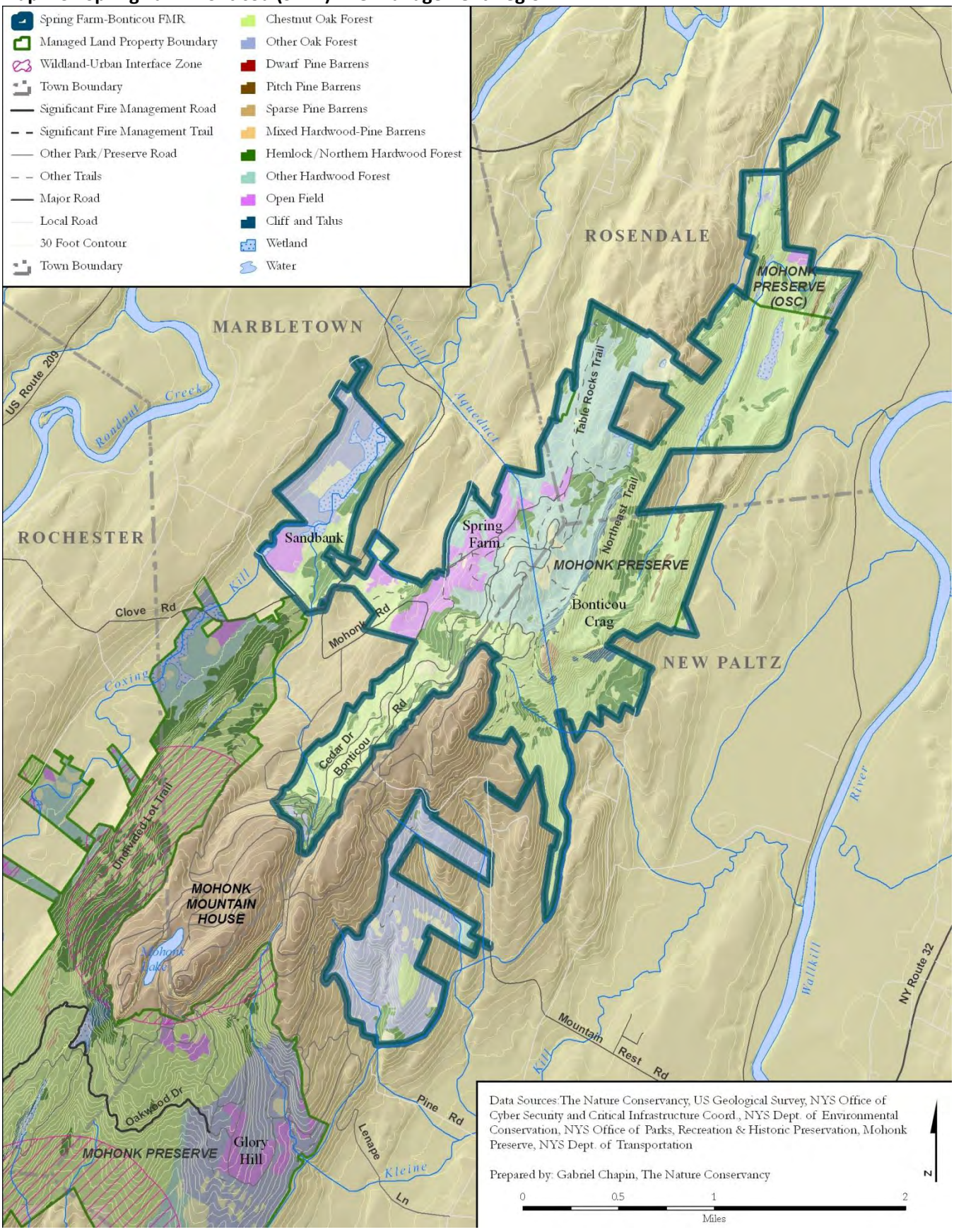
- They are limited to the boundaries of lands owned/managed by members of the SRBP.
- They are, for the most part, spatially contiguous. Disjunct areas were assigned to the closest or most similar fire management region.
- Wherever possible, they are separated by existing firebreak features that individual planned fire management activities are unlikely to cross over. In many cases, the FMR boundaries follow the priority firebreak features described in Section 2.4.

- They are similar enough with respect to vegetation, fuels, topography and other characteristics to allow fire management priorities to be identified and described for the entire FMR.

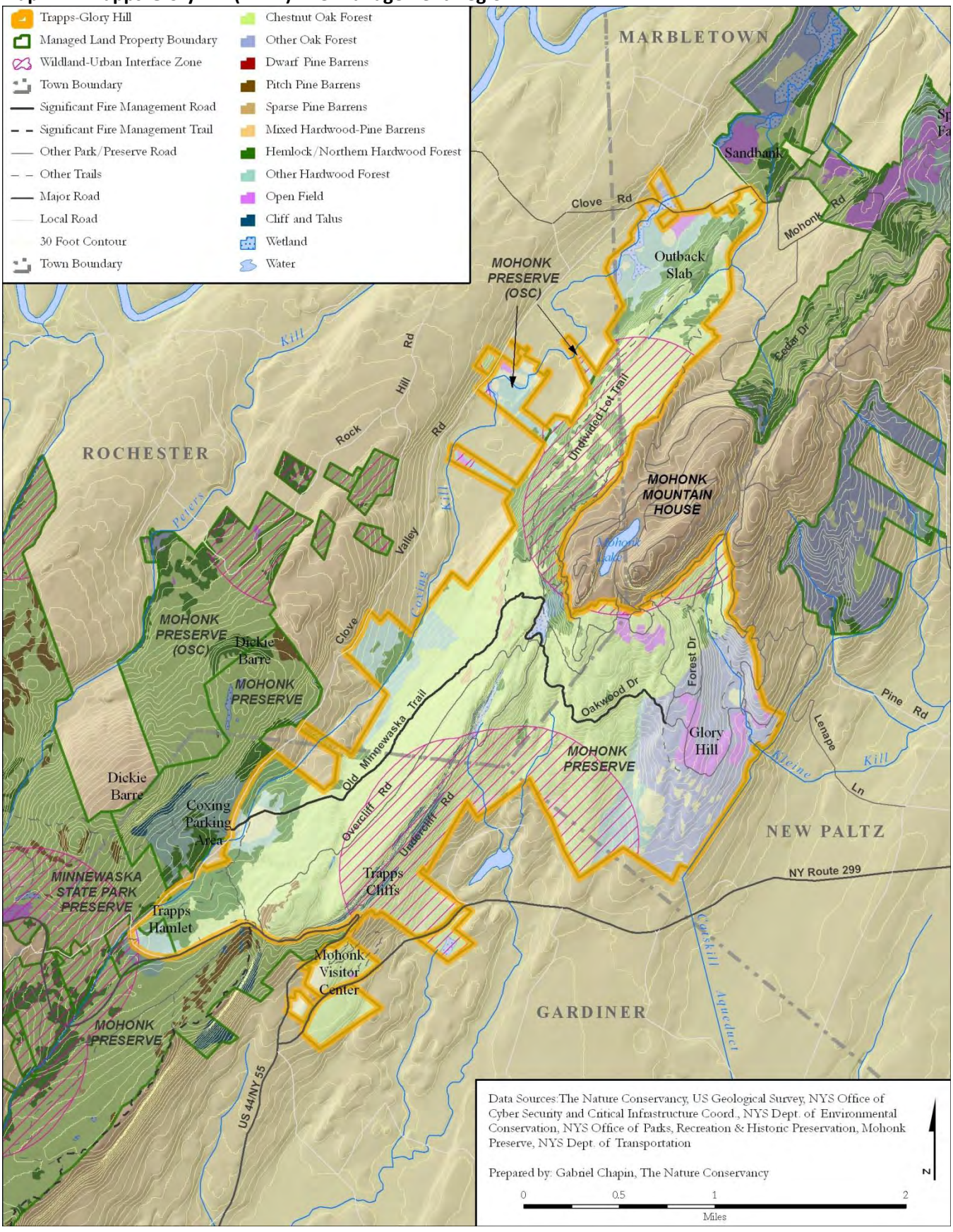
Table 2.4. Fire management regions identified for the Northern Shawangunks landscape, listed in general order from north to south.

Fire Management Region Name	Region Code	Size (acres)	Map #	General Location Description
Spring Farm-Bonticou	SPRF	2,563	2.3	Northern portion of Mohonk Preserve, including Sandbank, Spring Farm and Bonticou Crag areas extending to northern Preserve boundary; includes large disjunct parcel south of Mountain Rest Road
Trapps-Glory Hill	TRAP	3,096	2.4	Encompasses central region of Mohonk Preserve north of Route 44/55, including Trapps Cliffs, Glory Hill and Outback Slab areas
Peters Kill-Jenny Lane	PETE	3,320	2.5	Northernmost portions of Minnewaska State Park Preserve north of Route 44/55, including Jenny Lane area; also includes Dickie Barre and Ronde Barre portions of Mohonk Preserve
Millbrook Ridge	MILL	2,071	2.5	Eastern Minnewaska State Park Preserve and southern Mohonk Preserve south of Route 44/55; runs along the top of Gertrude's Nose, Millbrook Mountain and the Near Trapps cliffs; extends west to Lake Minnewaska and main entrance of park
Stony Kill-Overlooks	STON	2,888	2.6	Central-western portion of Minnewaska State Park south of Route 44/55, east of Stony Kill and north/west of Lower Awosting Rd.; extends south to Smiley Rd
Mine Hole-Witch's Hole	MINE	3,047	2.6	Southwestern portion of Minnewaska State Park Preserve northwest of the Stony Kill; Witch's Hole State Forest north of Smiley Rd.
Castle Point-Minnewaska	CAST	2,055	2.7	Central portion of Minnewaska State Park Preserve east/south of Lower Awosting Rd, including Lake Minnewaska, and extending west to Castle Point
Awosting	AWOS	3,313	2.7	Awosting Reserve and Lake Awosting areas in southern Minnewaska State Park Preserve; includes all of Palmaghatt Ravine, slope below Gertrude's Nose and Tillson Lake area
Badlands-Verkeerder Kill	BADL	3,311	2.8	Northeastern portion of Sam's Point Preserve, including Badlands and Verkeerder Kill basin areas, extending north to Smiley Road in Minnewaska State Park Preserve
North Gully-Shingle Gully	NORG	2,515	2.8	Northwest portion of Sam's Point Preserve including the North Gully drainage, extending north to the Smiley Road in Witch's Hole State Forest
Maratanza-Ice Caves-South Gully	MARA	1,711	2.9	Southern portion of Sam's Point Preserve surrounding L. Maratanza south to Losees Hill; includes the Ice Caves, Minnewaska State Park Preserve parcels on east flank of ridge, and South Gully area

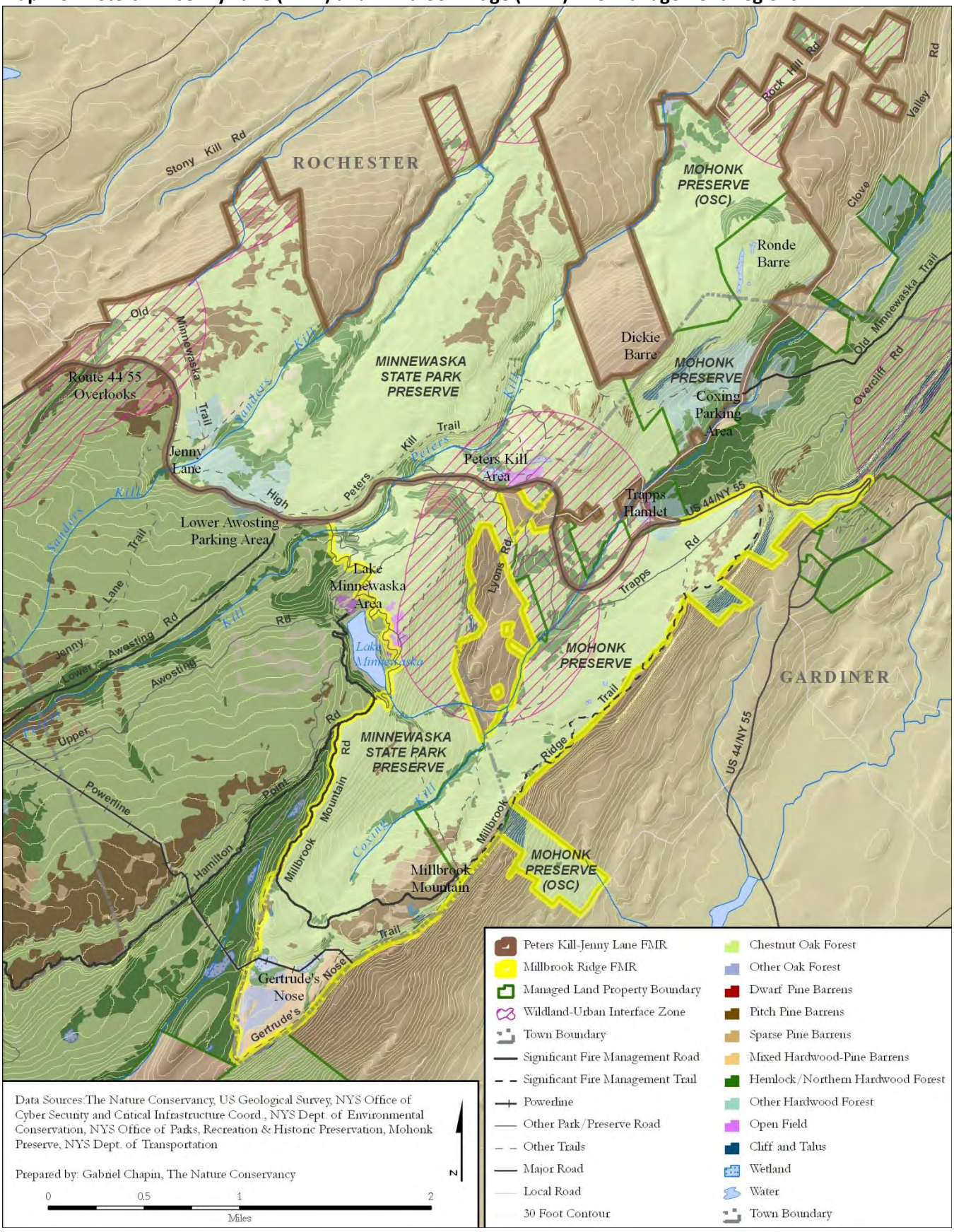
Map 2.3. Spring Farm-Bonticou (SPRF) Fire Management Region.



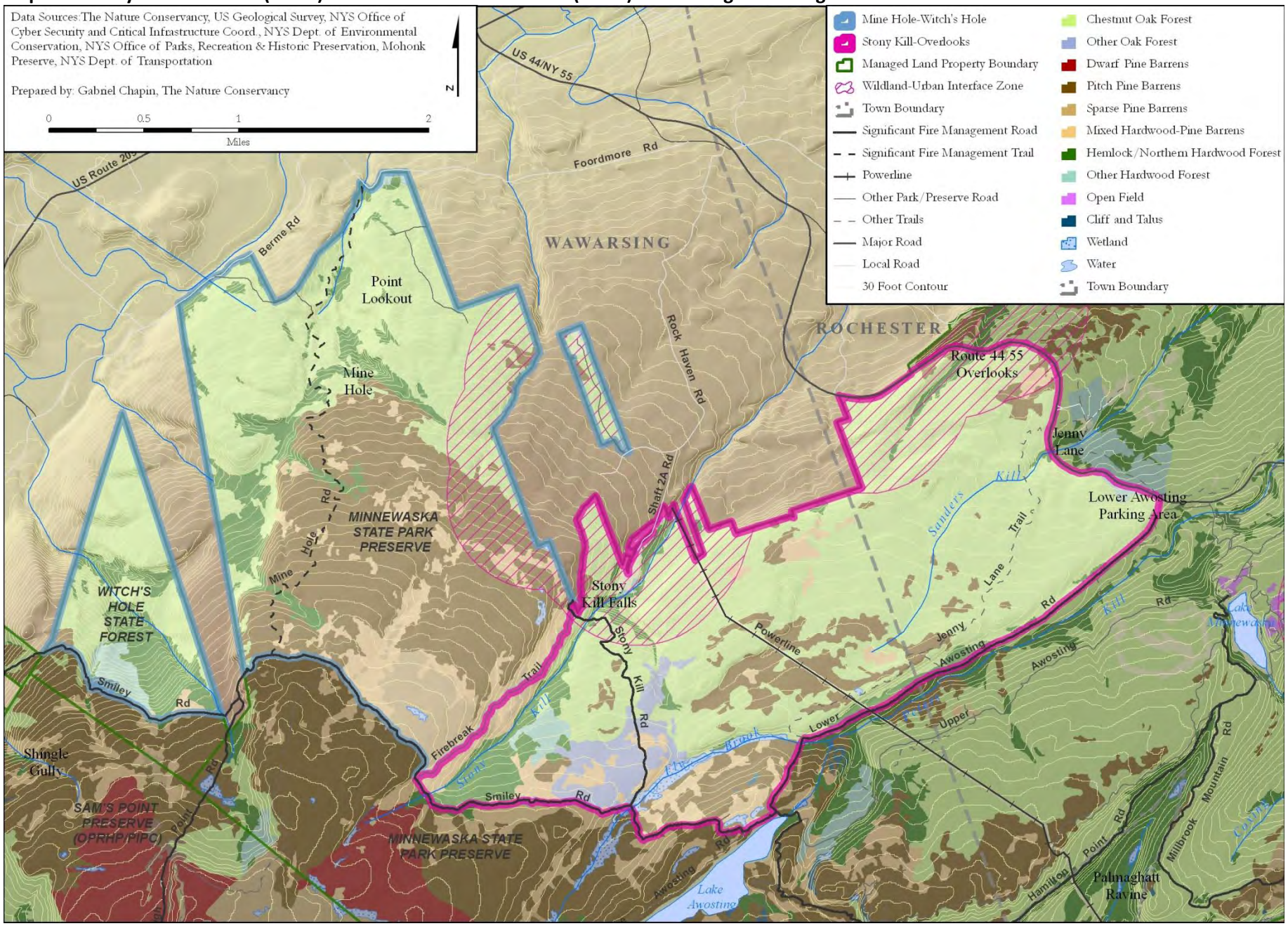
Map 2.4. Trapps-Glory Hill (TRAP) Fire Management Region.



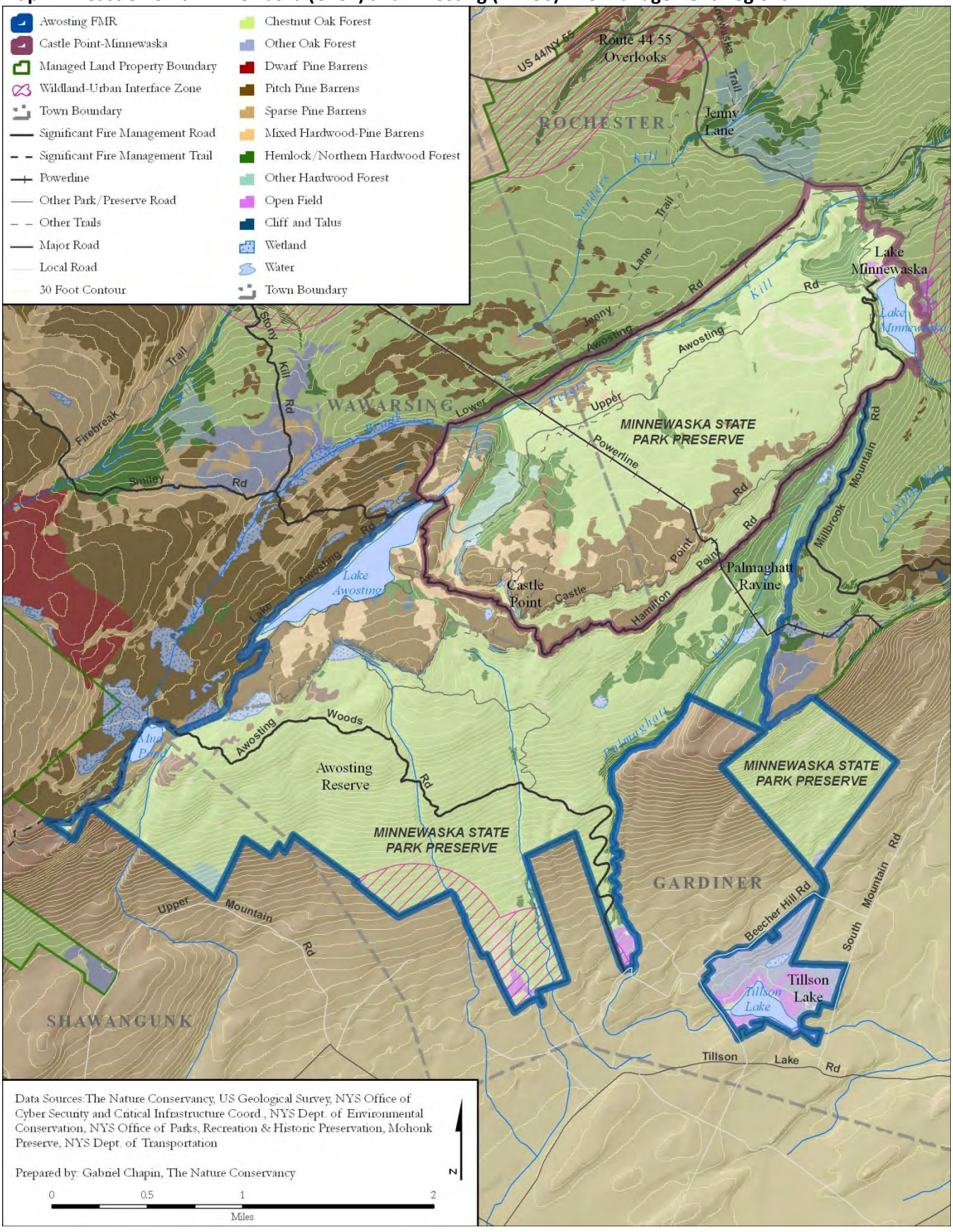
Map 2.5. Peters Kill-Jenny Lane (PETE) and Millbrook Ridge (MILL) Fire Management Regions.



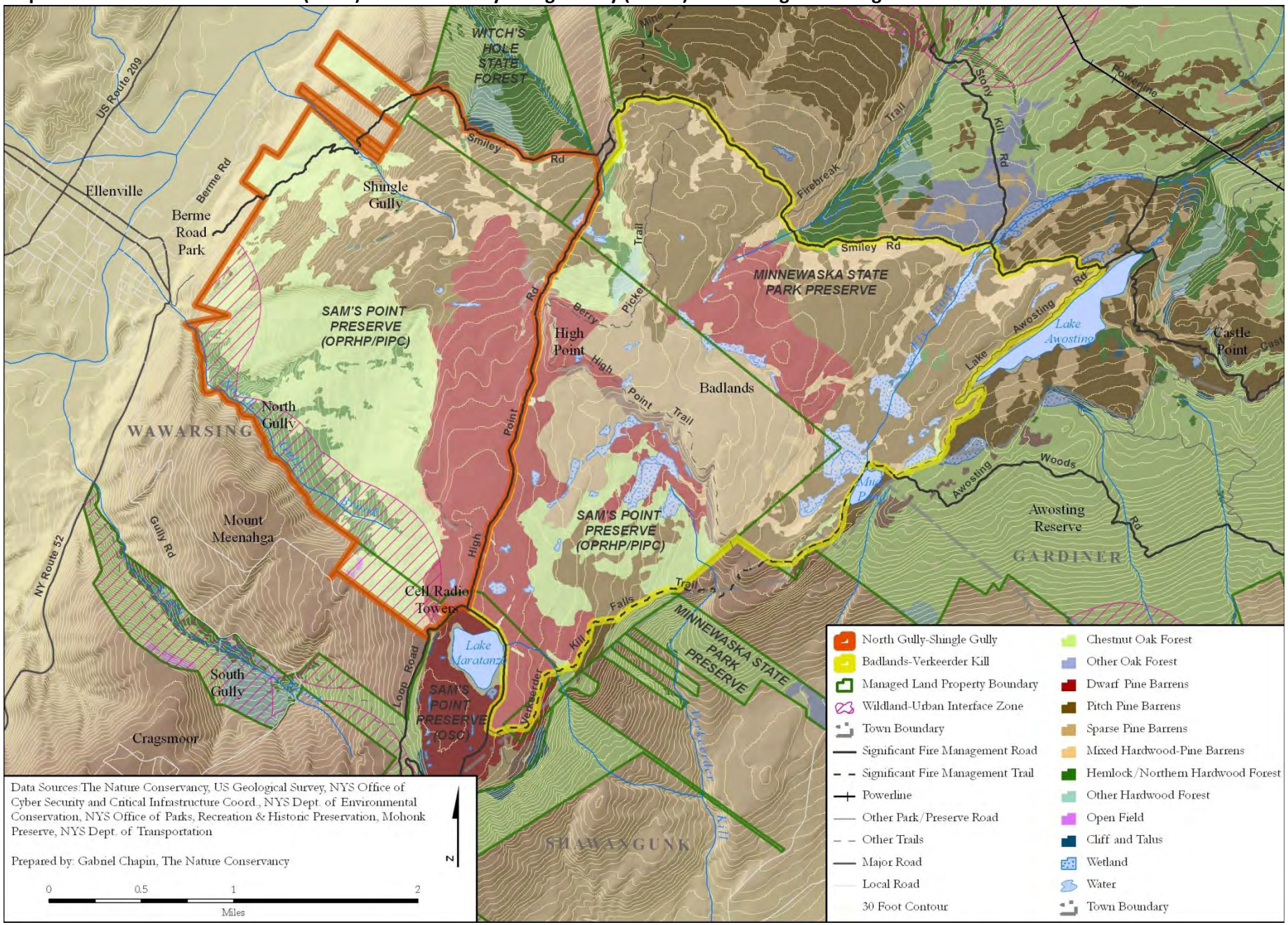
Map 2.6. Stony Kill-Overlooks (STON) and Mine Hole-Witch's Hole (MINE) Fire Management Regions.



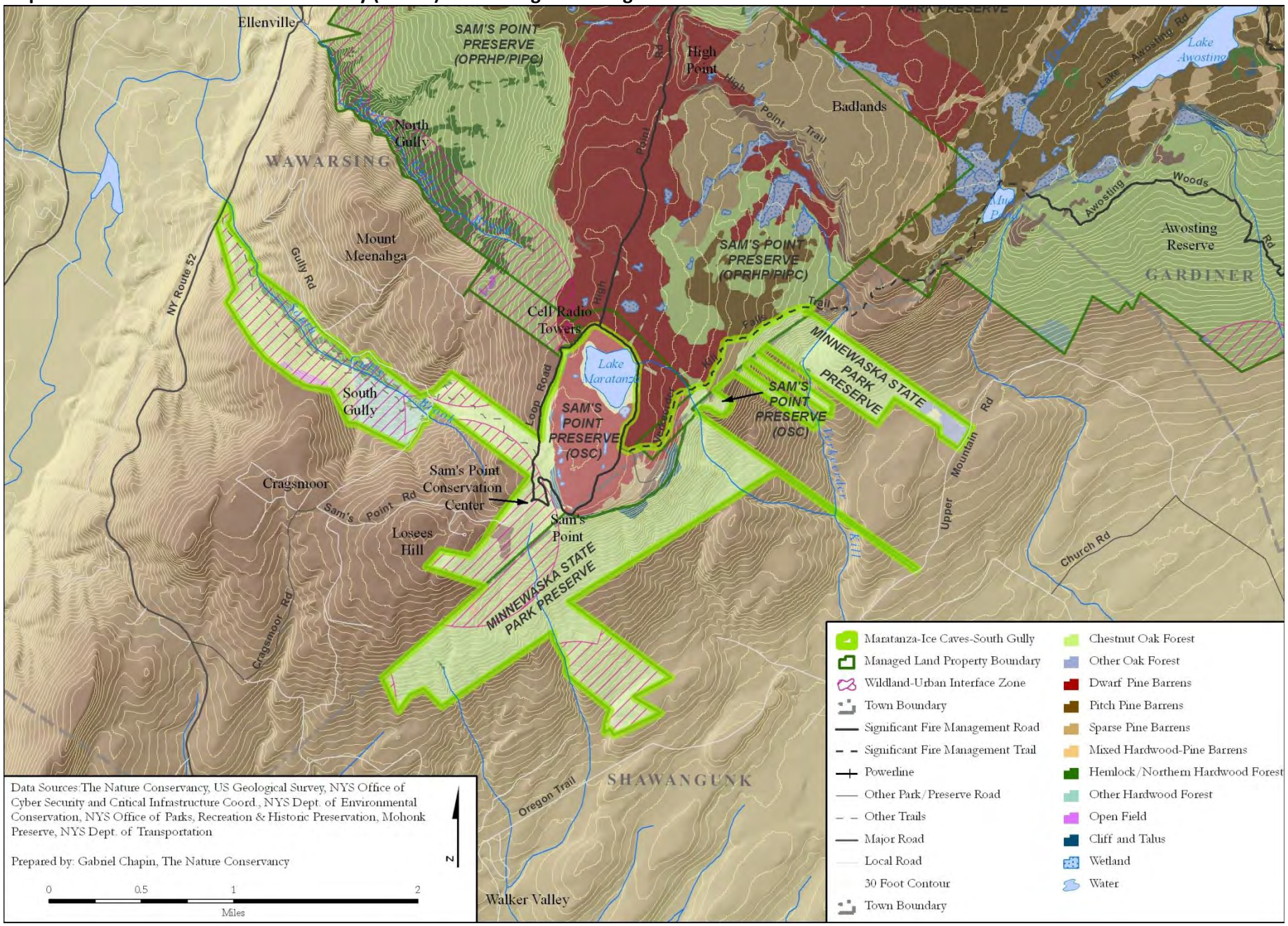
Map 2.7. Castle Point-Minnewaska (CAST) and Awosting (AWOS) Fire Management Regions.



Map 2.8. Badlands-Verkeerder Kill (BADL) and North Gully-Shingle Gully (NORG) Fire Management Regions.



Map 2.9. Maratanza-Ice Caves-South Gully (MARA) Fire Management Region.



Actions related to significant ridgewide priority roads and trails described in Section 2.4 are not discussed further under the various Fire Management Regions. A summary table of all high priority actions listed in Chapter 2 of the *Northern Shawangunk Ridge Fire Management Plan* is included in Appendix A.

The fire management region descriptions also include an assessment of the rare species that are known to exist within each region. These assessments are based on the most recently available Element Occurrence dataset provided by the New York Natural Heritage Program for all the rare species documented in the Shawangunks (NY Natural Heritage Program 2009; see complete list of species in Appendix B). Because timber rattlesnakes are known to occupy a wide range of habitats beyond the element occurrence locations documented by NY Natural Heritage Program, an Important Areas Buffer dataset was used to assess their occurrence and distribution within the various fire management regions.

