PLANNING FOR PRESCRIBED BURNING IN NEW HAMPSHIRE

Minimum Recommended Standards for Planning & Implementing Prescribed