Spring Farm-Bonticou Region

Table 2.5. Priority actions for the Spring Farm-Bonticou Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Prescribed Burning	• Conduct prescribed burns to promote oak regeneration and ecological management in areas around Spring Farm and Bonticou Crag	High
	• Conduct prescribed burns as feasible to maintain old field/grassland habitats at Spring Farm	Moderate
Firebreak Repair & Maintenance	• Maintain existing carriage roads, including Spring Farm Rd., Bonticou Rd. and Cedar Drive	Moderate
	• Reduce heavy fuels adjacent to existing roadways and along Northeast Trail	Moderate
Monitoring	• Conduct monitoring to determine effectiveness of prescribed fire and other treatments in promoting oak regeneration	Low

Region Description

The Spring Farm-Bonticou (SPRF) FMR covers 2,563 acres of northern Mohonk Preserve, including the Sandbank area and Spring Farm on the west slope of the Shawangunks, and Bonticou Crag and the east facing flank of the ridge above the Wallkill Valley. The region extends to the northern reaches of Mohonk Preserve lands, and includes a parcel owned by the Open Space Conservancy (OSC) at the northernmost point of the Preserve. To the south, the region also includes a large disjunct parcel south of Mountain Rest Road on the east flank of the ridge. The entire extent of the region is defined by the Mohonk Preserve property boundary.

Terrain & Fuels

The SPRF region is topographically complex and includes several vegetation and fuel types. The region includes both flanks of the Shawangunk Ridge and numerous small drainages. Chestnut oak forest is the dominant vegetation type in the southern and eastern parts of the region with sparse to moderate shrub cover. The northwestern area around Spring Farm is

dominated by beech-maple forest, and there is also a significant patch of Appalachian oak-hickory forest in the disjunct parcel south of Mountain Rest Road. The primary fuel type in both of these areas is hardwood leaf litter. Scattered pockets of hemlock forest occur on the west facing slopes above Spring Farm.

Access Routes & Firebreaks

There are numerous access routes in the western part of the region originating from the Spring Farm trailhead, including Spring Farm Road, Cedar Drive and Bonticou Road which provide vehicle access to the central portion of the region. Cedar Drive and Bonticou Road are also accessible off of Mohonk Road near the Mohonk Mountain House main entrance. The Northeast Trail provides access by foot to the north and south through the central portion of the region along the top of the Bonticou Crag ridgeline. It also forms a significant firebreak in the region in a relatively flammable fuel type, as there are no other maintained roads or trails in the eastern portion of the region along the slopes above Canaan Road and Springtown Road, nor in the disjunct parcel to the south. Foot and/or UTV access to the northern part of the region is via the Table Rocks Trail to the west and the old Clearwater Road, a former road and trail, which runs through the northeastern portion of the region.

Rare Species

The region also includes several rare species occurrences, described in Table 2.6.

Table 2.6. Rare plant and animal species occurrences documented in the Spring Farm-Bonticou Fire Management Region.

Common Name	Scientific Name	NYS Listing
Peregrine Falcon	*Falco peregrinus*	Endangered
Tawny Emperor	*Asterocampa clyton*	Unlisted
Timber Rattlesnake	*Crotalus horridus*	Threatened
Rough Avens	*Geum virginianum*	Endangered
Two-ranked Moss	*Pseudotaxiphyllum distichaceum*	Unlisted
Violet Wood Sorrel	*Oxalis violacea*	Threatened

Fire Sensitive Features & WUI

The region is one of few in the Shawangunks that does not include any designated WUI zones; however, the SPRF region does include several significant fire sensitive features including the barn and storage facilities, a private residence and trailhead kiosk in the vicinity of Spring Farm. The southern portion of the region lies adjacent to Mohonk Mountain House facilities along Mohonk Road near the golf course.

Trapps-Glory Hill Region

Table 2.7. Priority actions for the Trapps-Glory Hill Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Prescribed Burning	• Conduct prescribed burns for chestnut oak forest restoration and ecological management around the Trapps cliffs, Oakwood Drive and Glory Hill areas	High
	• Conduct prescribed burns as feasible to reduce hazardous shrub fuels in the Sparkling Ridge WUI area and enhance protection for the Mohonk Mountain House property and facilities	High
	• Conduct prescribed burns as feasible to maintain old field/grassland habitats at Glory Hill	Moderate
Monitoring	• Conduct intensive ecological monitoring in chestnut oak forest areas to assess the effectiveness of prescribed fire and other treatments in restoring degraded chestnut oak forest	High
Community Outreach	• Work with local communities to reduce wildfire hazard in Sparkling Ridge WUI area	Moderate
Firebreak Repair & Maintenance	• Maintain drainage and surface condition on important existing carriage roads, including Overcliff Rd., Old Minnewaska Rd., Laurel Ledge Rd., Old Stage Rd., Glory Hill Rd., Oakwood Drive and Forest Drive	Moderate
	• Manage vegetation and reduce heavy fuel accumulations directly adjacent to roadways and trails, particularly Overcliff Rd.	Moderate

Region Description

At 3,095 acres, the Trapps-Glory Hill (TRAP) FMR is a large but fragmented region at Mohonk Preserve that extends from Route 44/55 north to the Glory Hill area on the east slope of the ridge. The region extends further north to Clove Road along the west facing slopes above the Coxing Kill drainage and includes two sizeable parcels owned by OSC in the Coxing bottomlands. Due to the property configuration, the region is defined almost entirely by the property boundary of Mohonk Preserve. Route 44/55 makes up a small portion of the region boundary in the southeastern corner, and Clove Road bounds the northernmost extent of the region.

Terrain & Fuels

The TRAP FMR is one of the most topographically complex regions in the Shawangunks and is likewise highly variable with respect to fuels. The region spans both flanks of the main spine of the Shawangunks, and includes the Trapps cliffs, several small drainages in the Oakwood Drive/Glory Hill area, and flanks the Coxing Kill valley. Much of the region has relatively steep slopes, and chestnut oak forest is the predominant vegetation type. The fuels range from patches of tall, dense mountain laurel to an open leaf litter understory. Several large patches of hemlock forest exist along the slopes above the Coxing Kill.

Access Routes & Firebreaks

There are numerous vehicle access routes and substantial firebreaks in the interior of the TRAP region. The major vehicle access points are along Overcliff Road, Kleine Kill Road/Forest Drive/Oakwood Drive and Old Minnewaska Trail. Significant foot paths include the Duck Pond Trail—running from Duck Pond up to Forest Drive—and the Undivided Lot Trail which runs from the Old Minnewaska Trail northeast through the entire northwestern portion of the region out to Clove Road. Other important interior carriage road firebreaks and access routes for fire management include Laurel Ledge Road, Glory Hill Road and Old Stage Road.

Rare Species

Table 2.8 lists the NY State listed plant and animal species documented in the Trapps-Glory Hill FMR.

Table 2.8. Rare plant and animal species occurrences documented in the Trapps-Glory Hill Fire Management Region.

Common Name	Scientific Name	NYS Listing
Peregrine Falcon	*Falco peregrinus*	Endangered
Appalachian Sandwort	*Minuartia glabra*	Threatened
Mountain Spleenwort	*Asplenium montanum*	Threatened
Woodland Rush	*Juncus subcaudatus*	Endangered

Fire Sensitive Features & WUI

The region contains a large area (approximately 570 acres) of WUI zone adjacent to the Sparkling Ridge area off of Route 299. Some patches of heavy fuels exists within this WUI Zone, but the risk to these residences is mitigated somewhat by generally moderate fuel loads and prevailing topographic conditions (i.e. the community is downslope of heavy fuels. The region also includes an additional 350 acres of WUI surrounding the Mohonk Mountain House and associated grounds and facilities. The Mohonk Mountain House facilities are relatively well protected due to the presence of numerous carriage roads, and natural barriers to fire (e.g. hemlock forests, wetlands, talus slopes and cliff lines) that exist surrounding the resort facilities.

The TRAP region also includes several major fire sensitive features, including the Trapps Hamlet historic site at the extreme southwestern corner end of the region along Clove Road and the trailhead facilities at the West Trapps parking area and Trapps Bridge along Route 44/55. The Mohonk Preserve Visitor Center is also located just south of Route 44/55 at the southern end of the region and there are several parking areas and some trailhead facilities nearby.

Peters Kill-Jenny Lane Region

Table 2.9. Priority actions for the Peters Kill-Jenny Lane Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Community Outreach	• Work with local communities to reduce wildfire hazard in Laurel Hollow, Stony Kill Road, Raycliff Drive and Rock Hill Road WUI areas	High
Prescribed Burning	• Conduct initial test prescribed burns in the vicinity of the Jenny Lane parking area	High
Firebreak Repair & Maintenance	• Manage vegetation and reduce heavy fuel accumulations directly adjacent to the High Peters Kill Trail and Old Minnewaska Trail	Moderate

Region Description

The Peters Kill-Jenny Lane (PETE) FMR covers 3,320 acres of the northwest portion of Minnewaska State Park Preserve and a portion of west-central Mohonk Preserve west of Clove Valley Road. This includes several parcels owned by OSC surrounding Dickie Barre, as well as several disjunct parcels of Mohonk Preserve and OSC land near Rock Hill Road. Due to the configuration of the properties and the lack of significant constructed features, the majority of the region is defined by the park/preserve boundaries. To the south, the region is bordered by Route 44/55 and Clove Valley Road forms the eastern edge of the region.

Terrain & Fuels

The terrain in the PETE region is generally moderately sloping to the northeast. Steeper slopes exist along the Sanders Kill and Peters Kill drainages, and on the southeast slopes of the Dickie Barre and Ronde Barre areas. Vegetation in the region is dominated by chestnut oak forest with patches of hemlock forest along the Sanders Kill and Peters Kill. Several small to moderate sized patches of pitch pine woodland are also scattered throughout the region. Shrub fuels in the chestnut oak forest are variable but generally moderate to heavy with significant patches of dense, tall mountain laurel.

Access Routes & Firebreaks

Most of the region is not easily accessible. Parts of Old Minnewaska Trail and the Jenny Lane Trail are passable by UTV or four wheel drive truck but access is limited to the vicinity of the Jenny Lane parking area. The Old Minnewaska Trail is a former road that runs north along the western edge of the region, before leaving park property onto the Old Minnewaska Trail town road. The vast majority of foot trails in the region are concentrated around the Peters Kill climbing area. The High Peters Kill Trail runs north from Route 44/55 into the central portion of the region before cutting east out to the Coxing Kill parking area at Mohonk Preserve. A series of short trails flank the Peters Kill and intersect the High Peters Kill Trail.

Rare Species

The Peters Kill-Jenny Lane FMR includes several rare species which are listed below in Table 2.10.

Table 2.10. Rare plant and animal species occurrences documented in the Peters Kill-Jenny Lane Fire Management Region.

Common Name	Scientific Name	NYS Listing
Arrowhead Spiketail	*Cordulegaster obliqua*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Carey's Smartweed	*Persicaria careyi*	Threatened
Mountain Spleenwort	*Asplenium montanum*	Threatened

Fire Sensitive Features & WUI

The PETE region has a substantial WUI zone of approximately 832 acres. A portion of this area is near residences along Lyons Road which is separated from the region by Route 44/55. A larger portion of the WUI zone lies in the northern portions of the PETE region adjacent to Laurel Hollow Estates and residences along Stony Kill Road in Kerhonkson, Raycliff Drive in Accord and Rock Hill Road near Alligerville.

Other fire sensitive features include the Peters Kill office and parking area at Minnewaska State Park Preserve, and the Mohonk Preserve's Coxing parking area and trailhead facilities along Clove Road. The Trapps Hamlet historic site also covers a small area in the southern part of the region.

Millbrook Ridge Region

Table 2.11. Priority actions for the Millbrook Ridge Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Firebreak Repair & Maintenance	• Reduce fuel accumulations and improve surface condition on Gertrude's Nose Trail and Millbrook Mountain Trail	High
	• Manage vegetation along Coxing Trail, Millbrook Cross Trail and Bayards Path to improve utility as firebreaks	Moderate
	• Maintain Trapps Road as access route and firebreak	Moderate
Community Outreach	• Work with local communities to reduce wildfire hazard in Lyons Road WUI area	Moderate
Prescribed Burning	• Conduct prescribed burns as feasible to reduce fuels in sensitive areas and/or along roads and trails	Low
	• Conduct prescribed burns as feasible for ecological management in chestnut oak forest	Low

Region Description

The Millbrook Ridge (MILL) FMR includes 2,071 acres of southern Mohonk Preserve and Minnewaska State Park Preserve along the top of Millbrook Ridge and Gertrude's Nose and east and south of Lake Minnewaska. A parcel owned by OSC and managed by Mohonk Preserve extends down the flanks of the ridge to North Mountain Road north of Millbrook Mountain. The region is bounded by Route 44/55 to the north and Lake Minnewaska Road, Millbrook Mountain

Road and the Gertrude's Nose Trail to the west. The remainder of the region is defined by the property boundaries of Minnewaska State Park Preserve and Mohonk Preserve. The MILL region also surrounds a small inholding of private land along Lyons Road.

Terrain & Fuels

Topography in the region is variable, but the region is defined by higher areas to the east and west with the Coxing Kill drainage running through the center from southwest to northeast. The dominant vegetation type is chestnut oak forest with low to moderate shrub fuels, although pockets of heavier fuels exist. Along the top of Gertrude's Nose and Millbrook Mountain there are also small patches of pitch pine barrens and woodlands. A small ribbon of hemlock forest also lines the upper Coxing Kill.

Access Routes & Firebreaks

There are several roads and numerous trails that penetrate into the southern region, including the Millbrook Mountain Road near Gertrude's Nose and the Trapps Road at the northern end of the region. The Millbrook Mountain Trail is an important interior firebreak and access route that cuts from the top of Millbrook Mountain north to Lake Minnewaska. The Gertrude's Nose Trail is also a significant feature providing access to the southwestern portion of the region above the cliff tops surrounding Gertrude's Nose.

The Coxing Trail runs northeast from the Millbrook Mountain Trail through the eastern portion of the region. The Coxing Trail is also paralleled by the Millbrook Ridge Trail, a significant ridgewide firebreak, which runs along the easternmost edge of the region. The Millbrook Cross Trail and Bayards Path connect the Coxing Trail to the Millbrook Ridge Trail.

The northern portion of the region east of Lake Minnewaska is somewhat more developed. There are several roads, including the Awosting Falls Road and Beacon Hill Road, as well and the Beacon Hill Trail.

Rare Species

The Millbrook Ridge FMR includes many rare plant and animal species which are listed below in Table 2.12.

Table 2.12. Rare plant and animal species occurrences documented in the Millbrook Ridge Fire Management Region.

Common Name	Scientific Name	NYS Listing
A Noctuid Moth	*Zale curema*	Unlisted
Blueberry Gray Moth	*Glena cognataria*	Unlisted
Peregrine Falcon	*Falco peregrinus*	Endangered
Pine Barrens Zanclognatha Moth	*Zanclognatha martha*	Unlisted
Toothed Apharetra Moth	*Apharetra dentata*	Unlisted
Anderson's Peat Moss	*Sphagnum andersonianum*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Broom Crowberry	*Corema conradii*	Endangered
Clustered Sedge	*Carex cumulata*	Threatened
Georgia Bulrush	*Scirpus georgianus*	Endangered
Mountain Spleenwort	*Asplenium montanum*	Threatened

Fire Sensitive Features & WUI

The MILL region has a substantial WUI zone of approximately 490 acres near Lyons Road. The residences in this area are somewhat protected by existing roads, general topographic conditions and several patches of hemlock forest.

The region contains several fire sensitive features, including the main maintenance facility for the park which lies just inside the region boundary to the east of the Lake Minnewaska Road. There are also several structures including a small barn and bathrooms along the Lake Minnewaska Road. The most heavily developed portions of the park lie just outside the region boundary to the west of Lake Minnewaska Road (see Castle Point-Minnewaska region description). The electrical transmission line cuts across the tip of Gertrude's Nose through the southern part of the region. Both the powerlines and the supporting poles could be damaged by high intensity fire.

Stony Kill-Overlooks Region

Table 2.13. Priority actions for the Stony Kill-Overlooks Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Community Outreach	• Work with local community to reduce wildfire hazard in Decker Road WUI area	High
Prescribed Burning	• Conduct research prescribed burns in the 2008 Overlooks wildfire area to examine effects of repeated short interval burns	High
Monitoring	• Continue to monitor ecological recovery following wildfire and subsequent prescribed burns	High
Firebreak Repair & Maintenance	• Manage vegetation/fuels and maintain access along Firebreak Trail • Manage vegetation along Jenny Lane Trail	Moderate Moderate

Region Description

The Stony Kill-Overlooks (STON) FMR covers 2,888 acres in north-central Minnewaska State Park Preserve. The region is bounded by the Firebreak Trail—a dozer line installed during the 2008 Minnewaska wildfire—and the Smiley Road to the west, the Lower Awosting Road to the south and Route 44/55 to the east. Nearly the entire northern edge of the region is formed by the Minnewaska State Park Preserve boundary.

Terrain & Fuels

The region occupies a large, broad north/northwest facing slope that includes steeper slopes in the Stony Kill drainage area. The vast majority of the region burned in the 2008 Minnewaska wildfire—often referred to as the Overlooks Fire. Prior to that, the region was dominated by chestnut oak forest with some of the heaviest mountain laurel shrub fuels on the entire ridge. Following the fire, shrubs are recovering and creating a dense but relatively short (< 1.5 feet) shrub layer. Some patches of pitch pine woodland exist throughout the unit and a hemlock forest dominates the eastern flank of the Stony Kill drainage.

Access Routes & Firebreaks

The STON region has very limited interior access except for the Stony Kill Road and Jenny Lane Trails. The Stony Kill Road is accessible off of the Smiley Road and runs through the far western portion of the region. It was severely impacted by bulldozers during the 2008 wildfire and is currently accessible only by off-road vehicle. The Jenny Lane Trail runs somewhat parallel to the Lower Awosting Road through the central portion of the region and then bends northward and exits the region across Route 44/55 to the Jenny Lane parking area.

The large electrical transmission line runs through the central portion of the region aligned approximately southeast to northwest. The powerline cut is approximately 100 feet across and consists of low stature vegetation and open bedrock outcrops, although some areas support relatively dense and continuous flammable fuels. The southern portion is ATV/UTV accessible; northern areas are accessible only by foot due to rock ledges.

Rare Species

The Stony Kill-Overlooks FMR includes a number of rare species which are listed below in Table 2.14.

Table 2.14. Rare plant and animal species occurrences documented in the Stony Kill-Overlooks Fire Management Region.

Common Name	Scientific Name	NYS Listing
A Noctuid Moth	*Zale curema*	Unlisted
Eastern Small-footed Myotis Bat	*Myotis leibii*	Special Concern
Pine Barrens Zanclognatha Moth	*Zanclognatha martha*	Unlisted
Timber Rattlesnake	*Crotalus horridus*	Threatened
Toothed Apharetra Moth	*Apharetra dentata*	Unlisted
Anderson's Peat Moss	*Sphagnum andersonianum*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Black-edge Sedge	*Carex nigromarginata*	Endangered
Clustered Sedge	*Carex cumulata*	Threatened
Rhodora	*Rhododendron canadense*	Threatened

Fire Sensitive Features & WUI

The STON region has nearly 600 acres of WUI zone where the northern edge borders communities near the Shaft 2A Road/Rock Haven Road and the Kerhonkson Heights/Park Lane areas. Both of these communities were significantly threatened by the Overlooks Fire. The WUI zone in this region also borders the Laurel Hollow area, but is separated by Route 44/55.

The most significant fire sensitive feature in the region is the electrical transmission line and the associated wooden support poles, which could be damaged by high intensity fire. The region also includes several structures around Lake Awosting, including a former ranger cabin and several small cabins from a former camp. At the easternmost corner of the region, there are trailhead facilities and bathrooms at the Lower Awosting parking area.

Mine Hole-Witch's Hole Region

Table 2.15. Priority actions for the Mine Hole-Witch's Hole Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Community Outreach	• Work with local community to reduce wildfire hazard in Decker Road WUI area	High
Wildfire Suppression	• Promote the use of indirect wildfire suppression tactics when possible to minimize impacts to pine barrens in the upper Mine Hole area	High
Prescribed Burning	• Conduct prescribed burns in lower Mine Hole area for ecological management in oak forest and pine barrens	Moderate
	• Conduct prescribed burns as feasible around fringes of region to reduce fuels, reinforce firebreaks around large area of heavy fuel and enhance protection of the Decker Road WUI area	Moderate
Firebreak Repair & Maintenance	• Manage fuels along existing trails and woods roads in Mine Hole area as feasible to maintain suitability as firebreaks	Low

Region Description

The 3,047-acre Mine Hole-Witch's Hole (MINE) FMR consists of portions of the Witch's Hole State Forest that lie to the north of the Smiley Road, and the Mine Hole area of Minnewaska State Park Preserve that lies north of the Smiley Road and west of the Firebreak Trail. The two main portions of the MINE region are non-contiguous, separated by a narrow parcel of private land. The majority of the region is defined by the state forest/park property boundaries. The region also contains another small disjunct Minnewaska State Park Preserve parcel to the east of the Mine Hole area.

Terrain & Fuels

This region contains some of the most rugged terrain on the Shawangunk Ridge in Witch's Hole State Forest. This area has several steep west/northwest oriented drainages flanked by hemlock forest, but also supports chestnut oak forest with moderate to heavy shrub fuels. The Mine Hole area contains patches of chestnut oak forest—including areas that have been subject to logging activities—on lower slopes to the north. Shrub fuels are present in the region but moderate. The southern portion of the Mine Hole area is a broad north facing slope that supports a large patch of sparse pitch pine barrens. Although shrub fuels dominate this area, they are somewhat discontinuous with numerous rock outcrops present.

Access Routes & Firebreaks

The Witch's Hole portion of the region has several trails, but is largely inaccessible except for areas along the Smiley Road. The lower northern portion of the Mine Hole area contains numerous old logging and/or woods roads as well as both maintained and unmaintained trails. The old Mine Hole Road runs from the Smiley Road through the middle of the Mine Hole area and out onto Foordmore Road in Kerhonkson. Several former roads and trails also run through the upper Mine Hole area and adjacent private land, but they are rough and overgrown and are not suitable as firebreaks in their current condition.

Rare Species

Rare plant and animal species which have been documented in the Mine Hole-Witch's Hole Fire Management Region are listed below in Table 2.16.

Table 2.16. Rare plant and animal species occurrences documented in the Mine Hole-Witch's Hole Fire Management Region.

Common Name	Scientific Name	NYS Listing
Timber Rattlesnake	*Crotalus horridus*	Threatened
Appalachian Sandwort	*Minuartia glabra*	Threatened
Rhodora	*Rhododendron canadense*	Threatened

Fire Sensitive Features & WUI

The MINE region includes approximately 380 acres of WUI zone adjacent to residences along Decker Road. This area is highly vulnerable to wildfire and was significantly threatened by the 2008 wildfire at Minnewaska State Park Preserve.

Along Smiley Road in the upper Mine Hole area, there are several historic berry picker camps which contain a variety of cultural artifacts that could be damaged by fire. No other significant fire sensitive features exist.

Castle Point-Minnewaska Region

Table 2.17. Priority actions for the Castle Point-Minnewaska Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Prescribed Burning	• Conduct test prescribed burns in the former golf course area to assess fire behavior and ecological impacts in oak forest damaged by gypsy moth	High
	• Conduct prescribed burns as feasible around fringes of region to reduce fuels and reinforce firebreaks around large area of heavy fuel	High
	• Conduct prescribed burns around improved areas as necessary and practical to reduce fuels	Moderate
Firebreak Repair & Maintenance	• Conduct necessary repairs and manage fuels along Upper Awosting Road and Castle Point Road	High
	• Manage fuels along Blueberry Run and Rainbow Falls trails to enhance interior access routes and firebreaks	Low
Monitoring	• Conduct ecological monitoring in oak forest areas that have been impacted by gypsy moths and assess fire effects following prescribed burns	Moderate

Region Description

The Minnewaska-Castle Point (CAST) FMR is a relatively small 2,055-acre region that occupies the area roughly between Lake Minnewaska and Castle Point at Minnewaska State Park Preserve. The unit is bounded by Lower Awosting Road to the north, Castle Point and Lake

Awosting roads to the west, Hamilton Point Road to the south and Lake Minnewaska Road (east of Lake Minnewaska) to the east.

Terrain & Fuels

The region includes a large contiguous patch of chestnut oak forest on a moderate to steep north facing slope between Lower Awosting Road and Castle Point Road that has been severely impacted by gypsy moth (*Lymantria dispar)*. The area includes very heavy shrub fuels, numerous standing dead snags and downed logs. At the southwestern end of the region, the vegetation changes to pine barrens and woodlands with increasing elevation. Fuels include relatively heavy shrubs. Hemlock forest predominates along the Peters Kill in the northwestern and northern parts of the FMR.

Access Routes & Firebreaks

The center of the CAST region contains a large patch of relatively inaccessible forest. Vehicle access inside the region is limited to the fringes along Upper Awosting Road, through the old golf course area, and along Castle Point Road. The Blueberry Run and Rainbow Falls trails cut through the western half of the region and the Mossy Glen Trail provides foot access along the Peters Kill parallel to the Lower Awosting Road. The region is also bisected by the 30-meter wide powerline cut, which provides limited ATV/UTV access into the interior of the region. Portions of the powerline cut are covered with fairly dense, continuous fuels with only a moderate footpath to provide access.

Rare Species

The Castle Point-Minnewaska Fire Management Region includes a number of rare species which are listed below in Table 2.18.

Table 2.18. Rare plant and animal species occurrences documented in the Castle Point-Minnewaska Fire Management Region.

Common Name	Scientific Name	NYS Listing
A Noctuid Moth	*Zale curema*	Unlisted
Arrowhead Spiketail	*Cordulegaster obliqua*	Unlisted
Eastern Small-footed Myotis Bat	*Myotis leibii*	Special Concern
Pine Barrens Zanclognatha Moth	*Zanclognatha martha*	Unlisted
Timber Rattlesnake	*Crotalus horridus*	Threatened
Toothed Apharetra Moth	*Apharetra dentata*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Flat-leaved Peat Moss	*Sphagnum platyphyllum*	Unlisted
Mountain Spleenwort	*Asplenium montanum*	Threatened
Rhodora	*Rhododendron canadense*	Threatened
Soft-leaved Peat Moss	*Sphagnum tenellum*	Unlisted
Trinidad Peat Moss	*Sphagnum trinitense*	Unlisted

Fire Sensitive Features & WUI

There are numerous improved facilities within this FMR, including the former Phillips residence, the Nature Center and other structures in the vicinity of the main Lake Minnewaska parking area. There is also a privately owned residence adjacent to the parking area, and several restroom facilities near the parking area and swimming beach at Lake Minnewaska. The region is completely surrounded by Minnewaska State Park Preserve lands and has no WUI or adjacent private property.

Awosting Region

Table 2.19. Priority actions for the Awosting Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Prescribed Burning	• Conduct prescribed burns in the Awosting Reserve area for ecological management in chestnut oak forest	High
	• Conduct prescribed burns as feasible around Lake Awosting for ecological management in pine barrens	High
Firebreak Repair & Maintenance	• Maintain accessibility and manage fuels along woods roads through Awosting Reserve, Lake Awosting Road and Spruce Glen and Wolf Jaw Trails	Moderate
	• Reduce and maintain fuel loads along Scenic Trail to improve functionality as firebreak	Moderate
Community Outreach	• Work with local community to reduce wildfire hazard in adjacent WUI communities	Moderate

Region Description

The expansive 3,313-acre Awosting (AWOS) FMR extends across the area in southeastern Minnewaska State Park Preserve known as Awosting Reserve, as well as the Palmaghatt Ravine, and the area immediately surrounding Lake Awosting. The region also includes two semi-disjunct parcels including the Tillson Lake area and a roughly square area upslope of Tillson Lake below Gertrude's Nose. The entire western and southern boundary of the AWOS region is formed by the Minnewaska State Park Preserve boundary. The Scenic Trail, Lake Awosting Road, Castle Point Road and Hamilton Point Road comprise the northern border and the Millbrook Mountain Road defines the eastern extent of the region.

Terrain & Fuels

The vast majority of the region supports chestnut oak forest on a broad south/southeast facing flank of the ridge. Due to previous land use and site conditions, fuels are generally limited to low shrub types dominated by huckleberry and blueberry. This oak forest flank grades into the hemlock dominated Palmaghatt Ravine that occupies the eastern end of the FMR. This area has very steep slopes and low to moderate fuel loads, with isolated pockets of heavier shrub fuels. The AWOS region also includes a relatively small area on the ridge top immediately surrounding Lake Awosting. This area contains pitch pine woodlands with some relatively heavy shrub fuel loads of mountain laurel and huckleberry. The Tillson Lake area is dominated by somewhat less

volatile oak-hickory forest. Areas of the AWOS region have large populations of multiple invasive plant species, particularly in the Tillson Lake and Lower Awosting Reserve areas.

Access Routes & Firebreaks

The AWOS region has good vehicle access throughout much of the Awosting Reserve—due to the construction of numerous woods roads when the property was privately owned—as well as around Lake Awosting. There are also several foot trails, including the Scenic Trail, which run along the top of the Awosting escarpment and several ATV/UTV accessible spurs—the Wolf Jaw and Spruce Glen trails—that connect the Scenic Trail to Lake Awosting Road. The remaining areas of the region are relatively inaccessible, particularly the Palmaghatt Ravine area, but several access routes exist around Tillson Lake.

Rare Species

The Awosting Fire Management Region includes several rare species which are listed below in Table 2.20.

Table 2.20. Rare plant and animal species occurrences documented in the Awosting Fire Management Region.

Common Name	Scientific Name	NYS Listing
A Noctuid Moth	*Zale curema*	Unlisted
Pine Barrens Zanclognatha Moth	*Zanclognatha martha*	Unlisted
Timber Rattlesnake	*Crotalus horridus*	Threatened
Toothed Apharetra Moth	*Apharetra dentata*	Unlisted
Anderson's Peat Moss	*Sphagnum andersonianum*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Broom Crowberry	*Corema conradii*	Endangered
Clustered Sedge	*Carex cumulata*	Threatened
Mountain Spleenwort	*Asplenium montanum*	Threatened
Rhodora	*Rhododendron canadense*	Threatened
Woodland Rush	*Juncus subcaudatus*	Endangered

Fire Sensitive Features & WUI

The Awosting region includes approximately 190 acres of WUI in the vicinity of Campfire Road and Sheldon Road. Although not formally designated as WUI, there are also numerous structures on adjacent private property near the Awosting Reserve main access road, and several residences in the vicinity of Tillson Lake.

The major fire sensitive features in the Awosting Fire Management Region are structures on Minnewaska State Park Preserve land around Tillson Lake. There are also restroom facilities at the Lake Awosting swimming area.

Badlands-Verkeerder Kill Region

Table 2.21. Priority actions for the Badlands-Verkeerder Kill Fire Management Region

Priority Action Type	General Description of Actions	5-year Priority
Wildfire Suppression	• Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to potentially sensitive Badlands area and upper Verkeerder Kill watershed	High
Firebreak Repair & Maintenance	• Manage adjacent vegetation and fuels along High Point Trail to improve suitability as firebreak	High
	• Maintain vehicle access and reduce fuels along the Lake Awosting Road to the west and south of the lake	Moderate
	• Manage fuels adjacent to the Berry Picker Trail	Moderate
Prescribed Burning	• Conduct prescribed burns along fringes of region as feasible to reduce fuels and create buffers for managing wildfire	Moderate
Monitoring	• Conduct ecological monitoring in sparse dwarf pine barrens to assess current condition	Low

Region Description

At 3,311 acres, the Badlands-Verkeerder Kill (BADL) FMR is among the largest on the ridge and includes a significant amount of remote and relatively inaccessible lands at Sam's Point Preserve and southern Minnewaska State Park Preserve. The land covered by the region at Sam's Point Preserve is largely owned by OPRHP/PIPC, but managed by The Nature Conservancy. The southern portion of the region extends onto OSC lands north and west of the Loop Road.

The BADL region is bounded by the High Point Road to the west, the Loop Road and Ice Caves Road to the south, the Verkeerder Kill Falls Trail, Scenic Trail and Lake Awosting Road to the east, and the Smiley Road to the north. Portions of the Verkeerder Kill Falls Trail and Scenic Trail extend off of SRBP managed lands, and in these areas the FMR is limited to the Sam's Point Preserve/Minnewaska State Park Preserve boundaries.

Terrain & Fuels

The southern portion of this region lies in the Verkeerder Kill drainage basin, and consists of a mixture of dwarf pine ridge, sparse dwarf pine barrens, and chestnut oak forest vegetation. The area is thick and brushy, and supports dense shrub fuel types, although some areas are relatively moist. The northern portion of this region is a slightly elevated, gently north sloping plateau above the High Point escarpment. It contains large patches of sparse dwarf pine barrens (i.e. ~~"b~~badlands" vegetation) characterized by numerous rock outcrops, as well as patches of dwarf pine ridge and pitch pine woodland communities.

Access Routes & Firebreaks

The High Point Trail and Berry Picker Trail are the only maintained access routes into the interior of this fire management region. In addition to serving as an important access route, the

High Point Trail is a potentially significant firebreak on the interior of the region due to the presence of exposed rock outcrops and the lack of other suitable firebreaks. However it does run through some areas with heavy fuels. Vehicle access is limited to four-wheel drive truck/UTV along the High Point Road, Lake Awosting Road and portions of the Smiley Road on the margins of the region.

Rare Species

Table 2.22 lists the rare species documented in the Badlands-Verkeerder Kill Fire Management Region.

Table 2.22. Rare plant and animal species occurrences documented in the Badlands-Verkeerder Kill Fire Management Region.

Common Name	Scientific Name	NYS Listing
Northern Barrens Tiger Beetle	*Cicindela patruela patruela*	Unlisted
Timber Rattlesnake	*Crotalus horridus*	Threatened
Toothed Apharetra Moth	*Apharetra dentata*	Unlisted
Anderson's Peat Moss	*Sphagnum andersonianum*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Clustered Sedge	*Carex cumulata*	Threatened
Mock-pennyroyal	*Hedeoma hispida*	Threatened
Mountain Spleenwort	*Asplenium montanum*	Threatened
Rhodora	*Rhododendron canadense*	Threatened
Two-ranked Moss	*Pseudotaxiphyllum distichaceum*	Unlisted
Woodland Rush	*Juncus subcaudatus*	Endangered

Fire Sensitive Features & WUI

Given the relatively remote nature of this region, it does not contain any area in a WUI zone. A small portion of the eastern edge borders adjacent private land.

There are no improved park/preserve facilities within the region and the only significant fire sensitive features are an old cabin on the ridge above Lake Awosting in the northeast corner of the region and another small cabin located 0.6 miles northwest of Mud Pond in the badlands area of Sam's Point Preserve. This cabin is maintained by a private individual under license agreement with The Nature Conservancy. Several large radio/cell towers are located outside but directly adjacent to the BADL region near the intersection of High Point Road and Loop Road.

North Gully-Shingle Gully Region

Table 2.23. Priority Actions for the North Gully-Shingle Gully Fire Management Region.

Priority Action Type	General Description of Actions	5-year Priority
Mechanical Fuel Reduction Treatments	• Reduce fuels mechanically or by hand around the cell/radio towers to prevent damage from a wildfire or prescribed burn	High
Wildfire Suppression	• Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to rare dwarf pine barrens in eastern and northern portions of region	High
Prescribed Burning	• Conduct prescribed burns along fringes of the region as feasible to reduce fuels and create buffers for managing wildfire	High
	• Conduct initial small hazard reduction burns in vicinity of cell/radio towers	Moderate
	• Conduct ecological management prescribed burns in dwarf pine ridge community along High Point Road	Moderate
Firebreak Repair & Maintenance	• Manage fuels along the Indian Rock Trail to enhance and maintain suitability as firebreak	Moderate
Community Outreach	• Work with local community to reduce wildfire hazard in Route 52 and Mt. Meenahga WUI zone	Moderate
Monitoring	• Conduct ecological monitoring in dwarf pine barrens to assess effectiveness of prescribed fire in achieving management objectives	Moderate
	• Conduct status monitoring of unmanaged chestnut oak and dwarf pitch pine barrens to assess current ecological condition	

Region Description

The North Gully-Shingle Gully (NORG) FMR covers a total of 2,515 acres, including all of the area at Sam's Point Preserve west of the High Point Road and north of the Loop Rd. The vast majority of this property is owned by OPRHP/PIPC and managed by the Nature Conservancy, although a small portion of the region just north of Loop Road is owned by OSC. The region also extends north of Sam's Point to the Smiley Road and incorporates small portions of land in Witch's Hole State Forest and Minnewaska State Park Preserve. The NORG region also includes three parcels west of the Smiley Road that extend towards the Village of Ellenville. The western and southern boundaries of the FMR are comprised by the Sam's Point Preserve boundary line.

Terrain & Fuels

The largest topographic feature of the NORG FMR is the North Gully drainage, a broad southwest facing basin which supports an extensive patch of chestnut oak forest and a wide hemlock ravine directly adjacent to the North Gully Brook. Fuels in this area consist predominantly of leaf litter with patches of moderately heavy mountain laurel. Above the Indian Rock escarpment, the region contains the largest patch of the rare dwarf pine ridge community in the Shawangunks. Moving northward the dwarf pine ridge grades into a more open pitch pine

woodland with decreasing elevation. The far western portion of the region on the slopes above Ellenville has very steep slopes with a mixture of pitch pine woodland and oak forest with moderately dense shrub fuels.

Access Routes & Firebreaks

There are two main access points into the region, including the High Point Road via the Loop Road at Sam's Point Preserve, and the Smiley Road entrance at Berme Road Park in Ellenville. The High Point Road and Smiley Roads are also the only significant existing firebreaks in the region. There are also several old woods roads in the westernmost corner of the region that provide access to the outlet of the Lake Maratanza pipeline. The Indian Rock Trail is the only maintained trail in the region; however, numerous other unofficial trails exist, particularly in the vicinity of the Shingle Gully Ice Caves.

Rare Species

Table 2.24 lists the rare species documented in the North Gully-Shingle Gully Fire Management Region.

Table 2.24. Rare plant and animal species occurrences documented in the North Gully-Shingle Gully Fire Management Region.

Common Name	Scientific Name	NYS Listing
Northern Barrens Tiger Beetle	*Cicindela patruela patruela*	Unlisted
Timber Rattlesnake	*Crotalus horridus*	Threatened
Toothed Apharetra Moth	*Apharetra dentata*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Clustered Sedge	*Carex cumulata*	Threatened
Mock-pennyroyal	*Hedeoma hispida*	Threatened
Rhodora	*Rhododendron canadense*	Threatened
Two-ranked Moss	*Pseudotaxiphyllum distichaceum*	Unlisted

Fire Sensitive Features & WUI

The NORG region includes a large area of WUI—approximately 417 acres adjacent to Mt. Meenahga and along Route 52. A large proportion of the area in the WUI zone is covered by hemlock forest and does not support heavy fuel loads.

A cluster of cell/radio towers lies in the extreme southeast corner of the NORG FMR. These towers and their associated infrastructure—including power lines, generators and small buildings—are surrounded by very heavy fuels and represent a considerable fire sensitive feature. The majority of the towers lie on leased land, but several lie on inholdings owned by the tower operators. No other major fire sensitive features exist in the region.

Maratanza-Ice Caves-South Gully Region

Table 2.25. Priority actions for the Maratanza-Ice Cave-South Gully Fire Management Region

Priority Action Type	General Description of Actions	5-year Priority
Prescribed Burning	• Conduct fuels reduction burns in oak forest in vicinity of Sam's Point Conservation Center to reduce fuels and provide buffer between volatile pine barrens fuels and WUI areas.	High
	• Conduct initial burns in dwarf pine barrens around Lake Maratanza to assess fire operations and fire effects in this fuel/veg. type.	High
	• Conduct additional burns as feasible for fuels reduction/ecological management in oak forest and pine barrens	High
Firebreak Repair & Maintenance	• Conduct substantial repairs to drainage and surface condition on Ice Caves Road	High
Community Outreach	• Continue to work with Cragsmoor community to maintain Firewise program	High
	• Work with local community to reduce wildfire hazard in other WUI communities, including Mt. Meenahga and Walker Valley	High
Monitoring	• Conduct ecological monitoring in dwarf pine barrens to assess current condition and effectiveness of prescribed fire in achieving management objectives	High
Firebreak Repair & Maintenance	• Reduce isolated heavy fuels along upper portion of South Gully Trail	Moderate

Region Description

The 1,711-acre Maratanza-Ice Caves-South Gully (MARA) FMR includes portions of Sam's Point Preserve and Minnewaska State Park Preserve at the southernmost end of the Shawangunks. The region is largely defined by the Sam's Point and Minnewaska park/preserve boundaries to the south, east and west. The northern border of the region is formed by the Verkeerder Kill Trail and the northern portion of the Loop Road.

The configuration of the MARA region is somewhat fragmented due to the nature of land ownership patterns. The region includes the entire South Gully area of Sam's Point Preserve and areas surrounding Lake Maratanza and the former commercially run ice caves; lands which are owned by OSC and managed by The Nature Conservancy. It also includes OSC lands south and east of the Sam's Point Preserve Conservation Center extending south towards Losees Hill, and a relatively large parcel of Minnewaska State Park Preserve land extending down the east flank of the ridge above Walker Valley. In addition, the region includes three small OSC parcels and a larger Minnewaska State Park Preserve parcel extending east of the Verkeerder Kill Falls Trail towards Upper Mountain Road.

Terrain & Fuels

Due to the fragmented nature of the region, it represents a variety of topographic conditions on the east, west and top of the ridge, ranging from steep ravines in the South Gully area to the flat

plateau above Sam's Point. The dominant vegetation type in the region is chestnut oak forest, including both high and low shrub variants. Extremely dense tall mountain laurel is not abundant, but exists in patches. The area above Sam's Point around Lake Maratanza is dominated by a large dwarf pine ridge community that represents some of the most potentially volatile fuels in the Shawangunks.

Access Routes & Firebreaks

Access to the area is predominantly through the main gate at Sam's Point Preserve. The Loop Road is in moderate condition and accessible by truck, although significant maintenance is urgently needed to prevent deterioration. The majority of the region outside of the Loop Road is only accessible by foot along the South Gully and Verkeerder Kill Falls Trail. There are also several former woods roads in the southern portions of the region which extend southwest towards Losees Hill and southeast towards Walker Valley.

Rare Species

Table 2.26 lists the rare species documented in the Maratanza-Ice Caves-South Gully Fire Management Region.

Table 2.26. Rare plant and animal species occurrences documented in the Maratanza-Ice Caves-South Gully Fire Management Region.

Common Name	Scientific Name	NYS Listing
Northern Barrens Tiger Beetle	*Cicindela patruela patruela*	Unlisted
Toothed Apharetra Moth	*Apharetra dentata*	Unlisted
Appalachian Sandwort	*Minuartia glabra*	Threatened
Arctic Rush	*Juncus trifidus*	Threatened
Clustered Sedge	*Carex cumulata*	Threatened
Mountain Spleenwort	*Asplenium montanum*	Threatened
Reflexed Sedge	*Carex retroflexa*	Endangered
Rhodora	*Rhododendron canadense*	Threatened
Two-ranked Moss	*Pseudotaxiphyllum distichaceum*	Unlisted

Fire Sensitive Features & WUI

Three significant WUI communities exist in close proximity, including residences in Cragsmoor, Walker Valley and the Mt. Meenahga area. Despite its relatively small size, the MARA region includes a total of 605 acres within the WUI zone, mostly in the South Gully area. A significant portion of WUI also surrounds the Sam's Point Conservation Center adjacent to heavy dwarf pine barrens fuels.

The MARA region includes the most developed areas of Sam's Point Preserve, including the Sam's Point Preserve Conservation Center, main parking area and trailhead facilities. Other significant fire sensitive features include the electrical distribution lines running parallel to the west side of the Loop Road up to the cell/radio towers, and the historic berry picker

encampments along the west side of the Loop Road. All of these features are located in areas with significant fuel loads.

2.6 Wildfire Response & Preparedness

Wildfire suppression will continue to be an essential element of fire management efforts on the Shawangunk Ridge. Many actions described in the *Northern Shawangunk Ridge Fire Management Plan* are designed to reduce the risk of intense wildfire; however, wildfires—both human and naturally ignited—will inevitably occur. In order to protect human life and property and prevent damage to improved park/preserve facilities, all wildfires will be responded to as quickly as possible and suppressed or contained in an appropriate fashion given the nature of the individual incident.

While every wildfire is unique, maintaining firefighter safety and protecting human life and property in the wildand-urban interface are the highest priorities on any wildfire incident. No other considerations should compromise safety in any way. It should also be recognized, however, that members of the SRBP consider protection of biodiversity and ecological resources as central to their overall mission. Therefore, once firefighter and public safety has been provided for, protection of ecological, recreational and aesthetic resources should be prioritized during wildfire suppression operations, and weighed against the need to minimize acreage burned. This is particularly applicable when a wildfire escapes initial suppression efforts and the incident moves into an extended attack phase, or where fire behavior or other factors dictate the use of indirect suppression tactics.

There are no clear guidelines on when a specific approach will be most appropriate during a suppression operation, and this section is not intended to serve as a guide for how individual wildfire incidents should be managed. The purpose of this section is to provide a generalized framework for reporting and responding to wildfires and to describe actions that can be used to minimize the impacts of fire suppression operations on ecological resources. Each incident is unique given the on-site weather and fuel conditions, responding agencies involved and any values potentially at risk. Incident commanders or command teams will ultimately be responsible for determining the safest and most effective suppression tactics.

Wildfire Reporting & Response

Wildfire Suppression Authority

All wildfires will be reported to the Ulster County Emergency Communications Center (UCECC) via 911, the non-emergency line or other means. UCECC will notify the appropriate responders, including the local volunteer fire department. Depending on the property ownership, initial incident command responsibility and authority will vary.

On privately owned SRBP lands (including Mohonk Preserve and portions of Sam's Point Preserve), the local volunteer fire department is typically the first responder and maintains command of the incident for the duration. As the incident grows in scope and complexity, the

responding fire department can request additional assistance from NYS DEC and other cooperating fire departments under mutual aid agreements, and authority for managing the incident may be turned over to NYS DEC. Once multiple agencies become involved in the management of a wildfire incident, a unified command structure should be established including representatives from all responding organizations. On-site preserve personnel will work with the incident commander or command team to assist with the development of appropriate suppression strategies and tactics.

On state owned lands, the responsible state agency—OPRHP/PIPC for state park lands, and NYS DEC for other state owned lands—will also have wildfire suppression and incident command responsibilities that overlap with local volunteer fire department jurisdiction. In these instances, it is important that the responsible agency and local volunteer fire department work cooperatively to establish a unified command team to jointly manage the incident.

Once any suppression operation on SRBP land has extended beyond initial attack into a second operational period (i.e. the incident has progressed to the point where a new set of incident objectives, and potentially a new command structure, is necessary), it is likely that multiple local, county and state agencies have become involved and the incident has expanded significantly in size and complexity. At this point it is critical that a unified command structure has been established, including representatives from the various responding agencies, volunteer fire departments, land managers and other partners as necessary. Utilizing the Incident Command System and engaging agency representatives from the various cooperators will help to ensure that there is adequate communication and coordination on the incident.

SRBP Suppression Resources

Although the majority of wildfires can be quickly and safely suppressed by the initial responders, the Shawangunk environment is highly volatile. Given the potential for significant fire behavior and large fire growth to occur, it is important that all SRPB fire management partners are notified immediately when a wildfire ignition occurs on SRBP managed lands so that additional resources can be put on alert and mobilized as needed.

In addition to the NYS DEC Forest Rangers, the various members of the Shawangunk Ridge Biodiversity Partnership—including OPRHP/PIPC, The Nature Conservancy and Mohonk Preserve—maintain fireline qualified personnel as well as various kinds of equipments (e.g. brush truck engines, ATVs/UTVs, personal protective equipment and hand tools). In order to improve the ability of SRBP agencies to respond quickly and effectively to wildfire ignitions on partnership lands, fire management partners should work together to develop the capacity to support a multi-agency initial attack crew. This crew would consist of fireline qualified staff, volunteers and equipment resources from the various fire management cooperators in the SRBP that could be put on alert and mobilized as needed during periods of critical fire danger. This crew should be designed to function similarly to a National Wildfire Coordinating Group qualified (see Crew Qualification & Structure in Section 2.7 for additional detail) Type 2 crew, and should consist of personnel with adequate experience and training to respond effectively to ignitions that have the potential to escalate rapidly, particularly in remote and/or inaccessible locations.

Members of the SRBP can provide support for both initial attack and extended suppression operations on partnership lands; however, it should be noted that various organizations may maintain different position qualification standards for fireline personnel. When necessary, Cooperative Agreements or other agreements among partners should clearly state the qualifications standards that individual agencies or organizations will use when cooperating on a wildland fire incident. Regardless of who is in command of an incident, SRBP fireline personnel are responsible for ensuring that they are following the standards of their own agency and that they have the qualifications and experience needed to serve in the position they are holding.

Minimum Impact Suppression Tactics

Minimum Impact Suppression Tactics (MIST) include a list of operational guidelines for minimizing the impacts of various fire suppression activities. Relevant MIST guidelines are listed in Appendix C (National Wildfire Coordinating Group 2004). MIST tactics should serve as the operational standard for all SRBP managed wildfires, particularly important on larger incidents that involve significant suppression resources. These larger, more complex fires have a much greater potential to produce adverse impacts on the ecology and recreation infrastructure of the Shawangunks.

The greatest potential for significant ecological impacts during suppression operations comes from new fireline construction. Firelines that require significant soil disturbance—most notably firelines constructed with bulldozers—can take many years to revegetate without active restoration, potentially leading to severe erosion, invasion by non-native species, unauthorized use of ATVs and other unwanted secondary impacts. Particularly during extended operations, tactics that limit the creation of new firebreaks—including indirect attack utilizing existing features—should be favored. In areas where new control lines are required, hand constructed firelines that minimize soil disturbance should be used whenever possible. Both fixed wing air tankers and helicopters can be used to deliver water for reinforcing or creating control lines in remote areas with minimal impact to the ecosystem. Aviation resources are available through NYS DEC via cooperating agencies, including NY State Police, National Guard and Northeast Forest Fire Protection Compact.

Minimizing the impacts of suppression operations may also include rehabilitation of firelines or other areas that are susceptible to secondary impacts from erosion or invasive species infestation. This can involve construction of drainage features (e.g. water bars) or seeding/planting with appropriate vegetation. Other rehabilitation efforts may include repairs to trails impacted by suppression operations, clean-up of litter left behind during suppression activities, and dispersal of any piles of bulldozed materials.

Direct vs. Indirect Attack

In general, there are two broad approaches to suppressing a wildfire, often referred to as direct attack and indirect attack. Direct attack consists of directing suppression efforts and establishing control lines at the actual fire perimeter. The primary focus is on minimizing the area burned by extinguishing the fire as quickly as possible.

Direct attack has several key advantages. Most importantly, firefighters are working close to the ~~"b~~black"—or areas that have already been burned out and have little or no remaining fuel—which provides an easily accessible safety zone at all times. However, the safety and feasibility of direct attack is limited by fire behavior. As a general rule, direct attack with firefighters and hand tools is limited to flame lengths below four feet. Heavy equipment, such as bulldozers, can effectively perform direct attack when flame lengths are between four and eight feet, but flame lengths greater than 8 feet usually require an indirect method of attack.

By contrast, indirect attack involves utilizing natural or constructed barriers some distance from the active fire perimeter to contain the fire. Crews work further away from the flames to construct and/or improve firelines and then intentionally burn out fuels between the fireline and the main fire. The focus is on containing the fire safely and minimizing crew exposure to intense or unpredictable fire behavior, rather than minimizing the area burned.

Indirect attack methods are most commonly utilized when the wildfire is burning too intensely to allow for direct attack, or direct attack is otherwise impractical. In many cases, intentionally burning out fuels over large areas in front of the wildfire may be the only effective suppression strategy, particularly when a fire is spotting—or lofting burning embers in advance of the main flaming front which can cross over relatively narrow control lines.

Indirect attack can also minimize or eliminate the need for new fireline construction by utilizing existing features, thereby reducing the impacts of fire suppression on ecological resources. Firefighters are allowed to work out of the heat and smoke and any new firelines can be located wherever fuels and topography are most advantageous. The primary drawback of indirect attack is the possibility of conditions changing during fireline improvement/construction and burnout operations. Highly variable weather conditions could also cause the main fire or intentionally ignited burnouts to behave unpredictably.

The decision whether to employ direct or indirect tactics on any wildfire incident in the Shawangunks is the responsibility of the incident commander or incident command team given the exact nature of an individual incident. When possible, indirect attack methods are recommended to protect ecological resources and limit the negative impacts of suppression operations. Factors to consider include the current and anticipated fire behavior, fuels, topography, locations of existing barriers to fire spread, available suppression resources and the presence of any human or ecological values at risk. In reality, most wildfire incidents—particularly those that progress past the initial attack phase—will likely involve some combination of direct and indirect tactics.

Wildfire Preparedness & Prevention

A significant component of wildfire suppression and management is ensuring adequate response preparedness and fire prevention measures. Fire preparedness generally includes monitoring the potential for fires to occur—often referred to as Fire Danger—and managing response and suppression resources to maximize capacity where the risk is greatest.

Fire danger in New York is currently assessed by NYS DEC across 10 broad geographic rating areas based on available weather and fuels data from remote fire weather monitoring stations, and the Shawangunks fall within a region that covers the entire Hudson Valley. While this information is useful for alerting and directing state resources at a broad scale, SRBP partners should develop a coordinated approach to monitoring local fire weather with respect to key thresholds, and communicating among partners and with the public when fire risk is elevated. Local data can be used to enhance statewide assessments of fire danger as well as identify trigger points for local management actions to address fire risk. Fire managers should also be cognizant of fire weather products issued by the National Weather Service, including Red Flag Warning and Fire Weather Watch, which can indicate that the potential for problem fire behavior exists. Potential management responses to elevated fire danger can include a variety of actions appropriate to the level of risk. For example, on days when fire danger is moderate, management response may be as simple as alerting staff to the fact that wildfire ignitions are possible and communicating fire risk to the public. When fire danger reaches high or very high levels, managers may alert or mobilize additional personnel and/or equipment resources, or limit recreational activities that have a higher potential to result in wildfire ignitions. As part of a more coordinated approach to addressing wildfire risk, managers should work cooperatively to develop a consistent means of monitoring, communicating and responding to elevated fire danger.

Fire prevention efforts should also include post-fire investigations to determine the cause of ignition for all wildfires on partnership lands. This provides critical feedback into management actions that can be implemented to reduce the potential for future ignitions.

2.7 Requirements & Guidelines for Implementation of Prescribed Fire

Prescribed Burn Unit Plans

An approved prescribed burn unit plan—often referred to simply as a burn plan—is legally required for all prescribed burns in New York State. A burn plan is a document that describes the specific area to be burned and details the conditions under which the burn can be implemented. These conditions include, among others, acceptable weather parameters, necessary crew and equipment resources, and fireline preparation and mop-up specifications.

The minimum requirements for what information must be contained in a prescribed burn plan are described in New York State Department of Environmental Conservation Regulations, Chapter II-Lands & Forests, Part 194, and include the following:

a. **Landowner or prescribed burn manager qualifications:** a description of the landowner's or prescribed burn manager's training and expertise in conducting prescribed burn activities.

b. **Prescribed burn unit description:** a map at the appropriate scale and a narrative description identifying the area or areas on which prescribed burn activities will be undertaken.

c. **Goals and objectives:** a description of the ecological purposes and objectives of the prescribed burn, including an identification of the specific species or natural communities that are intended to be affected by the burn.

d. **Cover and fuel loads:** a description of the vegetative cover and fuel loads on each area to be subjected to prescribed burning.

e. **Timing and weather conditions:** a description of physical conditions, such as time of year, wind speed and direction, and air temperature and humidity, which must be met before a prescribed burn is initiated.

f. **Intensity and duration of burn:** a description of the anticipated intensity and duration of the prescribed burn, such as flame length and rate of spread, given the fuel loads and physical prescriptions described.

g. **Logistics:** a description of the logistics of the prescribed burn operation, number of personnel and description of duties, and fire management equipment that will be deployed to assure that the burn is restricted to the area or areas identified for prescribed burn management. This will include but not be limited to a description of the method of ignition, ignition pattern, containment, mop-up and patrol procedures.

h. **Suppression:** a description of fire suppression activities to be immediately implemented should the prescribed burn threaten to escape, or actually escape, beyond the boundaries identified for such burn.

i. **Notification:** a description of the procedures for notifying appropriate department forest protection and fire management staff, local fire officials, law enforcement personnel and adjoining landowners of the actual date, time and estimated duration of any prescribed burn.

j. **Communications:** a list of key communication contacts and telephone numbers.

k. **Smoke management:** identify potential smoke affected areas and smoke management strategies to avoid such areas, and to reduce and/or disperse emissions to minimize any adverse effect on the environment, including human health and welfare. Also note procedures for compliance with applicable State and local regulations.

l. **Required signatures and approvals:** the names and signature lines of the preparers of the prescribed fire plan, and for those who have the authority to review and approve the plan and modifications of the plan.

In addition to these required elements, various organizations and agencies in the SRBP may also require additional burn plan elements for burns conducted on lands that they own or manage, or which they will otherwise be responsible for implementing.

Burn Plan Review & Approval

NYS DEC and Agency Approval

Consistent with NYS DEC Regulations, all prescribed burn plans must be reviewed and approved by the Department of Environmental Conservation prior to implementation. SRPB partner agencies and organizations may also require additional levels of internal review and

approval of burn plans. Therefore, the actual approval process for an individual burn plan may vary depending on the agency preparing the plan.

Once approved, a prescribed burn plan will remain valid for a period of five years. If on-the-ground changes occur to a degree that a burn plan is no longer representative of the actual conditions in the burn unit, the burn plan must be updated and reapproved by all applicable agencies before the burn can be implemented.

Local Fire Department Review

Although the legal authority to review and approve burn plans rests with NYS DEC, local fire department chiefs or commanding officers must also be provided an opportunity to review and comment on prescribed burn plans for units that fall within their fire district or jurisdiction. Copies of burn plans that are being submitted for approval will be sent to the local volunteer fire department prior to implementation of the burns.

Previously approved burn plans will not be resubmitted to local fire departments to review on an annual basis until they are revised and/or resubmitted to NYS DEC for approval. However, a list of planned burns will be sent to the local fire departments and other emergency service responders prior to the beginning of the burn season each year and copies of any burn plans will be made available upon request.

Prescribed Burn Unit Size

Depending on the intended purpose and landscape configuration, prescribed burns may vary greatly in size—ranging in size from less than one acre to several hundred acres or more. Prescribed burn unit size affects actual burn operations in a number of ways. In many ways, larger prescribed burns are easier to manage and safer than smaller burns, although this is equally dependent on the shape and configuration of the unit. In general, however, larger burns provide more area to absorb changes in fire behavior due to wind shifts or other variable conditions. Burning larger units is also more efficient at utilizing staff and equipment resources, and typically requires less fireline relative to the area burned, which can reduce potential ecological impacts.

Larger prescribed burn units also pose several challenges. They have the potential to produce more smoke than smaller units, and have a higher probability of including rare species or other sensitive resources. Larger units also require more time for ignition, are more likely to produce significant overnight smoke following initial mop-up and generally require more secondary mop-up and patrolling over subsequent days.

Additional SEQR Review Requirements

Although the *Northern Shawangunk Ridge Fire Management Plan* is designed to fulfill public review requirements under the NY State Environmental Quality Review Act (SEQR), any burn plan for a prescribed burn unit greater than 500 acres in size in the Shawangunks will require SEQR review on an individual basis. Larger burn units have more potential to produce unintended impacts to the environment—particularly related to smoke production—than smaller burns, and are thus held to a higher standard of review under this plan. This review will require

a detailed assessment of any sensitive resources that exist in the burn unit and identification of specific actions to mitigate potential smoke impacts.

Fire Sensitive Feature Screening

Various fire sensitive features may exist within any given prescribed burn plan, including rare species, historical and cultural resources and park/preserve facilities. A screening for fire sensitive features should be conducted as part of the prescribed burn planning process. This screening process should include at a minimum:

- an analysis to identify any state listed rare plant and animal species known to be present in the prescribed burn unit based on the most current available NY Natural Heritage Program data;
- an assessment of any known cultural or historical resources present, which may include:
    - archeological sites from the Paleo-Indian period (12,000 – 9,500 years ago) through the Contact period (500 – 300 years ago), including rock shelters, open air sites and camps;
    - early European settlements and/or structures (e.g. Trapps Hamlet);
    - remnants of 18th – early 20th century industries (e.g. early stone quarries, charcoal pits, berry picker camps); and
    - "Resort Era" infrastructure, including former hotels and associated facilities
- identification of any other known fire sensitive features, including park/preserve facilities, outbuildings, power lines or other relevant features.

Any fire sensitive features present within the burn unit should be described in the prescribed burn plan and, if necessary, measures should be identified to mitigate or avoid any potential impacts to these features.

Smoke Management Screening

Highly smoke sensitive areas include, among other things, airports, highways, residential communities, recreation areas, schools, hospitals and nursing homes. To avoid impacting sensitive areas with smoke resulting from a prescribed burn, a detailed smoke screening evaluation is conducted for each prescribed burn unit as part of its prescribed burn plan. The screening process used for the Shawangunks includes four steps: 1) plot the direction(s) the smoke plume could travel given all possible prescribed wind directions; 2) identify smoke sensitive areas; 3) identify critical smoke sensitive areas; and 4) minimize risk.

Fuel & Weather Parameters

The specific fuel and weather parameters appropriate for an individual prescribed burn will depend on a variety of factors, including unit size and configuration, season of burning, topography, fuels, adjacent vegetation/fuel types and management objectives. General parameters appropriate for conducting prescribed burns are listed below in Table 2.27. While

these parameters should be adjusted as necessary to meet the needs of an individual burn, burn plans that include weather parameters outside of the ranges listed below should provide specific justification for doing so.

Table 2.27. General fuel and weather prescription parameters for conducting prescribed burns.

Fuel Parameters	MIN	PREFERRED	MAX
1-Hour Fuel Moisture (%)	5	6-10	14
10-Hour Fuel Moisture (%)	8	10-16	20
100-Hour Fuel Moisture (%)	10	14-25	N/A
Live Fuel Moisture (%)[1]	30	N/A	300
Keetch-Byram Drought Index (KBDI)[2]	0	50-200	400
Weather Parameters			
Air Temperature (°F)	35	60-85	95
Relative Humidity (%)	25	30-50	60
Days Since Rain	1	N/A	12
Midflame Windspeed (mph)[3]	1	2-5	10
Wind Gusts (mph)	N/A	N/A	15
Atmospheric Mixing Height (ft)[4]	1500	N/A	N/A

[1]Live fuel moisture can vary greatly depending on the season of burning. Live fuel moisture can drop as low as 30% in the dormant season and reach 300% shortly after initial spring leaf out.

[2]KBDI is an index of soil moisture in the upper soil layers (Keetch and Byron 1968). The potential for fire to burn into deep litter and duff layers increases with increasing KBDI.

[3]Winds should be steady and from a consistent direction. Calm or light and variable winds are only acceptable with justification in the burn plan.

[4]Atmospheric mixing height is the height above ground level that free mixing of air is occurring. Low mixing heights or very stable layers in the atmosphere (i.e. inversions) can prevent smoke from lifting and dispersing adequately.

Combined Factors

It should be noted that combinations of certain weather and fuel parameters can produce unacceptable fire behavior or present other difficulties. Prescribed burn unit plans should discuss combined weather/fuel conditions that should either be avoided or require some mitigating action. For example, relative humidity at the low end of the prescribed range or windspeeds at the upper end of the prescription may not individually be of any concern. However, if relative humidity and windspeed are both at the edge of their respective prescriptions, this may cause unacceptable fire behavior, particularly if these conditions align with other factors such as wind direction and slope.

Combinations of parameters that should be given special consideration in prescribed burn planning and implementation are:

- low relative humidity and high windspeed which could produce unacceptable fire behavior;

- very light winds and low mixing heights which may prevent adequate smoke dispersal; and
- high KBDI or days since rain combined with low relative humidity, which can lead to excessive smoldering of heavy fuels and ignition of snags (standing dead trees) in high branches.

Light and Variable Winds

Light and variable winds occur when there is no overriding factor—such as a frontal system, pressure gradient or convective air flow—that creates steady winds from a single direction. During light and variable conditions, wind speeds generally range from 0-2 mph and direction may shift frequently and unpredictably, potentially leading to erratic fire behavior and difficulties with smoke management. Because of this, light and variable conditions are only acceptable with proper justification in the burn plan.

Examples of mitigating conditions for light and variable winds include:

- sufficiently steep slopes within the burn unit that will override variations in wind direction and drive fire spread in a consistent direction;
- very light surface fuels that will not produce rapid spread or intense fire behavior, or generate heavy smoke; and
- burns conducted during the growing season (see below) when live fuel moistures are high, limiting rapid fire spread or sudden acceleration of fire behavior (note: growing season burns can produce heavy smoke due to high moisture content of fuels—smoke dispersal must be adequate).

Seasonality of Burning

Prescribed burns can be conducted at any time of year, although the vast majority will likely take place between March and November. In the fall of 2009, a new statewide ban was implemented on open burning annually between the dates of March 15 and May 15 to reduce wildfire ignitions. Prescribed burns are specifically exempt from this regulation, and there is no limitation on when prescribed burns can be implemented.

Historically, prescribed burns in the northeast are most often conducted prior to leaf-out in the spring and after leaves have dropped in the fall when most vegetation is in a dormant stage. Growing season burns conducted when the dominant vegetation is physiologically active are becoming increasingly common, and are more effective at meeting certain management objectives.

Similar to wildfires, fire behavior can vary dramatically between dormant and growing season prescribed burns, even within the same vegetation type. Growing season fires also have the potential to produce more smoke than dormant season burns. While it is not always necessary to specify alternative prescription parameters for dormant and growing season prescribed fires, burn plans should specify any special conditions that may limit implementation of a burn in a specific season. For example, light and variable winds may be acceptable in the growing season for a particular burn unit, but not in the dormant season.

Burn Unit Preparation

The amount of unit preparation required for an individual prescribed burn depends on a variety of factors including unit configuration, fuels, topography and necessary fireline holding resources (e.g. Type 6 engine, ATV and/or hand tools). Firelines should take advantage of existing roads and trails to the greatest extent possible. Natural barriers to fire—such as wetlands, streams, hemlock ravines, rock outcrops and cliff lines—can be used as containment features as appropriate. However, the suitability of these kinds of features as firebreaks can vary, particularly if dependent on seasonal factors such as water levels in a wetland or stream.

A variety of constructed firebreaks can be used to effectively contain a prescribed burn. If new firebreaks are necessary, they should conform to the MIST guidelines listed in Appendix C to the greatest extent practical and take advantage of favorable topographic and/or fuel conditions. New firelines should also be located such that they minimize the potential impacts on any sensitive ecological resources.

Depending on fuels and anticipated fire behavior, constructed firelines can consist of raked hand lines, ATV accessible trails, lines created by wetting down fuels prior to burning (i.e. wetlines) or some combination of the above. Firelines should be constructed to the minimum width necessary to adequately provide for safe and effective containment of the fire and potential contingency situations. Whenever possible, soil disturbance should be avoided or minimized during fireline construction.

Other kinds of unit preparation may include treatment of fuels (e.g. mowing, cutting, etc.), removal of invasive species, forest thinning or other physical or vegetative manipulations on the site. These types of treatments or preparations should be noted in the prescribed burn unit plan and any impacts on fire operations, including mop-up, should be accounted for during planning and implementation.

Crew Qualifications & Structure

Various agencies may maintain different standards for crew qualifications. In order to maximize consistency among SRBP partners and with federal agency standards, it is recommended that all agencies in the Shawangunk Ridge Biodiversity Partnership follow National Wildfire Coordinating Group crew qualification standards outlined in most current version of the National Interagency Incident Management System, Wildland Fire Qualifications System Guide, PMS 310-1 (National Wildfire Coordinating Group 2009). Prescribed burn plans and cooperative agreements among partners should describe any deviations from National Wildfire Coordinating Group (NWCG) standards.

The various duties and qualifications for the most common prescribed fire crew positions are listed below. It is important to note that qualifications alone may not necessarily be an adequate indicator of an individual's ability to serve a particular role. It is ultimately the responsibility of the prescribed fire burn boss to ensure that all crew are adequately experienced and capable of serving in their assigned roles given the specific conditions and complexity of the planned burn.

Prescribed Fire Burn Boss

All prescribed burns should be led by an NWCG or agency qualified Prescribed Fire Burn Boss Type 2 or Type 1 (RXB2/RXB1). In some instances, it may be appropriate for a Burn Boss Type 3 (RXB3) to lead burns of very low complexity; this should be documented and justified in the prescribed burn plan.

Firing Boss

Firing Boss (FIRB) is an NWCG position qualified at the Single Resource Boss level. The role of the Firing Boss is to direct ignition operations on a prescribed burn, particularly on larger or more complex burns that require multiple igniters working in the interior of the burn unit. Firing boss is not a position that is required for all prescribed burns, and in many instances, it may be appropriate for the burn boss to also serve the role of firing boss on a particular burn. While an NWCG or agency qualified FIRB is recommended for most moderate to high complexity burns, individuals qualified at FFT1 or higher level may oversee a squad of igniters under the direction of the burn boss on low to moderate complexity burns.

Engine Boss

Engine Boss (ENGB) is an NWCG position also qualified at the Single Resource Boss level. Although ENGB is not a position that is commonly required on a prescribed burn, it is recommended that personnel serving as a burn boss or holding specialist (see crew structure discussion below) also be NWCG or agency qualified as an ENGB.

Squad Boss

Squad Boss is a position that is qualified to oversee a small squad of firefighters (typically 4-8 crew members). Individuals serving as squad bosses on prescribed burns should be qualified by NWCG or agency standards as a Firefighter Type 1 (FFT1) or above.

Firefighter

All firefighters participating on a prescribed burn should, at a minimum, have completed the following NWCG courses: S-130 (Basic Firefighter), S-190 (Introduction to Fire Behavior), L-180 (Human Factors on the Fireline, typically included in S-130) and I-100 (Introduction to ICS) or be otherwise qualified by their own agency based on previous fire experience. In addition to completion of the basic coursework, qualification as a Firefighter Type 2 (FFT2) for a prescribed burn may also include participation on at least one burn as an FFT2 trainee.

Holding Specialist

Holding Specialist is a non-NWCG position that can be used on prescribed fires under certain crew structures. This position is responsible for overseeing holding operations under the Burn Boss and is typically filled by an ENGB qualified crew member. In certain instances it may be appropriate for an FFT1 qualified crew member or ENGB trainee to fill this role on low to moderate complexity burns.

Weather Observer/Fire Effects Monitor

Periodic observations of on-site weather conditions are critical to the safe implementation of prescribed burns. On every burn, an individual from the crew must be assigned the duty of

measuring, recording and reporting on-site weather conditions. This position can be filled by any qualified firefighter (FFT2 or above), and need not be a dedicated position—i.e. the individual serving as the weather observer can also function as a firefighter on the burn. When a firefighter is dedicated to this responsibility, the position is commonly referred to as a Fire Effects Monitor and includes documentation of fire behavior and first order fire effects on the burn.

Smoke Spotter

A smoke spotter provides critical feedback to the burn boss on smoke behavior, particularly if smoke sensitive resources exist in close proximity to the burn. This position is not required for all burns and may not be necessary on small or low complexity burns that are not expected to produce significant smoke, or when smoke sensitive resources do not exist near the burn unit. However, these conditions are not common in the Shawangunks, and the use of smoke spotters on most burns is recommended. There are no qualification requirements for the position other than the ability to effectively observe, interpret and report smoke behavior relative to landscape features and smoke sensitive areas. This position is typically filled by someone who is familiar with the local geography and has the ability to be mobile during the burn operations in order to access adequate vantage points.

Certification & Currency

How individuals get certified for various fireline positions will depend on the policies and qualification systems of their respective home agency. Certification for the NWCG positions described above, except for FFT2, requires the completion of a position taskbook. Position taskbooks include a variety of specific duties that must be completed by the firefighter, and documented by a qualified evaluator in order to be certified for a particular position. Utilizing the performance based taskbook system ensures that an individual has demonstrated competence, as a trainee, in all of the job duties of the position for which they are being certified. This method of certification is recommended for all SRBP organizations directly involved in fire management activities in the Shawangunks.

Maintaining currency in most NWCG qualified position requires serving in that position—or another position that will maintain currency in the original position—at least once every five years. For a complete description of NWCG certification and currency requirements, refer to the most current version of the National Interagency Incident Management System, Wildland Fire Qualifications System Guide, PMS 310-1 available at http://www.nwcg.gov/pms/docs/pms310-1.pdf (National Wildfire Coordinating Group 2009).

Physical Fitness & Annual Safety Refreshers

All fireline crew will be required to meet the physical fitness guidelines of their respective agencies. Unless otherwise specified by their agency, all prescribed fire crew members will be expected to pass either an arduous or moderate level fitness test—typically administered as the Work Capacity Test (i.e. pack test)—and complete an Annual Fireline Safety Refresher (RT-130). This training typically lasts from 4-8 hours and consists of safety oriented core topics supplemented with locally relevant topics. Suggested core and supplemental topics for the RT-130 training can be found at http://www.nifc.gov/wfstar/. Both the pack test and RT-130 must

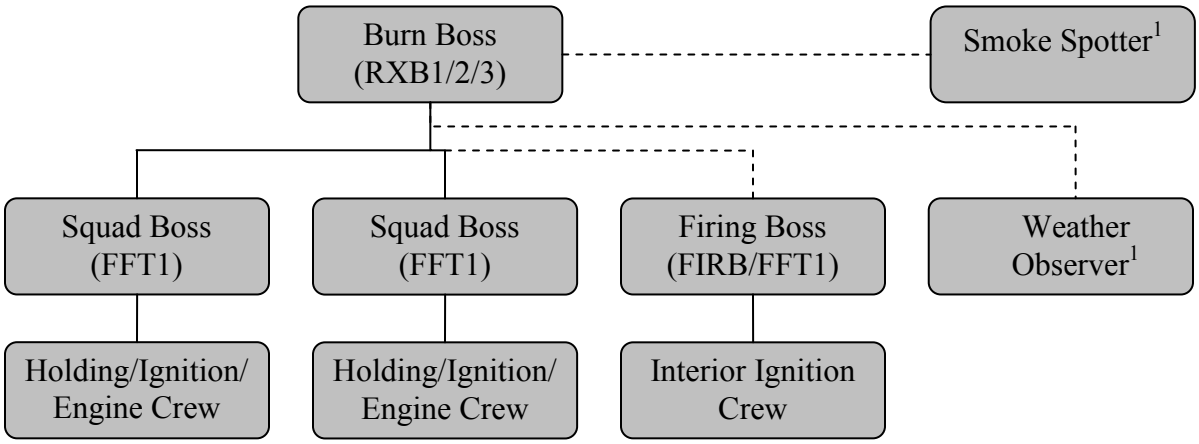
be completed every 12 months in order for personnel to maintain currency with their fireline qualifications.

Crew Structure

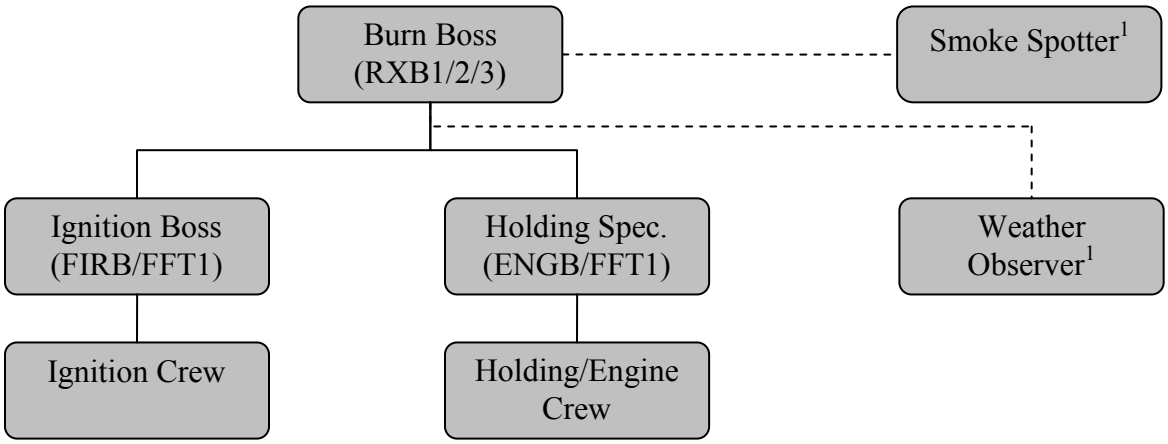
There are two acceptable generalized crew organizational structures that can be utilized on a prescribed fire (Figure 2.1). These crew structures can be modified slightly as needed for a particular burn operation, but justification for significant modifications to the recommended crew structure—including deviations from the required position qualifications—should be provided in the prescribed burn plan.

Figure 2.1. Recommended crew organizational structure options for conducting prescribed burns.

Option 1:



Option 2:



[1]Dashed lines indicate optional crew structure components. Weather Observer and Smoke Spotter do not need to exist as dedicated positions under either crew structure. If appropriate given the complexity of the burn and number of personnel on-site, these functions may be performed by holding crew members who have the ability to communicate directly with the burn boss.

Personnel & Equipment Resources

Every prescribed burn operation is different and will therefore require a detailed assessment of the necessary personnel and equipment resources. Table 2.28 provides an outline of the minimum resources needed to safely and effectively implement a prescribed fire in the Shawangunks. Table 2.29 lists items recommended for implementing most prescribed burns, in addition to resources included in Table 2.28. Any modifications to the minimum resources included in Table 2.28 must be documented in the prescribed burn plan. In addition, managers should also ensure that adequate qualified personnel and equipment resources are available on subsequent days if extended mop-up operations are anticipated to monitor and/or extinguish any residual smoldering material in the burn unit.

Table 2.28. Required crew and equipment resources for implementing prescribed burns.

Required Crew Resources	**Number**	**Notes**
Total Crew Members	10 (6)	Less than 10 crew members may be acceptable on low complexity burns; minimum of 6 crew members on any burn
RXB2 or higher	1	RXB3 may be acceptable for certain low complexity burns
FFT1 or higher	2	
Required Equipment Resources	**Number**	**Notes**
Primary engine (min. 150 gallons)	1	Requirement may be waived if alternate water source available (e.g. portable pump w/hoselay)
Secondary engine (min. 50 gallons)	1	Requirement may be waived if alternate water source available (e.g. portable pump w/hoselay)
Handheld radio	10	Or one per crew member if less than 10 crew
Personal protective equipment (PPE)	1 per crew member	Nomex or similar clothing, hard hat, eye protection, gloves, boots
Fire shelter	1 per crew member	
Fire rake/leaf rake	6	
Scraping hand tool	2	Pulaski, grub hoe, or similar
Backpack pump	6	
Drip torch w/fuel	4	
Additional drip torch fuel, 5 gallons	1	
Chain saw kit w/chaps and accessories	1	
Belt weather kit	1	
First aid kit	1	

Table 2.29. Recommended additional items for implementing prescribed burns.

Recommended Items	Number	Notes
Reserve engine (min. 150 gallons)	1	If primary engine is important element of holding operations
Portable water tank, 500-1000 gallons	1	Recommended for burns where nearest contingency water source is more than 5 minutes away
Portable pump w/accessories	1	Improves engine filling efficiency at contingency water source or portable water tank
Additional set of PPE & fire shelter	2	Extra sets in case of damage to crew member PPE during operations
Headlamps	1 per crew member	If any operations anticipated after dark (including mop-up)
Additional drip torches	4	Recommended for units where interior ignition is planned
Additional drip torch fuel, 5 gallons	1	
Additional chain saw kit w/chaps and accessories	1	
Additional belt weather kit	1	As backup for primary weather kit
Additional first aid kits	1 per vehicle	

Contingency Planning & Implementation

Contingency planning is an integral part of prescribed fire planning and implementation. Contingency situations can result from a variety of circumstances, including the following:

- fire or smoke behavior on a burn becomes unacceptable;
- crew injuries or equipment malfunctions result in less than adequate resources to continue burn operations;
- the prescribed fire threatens escape or actually escapes the control of the crew; or
- other conditions exist that prevent the burn from safely continuing.

While actual contingency situations are extremely rare, prescribed burn plans must include provisions for responding to various unanticipated events. Crew and equipment contingencies are addressed through redundancies in critical equipment and crew resources (e.g. secondary and/or reserve engines or additional crew members beyond what is minimally required to complete the burn).

More serious contingencies that involve fire escaping from the burn unit are addressed in the prescribed burn plan as follows:

- vegetation/fuel types and topography are described for adjacent areas outside of the burn unit and maximum anticipated fire behavior is calculated;
- secondary fallback firelines outside of the burn unit and emergency water sources are identified; and

- additional off-site suppression resources are identified and there is a clear process for requesting emergency assistance.

In addition, crew members are provided with maps of the area surrounding the burn unit, including topography, fuels, fallback firelines and water sources. The crew is also briefed prior to ignition of the fire on how contingency situations will be handled, and escape routes and safety zones for crew are identified.

Contingency Response

Small spot fires and spotovers are not uncommon on prescribed burns due to embers being carried short distances outside the unit or fire creeping across control lines. The vast majority of these situations can be handled easily with on-site crew and equipment resources. Any fire that occurs outside of the prescribed burn unit must be reported to the burn boss through the chain of command.

If a more serious spot fire occurs, the burn boss is responsible for determining whether or not the fire can be safely suppressed with on-site resources. If the burn boss determines that the fire can be safely suppressed, he/she will direct squad bosses in both managing the prescribed fire inside the burn unit and suppression of the spot fire outside the burn unit.

If the spot fire cannot be safely suppressed, the burn boss or a designee will report the fire to the Ulster County Emergency Communications Center (911) who will then dispatch the appropriate responders. The responsibility to declare the escaped prescribed burn a wildfire and request additional resources rests with the burn boss, and the decision to do so will depend on a wide variety of factors, including current and anticipated fire behavior, available resources and values potentially at risk.

There is no single condition that indicates a prescribed burn has escaped control and transitioned to a wildfire; however, the following list provides indicators that the fire is becoming difficult to control, or may pose an unusual risk. If one or more of the following conditions are met, the burn boss should consider reporting the fire to 911 unless mitigating factors exist:

- the spot fire has not been contained within 30 minutes of initial size up;
- multiple additional spot fires are being ignited, either by the prescribed burn or the initial spot fire, while suppression actions are underway; and/or
- the relative humidity drops below 25% during suppression of the spot fire.

If an escape is declared by the burn boss, prescribed fire operations will cease and fire inside the burn unit will be suppressed using the safest and most appropriate tactics. Under certain conditions, indirect attack (i.e. burning out from primary or secondary control lines) may be the most appropriate means of suppressing either the prescribed burn or the escaped fire.

Once outside resources arrive, the burn boss will work with the commander of the responding resources and park/preserve staff to establish a unified incident command team. The prescribed fire crew will become an assisting suppression resource and, from that point forward, the incident will be managed as a wildfire.

2.8 Additional Considerations

Training

Maintaining qualified fireline staff is critical to the safe and effective implementation of prescribed fire and other fire management activities. Well trained and experienced fireline personnel also provide a valuable resource for fire suppression operations. The various SRBP partners should provide opportunities for staff and personnel to receive both basic and advanced training whenever possible to the extent that is compatible with other job duties. The SRBP should also focus on developing the ability to provide various training courses locally to minimize travel and other associated costs. Table 2.30 provides a list of standard NWCG courses that would be beneficial for most staff and volunteers involved in fire management in the Shawangunks.

Table 2.30. Recommended NWCG training courses for SRBP fire management staff and volunteers.

Course Name and Number	Availability[1]	Duration	Notes
Basic Firefighter/Intro to Fire Behavior/Human Factors on the Fireline/Intro to ICS (S-130, S-190, L-180, I-100)	Local (NYS DEC, TNC), NYWIMA	36 – 44 hours	Basic training for all fireline personnel. New self guided electronic version should increase local availability.
Advanced Firefighter Type 1 (S-131)	NYWIMA	8 hours	Necessary to begin working towards FFT1 qualification. Capacity exists to offer locally.
Look Up, Look Down, Look Around (S-133)	NYWIMA	4 hours	Needed for FFT1 qualification. Capacity exists to offer locally.
Portable Pumps & Water Usage (S-211)	NYWIMA	8 hours	Valuable course for all fireline personnel. Can develop capacity to offer locally.
Wildfire Powersaws (S-212)	NYWIMA	24 – 36 hours	Valuable course for all fireline personnel. Can develop capacity to offer locally.
Intermediate Wildland Fire Behavior (S-290)	NYWIMA	32 hours	Valuable for those pursuing FFT1 qualification or higher.
Fire Operations in the Wildland-Urban Interface (S-215)	NYWIMA	28-32 hours	Valuable for those pursuing FFT1 qualification or higher.

[1]New York Wildfire & Incident Management Academy (NYWIMA) is a fire training academy that is typically held in late October at the Brookhaven National Laboratory in Upton, NY.

In addition to these basic courses, there are numerous higher level courses available at the New York Wildfire & Incident Management Academy or various other fire training academies in the Northeast and other regions of the country. Those looking to pursue qualifications above FFT1 should work with experienced personnel to identify a suitable training curriculum.

In addition to formal training courses, hands-on experience is a critical component of developing advanced skills and qualifications. Position taskbooks developed by the NWCG are an effective means of ensuring that personnel have demonstrated the competencies needed to advance their fireline qualifications. Partnership members should identify staff and volunteers who are seeking advanced qualifications and provide them with opportunities to serve in trainee roles to complete positions taskbooks, including both prescribed fire and wildfire assignments.

Local Equipment Resources

Several members of the SRBP—including The Nature Conservancy, OPRHP/PIPC, and Mohonk Preserve—currently maintain small to moderately sized fire equipment caches. In addition, the NYS DEC maintains several larger equipment caches in Region 3 suitable for larger and more complex fire operations. Maintaining and improving locally available sources of fireline supplies and equipment is necessary to support the types of fire management activities outlined in the *Northern Shawangunk Ridge Fire Management Plan*. As resources permit, SRBP partners should continue to acquire new equipment resources, including fireline personal protective equipment, hand tools and water handling equipment (e.g. portable pumps, hose, and appliances).

Mechanized resources—including wildland engines and UTVs/ATVs—are also critical to safe implementation of prescribed burns, and can be valuable resources for responding to certain types of wildfire incidents. Currently, NYS DEC, The Nature Conservancy and Minnewaska State Park Preserve all have various types of wildland engines. Partners should continue to ensure that these resources are locally available and maintained in proper working order. As needed, the Partnership should seek additional resources for purchasing and/or maintaining wildland engines necessary to implement fire management activities. Table 2.31 describes the types of wildland engines typically used to support the types of activities described in the *Northern Shawangunks Fire Management Plan*.

Table 2.31. Description of wildland engine types and uses.

	Engine Type		
	Type 6 Engine[1]	**Type 7 Engine[1]**	**Non-Typed Engine[2]**
Pump Rating[3]	30 gpm @ 100 psi	10 gpm @ 100 psi	30 gpm @ 50 psi
Tank Capacity	150 – 400 gallons	50 – 200 gallons	50 – 100 gallons
Hose 1 ½ inch 1 inch	 300 feet 300 feet	 - 200 feet	 - 200 feet
General Description	Wildland fire brush truck; one-ton or larger pickup with fixed tank and firefighting apparatus	¾ - 1 ton pickup with slip-on tank and firefighting apparatus	UTV with slip-on apparatus and lightweight pump
Typical Uses	Wildfire initial attack, extended attack; prescribed fire contingency resource	Prescribed fire general use	Prescribed fire general and off-road use; wildland fire off-road use

[1]Based on Water Handling Equipment Guide published by NWCG Fire Equipment Working Team (2003).
[2] Specifications may vary widely. Table describes most typical specification on non-typed engines used in Shawangunks.
[3]Pump rating is defined by minimum volume in gallons per minute (gpm) at a given pressure in pounds per square inch (psi).

Non-broadcast Burning

Various members of the SRBP may engage in non-broadcast burning of brush piles for a variety of reasons. Non-broadcast or pile burns are not subject to any of the requirements and guidelines for prescribed burns described above, but any implementation of non-broadcast burns must comply with all internal agency policies, municipal ordinances and NY State laws.

Non-broadcast burns conducted on SRBP lands are subject to the NY State restrictions on open burning annually between the dates of March 15 and May 15, as well as any burn bans implemented by local municipalities or fire departments.

Research

Research on fire management, fire ecology or related topics is encouraged to continue to build on the existing body of scientific knowledge. Various members of the SRBP are already involved in ongoing research projects, and the Partnership should continue to engage various academic partners to promote continued research in the Shawangunks.

3. Potential Environmental Impacts & Mitigation

3.1 Soil & Water

The two management actions described in this plan that have some potential to impact soil and water resources are prescribed burning and firebreak maintenance/construction. This section provides a brief overview of the potential effects of these actions on soil and water and provides some guidance for mitigation when impacts are expected.

While activities such as prescribed fire can substantially affect the physical, chemical and biological processes of soil and water, these impacts are generally well within the range of natural processes that have sustained above and below ground ecosystems in the Shawangunks for millennia. Negative impacts that do occur tend to be greatest when fires are of high intensity and burn large portions of the landscape—conditions which are much more commonly associated with severe wildfire, particularly following extended periods of fire exclusion. Many actions proposed in the *Northern Shawangunk Ridge Fire Management Plan* would actually reduce the potential for high intensity wildfire, thereby mitigating the long term impacts of fire on various soil and hydrological processes.

Effects of Fire on Soils & Water

Soils

Both prescribed and wildfires can cause significant changes to the physical, chemical and biological properties of the soil, most importantly (from DeBano et al. 2005, Knoepp at al. 2005, and Busse and DeBano 2005):

- consumption of litter and organic matter in the upper layers of the soil;
- alteration of soil structure, including decreased porosity and infiltration rates;
- increased potential for erosion due to loss of protective vegetation and organic material and possibly development of water repellent layers in the soil profile;
- volatilization and loss of soil nutrients—particularly carbon and nitrogen; and
- temporary reduction in the abundance of soil microorganisms.

The degree to which soil physical, chemical and biological properties are impacted by fire is almost entirely a function of how much heat is transferred into various soil layers. A fire that burns hotter and longer in a given area will transfer more heat into the soil and result in greater impacts to soils. Certain fire impacts, such as the periodic reduction of the amount of litter and organic matter on the soil surface, may be necessary for the successful regeneration of some

species, such as oak and pitch pine. Other effects, including the loss of soil microorganisms, are transitory and quickly recover to pre-fire conditions (Busse and DeBano 2005).

Fire effects on nutrient cycling are complex and poorly understood, but in general a variety of compounds are volatilized into the atmosphere. Nitrogen in particular—an important nutrient that often limits forest productivity and growth—is highly susceptible to volatilization during a fire. While this can result in a net loss in total soil nitrogen, fires typically increase the amount of nitrogen that is available to plants, resulting in a temporary ―fertilization" effect (Knoepp et al. 2005). In addition, periodic fires may play an important long term role in limiting soil nutrient and moisture levels, thereby promoting characteristic ecological communities in the Shawangunks such as dry chestnut oak forest and pitch pine woodlands.

Perhaps the most serious potential impacts to soil are related to erosion. Nearly all fires result in some increase in soil erosion. In extreme scenarios, severe wildfires followed by intense precipitation events can lead to devastating erosion on steep slopes. Severe soil impacts that can dramatically increase the potential for erosion—including the development of water repellent layers and loss of soil porosity—are associated with extreme soil heating (DeBano et al. 2005) and are unlikely to occur as a result of prescribed fire. The increased potential for erosion following fire is also temporary, declining rapidly in the years following a fire as vegetation becomes reestablished on the site.

Water

Fires can also affect aquatic habitats and water quality, primarily as a secondary result of the various impacts on the soil. The greatest potential impacts to water include (from Neary et al. 2005a and Neary et al. 2005b):

- increase in stream flow following precipitation events, including exacerbation of floods due to increased surface water runoff; and
- increased sedimentation from post-fire soil erosion.

Increased stream flow occurs when fires increase the amount of surface runoff—both directly as a result of decreasing water infiltration into the soil and indirectly due to reduced uptake of soil moisture by vegetation. Again, the severity of this impact is a function of fire intensity and significant impacts are associated with high intensity wildfire that alters soil structure and completely removes vegetation (Neary et al. 2005a).

Prescribed burns are unlikely to result in any serious impacts to soil and water resources, but burns conducted when soil moisture is very low can burn deeply into the duff layer, consuming significant amounts of organic material and increasing the amount of soil heating. These types of burns could increase the potential for soil impacts; however, they are uncommon and are typically used to achieve specific management objectives that will have a beneficial ecological impact (e.g. exposing rock outcrop habitat, preparing mineral soil seedbed, limiting post-fire resprouting of shrubs and other species).

Potential Impacts of Firebreak Maintenance and Construction on Soils & Water

The creation and/or maintenance of firebreaks also has the potential to impact soil and water resources. Poorly constructed temporary firebreaks installed during prescribed burn or wildfire suppression operations—for example firebreaks that involve significant soil disturbance, incorporate steep grades, or cross watercourses—can experience significant erosion. This can cause lasting damage to the soil profile within the firebreak and lead to sedimentation in nearby streams. These impacts can be exacerbated by heavy vehicle or foot traffic. Following the guidelines for firebreak construction described in Section 2.3 and implementing Minimum Impact Suppression Tactics (MIST) when constructing and rehabilitating any new firebreaks should prevent any serious impacts to soil and water resources.

Maintenance or repairs to existing permanent firebreaks could also result in erosion and/or stream sedimentation if conducted improperly. However, increased maintenance of road and trail surfaces and drainage systems should actually reduce the potential for significant erosion to occur.

Minimizing Impacts to Soils & Water Resources

Adherence to best management practices and accepted standards when implementing fire management activities should result in minimal impacts to soil and water resources. In general, the following techniques can be used to further reduce any anticipated impacts to soil and water from a specific management action.

- Avoid prescribed burning under conditions that are likely to result in very high fire intensity on steep slopes and favor conditions that promote a patchy mosaic of burn severity.
- Select conditions for burning that minimize the potential for extended smoldering of soil organic matter, and avoid burning large concentrations of heavy fuels to prevent excessive soil heating.
- Utilize MIST guidelines when constructing new firebreaks for prescribed burning and wildfire suppression to the greatest extent possible (see Appendix C).
- Locate firebreaks away from wet soils that may be more susceptible to physical disturbance and avoid watercourses that may be impacted by erosion of firebreaks.
- Conduct proper maintenance of road and trail surfaces and drainage systems, and use proper design and construction standards when conducting repairs.

3.2 Air Quality

Prescribed burning helps achieve many desired resource objectives, but it nevertheless generates particulate matter and other substances that can pollute the air. Carbon dioxide (CO2) and water vapor make up about 90% of smoke emissions from a wildland fire. Other important components of smoke are carbon monoxide, hydrocarbons, nitrogen oxides and particulate matter (Ottmar 2001). Of all the pollutants generated during wildland fires, particulate matter less than 10 microns (PM10) and particulate matter less than 2.5 microns (PM2.5) pose the greatest risk to human health (Sandberg et al. 2002).

Pollutant emissions from a fire can vary dramatically based on a number of factors—including the amount of fuel/area burned, fire intensity, fuel moisture, etc. Impacts on air quality from smaller prescribed fires tend to be localized to the area immediately downwind of the burn and are generally limited in duration to a few hours during and immediately following the burn. Larger burns or burns in areas with heavy fuel loads can produce substantial amounts of smoke, and may impact larger areas. Smoke from large severe wildfires can affect air quality hundreds of miles away and has been documented to produce PM10 concentrations that exceed national ambient air quality standards for ~~"i~~mminent and substantial endangerment of public health" in nearby communities (Sandberg et al. 2002).

Smoke dispersion during a prescribed fire is dependent on a variety of fuel and atmospheric conditions. Smoke produced from dry fuels burning under favorable atmospheric conditions can disperse rapidly and produce little or no perceptible impact on visibility or air quality. Fuels with a higher moisture content do not burn as completely and thus produce more smoke, but higher fuel moistures may also result in less fuel being consumed thereby limiting smoke production (Ottmar 2001). In general, the amount of smoke produced from a prescribed fire will be less than that of a wildfire, which would typically be burning under hotter and drier conditions and therefore consuming more fuel. Prescribed burns conducted regularly should reduce the potential for high intensity fires to occur, and thereby reduce the potential for concentrated impacts on air quality resulting from a large, severe wildfire.

When conducting burns, managers typically use conditions of favorable wind speed and direction and atmospheric instability to help disperse smoke away from ground level and any potentially smoke sensitive areas. Fire intensity can also be managed to either a) produce less smoke; or b) help to disperse smoke by creating additional convective lifting of the smoke column. At night, smoke can accumulate in low lying areas following a prescribed fire due to cold air drainage and very stable atmospheric conditions. This can result in significant concentrations of smoke in certain areas but impacts are again localized and typically clear shortly after atmospheric mixing resumes the following morning.

Minimizing Smoke Emissions

If substantial smoke production from a prescribed burn is anticipated, managers have a variety of additional techniques for mitigating impacts to air quality from prescribed fire smoke emissions. In general, two approaches exist for managing the effects of wildland smoke on air quality: 1)

use techniques that reduce emissions produced for a given area treated; and 2) redistribute emissions (i.e. disperse smoke) by using desirable wind and mixing patterns (Ottmar et al. 2001). Smoke management methods described by Ottmar et al. (2001) applicable to fire management in the Shawangunks have been summarized below. No one strategy is appropriate for every situation, and managers will need to select and implement effective smoke management techniques that are most compatible with achieving ecological and hazard reduction objectives.

Reduce the Area Burned

1. Isolate Fuels—depending on the management unit and the given weather conditions, pockets of heavy fuel may be isolated during a prescribed burn in a number of ways, by: constructing fireline around the fuels of concern, not lighting individual or concentrated fuels, using natural barriers or snow, scattering fuels or spraying them with foam or other fire retardant material.
2. Mosaic Burning—even within a given vegetation type, fuel conditions in the Shawangunk landscape vary in continuity and moisture. Prescribed fires can be planned and applied to use this heterogeneity to mimic natural fires and create patches of burned and unburned areas. Mosaic burning is most useful when large units (e.g. > 100 acres) can be burned.

Reduce Fuel Load

Mechanically removing fuels from a site reduces emissions proportionally to the amount of fuel removed. In the Shawangunks, it may be appropriate to mechanically reduce wildland fuels in certain instances but it is not feasible over large areas due to the difficult terrain.

Reduce Fuel Consumed

1. Conduct burns when large woody fuels (3+ inches in diameter) have high moisture content and are unlikely to burn or smolder.
2. Burn when litter and duff moisture is high and unlikely to smolder. This technique is frequently used to manage smoke in the northeastern United States; however it may be desirable to consume organic material during some burns to achieve certain management objectives.

Schedule Burning Before New Fuels Appear

Burning prior to spring green up or leaf drop in the fall can reduce the amount of available fuel. While this may help to reduce smoke impacts, fires during green up or after litter fall may have ecological benefits and may coincide with more favorable weather conditions.

Increase Combustion Efficiency

1. The use of backing fires—fires burning more slowly into the wind—can be favored when practical to reduce smoke production. Flaming combustion is cleaner than smoldering combustion. A backing fire takes advantage of this relationship by causing more fuel consumption to take place in the flaming phase than would occur if a heading fire were used.

2. Use aggressive mop-up to extinguish residual smoke caused by smoldering as quickly as possible following flaming combustion. This will also minimize the amount of overnight smoke production and reduce the potential for down-drainage smoke accumulation.

Burn When Dispersal is Good

Smoke concentrations can be reduced by diluting the smoke through a greater volume of air, either by burning during good dispersal conditions (when the atmosphere is unstable) or burning at slower rates. Mixing heights, transport winds and other meteorological parameters can be used to estimate atmospheric stability and the anticipated degree of dispersal on a given day. This mitigation measure is incorporated into the prescribed burn planning process through the use of prescription parameters.

Avoid Sensitive Areas

The most obvious way to avoid smoke issues is to burn when the wind is blowing away from smoke sensitive features such as roadways, hospitals, nursing homes, residential or other developed areas. Wind direction is considered during all phases of prescribed burn planning and implementation.

Burn Smaller Units

Burning smaller units—or portions of larger units over several days—reduces the amount of smoke produced at any given time thereby reducing concentrations of emissions. This technique may be desirable in close proximity to smoke sensitive features, but is less efficient than burning larger areas.

Burn More Frequently

Burning areas on a more frequent basis prevents heavy accumulations of fuel and distributes smoke emissions over time. As the interval between burns increases, more biomass is allowed to accumulate and subsequent burns or wildfires will produce more smoke.

3.3 Plants & Animals

The plant and animal communities that exist in the Shawangunks are, in many cases, a direct result of the historical fire regime and other natural processes that have occurred here. As described in Chapter 1, much of the flora and fauna found in the Shawangunks are dependent on periodic fires to maintain suitable habitat or stimulate regeneration. A primary focus of the *Northern Shawangunk Ridge Fire Management Plan* is to restore a more ecologically appropriate fire regime to many areas of the Shawangunks to benefit the unique species and natural communities that exist here.

While the Shawangunks ecosystem is likely to benefit substantially from the implementation of this plan, there are some rare plant and animal species that are potentially more susceptible to impacts from the proposed actions. Individual species of concern are discussed below. Appendix B includes a complete list of significant natural communities and rare plant and animal

species documented by the NY Natural Heritage Program for the Northern Shawangunks (New York Natural Heritage Program 2009).

Fire Management Impacts on Plants

Implementation of fire management activities can impact individual plants in many ways, depending on their life history and physiological traits. Construction and maintenance of firebreaks and mechanical fuel reduction treatments can result in the cutting of vegetation over small areas, and impacts are generally the same for all species. Constructed firebreaks for prescribed fires are typically narrow (4-8 feet in total width), revegetate quickly and—although they may be visually perceptible for some time—these types of firebreaks will have little impact on plants other than those that are physically removed when the firebreak is constructed.

Plants have a variety of responses to fire and accordingly will be impacted in different ways by the implementation of prescribed fire. Many trees—including pitch pine and chestnut oak—have thick insulating bark to help them survive during a fire. Many trees and herbaceous plants can be ~~"~~topkilled" but resprout vigorously from surviving root systems, while others may die but take advantage of favorable post-fire conditions to regenerate from seed (Miller 2000). While periodic fires favor some species, others such as red maple and white pine are typically sensitive to fire, particularly when trees are younger. In many cases, exclusion of these fire sensitive species in favor of more fire adapted species is a primary ecological management goal. In general, increased implementation of prescribed fire will favor species that prefer more open, drier habitats at the expense of those that flourish in shadier, more mesic environments. Mesic habitats will continue to exist in ravines, lower lying areas and other areas sheltered from fire.

While prescribed fire can be implemented over wide areas, most plants in the Shawangunks can easily recover from dormant season fires that only affect the above ground portions of the plant. In particular, low shrub species such as huckleberry, blueberry and sheep laurel—which can resprout vigorously following dormant season fires—quickly return to or exceed their pre-fire abundance within a few growing seasons. Fires that burn when plants are physiologically active, or fires that burn into the organic soil layers, can result in more extensive plant mortality (Miller 2000). A management goal in some areas may be to reduce the amount of certain shrub species through the use of growing season fires to provide habitat for a greater number of smaller herbaceous plants and enhance tree regeneration.

Rare Plant Species

The Shawangunks are home to numerous plants that are rare in New York State, many of which are locally abundant and widely distributed across the landscape. Others, however, are more restricted to one or a very few locations. Widespread species occurrences are far less likely to be impacted by any management activities proposed in the *Northern Shawangunk Ridge Fire Management Plan* and many are likely to significantly benefit from enhanced and/or expanded habitat on the ridge. Smaller isolated populations may be potentially vulnerable depending on their particular physiological traits. Several management actions described in this plan—including prescribed fire, construction of firebreaks, mechanical treatments and forest thinning—

have the potential to impact rare plant populations in the Shawangunks.

Wildfires are more likely to burn large areas that may include entire populations of a species and are also more likely to burn under conditions of extreme summer drought when many species are most vulnerable. If necessary, prescribed burns can be planned to exclude rare plant occurrences or they can be timed to avoid sensitive periods during plant life cycles. Baseline and follow-up monitoring of rare plant occurrences following fires will be important for gaining a better understanding of fire effects on rare plants.

Some rare plant populations may be impacted by the construction or expansion of firebreaks, or other activities that may physically damage plant root systems or disturb the soil. Most of the priority firebreaks identified in this plan are existing features and maintenance or restoration of these firebreaks poses little risk to rare plants. New firebreaks installed for prescribed burning or wildfire suppression—particularly those that are expected to incur substantial foot or vehicle traffic—could result in damage to rare species occurrences if not properly located, but this risk can be easily mitigated. Similarly, forest thinning and mechanical treatments for fire management can easily be planned to avoid rare plant populations. While soil disturbances or severe fires may be damaging to isolated individuals or small populations of rare plants, many rare species found in the Shawangunks thrive on recently disturbed sites and are often absent from more interior forest areas (T. Weldy, personal communication). Accordingly, actions proposed in this plan should benefit most rare plant species provided that impacts to highly isolated individuals or sensitive populations are mitigated.

Broom crowberry (*Corema conradii*) occurs in only one location in the Shawangunks and that occurrence is in fact the only known location where the species exists in New York (New York Natural Heritage Program 2010). In addition, it is the only non-coastal location where the species has been documented. While broom crowberry is almost exclusively associated with fire maintained pine barrens throughout its range, the small size of this particular occurrence could make it somewhat susceptible to burning, physical disturbance from firebreak construction or trampling. This species occurrence is also protected from fire to some degree by rock outcrops and the population is unlikely to be extirpated by an individual fire event. Further, fire should enhance surrounding habitat by reducing competition from other shrubs.

Several other rare plant species have a highly limited distribution in the Shawangunks, including black-edge sedge (*Carex nigromarginata*) and mock-pennyroyal (*Hedeoma hispida*). Although it is probable that these species occur in other locations that are not documented, they should be protected from physical disturbance or burning at potentially sensitive times of year to prevent impacts to the overall population. However, both of these species are pine barrens associates that require disturbance to maintain their populations. Accordingly, they are likely to benefit from occasional fires over the long term.

Fire Management Impacts on Animals

In contrast to plants, most animal species are mobile and have the ability to avoid many of the direct physical impacts of fire. As a result, animal species are much more likely to be affected by altered habitat as a result of fire management activities, rather than during the actual

implementation. A number of the animal species in the Shawangunks depend on fire maintained habitats to thrive and they will likely benefit from fire management activities.

While direct exposure to fire can be lethal to virtually every animal species, the actual degree of injury and mortality sustained by various animal populations during wildland fires is typically very low (Lyon et al. 2000a). Birds and large mammals tend to be highly mobile and can simply leave a burning area. Many less mobile species burrow beneath the soil where they are protected from lethal temperatures or seek out unburned areas (i.e. refugia) where they remain unharmed (Lyon et al. 2000a).

Construction of firebreaks can also indirectly impact animals by creating fragmenting features or barriers to movement in their habitat. These impacts are likely reduced by maintaining some vegetative cover and minimizing soil exposure and disturbance when creating firebreaks for prescribed burning. The impacts of prescribed fire control lines as firebreaks will be temporary and should not affect most species. Heavy dozer lines constructed during wildfire suppression operations have a much greater potential to function as fragmenting features for most species due to their width, exposure of mineral soil and the longer recovery period. Fragmentation impacts to wildlife could be exacerbated if firebreaks subsequently receive either authorized or unauthorized human uses (e.g. hiking, biking, ATV use) that could disturb adjacent wildlife such as nesting birds.

Birds

Due to the wide diversity of forest and shrubland nesting bird species that inhabit the Shawangunks, the area has been designated both as an Important Bird Area (IBA) by Audubon NY and as a Bird Conservation Area (BCA) by New York State. The IBA designation includes the entire ridge area and recognizes that the habitats of the Shawangunks harbor both individual species at risk, as well as an exemplary upland forest breeding bird assemblage (Burger and Liner 2005). The BCA status of the Shawangunks extends over the majority of Minnewaska State Park Preserve and is based on several criteria including the importance of the ridge as a migratory bird site, diverse species concentration site, species at risk site and bird research site (NYS Department of Environmental Conservation 2010). The goal of the BCA program is to ensure that bird conservation is considered and integrated into planning and management activities. The Minnewaska BCA Management Guidance Summary recognizes that chestnut oak forest and pine barrens are critical habitats for birds in the Shawangunks and encourages investigating the use of prescribed fire for habitat improvement (NYS Department of Environmental Conservation 2010).

Most fire management activities other than prescribed burning will have little impact on bird species. Fire caused mortality among adult birds is rare, but nesting birds can be significantly impacted by fires during the late spring and early summer (Lyon et al. 2000b). This sensitive nesting period can overlap with periods that are suitable for prescribed burning in the Shawangunks region. Species that nest on the ground and in the shrub layers are particularly vulnerable, although many of these species thrive in habitats that are maintained by fire. Fire impacts to nesting birds are localized to the immediate burned area and small to moderately sized burns should not impact bird populations overall, even if conducted during the nesting season.

Much of the bird habitat in the Shawangunks is fire maintained and fire management activities should provide a net benefit to most bird species. A study by the Shawangunk Ridge Biodiversity Partnership is currently underway to better understand the impacts of both wildfire and prescribed burning on songbird species habitat in the Shawangunks. Preliminary results following spring wildfire at Minnewaska State Park Preserve indicate that fire effects significantly altered bird habitat and the abundance of many species dropped sharply following the burn. However, numerous species quickly re-colonized the area and some—particularly those that nested in open shrub habitat—may even be increasing in abundance within 3 years following the fire (The Nature Conservancy, unpublished data).

Reptiles & Amphibians

Reptiles and amphibians—collectively referred to as herpetofauna—are another group of species that can potentially be impacted by fire. There are few documented reports of herpetofauna being directly impacted by fire (Lyon et al. 2000b)—probably a result of their preference for relatively moist habitats, use of underground burrows and ability to seek out unburned refugia. Despite their apparent vulnerability, reptiles and amphibians can often be seen actively moving about burned areas immediately following a fire (Ulev 2008, G. Chapin, personal observation). Studies of box turtles (*Terrapene carolina*) —a potentially vulnerable species that prefers drier upland habitat—have shown wide variability in fire caused injury and mortality. While there are numerous reports of turtles burrowing to avoid fire or simply withdrawing into their shells and allowing the fire to burn over them unharmed, there are also reports of relatively high mortality following fires (Luensmann 2006). Direct fire caused mortality is not generally thought to have significant impacts on populations of most common amphibian species (Pilliod et al. 2003).

Reptiles and amphibians are far more likely to be impacted by altered habitat than directly by fire, and these impacts are likely to vary greatly among species based on their physiological and life history characteristics. In general, short term fire effects on amphibian habitat are thought to be negative, but fire is likely to positively alter many of the same habitat characteristics over the long term (Pilliod et al. 2003). While the populations of most widespread species should not be impacted, fire management activities should be planned to avoid impacting particularly sensitive life stages of species that have restrictive habitat requirements and have a limited distribution in the Shawangunks.

Rare Animal Species

Implementation of prescribed fire does pose a degree of risk to certain rare animal species, particularly those that live above ground and have very small populations and/or limited mobility. Intense fires that are fast moving and cover large areas generally pose the greatest threat to most animal species. The timing of a fire can also be extremely important, as many animals may be significantly more vulnerable during certain seasons (e.g. nesting, mating or emergence) or life stages (e.g. larva vs. adult).

Timber Rattlesnake

The timber rattlesnake is one rare animal species (NYS threatened) that may be potentially impacted by the implementation of prescribed fire due to its relatively limited mobility and low reproductive rate. While there is little available information on the impacts of fire on timber

rattlesnakes, studies and anecdotal evidence suggest that eastern diamondback rattlesnakes in the southeastern US effectively utilize unburned refugia during a fire, and even very frequent burning is thought to have little impact on populations of this species (Ulev 2008 and references therein). While documented individual mortality of eastern diamondback rattlesnakes is very rare, there may be some increased vulnerability with skin shedding which limits snake mobility (Ulev 2008).

In the Shawangunks, rattlesnakes tend to occur most frequently in the chestnut oak forest and pine barrens habitats with available exposed rock outcrops for gestation and basking. Periodic fire should help to improve and maintain this habitat, and it is expected that low to moderate severity prescribed fires would provide a net benefit to this species.

Spring emergence of rattlesnakes in the Shawangunks occurs in late April and early May, and snakes typically return to dens for winter hibernation in late September and early October (E. McGowan, personal communication). Although rattlesnake den sites in the Shawangunks are typically located in rocky crevices that are unlikely to be affected by fire, den populations may be particularly vulnerable to fire when concentrated in the vicinity of den areas during spring egress and fall ingress, owing to the entire den population being confined to a small area at those times. Suitable rocky habitat immediately surrounding dens sites is also heavily used by gravid (pregnant) female snakes for gestation throughout the summer season (Ulev 2008 and references therein); however, gravid females in the Shawangunks are also known to travel long distances from the den to gestate and, in some cases, give birth to young (McGowan 1999). Other critical habitat includes basking sites where dispersed snakes are more likely to be found during the summer months. Although there is a greater probability of snakes occupying gestation and basking areas in the summer, these habitats are also more likely to include rock outcrops and crevices which provide refugia, somewhat mitigating the vulnerability of these snakes to fire caused mortality. Vulnerability would be greatest for snakes in wooded foraging habitat lacking suitable refugia from fire.

Rare Insects

Four species of rare moth inhabit the pine barrens and oak forests in the Shawangunks. Although they are vulnerable to fire at all stages of their life cycle, they depend largely on the presence of pitch pine and blueberry, both of which are promoted and maintained by fire. While the rare moth species in the Shawangunks could be potentially impacted by fires that affect a very large proportion of their habitat in a single year, or by several large adjacent fires in consecutive years, they will likely benefit from increased fire frequency.

The dwarf pine barrens also harbor another rare insect species, the northern barrens tiger beetle (*Cicindela patruela patruela*). Recent surveys from 2006 – 2007 revealed an apparently well distributed population of beetles in several disturbed areas and open rock outcrops in the Shawangunks (Schlesinger 2010). Similar to the rare moths, the northern barrens tiger beetle can suffer direct mortality from fire but this impact is likely outweighed by the benefit of fires that maintain pine barrens openings, provided that a large proportion of the available habitat is not impacted by a single fire event.

Significant Ecological Communities

The dominant ecological communities that exist in the Shawangunks have evolved with fire as a periodic disturbance and are likely to either be tolerant of or benefit from fire management activities. Although some significant ecological communities in the Shawangunks (see Appendix B for complete list) may occur only in small isolated patches—for example small wetlands or vernal pools—the majority of communities that could be potentially impacted by fire management activities are relatively widespread and range from several hundred to many thousands of acres in size.

Smaller disturbances, such as temporary firebreak construction or small scale mechanical treatments will generally have a low potential for impacting significant ecological communities, although there are important exceptions to this generalization. Construction of new permanent or semi-permanent firebreaks can fragment ecological communities, possibly disrupting certain ecological functions. This potential impact will increase as firebreaks increase in width or length and/or along those firebreaks that receive increased foot or vehicle traffic. In addition, construction of even small or temporary firebreaks through or near sensitive small patch communities—such as wetlands—can cause physical disturbance to the site that result in lasting negative impacts.

Invasive Plants

Certain firebreaks provide potential avenues for the establishment and spread of invasive plant species into ecological communities. Invasive plants can have several negative impacts, including displacement of native plant species (a particular threat to rare native plant species) and disruption of certain ecological functions. The potential for invasive species to establish and spread increases when mineral soil is exposed, particularly on more mesic sites. Seeds of invasive species can also be transported by vehicles and firefighters during fire operations, as well as by hikers who subsequently use the area.

Recently burned areas can also provide sites for the establishment of invasive species, but the quick recovery of native flora usually prevents infestations from occurring. Again, invasive species are more likely to establish following fires that burn deeply into the duff and expose mineral soil.

The potential impacts to significant ecological communities from invasive species varies depending on a variety of factors, including site conditions, proximity to other infested areas, amount of soil disturbance and the amount of vehicle and foot traffic during and after firefighting operations. Where significant potential exists for invasive species to establish as a result for fire management activities, steps can be taken to mitigate potential impacts, including monitoring for the spread of invasive species in potentially vulnerable areas, minimizing soil disturbance when creating firebreaks, properly cleaning engines and other firefighting equipment that has been used at sites with invasive plants and, if necessary, closing firebreaks and/or burned areas to hiking following a fire until native vegetation has recovered.

Minimizing Impacts to Plants & Animals

Overall, fire management activities are expected to benefit the ecology of the Shawangunks ecosystem and enhance and expand habitat for the species that have historically thrived here, including those that are rare. While many plant and animal species—including some rare species—may suffer localized mortality as a result of fire management, the continued exclusion of fire from the ecosystem may, in many cases, pose a much greater risk. The loss of suitable habitat could lead to significant long term population declines, or even result in the extirpation of entire populations from the Shawangunks.

By managing for a dynamic fire adapted system with a mosaic of burned areas and refugia, the majority of species should continue to survive and even thrive under a more natural fire regime. Certain species may still be more sensitive to management activities than others, and the potential impacts of an individual action on sensitive plants and animals should be assessed and evaluated against the expected benefits. In addition, there are several general strategies that managers can use to minimize the potential impacts of fire management activities on plant and animal population.

- Acknowledge the presence of rare plant or animal species within a potential management area during the planning process, assess the potential impacts versus benefits of management and identify any mitigating actions if necessary.
- Minimize the construction of firebreaks in areas that could directly impact rare plant populations and avoid construction of firebreaks in wet areas that are more susceptible to physical disturbance.
- Monitor as necessary for the establishment and spread of invasive plant species in potentially vulnerable areas (e.g. firebreaks with exposed mineral soil, burn areas with exposed soil) following fire management activities.
- Favor ignition patterns, burn unit sizes and configurations, and fuel/weather conditions that provide adequate unburned refugia for wildlife during prescribed burns.
- Strategically plan prescribed fires to limit the proportion of any individual species' habitat type that is burned in a single event and provide an adequate period of recovery before burning adjacent areas.

In order to minimize the potential impacts to timber rattlesnakes, a series of guidelines for conducting prescribed burns in rattlesnake habitat are included below:

- There are no limitations on burning between October 31 and April 1 while snakes are generally in hibernation.
- Prescribed burns within 0.25 miles of known timber rattlesnake den locations will only occur after October 31 or before April 1, unless a significant mitigating factor exists and is documented in the approved burn plan or otherwise approved by NYS DEC (e.g. significant habitat or physical barrier to snake movement exists between den and burn unit, area surrounding den is substantially protected from fire, snakes are otherwise known to be absent from burn unit at the time of the burn).

- Prescribed burn plans within 2.0 miles of a rattlesnake den location will be screened by NYS DEC and NYS OPRHP and/or PIPC staff with appropriate expertise for known basking areas or other sensitive timber rattlesnake habitat features. If a known habitat feature exists within or adjacent to the proposed burn area, an assessment will be made to determine the potential impacts of the proposed burn. If necessary, the prescribed burn plan will describe mitigating actions, such as physically protecting the habitat features during the burn with firebreaks and/or water, adjusting burn timing to avoid sensitive periods, and burning under conditions that promote greater variability in fire behavior and provide more unburned refugia for snakes.

3.4 Historical & Archeological Resources

The Shawangunks have a long and fascinating history of human use, dating back to early Paleo-Indians that inhabited the area as early as 10,000-12,000 years ago (The Nature Conservancy 2010 and references therein). Rock shelters—temporary shelters used seasonally by Paleo-Indians and by more recent American Indians while foraging and hunting on the ridge—are common in the Shawangunks, particularly in the northern portions of the ridge. These sites contain various artifacts and remains that provide an important record of the pre-European human history of the region.

There are also numerous cultural resources in the Shawangunks that post-date widespread European settlement of the region. Several small settlements—including the Trapps Hamlet and other isolated homesteads—were established on the ridge in the early 1800s. Old foundations, charcoal pits and early quarries associated with this period are common throughout the Shawangunks as well.

In the mid to late 1800s seasonal camps were established across the southern portions of the ridge for picking and selling blueberries during the summer months. Many remnants of these seasonal camps exist, although there has been little in the way of formal excavation at these sites. During this time, several significant resort hotels were also established in the Shawangunks, nearly all of which were subsequently destroyed by fires. There are numerous sites that contain remnants of these resorts and other associated facilities from the ~~"~~Resort Era". Due to the rich cultural history of the region, three sites in the Shawangunks have been placed on the National Register of Historic Places: the Trapps Mountain Hamlet, the Lake Mohonk Mountain House Complex and the Cragsmoor Historic District.
The cultural resources in the Shawangunks will not be affected by any fire management activities given proper planning. Screening for important historical or archaeological resources will be incorporated into the planning process for fire management and sensitive sites should be avoided or protected. These sites are potentially sensitive to physical disturbance resulting from firebreak construction, which could impact not only the various artifacts but the unique context in which they remain. Prescribed burns also have the potential to damage remnants of berry picker camps if not properly implemented. Relatively simple measures—such as routing firebreaks around sensitive areas, excluding significant historical or archeological sites from burn units or protecting them with firelines or water during a burn—can prevent any damage to these resources.

3.5 Recreational & Aesthetic Resources

The Shawangunk Mountains receive huge numbers of recreational visitors each year, estimated at several hundred thousand annually for Mohonk Preserve, Minnewaska State Park Preserve and Sam's Point Preserve combined. The Shawangunks represent a significant recreational resource in southeastern New York and accordingly, recreational impacts must be included in any fire management planning and implementation efforts. The most common recreational activities on the ridge are hiking, rock climbing and biking.

Any impacts on recreational and aesthetic resources will be temporary in nature. The most significant issue for both the public and for land managers will be the closing of trailheads and portions of park/preserve property while prescribed burns are being conducted. As a matter of safety, the public will not be allowed to enter areas where prescribed burns are about to occur or while burns are actually taking place. Additional closure may result if there is a residual hazard (e.g. significant smoking material, hot spots, unstable standing dead trees) but these closures will likely last for only one or several days, depending on the actual conditions. If there is some secondary threat associated with post fire recreational activities, such as the establishment of invasive species, an area may stay closed for a longer period of time but can be reopened as soon as native vegetation becomes reestablished.

Portions of former carriage roads or trails may also need to be closed while being repaired; however, such closures will again be temporary in nature and will ultimately maintain the primary recreational infrastructure (i.e. carriage roads and trails) on the ridge over time.

The impacts of fire management activities on public use and enjoyment of the various park/preserve properties in the Shawangunks will likely vary somewhat. Severe fire can decrease public use and enjoyment of an area due to the aesthetic impacts of the burned landscape while low intensity fire may actually improve aesthetic value over time by creating a more open forest structure and increasing wildflower abundance (Vaux et al. 1984). Fire management that focuses on low to moderate intensity prescribed fires should not result in any long term degradation of recreational and aesthetic resources, and may in fact reduce the risk of high severity wildfire that could lead to extended closures and greater aesthetic impacts.

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Appendices

Appendix A. Summary of High Priority Actions

Table A.1. Table of high priority 5-year actions summarized by action type from Sections 2.4 and 2.5.

	Fire Mgmt Region	General Description of Action
Firebreak Repairs & Maintenance	All FMRs	• Conduct significant vegetation management and surface/drainage repairs on Smiley Road from Ellenville to Lake Awosting Road at Sam's Point Preserve and Minnewaska State Park Preserve • Repair drainage and surface on Loop Road at Sam's Point Preserve • Conduct surface and drainage repairs to High Point Road between Loop Road and High Point at Sam's Point Preserve; maintain vegetation along High Point Rd., including extension from High Point to Smiley Road at Minnewaska State Park Preserve • Manage vegetation, reduce adjacent fuels and improve surface along Verkeerder Kill Falls Trail and Scenic Trail at Sam's Point Preserve and Minnewaska State Park Preserve
	MILL	• Reduce fuel accumulations and improve surface condition on Gertrude's Nose Trail and Millbrook Mountain Trail
	CAST	• Conduct necessary repairs and manage fuels along Upper Awosting Road and Castle Point Road
	BADL	• Manage adjacent vegetation and fuels along High Point Trail to improve suitability as firebreak
	MARA	• Conduct substantial repairs to drainage and surface condition on Ice Caves Road
Prescribe Burning	SPRF	• Conduct prescribed burns to promote oak regeneration and ecological management in areas around Spring Farm and Bonticou Crag
	TRAP	• Conduct prescribed burns for chestnut oak forest restoration and ecological management around the Trapps cliffs, Oakwood Drive and Glory Hill areas • Conduct prescribed burns as feasible to reduce hazardous shrub fuels in the Sparkling Ridge WUI area and enhance protection for the Mohonk Mountain House property and facilities
	PETE	• Conduct initial test prescribed burns in the vicinity of the Jenny Lane parking area
	STON	• Conduct research prescribed burns in the 2008 Overlooks wildfire area to examine effects of repeated short interval burns
	CAST	• Conduct test prescribed burns in the former golf course area to assess fire behavior and ecological impacts in oak forest damaged by gypsy moth • Conduct prescribed burns as feasible around fringes of region to reduce fuels and reinforce firebreaks around large area of heavy fuel
	AWOS	• Conduct prescribed burns in the Awosting Reserve area for ecological management in chestnut oak forest • Conduct prescribed burns as feasible around Lake Awosting for ecological management in pine barrens

	NORG	• Conduct prescribed burns along fringes of the region as feasible to reduce fuels and create buffers for managing wildfire
	MARA	• Conduct fuels reduction burns in oak forest in vicinity of Sam's Point Conservation Center to reduce fuels and provide buffer between volatile pine barrens fuels and WUI areas. • Conduct initial burns in dwarf pine barrens around Lake Maratanza to assess fire operations and fire effects in this fuel/veg. type. • Conduct additional burns as feasible for fuels reduction/ecological management in oak forest and pine barrens
Wildfire Suppression	MINE	• Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to pine barrens in the upper Mine Hole area.
	BADL	• Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to potentially sensitive Badlands area and upper Verkeerder Kill watershed
	NORG	• Promote the use of indirect wildfire suppression tactics when possible that minimize impacts to rare dwarf pine barrens in eastern and northern portions of region
Community Outreach	PETE	• Work with local communities to reduce wildfire hazard in Laurel Hollow, Stony Kill Road, Raycliff Drive and Rock Hill Road WUI areas
	STONE	• Work with local community to reduce wildfire hazard in Decker Road WUI area
	MARA	• Continue to work with Cragsmoor community to maintain Firewise program • Work with local community to reduce wildfire hazard in other WUI communities, including Mt. Meenahga and Walker Valley
Monitoring	TRAP	• Conduct intensive ecological monitoring in chestnut oak forest areas to assess the effectiveness of prescribed fire and other treatments in restoring degraded chestnut oak forest
	STON	• Continue to monitor ecological recovery following wildfire and subsequent prescribed burns
	MARA	• Conduct ecological monitoring in dwarf pine barrens to assess current condition and effectiveness of prescribed fire in achieving management objectives

Appendix B. List of Rare Species and Natural Communities in the Shawangunks

NEW YORK NATURAL HERITAGE PROGRAM
Report on Rare Plants, Rare Animals, and Significant Natural Communities
for the
NORTHERN SHAWANGUNK RIDGE

This report does not contain precise locations, and therefore may be included in documents. However, information that does disclose the precise locations of rare plants or animals may lead to the collection or disturbance of those plants or animals. Therefore, information on precise locations should not be included in any reports or maps made available to the public. The New York Natural Heritage Program can offer guidance on presenting rare species location information in such a way as to minimize the risks to the plants and animals.

Prepared March 2009, from the Biodiversity Databases of the New York Natural Heritage Program, NYS DEC, 625 Broadway, Albany, NY, 12233-4757.

	COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	NY STATE RANK*	GLOBAL RANK**
Last documented since 1980					
Animals	Eastern Small-footed Myotis	*Myotis leibii*	Special Concern	S2	G3
	Bald Eagle	*Haliaeetus leucocephalus*	Threatened	S2S3B,S2N	G5
	Peregrine Falcon	*Falco peregrinus*	Endangered	S3B	G4
	Pied-billed Grebe	*Podilymbus podiceps*	Threatened	S3B,S1N	G5
	Bog Turtle	*Glyptemys muhlenbergii*	Endangered (also federally listed as Threatened)	S2	G3
	Timber Rattlesnake	*Crotalus horridus*	Threatened	S3	G4
	A Noctuid Moth	*Zale curema*	Unlisted	SU	G3G4
	Blueberry Gray	*Glena cognataria*	Unlisted	S1S3	G4
	Pine Barrens Zanclognatha	*Zanclognatha martha*	Unlisted	S1S2	G4
	Tawny Emperor	*Asterocampa clyton*	Unlisted	S2S4	G5
	Toothed Apharetra	*Apharetra dentata*	Unlisted	S2S4	G4
	Northern Barrens Tiger Beetle	*Cicindela patruela patruela*	Unlisted	S1	G3T3
	Arrowhead Spiketail	*Cordulegaster obliqua*	Unlisted	S2S3	G4
	Brook Snaketail	*Ophiogomphus aspersus*	Unlisted	S2	G4
	Rapids Clubtail	*Gomphus quadricolor*	Unlisted	S1S2	G3G4
	Brook Floater	*Alasmidonta varicosa*	Threatened	S1	G3
Plants	Appalachian Sandwort	*Minuartia glabra*	Threatened	S2	G4
	Arctic Rush	*Juncus trifidus*	Threatened	S2	G5
	Beakgrass	*Diarrhena obovata*	Endangered	S2	G4G5

	COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	NY STATE RANK*	GLOBAL RANK**
	Black-edge Sedge	*Carex nigromarginata*	Endangered	S1S2	G5
	Blue Wild Rye	*Elymus glaucus ssp. glaucus*	Unlisted	S1	G5T5
	Broom Crowberry	*Corema conradii*	Endangered	S1	G4
	Button-bush Dodder	*Cuscuta cephalanthi*	Endangered	S1	G5
	Carey's Smartweed	*Persicaria careyi*	Threatened	S1S2	G4
	Clustered Sedge	*Carex cumulata*	Threatened	S2S3	G4?
	Davis' Sedge	*Carex davisii*	Threatened	S2	G4
	False Hop Sedge	*Carex lupuliformis*	Rare	S2	G4
	Georgia Bulrush	*Scirpus georgianus*	Endangered	S1	G5
	Mock-pennyroyal	*Hedeoma hispida*	Threatened	S2S3	G5
	Mountain Spleenwort	*Asplenium montanum*	Threatened	S2S3	G5
	Reflexed Sedge	*Carex retroflexa*	Endangered	S2S3	G5
	Rhodora	*Rhododendron canadense*	Threatened	S2	G5
	Riverweed	*Podostemum ceratophyllum*	Threatened	S2	G5
	Rough Avens	*Geum virginianum*	Endangered	S2	G5
	Violet Wood-sorrel	*Oxalis violacea*	Threatened	S2S3	G5
	Wood Reedgrass	*Calamagrostis perplexa*	Endangered	S1	G1
	Woodland Rush	*Juncus subcaudatus*	Endangered	S1	G5
	Anderson's peat moss	*Sphagnum andersonianum*	Unlisted	S1	G3?
	Flat-leaved peat moss	*Sphagnum platyphyllum*	Unlisted	S1	G5
	Soft-leaved peat moss	*Sphagnum tenellum*	Unlisted	S2	G5
	Trinidad peat moss	*Sphagnum trinitense*	Unlisted	S1	G4
	Two-ranked moss	*Pseudotaxiphyllum distichaceum*	Unlisted	S2S3	G4G5
Communities	Acidic Talus Slope Woodland			S3	G4?
	Chestnut Oak Forest			S4	G5
	Cliff Community			S4	G5
	Confined River			S3S4	G4
	Dwarf Pine Ridges			S1	G1G2
	Dwarf Shrub Bog			S3	G4
	Floodplain Forest			S2S3	G3G4
	Hemlock-Northern Hardwood Forest			S4	G4G5
	Highbush Blueberry Bog Thicket			S3	G4
	Ice Cave Talus Community			S1S2	G3?
	Perched Bog			S1S2	G3G4
	Pitch Pine-Blueberry Peat Swamp			S1	G3?
	Pitch Pine-Oak-Heath Rocky Summit			S3S4	G4
	Vernal Pool			S3S4	G4
Last documented prior to 1980					
Animal	Allegheny Woodrat	*Neotoma magister*	Endangered	S1	G3G4

	COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	NY STATE RANK*	GLOBAL RANK**
Plants	Bradley's Spleenwort	*Asplenium bradleyi*	Endangered	SH	G4
	Cut-leaved Evening-primrose	*Oenothera laciniata*	Endangered	S1	G5
	Hyssop-skullcap	*Scutellaria integrifolia*	Endangered	S1	G5
	Large Twayblade	*Liparis liliifolia*	Endangered	S1	G5
	Northern Running-pine	*Diphasiastrum complanatum*	Endangered	S1	G5
	Prairie Wedgegrass	*Sphenopholis obtusata*	Endangered	S1	G5
	Primrose-leaf Violet	*Viola primulifolia*	Threatened	S2	G5
	Puttyroot	*Aplectrum hyemale*	Endangered	S1	G5
	Riverbank Quillwort	*Isoetes riparia*	Endangered	S1	G5?
	Scarlet Indian-paintbrush	*Castilleja coccinea*	Endangered	S1	G5

* Rarity in NYS as ranked by NY Natural Heritage Program on a 1 to 5 scale:
S1 = Critically imperiled; S2 = Imperiled; S3 = Rare or uncommon;
S4 = Abundant and apparently secure; S5 = Demonstrably abundant and secure;
SH = Historical records only; no recent information available.
B = Breeding population; N = Non-breeding/wintering population.

** Global rarity as ranked by Nature Serve on a 1 to 5 scale:
G1 = Critically imperiled; G2 = Imperiled; G3 = Rare or vulnerable;
G4 = Apparently secure; G5 = Secure;
GH = Historically known, with the expectation that it might be rediscovered;
GX = Species believed to be extinct; GU = Status unknown.
Range ranks, e.g. G1G2, indicate not enough information is available to distinguish between two ranks.
? = a question exists about the rank. Q = a question exists whether or not the species or variety is a good taxonomic entity.
T-ranks (T1 - T5) are defined the same as G-ranks (G1 - G5), but the T-rank refers only to the rarity of the subspecies or variety.

Appendix C. Minimum Impact Suppression Tactics (MIST) Guidelines

Relevant guidelines from National Wildfire Coordinating Group Resource Advisors Guide for Wildland Fire, PMS 313 are included below (National Wildfire Coordinating Group 2004). The full publication is available from the NWCG website at www.nwcg.gov.

Implementation

Keep this question in mind: What creates the greater impact, the fire suppression effort or the fire?

Safety

- Apply principles of LCES to all planned actions.
- Constantly review and apply the 18 Watchout Situations and 10 Standard Firefighting Orders.
- Be particularly cautious with:
    - Burning snags allowed to burn.
    - Burning or partially burned live and dead trees.
    - Unburned fuel between you and the fire.

Escape Routes and Safety Zones

- In any situation, the best escape routes and safety zones are those that already exist.
- Identifying natural openings, existing roads and trails and taking advantage of safe black will always be a preferred tactic compatible with MIST. If safety zones must be created, follow guidelines similar to those for helispot construction.
- Constructed escape routes and safety zones in heavier fuels will have a greater impact, be more time consuming, labor intensive, and ultimately less safe.

General Considerations

- Consider the potential for introduction of noxious weeds and mitigate by removing weed seed from vehicles, personal gear, cargo nets, etc. Equipment should be washed down prior to leaving the incident in order to prevent the spread of noxious weeds.
- Consider impacts to riparian areas when setting up water handling operations.
    - Use longer draft hoses to place pumps out of sensitive riparian areas.
    - Plan travel routes for filling bladder bags to avoid sensitive riparian areas.
- Ensure adequate spill containment at fuel transfer sites and pump locations. Stage spill containment kits at the incident.

Line Construction Phase

- Select tactics, tools, and equipment that least impact the environment.
- Give serious consideration to use of water or foam as a firelining tactic.
- Use alternative mechanized equipment such as motor patrols, disks, rubber-tired skidders, etc., when available and appropriate rather than dozers when constructing mechanical line.
- When constructed fireline is necessary, use only the minimum width and depth needed to prevent the fire's spread.
- Allow fire to burn to natural barriers and existing roads and trails.
- Monitor and patrol firelines to ensure continued effectiveness.

Ground Fuels

- Use cold-trail, wet line, or combination when appropriate. If constructed fireline is necessary, use minimum width and depth to stop fire spread.
- Consider the use of fireline explosives (FLE) for line construction and snag falling to create more natural appearing firelines and stumps.
- Burn out and use low impact tools like swatters and gunny sacks.
- Minimize bucking to establish fireline: preferably move or roll downed material out of the intended constructed fireline area. If moving or rolling out is not possible, or the downed log/bole is already on fire, build line around it and let the material be consumed.

Aerial Fuels–brush, trees, and snags

- Adjacent to fireline: limb only enough to prevent additional fire spread.
- Inside fireline: remove or limb only those fuels which would have potential to spread fire outside the fireline.
- Cut brush or small trees necessary for fireline construction flush to the ground.
- Trees, burned trees, and snags:
    - Minimize cutting of trees, burned trees, and snags.
    - Do not cut live trees unless it is determined they will cause fire spread across the fireline or seriously endanger workers. Cut stumps flush with the ground.
    - Scrape around tree bases near fireline if hot and likely to cause fire spread.
    - Identify hazard trees with flagging, glowsticks, or a lookout.
- When using indirect attack:
    - Do not fall snags on the intended unburned side of the constructed fireline unless they are an obvious safety hazard to crews.
    - Fall only those snags on the intended burn-out side of the line that would reach the fireline should they burn and fall over.

Mop-up Phase

- Consider using ~~–h~~ot-spot" detection devices along perimeter (aerial or handheld).
- Use extensive cold-trailing to detect hot areas.

- Cold-trail charred logs near fireline: do minimal scraping or tool scarring. Restrict spading to hot areas near fireline.
- Minimize bucking of logs to check for hot spots or extinguish fire: preferably roll the logs and extinguish the fire.
- When ground is cool return logs to original position after checking.
- Refrain from piling: burned/partially burned fuels that were moved should be arranged in natural positions as much as possible.
- Consider allowing larger logs near the fireline to burn out instead of bucking into manageable lengths. Use a lever, etc., to move large logs.
- Use gravity socks in stream sources and/or combination of water blivets and fold-a-tanks to minimize impacts to streams.
- Personnel should avoid using rehabilitated firelines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehabilitation work.
- Avoid use of non-native materials for sediment traps in streams.
- Aerial fuels (brush, small trees, and limbs): remove or limb only those fuels which if ignited have potential to spread fire outside the fireline.
- Burning trees and snags:
    - Be particularly cautious when working near snags. *(*Ensure adequate safety measures are communicated.)
    - The first consideration is to allow a burning tree/snag to burn itself out or down.
    - Identify hazard trees with flagging, glowsticks or a lookout.
    - If there is a serious threat of spreading firebrands, extinguish with water or dirt.
    - Consider felling by blasting, if available.

Aviation Management

- Minimize the impacts of air operations by incorporating MIST in conjunction with standard aviation risk assessment processes.
- Possible aviation-related impacts include:
    - Damage to soils and vegetation resulting from heavy vehicle traffic, noxious weed transport, and/or extensive modification of landing sites.
    - Impacts to soil, fish and wildlife habitat, and water quality from hazardous material spills.
    - Chemical contamination from use of retardant and foam agents.
    - Biological contamination to water sources; e.g., whirling disease.
    - Safety and noise issues associated with operations in proximity to populated areas, livestock interests, wildland-urban interface, and incident camps and staging areas.
- Helispot Planning
    - When planning for helispots, determine the primary function of each helispot; e.g., crew transport or logistical support.

    - Consider using long-line remote hook in lieu of constructing a helispot.
    - Consult Resource Advisors in the selection and construction of helispots during incident planning.
    - Estimate the amount and type of use a helispot will receive and adapt features as needed.
- Balance aircraft size and efficiency against the impacts of helispot construction.
- Use natural openings as much as possible. If tree felling is necessary, avoid high visitor-use locations unless the modifications can be rehabilitated. Fall, buck, and limb only what is necessary to achieve a safe and practical operating space.

Retardant, Foam, and Water Bucket Use

- Assess risks to sensitive watersheds from chemical retardants and foam. Communicate specific drop zones to air attack and pilots, including areas to be avoided.
- Fire managers should weigh use of retardant with the probability of success by unsupported ground force. Retardant may be considered for sensitive areas when benefits will exceed the overall impact. This decision must take into account values at risk and consequences of expanded fire response and impact on the land.
- Consider biological and/or chemical contamination impacts when transporting water.
- Limited water sources expended during aerial suppression efforts should be replaced. Consult Resource Advisors prior to extended water use beyond initial attack.

Restoration and Rehabilitation

- Firelines:
    - After fire spread has stopped and lines are secured, fill in deep and wide firelines and cup trenches and obliterate any berms. The berm material should be spread back into the fireline or recontoured to the fireline.
    - Be careful not to reignite or spread hot material hidden in berms across the fireline.
    - Restore drainages by removing fill or dams, reestablish crossings and return to natural configuration.
    - Use waterbars only when necessary to prevent erosion or use woody material to act as sediment dams. Waterbars should only be used on steep slopes and only when necessary. General guidelines for waterbar spacing are listed in the table below. However, it is important to note that improper construction and inappropriate placement of waterbars can create excessive erosion.
    - Maximum Waterbar Spacing General Guidelines:

Percent Grade	*Maximum Spacing (Feet)*
< 9	400
10 – 15	200
15 – 25	100
25 +	50

    - Ensure stumps are cut flush with ground.

    - Camouflage cut stumps by flush-cutting, chopping, covering, or using FLE to create more natural appearing stumps.
    - Any trees or large size brush cut during fireline construction should be scattered to appear natural.
    - Discourage the use of newly created firelines and trails by blocking with brush, limbs, poles, and logs in a naturally appearing arrangement.
- Pack out all garbage and dispose of in an approved facility.
- General:
    - Remove all signs of human activity.
    - Remove all flagging.
    - Restore helicopter landing sites.
    - Fill in and cover latrine sites.
- Walk through adjacent undisturbed areas and take a look at your rehabilitation efforts to determine your success at returning the area to as natural a state as possible.

Appendix D. Environmental Assessment Forms

617.20
Appendix A
State Environmental Quality Review
FULL ENVIRONMENTAL ASSESSMENT FORM

Purpose: The full EAF is designed to help applicants and agencies determine, in an orderly manner, whether a project or action may be significant. The question of whether an action may be significant is not always easy to answer. Frequently, there are aspects of a project that are subjective or unmeasurable. It is also understood that those who determine significance may have little or no formal knowledge of the environment or may not be technically expert in environmental analysis. In addition, many who have knowledge in one particular area may not be aware of the broader concerns affecting the question of significance.

The full EAF is intended to provide a method whereby applicants and agencies can be assured that the determination process has been orderly, comprehensive in nature, yet flexible enough to allow introduction of information to fit a project or action.

Full EAF Components: The full EAF is comprised of three parts:

Part 1: Provides objective data and information about a given project and its site. By identifying basic project data, it assists a reviewer in the analysis that takes place in Parts 2 and 3.

Part 2: Focuses on identifying the range of possible impacts that may occur from a project or action. It provides guidance as to whether an impact is likely to be considered small to moderate or whether it is a potentially-large impact. The form also identifies whether an impact can be mitigated or reduced.

Part 3: If any impact in Part 2 is identified as potentially-large, then Part 3 is used to evaluate whether or not the impact is actually important.

DETERMINATION OF SIGNIFICANCE -- Type 1 and Unlisted Actions

Identify the Portions of EAF completed for this project: X Part 1 X Part 2 X Part 3

Upon review of the information recorded on this EAF (Parts 1 and 2 and 3 if appropriate), and any other supporting information, and considering both the magnitude and importance of each impact, it is reasonably determined by the lead agency that:

X A. The project will not result in any large and important impact(s) and, therefore, is one which **will not** have a significant impact on the environment, therefore **a negative declaration will be prepared.**

B. Although the project could have a significant effect on the environment, there will not be a significant effect for this Unlisted Action because the mitigation measures described in PART 3 have been required, therefore **a CONDITIONED negative declaration will be prepared.***

C. The project may result in one or more large and important impacts that may have a significant impact on the environment, therefore **a positive declaration will be prepared**.

*A Conditioned Negative Declaration is only valid for Unlisted Actions

Name of Action: **Northern Shawangunk Ridge Fire Management Plan**

Name of Lead Agency
New York State Department of Environmental Conservation

New York State Office of Parks, Recreation and Historic Preservation

Print or Type Name of Responsible Officer in Lead Agency	Title of Responsible Officer
William Rudge, NYS DEC	**Region 3 Natural Resources Supervisor**
Edwina Belding, NYS OPRHP	**Environmental Analyst 2**

Signature of Responsible Officer in Lead Agency	Date	Signature of Preparer (If different from responsible officer)	Date
			**10/22/2010**

PART 1--PROJECT INFORMATION
Prepared by Project Sponsor

NOTICE: This document is designed to assist in determining whether the action proposed may have a significant effect on the environment. Please complete the entire form, Parts A through E. Answers to these questions will be considered as part of the application for approval and may be subject to further verification and public review. Provide any additional information you believe will be needed to complete Parts 2 and 3.

It is expected that completion of the full EAF will be dependent on information currently available and will not involve new studies, research or investigation. If information requiring such additional work is unavailable, so indicate and specify each instance.

NAME OF ACTION: **Northern Shawangunk Ridge Fire Management Plan**		
LOCATION OF ACTION (INCLUDE STREET ADDRESS, MUNICIPALITY AND COUNTY) **Towns of Rosendale, New Paltz, Gardiner, Shawangunk, Wawarsing, Rochester and Marbletown, and Village of Ellenville, Ulster County, New York (see Attachment A for map of project location)**		
NAME OF APPLICANT/SPONSOR **The Nature Conservancy, Shawangunk Ridge Program**	BUSINESS TELEPHONE **845-255-9051**	
ADDRESS **108 Main St.**		
CITY/PO **New Paltz**	STATE **NY**	ZIP CODE **12561**
NAME OF OWNER (IF DIFFERENT) **1. NYS Office of Parks, Recreation & Historic Preservation** **2. Palisades Interstate Park Commission** **3. NYS Department of Environmental Conservation** **4. Mohonk Preserve** **5. Open Space Conservancy**	BUSINESS TELEPHONE **1. (518) 474-0443** **2. (845)-786-7911** **2. (845) 256-3000** **3. (845) 255-0919** **4. (212) 629-3981**	
ADDRESS **1. Empire State Plaza, Agency Building 1** **2. Administration Building – Bear Mountain** **3. 21 South Putt Corners Road** **4. P.O. Box 715** **5. 1350 Broadway, Room 201**		
CITY/PO **1. Albany** **2. Bear Mountain** **3. New Paltz** **4. New Paltz** **5. New York**	STATE **New York**	ZIP CODE **1. 12238** **2. 10911** **3. 12561** **4. 12561** **5. 10018**

DESCRIPTION OF ACTION

The New York State Department of Environmental Conservation and New York State Office of Parks, Recreation and Historic Preservation, as joint lead agencies with the support of the Shawangunk Ridge Biodiversity Partnership, propose to develop a Fire Management Plan for protected state and private lands in the Northern Shawangunk Mountains, including Mohonk Preserve, Minnewaska State Park Preserve, Sam's Point Preserve and Witch's Hole State Forest. Together, these lands currently include nearly 30,000 acres of habitat for a suite of rare species and forest types, many of which are adapted to periodic wildfire. In the absence of wildfire over the past 50-100 years, fire adapted ecological communities have suffered significant degradation including encroachment by fire-sensitive species, lack of regeneration by characteristics species (oak & pitch pine) and substantial accumulation of flammable fuels increasing the risk of high intensity wildfire. This threat of extreme wildfire was realized in April 2008 when a fire burned over 3,000 acres at Minnewaska State Park Preserve and adjacent private land, endangering several local communities.

In order to protect the sensitive ecological resources that exist in the Northern Shawangunks and the human communities that surround the ridgetop open space, this plan will address critical issues related to safe and ecologically appropriate fire management. Actions discussed in the plan include fire suppression, prescribed fire, mechanical fuels reduction treatments, firebreak construction and maintenance, community education programs, ecological monitoring and other relevant issues. The plan also discusses the potential ecological and human impacts of the actions discussed, methods for mitigating impacts, and threshold actions that will require additional SEQRA review prior to implementation.

Please Complete Each Question--Indicate N.A. if not applicable

A. SITE DESCRIPTION

Physical setting of overall project, both developed and undeveloped areas.

1. Present Land Use: [ ] Urban [ ] Industrial [ ] Commercial [ ] Residential (suburban) [ ] Rural (non-farm)

[ ] Forest [ ] Agriculture [X] Other — Various natural non-forest land cover & unvegetated types (e.g. pine barren shrublands/woodlands, cliffs/talus fields) and post-agricultural lands (e.g. old fields, successional woodlands)

2. Total acreage of project area: **Approx 29,891** Acres.

APPROXIMATE ACREAGE	PRESENTLY		AFTER COMPLETION	
		Acres		acres
Meadow or Brushland (Non-agricultural)	**522**	Acres	**522**	acres
Forested	**20,809**	Acres	**20,809**	acres
Agricultural (Includes orchards, cropland, pasture, etc.)	**0**	Acres	**0**	acres
Wetland(Freshwater or tidal as per Articles 24,25 of ECL)	**399**	Acres	**399**	acres
Water Surface Area	**203**	Acres	**203**	acres
Unvegetated (Rock, earth or fill)	**290**	Acres	**290**	acres
Roads, buildings and other paved surfaces	**124**	Acres	**124**	acres
Other (Indicate type) **Pine Barren Shrubland & Woodland**	**7544**	Acres	**7544**	acres

3. What is predominant soil type(s) on project site? **Rock outcrop and silty loam**

a. Soil drainage: [X] Well drained **92** % of site [X] Moderately well drained **2** % of site.
[X] Poorly drained **6** % of site

b. If any agricultural land is involved, how many acres of soil are classified within soil group 1 through 4 of the NYS Land Classification System? **N/A** Acres (see 1NYCRR 370).

4. Are there bedrock outcroppings on project site? [X] YES [ ] NO
   a. What is depth to bedrock? (in feet) **Depth to bedrock is highly variable across the landscape based on topographic position. Rock outcrops and exposed bedrock slabs are common high on the ridge with deeper soils in excess of several feet on lower slopes.**

5. Approximate percentage of proposed project site with slopes: [X] 0-10% **34** % [X] 10-15% **17** % [X] 15% or greater **49** %

6. Is project substantially contiguous to, or contain a building, site, or district, listed on the State or National Registers of Historic Places? [X] YES [ ] NO **Cragsmoor Historic District, Lake Mohonk Mountain House Complex, Trapps Mountain Hamlet**

7. Is project substantially contiguous to a site listed on the Register of National Natural Landmarks? [ ] YES [X] NO **Ellenville Fault-Ice Caves at Sam's Point Preserve**

8. What is the depth of the water table? **Variable: 0 to >6** (in feet)

9. Is site located over a primary, principal, or sole source aquifer? [ ] YES [X] NO

10. Do hunting, fishing or shell fishing opportunities presently exist in the project area? [X] YES [ ] NO

11. Does project site contain any species of plant or animal life that is identified as threatened or endangered? [X] YES [ ] NO
    According to: **New York Natural Heritage Program**
    Identify each species: **See Attachment B for complete list. Fire management activities will directly benefit many of the rare species and ecological communities present on the Shawangunk Ridge.**

12. Are there any unique or unusual land forms on the project site? (i.e., cliffs, dunes, other geological formations)? [X] YES [ ] NO
    Describe: **The Shawangunks contain many unique geological features including numerous cliff, rock outcrops and ice caves.**

13. Is the project site presently used by the community or neighborhood as an open space or recreation area? [X] YES [ ] NO
    If yes, explain: **All of the protected conservation lands in the Shawangunks are open to day use recreation activities, and overnight camping is permitted on DEC owned lands. Approximately 500,000 visitors come to the Shawangunks each year to hike, mountain bike, rock climb, ski and swim.**

14. Does the present site include scenic views known to be important to the community? [X] Yes [ ] No

15. Streams within or contiguous to project area: **Several, see below**

a. Name of Stream and name of River to which it is tributary: **Verkeerder Kill, Dwaar Kill, Palmaghatt Kill, Mara Kill (tributaries of Shawangunk Kill); Kleine Kill (tributary of Wallkill River); Coxing Kill, Fly Brook, Peters Kill, Sanders Kill, Stony Kill (tributaries of Rondout Creek)**

16. Lakes, ponds, wetland areas within or contiguous to project area: **5 lakes and numerous small wetlands that are not named (see Attachment C for map of lakes & wetlands)**

a. Name: **Lake Maratanza, Mud Pond, Lake Awosting, Tillson Lake, Lake Minnewaska**

b. Size (in acres): **50.9, 10.2, 96.6, 25.9, 35.5 acres respectively**

17. Is the site served by existing public utilities? [ ] Yes [X] No

a. If **YES,** does sufficient capacity exist to allow connection? [ ] Yes [ ] No

b. If **YES**, will improvements be necessary to allow connection? [ ] Yes [ ] No

18. Is the site located in an agricultural district certified pursuant to Agriculture and Markets Law, Article 25-AA, Section 303 and 304? [ ] Yes [X] No

19. Is the site located in or substantially contiguous to a Critical Environmental Area designated pursuant to Article 8 of the ECL, and 6 NYCRR 617? **Small portion of project location lies within Shawangunk Ridge CEA in the Town of Shawangunk** [X] Yes [ ] No

20. Has the site ever been used for the disposal of solid or hazardous wastes? [ ] Yes [X] No

B. Project Description

1. Physical dimensions and scale of project (fill in dimensions as appropriate).

a. Total contiguous acreage owned or controlled by project sponsor **29,891 (owned by various partner organizations)** acres.

b. Project acreage to be developed: **0** acres initially; **0** acres ultimately.

c. Project acreage to remain undeveloped **29,891** acres.

d. Length of project, in miles: **N/A** (if appropriate)

e. If the project is an expansion, indicate percent of expansion proposed **N/A** %

f. Number of off-street parking spaces existing **N/A** ; proposed **N/A**

g. Maximum vehicular trips generated per hour **N/A** (upon completion of project)?

h. If residential: Number and type of housing units: **N/A**

	One Family	Two Family	Multiple Family	Condominium
Initially				
Ultimately				

I. Dimensions (in feet) of largest proposed structure **N/A** height; _____ width; length.

J. Linear feet of frontage along a public thoroughfare project will occupy is? **N/A** **ft.**

2. How much natural material (i.e. rock, earth, etc.) will be removed from the site? **0** tons/cubic yards.

3. Will disturbed areas be reclaimed? [X] N/A [ ] Yes [ ] No

a. If yes, for what intended purpose is the site being reclaimed? _____

b. Will topsoil be stockpiled for reclamation? [ ] Yes [ ] No

c. Will upper subsoil be stockpiled for reclamation? [ ] Yes [ ] No

4. How many acres of vegetation (trees, shrubs, ground covers) will be removed from site? **0**
Some disturbance to vegetation may occur during firebreak construction and/or prescribed burning, however, natural vegetative cover will remain. acres.

5. Will any mature forest (over 100 years old) or other locally-important vegetation be removed by this project? [ ] Yes [X] No

6. If single phase project: Anticipated period of construction **N/A** Months, (including demolition)

7. If multi-phased: **N/A**

a. Total number of phases anticipated _____ (number)

b. Anticipated date of commencement phase 1 _____ month _____ year, (including demolition)

c. Approximate completion date of final phase _____ month _____ year.

d. Is phase 1 functionally dependent on subsequent phases? [ ] YES [ ] NO

8. Will blasting occur during construction? [ ] YES [X] NO

9. Number of jobs generated: during construction **N/A** ; after project is complete _____

10. Number of jobs eliminated by this project **N/A**

11. Will project require relocation of any projects or facilities? [ ] YES [X] NO
If yes, explain: _____

12. Is surface liquid waste disposal involved? [ ] YES [X] NO

a. If yes, indicate type of waste (sewage, industrial, etc) and amount _____

b. Name of water body into which effluent will be discharged _____

13. Is subsurface liquid waste disposal involved? Type _____ [ ] YES [X] NO

14. Will surface area of an existing water body increase or decrease by proposal? [ ] YES [X] NO
If yes, explain: _____

15. Is project or any portion of project located in a 100 year flood plain? **Some areas of Coxing Kill floodplain at Mohonk Preserve** [X] YES [ ] NO

16. Will the project generate solid waste? [ ] YES [X] NO

a. If yes, what is the amount per month _____ Tons

b. If yes, will an existing solid waste facility be used? [ ] YES [ ] NO

c. If yes, give name _____ ; location _____

d. Will any wastes not go into a sewage disposal system or into a sanitary landfill? [ ] YES [ ] NO

e. If yes, explain: _____

17. Will the project involve the disposal of solid waste? [ ] YES [X] NO

a. If yes, what is the anticipated rate of disposal? _____ tons/month.

b. If yes, what is the anticipated site life? _____ years.

18. Will project use herbicides or pesticides? [ ] YES [X] NO

19. Will project routinely produce odors (more than one hour per day)? [ ] YES [X] NO

20. Will project produce operating noise exceeding the local ambient noise levels? [ ] YES [X] NO

21. Will project result in an increase in energy use? [ ] YES [X] NO
If yes, indicate type(s) _____

22. If water supply is from wells, indicate pumping capacity **N/A** gallons/minute.

23. Total anticipated water usage per day **N/A** gallons/day.

24. Does project involve Local, State or Federal funding? [X] YES [ ] NO

If yes, explain: **Organizations involved in implementation of the Shawangunk Ridge Fire Management Plan have received and will continue to seek federal and state funding for project activities (e.g. National Fire Plan Grants, State Wildlife Grants, etc.). State Agencies (NYS DEC, NYS OPRHP/PIPC) may also use internal NY State funds to complete project activities as appropriate.**

25. Approvals Required:

			TYPE	SUBMITTAL DATE
City, Town, Village Board	[ ] YES	[X] NO	_____	_____
City, Town, Village Planning Board	[ ] YES	[x] NO	_____	_____
City, Town Zoning Board	[ ] YES	[x] NO		_____
City, County Health Department	[ ] YES	[x] NO	_____	_____
Other Local Agencies	[ ] YES	[x] NO		_____
Other Regional Agencies	[ ] YES	[x] NO	_____	_____
State Agencies	[X] YES	[ ] NO	**Prescribed burn actions must be approved in writing by the Regional Land Manager pursuant to a written**	_____

				plan for the conduct of the requested burn (6 NYCRR Part 194.7)). In addition, state agencies (NYS DEC, NYS OPRHP, PIPC) will need to approve and adopt the Northern Shawangunks Fire Management Plan in order for prescribed burns to occur on state owned lands.	
Federal Agencies		YES	X NO		

C. Zoning and Planning Information

1. Does proposed action involve a planning or zoning decision? ☐ YES ☒ NO

If Yes, indicate decision required:

☐ Zoning amendment ☐ Zoning variance ☐ New/revision of master plan ☐ Subdivision

☐ Site plan ☐ Special use permit ☐ Resource management plan ☐ Other

2. What is the zoning classification(s) of the site? **N/A**

3. What is the maximum potential development of the site if developed as permitted by the present zoning?

N/A

4. What is the proposed zoning of the site? **N/A**

5. What is the maximum potential development of the site if developed as permitted by the proposed zoning?

N/A

6. Is the proposed action consistent with the recommended uses in adopted local land use plans? ☒ YES ☐ NO

7. What are the predominant land use(s) and zoning classifications within a ¼ mile radius of proposed action?

State Park & State Forest land, privately owned conservation land

8. Is the proposed action compatible with adjoining/surrounding land uses with a ¼ mile? ☒ YES ☐ NO

9. If the proposed action is the subdivision of land, how many lots are proposed? **N/A**

   a. What is the minimum lot size proposed?

10. Will proposed action require any authorization(s) for the formation of sewer or water districts? ☐ YES ☒ NO

11. Will the proposed action create a demand for any community provided services (recreation, education, police, fire protection? **None anticipated but there is potential demand for fire protection in event of an escaped prescribed burn.** ☐ YES ☒ NO

    a. If yes, is existing capacity sufficient to handle projected demand? ☒ YES ☐ NO

12. Will the proposed action result in the generation of traffic significantly above present levels? ☐ YES ☒ NO

    a. If yes, is the existing road network adequate to handle the additional traffic. ☐ YES ☐ NO

D. Informational Details

Attach any additional information as may be needed to clarify your project. If there are or may be any adverse impacts associated with your proposal, please discuss such impacts and the measures which you propose to mitigate or avoid them.

Attachment A: Map of Project Location & Land Ownership
Attachment B: Rare Plants, Rare Animals, and significant Natural Communities for the Northern Shawangunk Ridge
Attachment C: Map of Significant Natural Communities, Lakes & Wetlands in Project Area

E. Verification

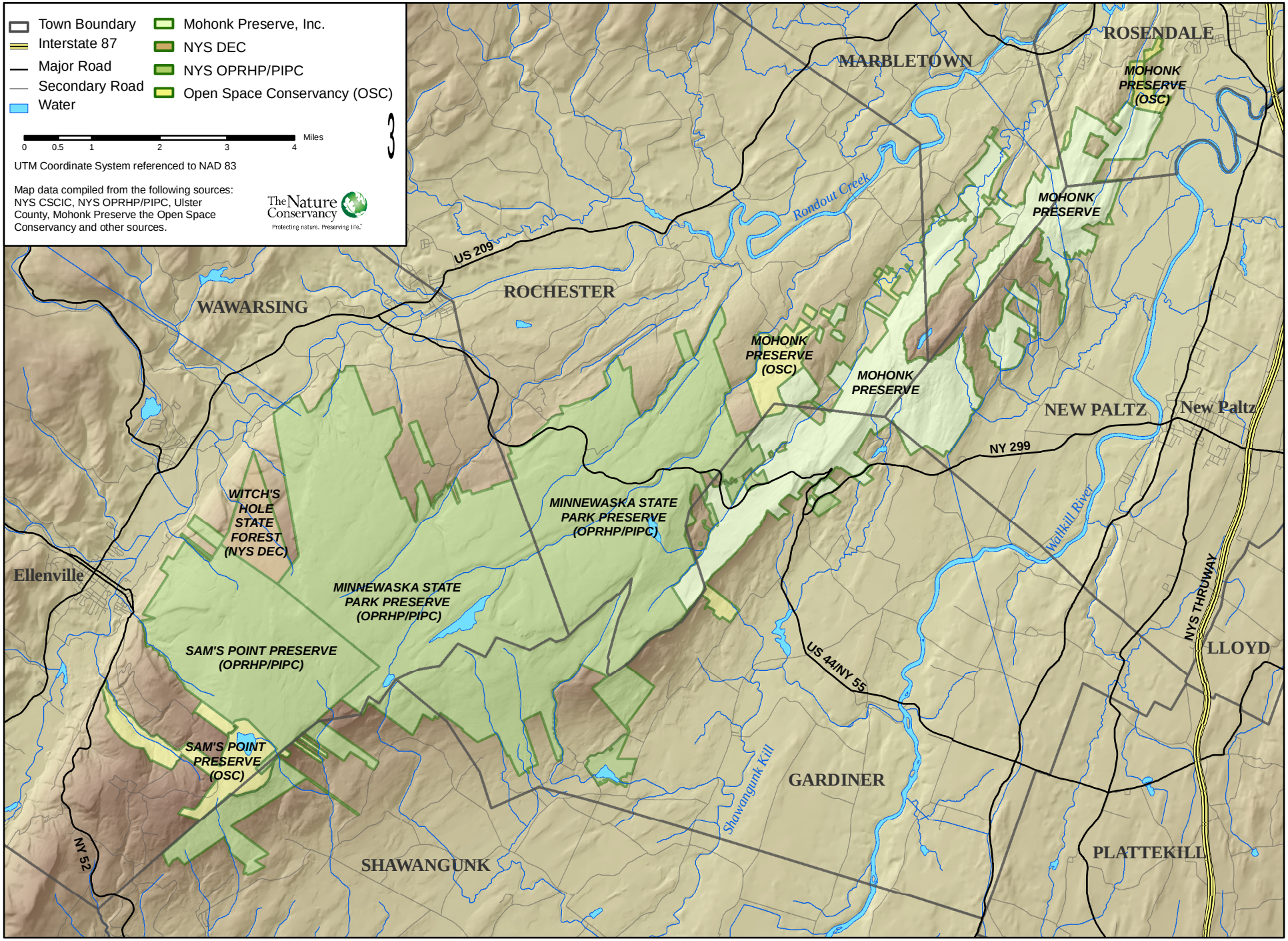
I certify that the information provided above is true to the best of my knowledge.

Applicant/Sponsor Name **Gabriel D. Chapin** Date **10/22/2010**

Signature  Title **Forest & Fire Ecologist, The Nature Conservancy, Eastern NY**

If the action is in the Coastal Area, and you are a state agency, complete the Coastal Assessment Form before proceeding with this assessment.

ATTACHMENT A. MAP OF PROJECT LOCATION & LAND OWNERSHIP



ATTACHMENT B. NEW YORK NATURAL HERITAGE PROGRAM REPORT ON RARE PLANTS, RARE ANIMALS, AND SIGNIFICANT NATURAL COMMUNITIES FOR THE NORTHERN SHAWANGUNK RIDGE

This report does not contain precise locations, and therefore may be included in documents. However, information that does disclose the precise locations of rare plants or animals may lead to the collection or disturbance of those plants or animals. Therefore, information on precise locations should not be included in any reports or maps made available to the public. The New York Natural Heritage Program can offer guidance on presenting rare species location information in such a way as to minimize the risks to the plants and animals.

Prepared March 2009, from the Biodiversity Databases of the New York Natural Heritage Program, NYS DEC, 625 Broadway, Albany, NY, 12233-4757.

	COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	NY STATE RANK*	GLOBAL RANK**
Last documented since 1980					
Animals	Eastern Small-footed Myotis	*Myotis leibii*	Special Concern	S2	G3
	Bald Eagle	*Haliaeetus leucocephalus*	Threatened	S2S3B,S2N	G5
	Peregrine Falcon	*Falco peregrinus*	Endangered	S3B	G4
	Pied-billed Grebe	*Podilymbus podiceps*	Threatened	S3B,S1N	G5
	Bog Turtle	*Glyptemys muhlenbergii*	Endangered (also federally listed as Threatened)	S2	G3
	Timber Rattlesnake	*Crotalus horridus*	Threatened	S3	G4
	A Noctuid Moth	*Zale curema*	Unlisted	SU	G3G4
	Blueberry Gray	*Glena cognataria*	Unlisted	S1S3	G4
	Pine Barrens Zanclognatha	*Zanclognatha martha*	Unlisted	S1S2	G4
	Tawny Emperor	*Asterocampa clyton*	Unlisted	S2S4	G5
	Toothed Apharetra	*Apharetra dentata*	Unlisted	S2S4	G4
	Northern Barrens Tiger Beetle	*Cicindela patruela patruela*	Unlisted	S1	G3T3
	Arrowhead Spiketail	*Cordulegaster obliqua*	Unlisted	S2S3	G4
	Brook Snaketail	*Ophiogomphus aspersus*	Unlisted	S2	G4
	Rapids Clubtail	*Gomphus quadricolor*	Unlisted	S1S2	G3G4
	Brook Floater	*Alasmidonta varicosa*	Threatened	S1	G3
Plants	Appalachian Sandwort	*Minuartia glabra*	Threatened	S2	G4
	Arctic Rush	*Juncus trifidus*	Threatened	S2	G5
	Beakgrass	*Diarrhena obovata*	Endangered	S2	G4G5
	Black-edge Sedge	*Carex nigromarginata*	Endangered	S1S2	G5
	Blue Wild Rye	*Elymus glaucus ssp. glaucus*	Unlisted	S1	G5T5
	Broom Crowberry	*Corema conradii*	Endangered	S1	G4
	Button-bush Dodder	*Cuscuta cephalanthi*	Endangered	S1	G5
	Carey's Smartweed	*Persicaria careyi*	Threatened	S1S2	G4
	Clustered Sedge	*Carex cumulata*	Threatened	S2S3	G4?

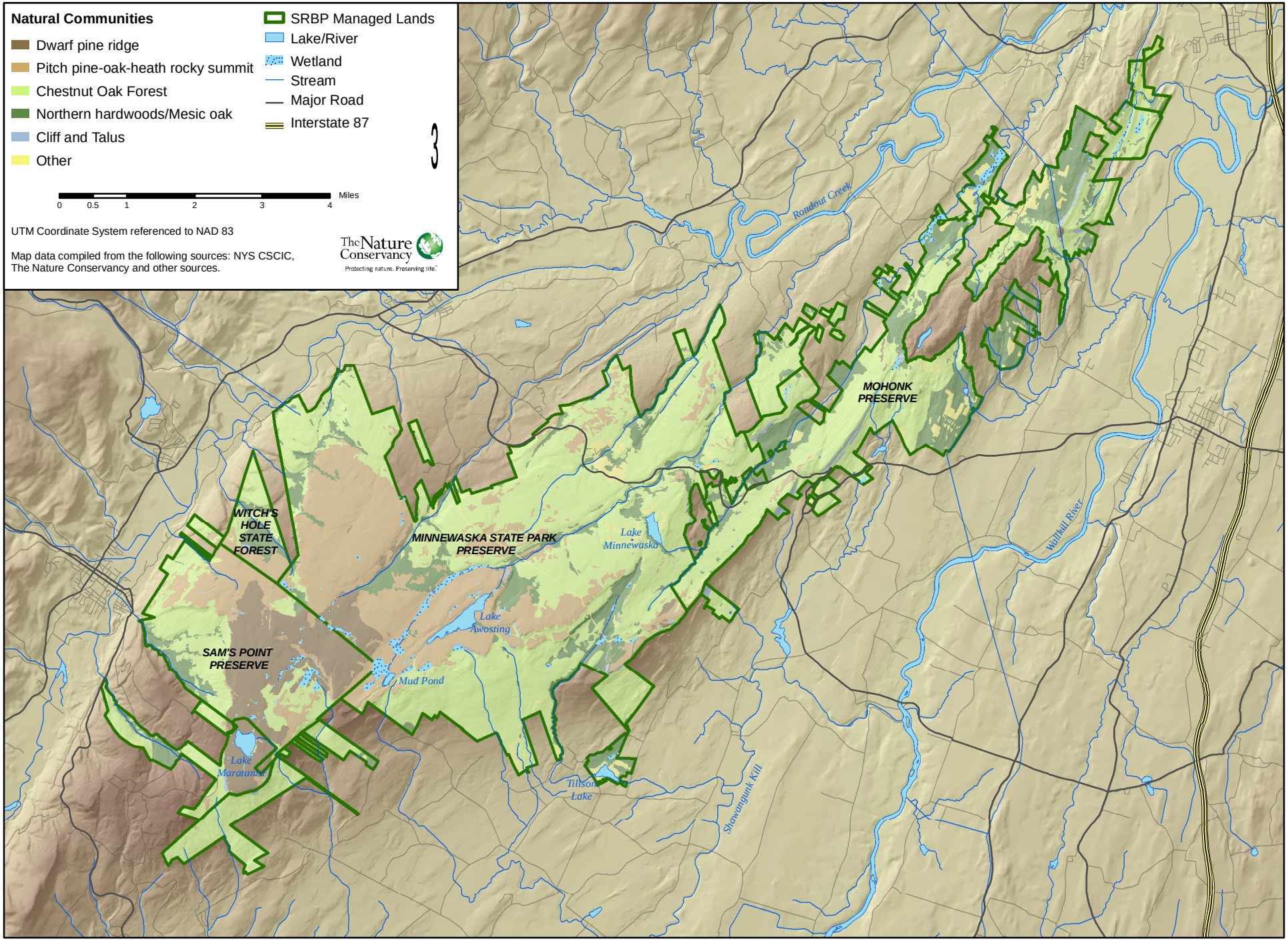
	COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	NY STATE RANK*	GLOBAL RANK**
	Davis' Sedge	*Carex davisii*	Threatened	S2	G4
	False Hop Sedge	*Carex lupuliformis*	Rare	S2	G4
	Georgia Bulrush	*Scirpus georgianus*	Endangered	S1	G5
	Mock-pennyroyal	*Hedeoma hispida*	Threatened	S2S3	G5
	Mountain Spleenwort	*Asplenium montanum*	Threatened	S2S3	G5
	Reflexed Sedge	*Carex retroflexa*	Endangered	S2S3	G5
	Rhodora	*Rhododendron canadense*	Threatened	S2	G5
	Riverweed	*Podostemum ceratophyllum*	Threatened	S2	G5
	Rough Avens	*Geum virginianum*	Endangered	S2	G5
	Violet Wood-sorrel	*Oxalis violacea*	Threatened	S2S3	G5
	Wood Reedgrass	*Calamagrostis perplexa*	Endangered	S1	G1
	Woodland Rush	*Juncus subcaudatus*	Endangered	S1	G5
	Anderson's peat moss	*Sphagnum andersonianum*	Unlisted	S1	G3?
	Flat-leaved peat moss	*Sphagnum platyphyllum*	Unlisted	S1	G5
	Soft-leaved peat moss	*Sphagnum tenellum*	Unlisted	S2	G5
	Trinidad peat moss	*Sphagnum trinitense*	Unlisted	S1	G4
	Two-ranked moss	*Pseudotaxiphyllum distichaceum*	Unlisted	S2S3	G4G5
Communities	Acidic Talus Slope Woodland			S3	G4?
	Chestnut Oak Forest			S4	G5
	Cliff Community			S4	G5
	Confined River			S3S4	G4
	Dwarf Pine Ridges			S1	G1G2
	Dwarf Shrub Bog			S3	G4
	Floodplain Forest			S2S3	G3G4
	Hemlock-Northern Hardwood Forest			S4	G4G5
	Highbush Blueberry Bog Thicket			S3	G4
	Ice Cave Talus Community			S1S2	G3?
	Perched Bog			S1S2	G3G4
	Pitch Pine-Blueberry Peat Swamp			S1	G3?
	Pitch Pine-Oak-Heath Rocky Summit			S3S4	G4
	Vernal Pool			S3S4	G4
Last documented prior to 1980					
Animal	Allegheny Woodrat	*Neotoma magister*	Endangered	S1	G3G4
Plants	Bradley's Spleenwort	*Asplenium bradleyi*	Endangered	SH	G4
	Cut-leaved Evening-primrose	*Oenothera laciniata*	Endangered	S1	G5
	Hyssop-skullcap	*Scutellaria integrifolia*	Endangered	S1	G5
	Large Twayblade	*Liparis liliifolia*	Endangered	S1	G5
	Northern Running-pine	*Diphasiastrum complanatum*	Endangered	S1	G5
	Prairie Wedgegrass	*Sphenopholis obtusata*	Endangered	S1	G5

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	NY STATE RANK*	GLOBAL RANK**
Primrose-leaf Violet	*Viola primulifolia*	Threatened	S2	G5
Puttyroot	*Aplectrum hyemale*	Endangered	S1	G5
Riverbank Quillwort	*Isoetes riparia*	Endangered	S1	G5?
Scarlet Indian-paintbrush	*Castilleja coccinea*	Endangered	S1	G5

* Rarity in NYS as ranked by NY Natural Heritage Program on a 1 to 5 scale:
S1 = Critically imperiled; S2 = Imperiled; S3 = Rare or uncommon;
S4 = Abundant and apparently secure; S5 = Demonstrably abundant and secure;
SH = Historical records only; no recent information available.
B = Breeding population; N = Non-breeding/wintering population.

** Global rarity as ranked by Nature Serve on a 1 to 5 scale:
G1 = Critically imperiled; G2 = Imperiled; G3 = Rare or vulnerable;
G4 = Apparently secure; G5 = Secure;
GH = Historically known, with the expectation that it might be rediscovered;
GX = Species believed to be extinct; GU = Status unknown.
Range ranks, e.g. G1G2, indicate not enough information is available to distinguish between two ranks.
? = a question exists about the rank. Q = a question exists whether or not the species or variety is a good taxonomic entity.
T-ranks (T1 - T5) are defined the same as G-ranks (G1 - G5), but the T-rank refers only to the rarity of the subspecies or variety.

ATTACHMENT C. MAP OF SIGNIFICANT NATURAL COMMUNITIES, LAKES & WETLANDS IN PROJECT AREA



PART 2 - PROJECT IMPACTS AND THEIR MAGNITUDE

Responsibility of Lead Agency

General Information (Read Carefully)

- ! In completing the form the reviewer should be guided by the question: Have my responses and determinations been **reasonable?** The reviewer is not expected to be an expert environmental analyst.
- ! The **Examples** provided are to assist the reviewer by showing types of impacts and wherever possible the threshold of magnitude that would trigger a response in column 2. The examples are generally applicable throughout the State and for most situations. But, for any specific project or site other examples and/or lower thresholds may be appropriate for a Potential Large Impact response, thus requiring evaluation in Part 3.
- ! The impacts of each project, on each site, in each locality, will vary. Therefore, the examples are illustrative and have been offered as guidance. They do not constitute an exhaustive list of impacts and thresholds to answer each question.
- ! The number of examples per question does not indicate the importance of each question.
- ! In identifying impacts, consider long term, short term and cumulative effects.

Instructions (Read carefully)

a. Answer each of the 20 questions in PART 2. Answer **Yes** if there will be **any** impact.

b. **Maybe** answers should be considered as **Yes** answers.

c. If answering **Yes** to a question then check the appropriate box(column 1 or 2)to indicate the potential size of the impact. If impact threshold equals or exceeds any example provided, check column 2. If impact will occur but threshold is lower than example, check column 1.

d. Identifying that an Impact will be potentially large (column 2) does not mean that it is also necessarily **significant**. Any large impact must be evaluated in PART 3 to determine significance. Identifying an impact in column 2 simply asks that it be looked at further.

e. If reviewer has doubt about size of the impact then consider the impact as potentially large and proceed to PART 3.

f. If a potentially large impact checked in column 2 can be mitigated by change(s) in the project to a small to moderate impact, also check the **Yes** box in column 3. A **No** response indicates that such a reduction is not possible. This must be explained in Part 3.

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change
Impact on Land			
1. Will the Proposed Action result in a physical change to the project site? NO ■ YES ☐			
Examples that would apply to column 2			
C Any construction on slopes of 15% or greater, (15 foot rise per 100 foot of length), or where the general slopes in the project area exceed 10%.	☐	☐	☐ Yes ☐ No
C Construction on land where the depth to the water table is less than 3 feet.	☐	☐	☐ Yes ☐ No
C Construction of paved parking area for 1,000 or more vehicles.	☐	☐	☐ Yes ☐ No
C Construction on land where bedrock is exposed or generally within 3 feet of existing ground surface.	☐	☐	☐ Yes ☐ No
C Construction that will continue for more than 1 year or involve more than one phase or stage.	☐	☐	☐ Yes ☐ No
C Excavation for mining purposes that would remove more than 1,000 tons of natural material (i.e., rock or soil) per year.	☐	☐	☐ Yes ☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change
C Construction or expansion of a santary landfill.	☐	☐	☐ Yes ☐ No
C Construction in a designated floodway.	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

2. Will there be an effect to any unique or unusual land forms found on the site? (i.e., cliffs, dunes, geological formations, etc.)
☒ NO ☐ YES

C Specific land forms:	☐	☐	☐ Yes ☐ No

Impact on Water

3. Will Proposed Action affect any water body designated as protected? (Under Articles 15, 24, 25 of the Environmental Conservation Law, ECL)
☒ NO ☐ YES

Examples that would apply to column 2

C Developable area of site contains a protected water body.	☐	☐	☐ Yes ☐ No
C Dredging more than 100 cubic yards of material from channel of a protected stream.	☐	☐	☐ Yes ☐ No
C Extension of utility distribution facilities through a protected water body.	☐	☐	☐ Yes ☐ No
C Construction in a designated freshwater or tidal wetland.	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

4. Will Proposed Action affect any non-protected existing or new body of water?
☒ NO ☐ YES

Examples that would apply to column 2

C A 10% increase or decrease in the surface area of any body of water or more than a 10 acre increase or decrease.	☐	☐	☐ Yes ☐ No
C Construction of a body of water that exceeds 10 acres of surface area.	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change

5. Will Proposed Action affect surface or groundwater quality or quantity?

☒ NO ☐ YES

Examples that would apply to column 2

C	Proposed Action will require a discharge permit.	☐	☐	☐ Yes ☐ No
C	Proposed Action requires use of a source of water that does not have approval to serve proposed (project) action.	☐	☐	☐ Yes ☐ No
C	Proposed Action requires water supply from wells with greater than 45 gallons per minute pumping capacity.	☐	☐	☐ Yes ☐ No
C	Construction or operation causing any contamination of a water supply system.	☐	☐	☐ Yes ☐ No
C	Proposed Action will adversely affect groundwater.	☐	☐	☐ Yes ☐ No
C	Liquid effluent will be conveyed off the site to facilities which presently do not exist or have inadequate capacity.	☐	☐	☐ Yes ☐ No
C	Proposed Action would use water in excess of 20,000 gallons per day.	☐	☐	☐ Yes ☐ No
C	Proposed Action will likely cause siltation or other discharge into an existing body of water to the extent that there will be an obvious visual contrast to natural conditions.	☐	☐	☐ Yes ☐ No
C	Proposed Action will require the storage of petroleum or chemical products greater than 1,100 gallons.	☐	☐	☐ Yes ☐ No
C	Proposed Action will allow residential uses in areas without water and/or sewer services.	☐	☐	☐ Yes ☐ No
C	Proposed Action locates commercial and/or industrial uses which may require new or expansion of existing waste treatment and/or storage facilities.	☐	☐	☐ Yes ☐ No
C	Other impacts:	☐	☐	☐ Yes ☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change

6. Will Proposed Action alter drainage flow or patterns, or surface water runoff?

☒ NO ☐ YES

Examples that would apply to column 2

C Proposed Action would change flood water flows	☐	☐	☐ Yes	☐ No
C Proposed Action may cause substantial erosion.	☐	☐	☐ Yes	☐ No
C Proposed Action is incompatible with existing drainage patterns.	☐	☐	☐ Yes	☐ No
C Proposed Action will allow development in a designated floodway.	☐	☐	☐ Yes	☐ No
C Other impacts:	☐	☐	☐ Yes	☐ No

IMPACT ON AIR

7. Will Proposed Action affect air quality?

☐ NO ☒ YES

Examples that would apply to column 2

C Proposed Action will induce 1,000 or more vehicle trips in any given hour.	☐	☐	☐ Yes	☐ No
C Proposed Action will result in the incineration of more than 1 ton of refuse per hour.	☐	☐	☐ Yes	☐ No
C Emission rate of total contaminants will exceed 5 lbs. per hour or a heat source producing more than 10 million BTU's per hour.	☐	☐	☐ Yes	☐ No
C Proposed Action will allow an increase in the amount of land committed to industrial use.	☐	☐	☐ Yes	☐ No
C Proposed Action will allow an increase in the density of industrial development within existing industrial areas.	☐	☐	☐ Yes	☐ No
C Other impacts:	☒	☐	☒ Yes	☐ No

Smoke from prescribed fires may affect air quality in adjacent areas. See the Northern Shawangunk Ridge Fire Management Plan for details on potential impacts and mitigation techniques.

IMPACT ON PLANTS AND ANIMALS

8. Will Proposed Action affect any threatened or endangered species?

☐ NO ☒ YES

Examples that would apply to column 2

C Reduction of one or more species listed on the New York or Federal list, using the site, over or near the site, or found on the site.	☐	☐	☐ Yes	☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change
C Removal of any portion of a critical or significant wildlife habitat.	☐	☐	☐ Yes ☐ No
C Application of pesticide or herbicide more than twice a year, other than for agricultural purposes.	☐	☐	☐ Yes ☐ No
C Other impacts:	☒	☐	☒ Yes ☐ No

Prescribed fires may result in mortality of individual timber rattlesnakes. See Northern Shawangunk Ridge Fire Management Plan for details on potential impacts and mitigation techniques.

9. Will Proposed Action substantially affect non-threatened or non-endangered species?

☒ NO ☐ YES

Examples that would apply to column 2

C Proposed Action would substantially interfere with any resident or migratory fish, shellfish or wildlife species.	☐	☐	☐ Yes ☐ No
C Proposed Action requires the removal of more than 10 acres of mature forest (over 100 years of age) or other locally important vegetation.	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

IMPACT ON AGRICULTURAL LAND RESOURCES

10. Will Proposed Action affect agricultural land resources?

☒ NO ☐ YES

Examples that would apply to column 2

C The Proposed Action would sever, cross or limit access to agricultural land (includes cropland, hayfields, pasture, vineyard, orchard, etc.)	☐	☐	☐ Yes ☐ No
C Construction activity would excavate or compact the soil profile of agricultural land.	☐	☐	☐ Yes ☐ No
C The Proposed Action would irreversibly convert more than 10 acres of agricultural land or, if located in an Agricultural District, more than 2.5 acres of agricultural land.	☐	☐	☐ Yes ☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change
C The Proposed Action would disrupt or prevent installation of agricultural land management systems (e.g., subsurface drain lines, outlet ditches, strip cropping); or create a need for such measures (e.g. cause a farm field to drain poorly due to increased runoff).	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

IMPACT ON AESTHETIC RESOURCES

11. Will Proposed Action affect aesthetic resources? (If necessary, use the Visual EAF Addendum in Section 617.20, Appendix B.)
☒ NO ☐ YES

Examples that would apply to column 2

C Proposed land uses, or project components obviously different from or in sharp contrast to current surrounding land use patterns, whether man-made or natural.	☐	☐	☐ Yes ☐ No
C Proposed land uses, or project components visible to users of aesthetic resources which will eliminate or significantly reduce their enjoyment of the aesthetic qualities of that resource.	☐	☐	☐ Yes ☐ No
C Project components that will result in the elimination or significant screening of scenic views known to be important to the area.	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

IMPACT ON HISTORIC AND ARCHAEOLOGICAL RESOURCES

12. Will Proposed Action impact any site or structure of historic, prehistoric or paleontological importance?
☒ NO ☐ YES

Examples that would apply to column 2

C Proposed Action occurring wholly or partially within or substantially contiguous to any facility or site listed on the State or National Register of historic places.	☐	☐	☐ Yes ☐ No
C Any impact to an archaeological site or fossil bed located within the project site.	☐	☐	☐ Yes ☐ No
C Proposed Action will occur in an area designated as sensitive for archaeological sites on the NYS Site Inventory.	☐	☐	☐ Yes ☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change
C Other impacts:	☐	☐	☐ Yes ☐ No

IMPACT ON OPEN SPACE AND RECREATION

13. Will proposed Action affect the quantity or quality of existing or future open spaces or recreational opportunities?
☒ NO ☐ YES

Examples that would apply to column 2

C The permanent foreclosure of a future recreational opportunity.	☐	☐	☐ Yes ☐ No
C A major reduction of an open space important to the community.	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

IMPACT ON CRITICAL ENVIRONMENTAL AREAS

14. Will Proposed Action impact the exceptional or unique characteristics of a critical environmental area (CEA) established pursuant to subdivision 6NYCRR 617.14(g)?
☒ NO ☐ YES

List the environmental characteristics that caused the designation of the CEA.

Examples that would apply to column 2

C Proposed Action to locate within the CEA?	☐	☐	☐ Yes ☐ No
C Proposed Action will result in a reduction in the quantity of the resource?	☐	☐	☐ Yes ☐ No
C Proposed Action will result in a reduction in the quality of the resource?	☐	☐	☐ Yes ☐ No
C Proposed Action will impact the use, function or enjoyment of the resource?	☐	☐	☐ Yes ☐ No
C Other impacts:	☐	☐	☐ Yes ☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change

IMPACT ON TRANSPORTATION

15. Will there be an effect to existing transportation systems?

☒ NO ☐ YES

Examples that would apply to column 2

- Alteration of present patterns of movement of people and/or goods. ☐ ☐ ☐ Yes ☐ No
- Proposed Action will result in major traffic problems. ☐ ☐ ☐ Yes ☐ No
- Other impacts: ☐ ☐ ☐ Yes ☐ No

IMPACT ON ENERGY

16. Will Proposed Action affect the community's sources of fuel or energy supply?

☒ NO ☐ YES

Examples that would apply to column 2

- Proposed Action will cause a greater than 5% increase in the use of any form of energy in the municipality. ☐ ☐ ☐ Yes ☐ No
- Proposed Action will require the creation or extension of an energy transmission or supply system to serve more than 50 single or two family residences or to serve a major commercial or industrial use. ☐ ☐ ☐ Yes ☐ No
- Other impacts: ☐ ☐ ☐ Yes ☐ No

NOISE AND ODOR IMPACT

17. Will there be objectionable odors, noise, or vibration as a result of the Proposed Action?

☒ NO ☐ YES

Examples that would apply to column 2

- Blasting within 1,500 feet of a hospital, school or other sensitive facility. ☐ ☐ ☐ Yes ☐ No
- Odors will occur routinely (more than one hour per day). ☐ ☐ ☐ Yes ☐ No
- Proposed Action will produce operating noise exceeding the local ambient noise levels for noise outside of structures. ☐ ☐ ☐ Yes ☐ No
- Proposed Action will remove natural barriers that would act as a noise screen. ☐ ☐ ☐ Yes ☐ No
- Other impacts: ☐ ☐ ☐ Yes ☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change

IMPACT ON PUBLIC HEALTH

18. Will Proposed Action affect public health and safety?
☒ NO ☐ YES

C Proposed Action may cause a risk of explosion or release of hazardous substances (i.e. oil, pesticides, chemicals, radiation, etc.) in the event of accident or upset conditions, or there may be a chronic low level discharge or emission.	☐	☐	☐ Yes	☐ No
C Proposed Action may result in the burial of "hazardous wastes" in any form (i.e. toxic, poisonous, highly reactive, radioactive, irritating, infectious, etc.)	☐	☐	☐ Yes	☐ No
C Storage facilities for one million or more gallons of liquefied natural gas or other flammable liquids.	☐	☐	☐ Yes	☐ No
C Proposed Action may result in the excavation or other disturbance within 2,000 feet of a site used for the disposal of solid or hazardous waste.	☐	☐	☐ Yes	☐ No
C Other impacts:	☐	☐	☐ Yes	☐ No

IMPACT ON GROWTH AND CHARACTER OF COMMUNITY OR NEIGHBORHOOD

19. Will Proposed Action affect the character of the existing community?
☒ NO ☐ YES

Examples that would apply to column 2

C The permanent population of the city, town or village in which the project is located is likely to grow by more than 5%.	☐	☐	☐ Yes	☐ No
C The municipal budget for capital expenditures or operating services will increase by more than 5% per year as a result of this project.	☐	☐	☐ Yes	☐ No
C Proposed Action will conflict with officially adopted plans or goals.	☐	☐	☐ Yes	☐ No
C Proposed Action will cause a change in the density of land use.	☐	☐	☐ Yes	☐ No
C Proposed Action will replace or eliminate existing facilities, structures or areas of historic importance to the community.	☐	☐	☐ Yes	☐ No
C Development will create a demand for additional community services (e.g. schools, police and fire, etc.)	☐	☐	☐ Yes	☐ No

Reset

	1 Small to Moderate Impact	2 Potential Large Impact	3 Can Impact Be Mitigated by Project Change
c Proposed Action will set an important precedent for future projects.	☐	☐	☐ Yes ☐ No
c Proposed Action will create or eliminate employment.	☐	☐	☐ Yes ☐ No
c Other impacts:	☐	☐	☐ Yes ☐ No

20. Is there, or is there likely to be, public controversy related to potential adverse environment impacts?
☒ NO ☐ YES

If Any Action in Part 2 Is Identified as a Potential Large Impact or If you Cannot Determine the Magnitude of Impact, Proceed to Part 3

Reset

PART 3 - EVALUATION OF THE IMPORTANCE OF IMPACTS

Responsibility of Lead Agency

Part 3 must be prepared if one or more impact(s) is considered to be potentially large, even if the impact(s) may be mitigated.

Instructions (If you need more space, attach additional sheets)
Discuss the following for each impact identified in Column 2 of Part 2:
1. Briefly describe the impact.
2. Describe (if applicable) how the impact could be mitigated or reduced to a small to moderate impact by project change(s).
3. Based on the information available, decide if it is reasonable to conclude that this impact is **important**.

To answer the question of importance, consider:
! The probability of the impact occurring
! The duration of the impact
! Its irreversibility, including permanently lost resources of value
! Whether the impact can or will be controlled
! The regional consequence of the impact
! Its potential divergence from local needs and goals
! Whether known objections to the project relate to this impact.

Implementation of the *Northern Shawangunk Ridge Fire Management Plan* could produce impacts to air quality, due to smoke from prescribed fires, and to threatened and endangered species resulting from incidental mortality of timber rattlesnakes (*Crotalus horridus*) during prescribed fires. The potential magnitude of these impacts is described in detail in the *Northern Shawangunk Ridge Fire Management Plan* and, where necessary, mitigating actions are included to ensure that these impacts are minimal.

Other potential impacts to soil and water, non-listed wildlife species, rare plant species, natural communities, and cultural, historic and aesthetic resources are evaluated in the *Northern Shawangunk Ridge Fire Management Plan.* Implementation of the actions as described in the plan should not substantially affect these other elements of the environment.

For details on the proposed actions and a description of potential impacts and mitigation strategies, please refer directly to the *Northern Shawangunk Ridge Fire Management Plan*.

Appendix E. Summary of Comments and Responses from the Public Information Meetings and Public Comment Period

Introduction

This is a summary of the comments received on the *Draft Northern Shawangunk Ridge Fire Management Plan* and the responses to those comments by the co-lead agencies, the NYS Department of Environmental Conservation (DEC) and the NYS Office of State Parks, Recreation and Historic Preservation (OPRHP). The Draft Plan was issued on December 6, 2010. In addition to the Draft Plan, a draft Environmental Assessment and draft Negative Declaration were prepared and an opportunity for their review provided. Two public information meetings were held; one on December 20th, 2010 at the NYS DEC Region 3 Headquarters in New Paltz and a second at the Napanoch Firehouse on December 21st, 2010. The public comment period for the Draft Plan and Environmental Assessment extended through January 14, 2011.

At each meeting comments were recorded. During the comment period for the Draft Plan, the Co-lead Agencies did not receive any written comment letters.

NYS DEC and NYS OPRHP appreciate the time and effort that persons interested in the future of the Shawangunk Ridge invested in their review and comments on the Draft Plan and their participation in the public meetings.

Comments and Responses

The following section contains a listing of comments received from the public during the comment period and at the public meetings. The comments are organized by category. Following each category heading, there is a summarized comment. Following each summarized comment is the response by the co-lead agencies – NYS DEC and NYS OPRHP.

Prescribed Burns

Comment: Are prescribed burns being done at Mohonk?

Response: Yes. Test burns have been conducted at Mohonk and information gained through those burns helped in the preparation of this plan. Mohonk is one of the partners within the SRBP. The plan includes the land holdings of other major partners such as the Minnewaska State Park Preserve administered by PIPC and NYS OPRHP and lands of the NYS DEC.

Comment: What are the general sizes of prescribed burns and are they conducted on a periodic basis (e.g. does the plan call for coming back to burn an area again)?

Response: The plan is conceptual and does not specify detailed areas for prescribed burns. This is accomplished through the more detailed prescriptions that the plan calls for. These more detailed plans are very specific and are fully vetted through all involved agencies. To date, there

have been some small test burns of several acres within Mohonk. These burns and the experiences of The Nature Conservancy on a statewide basis (e.g. Albany Pine Bush Preserve) will serve as references and basis for the development of detailed prescribed burn plans on the Shawangunk Ridge. The size of prescribed burns can be up to 500 acres without triggering additional SEQR review. Also, future prescribed burns will be evaluated in the context of long term needs for revisiting areas that have been burned so as to meet long term goals identified in the plan.

Partnerships

Comment: Mohonk Preserve appreciates the opportunity to work with all of the partners (including DEC, OPRHP and local fire companies) on developing this great plan that looks to manage the landscape.

Response: The support of Mohonk and all the partners within the SRBP is much appreciated.

Comment: The comprehensive plan is good in that it brings all the interests together. This wildland fire plan for Shawangunks will serve as an example for NY State. NY State Parks joining the effort is an important step in advancing plan.

Response: This is one of the strengths of comprehensive planning. Successful implementation of this plan will require support from all interests and such support begins with the planning process itself. The bringing together of the partners in the SRBP will help facilitate the plan's implementation and provide a proper focus.

Archeological Resources

Comment: The archaeological resources surrounding Smiley Road and Lake Awosting area are important and should be noted and protected. This area was negatively impacted during the 2008 fire. For example, carefully widen the road to help protect resources in the case of a wildfire or prescribed burn.

Response: Coordination with OPRHP's Division for Historic Preservation will be part of the approval process for individual burn plans to insure that cultural resources are protected. Cultural and archeological resources will be addressed in detail within each individual prescribed burn. In addition the resources will be mapped for reference purposes in control of any future wildfires should they occur.

Community Involvement

Comment: As a municipality (Gardiner), we are having problems getting the community involved in the Firewise Program.

Response: You may want to reach out to homeowner groups and local fire companies to increase involvement and interest in the program. It was suggested to focus on high fire risk areas including individual fire departments and/or small communities identified as high risk. The neighborhood approach can be important and the key to getting community involvement.

Comment: It may be beneficial to get *on the ground* volunteers to monitor conditions both before and after fires. For example, volunteers could identify areas that are at risk for wildfires. I would suggest reaching out to the NY/NJ Trail Conference for volunteers, they could conduct monitoring (both pre and post fire) when they are out doing trail assessments and improvements. Plus, the group can work to educate others in their organization.

Response: The suggestion is much appreciated and will be considered in developing individual prescription plan as well as identifying areas at higher risk for wildfires.

Comment: How is private property protected?

Response: A primary tenet of the fire management program is to reduce fuel load within forested areas. Achieving this goal will reduce the intensity of any wildfires in the future and in so doing reduce the potential for fire impacts on private lands and facilities. Impacts of actual prescribed burns on people and private property are addressed in detail within each and every site-specific burn plan. This plan is created in conjunction with not only the SRBP partners but also community organizations as well as private individuals. Moreover, burn plans are public documents and made available to local volunteer fire departments for review. The plans specifically outline precautions to protect resources both private and public.

Comment: Plan implementation should consider making available any firewood that might be generated by mechanical treatments. In addition this would contribute to fuel reduction in the forest setting.

Response: Both of these positive impacts will be considered in plan implementation.

Firebreaks

Comment: One significant element of the plan relates to fire breaks. It would seem that the size and extent of fire breaks would depend on the amount of fuel in potential burn areas as well as other site specific conditions. How large are these firebreaks? Also, stream and brook areas might possibly serve as firebreak areas.

Response: The plan places an emphasis on the use of existing firebreak areas such as existing carriage roads. These areas would be restored and upgraded to better fit the criteria for firebreaks. Use of small stream or brook corridors can be considered, but they may not necessarily meet the criteria for effective firebreaks without some type of fuel manipulation. The width and type of firebreak necessary in a given situation will depend entirely on the adjacent fuel conditions and anticipated fire behavior.

Implementation

Comments: How will implementation occur especially with limited resources?

Response: The identification of criteria for setting priorities is an important consideration. Also, there is a need to determine estimates of anticipated expenses. These two factors coupled with knowledge of available funding will be the driving forces determining what can be done. Clearly, however, funding is a primary consideration. The SRBP will monitor potential funding

through state, federal and private sources and apply for such funding to assist in plan implementation. An important first step, however, is this plan. It becomes the framework for both management actions and fundraising efforts.

Wildlife Impacts

Comment: How do you prevent wildlife from being harmed during prescribed burns? How are rare species protected? Can they be relocated?

Response: Most species are able to move away from or seek shelter from fire, for example, some animals burrow into the soil for protection. This is even more so during prescribed burning than wildfires as prescribed burns are done under very controlled conditions. With respect to rare species, the fire management program includes significant involvement of scientists from the NY Natural Heritage Program. They provide information on the type, extent and location of sensitive species and also provide recommendations for the protection of rare species. Also, timing is considered in relation to the protection of sensitive habitats and/or threatened and endangered species. Burns are not conducted during critical breeding times of rare and sensitive species.

Comment: How are invasive species considered in prescribed burn plans?

Response: One of the benefits and goals of prescribed burns is often the control of invasive species. However, this comment is important because disturbed areas can provide an opening for invasive species to move into an area. The extent of concern over invasive species varies with respect to site conditions, the particular invading species and the avenue for infestation. Prescribed burn planning should include consideration of preventing the introduction of invasive species. For example, equipment brought in from other areas and used in the burn should be thoroughly cleaned and inspected. It is important to note, however, that experiences with prescribed burning in other areas have shown the invasive species are not a significant concern. Moreover, places like Minnewaska State Park Preserve have very large areas that are considered invasive free. The presence of "weed free" areas places much greater importance on not bringing in invasives from other areas, but it also indicates that the threat of spreading invasives that are already present is very low. Finally, Minnewaska is the home base for OPRHP's invasive species management team that will play a significant role in preparation and review of the specific burn plans.

Resource Impacts

Comment: **With the preparation of specific burn plans there is a need to consider the goals for the management. For example, what impact might the burn have on regeneration of oak vs. red maple or red spruce in the Mud Pond area? Will the goals of the plans be for silvicultural or ecological purposes? It is important that a forester be on the planning team. Also, consider the impacts on restoration of American chestnut. Research findings from the Alleghany National Forest may help here. Forest ecology is very complex and includes many interactions between deer, invasive species, fire and other factors.**

Response: Overall, the primary resource management goals within the fire management plan are ecological, especially with respect to the importance of fire in providing quality biodiversity of plants and wildlife. Specific forest stand management objectives will be set within a given burn plan. DEC foresters will be directly involved in plan preparations and reviews. Fire can be a good tool for achieving agreed upon goals provided there is collaboration and review by various interests during plan preparation. Research findings from the US Forest Service and other areas are an important element in keeping the prescribed planning current. Local research findings can help in addressing the complexity of forest ecology. In fact, post burn monitoring of prescribed burns is considered an important research element to feedback into future planning efforts.

Fuel Accumulations

Comment: Build-up of fuels needs to be addressed.

Response: This is for certain. Fuel load reduction is one of the primary tenets of the plan. Wildfires through areas with heavy fuel accumulation burn with very high intensity and can have negative impacts on ecology. Prescribed fires are more controlled both in terms of management and intensity.

Mechanical Treatments

Comment: To what extent are mechanical fuels or forest treatments considered in the plan?

Response: The Plan calls for minimal use of mechanical treatments, such as mowing or cutting vegetation, and relies heavily on prescribed fire to address and attain the primary goals of safety, fuel reduction and maintaining biodiversity. The amount of mechanical removals will depend on site-specific conditions but in most instances will be relatively low. Mechanical treatments will generally be used to achieve targeted management objectives to reduce fuels around structures or along important firebreaks.

Safety

Comment: Public and responders' safety should be the highest priority.

Response: The Plan clearly states that firefighter and public safety is the highest priority during all phases of fire management implementation. Further, the Plan outlines specific measures for protecting firefighter and public safety during the planning and implementation of prescribed burning and wildfire suppression.

Education

Comment: Community involvement and support is critical, thus education efforts (e.g. Firewise programs) need to continue and be enhanced. Implementation of the plan provides a good opportunity for education of park patrons across the state regarding fire and fire management.

Response: All members of the SRBP partnership are solidly behind these comments. Education and outreach have been and will continue to be important and critical elements of plan preparation and its implementation.

Cabin at Sam's Point

Comment: Information about a small rustic cabin located in the Badlands area at Sam's Point Preserve and its owner's license to use it for life should be acknowledged in the Plan.

Response: The plan has been revised to include this building as a fire sensitive feature in the Badlands-Verkeerder Kill Fire Management Region (Section 2.5). In accordance with the license agreement to use the cabin, the owner will be notified prior to any planned fire management activities in the vicinity of his cabin.

Appendix F. Notice of Negative Declaration

SEQR

State Environmental Quality Review

NEGATIVE DECLARATION

Notice of Determination of Non-Significance

Identifying # NA

Date February 17, 2011

This notice is issued pursuant to Part 617 of the implementing regulations pertaining to Article 8 (State Environmental Quality Review Act) of the Environmental Conservation Law.

The NYS Department of Environmental Conservation (DEC) and the Office of Parks, Recreation and Historic Preservation (OPRHP) as the co-lead agencies, have determined that the proposed action described below will not have a significant environmental impact and a Draft Environmental Impact Statement will not be prepared.

Name of Action: Adoption of the Northern Shawangunks Fire Management Plan

SEQR Status: **Type 1** X
Unlisted

Conditioned Negative Declaration: ___ **Yes**
X **No**

Description of Action: The Northern Shawangunks Fire Management Plan sets forth goals, objectives, and management actions to address the need for a more proactive approach to fire management in the northern Shawangunks. This plan has been developed to describe and guide actions to be implemented by major land managers along the northern Shawangunks, including NYS DEC, NYS OPRHP, Palisades Interstate Park Commission (PIPC), The Nature Conservancy (TNC) and Mohonk Preserve. The majority of the proposed actions will occur on lands managed by these organizations including Minnewaska State Park Preserve, Sam's Point Preserve, Mohonk Preserve and Witch's Hole State Forest. These organizations may also collaborate with other private landowners in order to implement fire management actions on lands outside of these park/preserve boundaries.
The *Northern Shawangunk Ridge Fire Management Plan* has been developed to protect the ecological integrity and reduce hazardous fuel loads in the highly volatile Shawangunk environment. Accordingly, the purpose of the plan is to a) provide a planning framework for implementing fire management actions in accordance with the

policies of the various partner organizations; b) ensure that all fire management activities are science-based and that potential negative impacts to the environment have been assessed and mitigated for as necessary; and c) ensure that fire management is a collaborative effort focused on improving public safety and ecosystem health.

Proposed Fire Management Actions Addressed in the Plan:

Wildfire Suppression

Wildfire suppression will continue to be the primary response for wildfires on SRBP managed lands in the Shawangunks. The Plan outlines infrastructure improvements and planning for managing wildfire suppression. Being prepared to respond effectively to wildfire may include prescribed fire and other treatments to create reduced fuel buffers for adjacent communities, restoration of former carriage roads and other natural or constructed firebreaks, staff training and acquisition of equipment necessary to effectively respond to wildfire incidents.

Prescribed Fire

Prescribed fire will be a key management strategy in the Shawangunks for achieving ecological and fire hazard reduction goals. Although prescribed fire implementation will be focused on restoring and improving the health of pine barrens and oak forests, it may also be used as a tool to reduce fuel accumulations, maintain open grassland and shrubland habitats, and manage invasive species infestations.

Firebreak Maintenance, Repair & Construction

The safe and effective implementation of wildfire suppression activities and prescribed burn operations requires the use of various kinds of firebreaks, including raked hand lines, trails, cut paths through shrub fuels, old logging roads, and carriage roads. Many existing carriage road firebreaks in the Shawangunks will need to be repaired and maintained to a condition that allows for the safe and efficient implementation of fire management activities. New firebreaks will be evaluated for their future management value.

Fuel Reduction - Mechanical Treatments & Forest Thinning

In some instances cutting, mowing or grinding of vegetation may be necessary to reduce heavy fuel loads, protect sensitive resources, improve critical firebreaks or mimic fire effects where prescribed fire treatments are impractical. Widespread use of mechanical treatments and forest thinning for fuel reduction is not practical in the Shawangunks given the rugged terrain and vegetation types. Thus these treatments will be limited to relatively small scale applications to achieve specific management objectives.

Monitoring

Land managers will monitor the ecological effects of fire management practices as well as operational performance to improve the ecological benefits and evaluate the effectiveness of management actions and community outreach.

Location: Approximately 30,000 acres in the northern Shawangunks are managed as wildlands, and are encompassed by Minnewaska State Park Preserve, Sam's Point Preserve, Mohonk Preserve and Witch's Hole State Forest. These lands are in the towns of New Paltz, Gardiner, Shawangunk, Wawarsing, Rochester, Marbletown, Rosendale, and the Village of Ellenville, Ulster County. (see attached map).

Reasons Supporting This Determination: (See 617.7(a)-(c) for requirements of this determination; see 617.7(d) for Conditioned Negative Declaration). This plan is consistent with existing land use plans for this area including *The Protection and Management Guidelines for the Shawangunk Mountains of New York,* the *Minnewaska State Park Preserve Master Plan*, *Sam's Point Preserve Master Plan* and *Mohonk Preserve Land Management Plan and OPRHP's Fire Management in State Parks and State Historic Sites Policy.*

The Plan includes a description of potential environmental impacts to soil and water, air quality, plants and animals including significant communities and species, historic and archeological resources and recreational and aesthetic resources. These impacts were evaluated for their significance and mitigation measures to minimize impacts were identified.

Fire is a key ecological process that sustains the biodiversity found on in the Shawangunk Mountains. Fire suppression has resulted in degradation of these ecosystems and has resulted in a substantial fuel build-up which is a threat to residents in the wildland-urban interface. Carrying out the *Northern Shawangunk Fire Management Plan* will benefit the majority of ecological communities and species in the Shawangunks and provide long term protection for local communities from wildfires. Secondary impacts to air quality and potential impacts to certain individual species (e.g. rattlesnakes) are expected to be small, and the plan provides managers with guidance for minimizing these impacts further.

Consistent with NYS DEC regulations, all prescribed burn plans must be reviewed and approved by the Department of Environmental Conservation prior to implementation. Partner agencies and organizations may also require additional levels of internal review and approval of burn plans. Therefore, the actual approval process for an individual burn plan may vary depending on the agency preparing the plan.

Any burn plan for a prescribed burn unit greater than 500 acres in size in the Shawangunks will require SEQR review on an individual basis. Larger burn units have more potential to produce unintended impacts to the environment—particularly related to smoke production—than smaller burns, and are thus held to a higher standard of review under this plan. This review will require a detailed assessment of any sensitive

resources that exist in the burn unit and identification of specific actions to mitigate potential smoke impacts.

Impacts to Protected Species –The timber rattlesnake is one rare animal species (NYS threatened) that may be potentially impacted by the implementation of prescribed fire. In the Shawangunks, rattlesnakes tend to occur most frequently in the chestnut oak forest and pine barrens habitats with available exposed rock outcrops for gestation and basking. Periodic fire will help to improve and maintain this habitat, and it is expected that prescribed fires would provide a net benefit to this species. To minimize the potential impacts of prescribed fire to timber rattlesnakes, guidelines for conducting prescribed burns in rattlesnake habitat are provided in the plan. These guidelines address timing, spatial design of prescribed burns units to avoid critical habitat areas and mitigating actions that may be employed if known habitat features exists within or adjacent to the proposed burn area.

Air quality Impacts – Prescribed burning helps achieve many desired resource objectives, but it nevertheless generates particulate matter and other substances that can pollute the air. In general, the amount of smoke produced from a prescribed fire will be less than that of a wildfire, which would typically be burning under hotter and drier conditions and therefore consuming more fuel. Prescribed burns conducted regularly should reduce the potential for high intensity fires to occur, and thereby reduce the potential for concentrated impacts on air quality resulting from a large, severe wildfire. The plan provides specific actions that can be implemented by prescribed burn managers to minimize the impacts of smoke on air quality. These mitigation measures are considered during all phases of prescribed burn planning and implementation, and serve to mitigate the impacts of smoke on air quality.

Fire Break Construction - The safe and effective implementation of wildfire suppression activities and prescribed burn operations requires the use of various kinds of firebreaks. Whenever possible, managers should utilize existing permanent firebreaks for fire suppression and prescribed fire activities; however these types of activities will inevitably require the construction of new temporary, semi-permanent or permanent firebreaks. Planning and preparing of firebreaks in advance of wildfire incidences will allow managers to minimize the impacts of creating new firebreaks. The Plan provides guidelines for minimizing the impacts of new firebreaks, in terms of width, location, avoidance of sensitive resources and reliance on natural barriers to the maximum extent possible. The plan provides managers with guidelines for restoration of existing firebreaks and well as considerations for determining whether or not a new firebreak should be maintained over time, with an emphasis on minimizing ecological impacts and avoiding forest fragmentation.

Public Comments Received - Two information meetings were held to present the Draft Plan and Environmental Assessment to the public; one on December 20th, 2010 at NYSDEC Headquarters in New Paltz and a second on December 21st, 2010 at the Napanoch Firehouse. In addition to these public meetings, the public comment period extended through January 14, 2011. All public comments received were reviewed and

considered in development of the final plan. A summary of the comments received and the agency responses is included in Appendix E of the final plan.

The Final Plan is available online at the following web address:

http://www.nysparks.com/inside-our-agency/public-documents.aspx

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Environmental Notice Bulletin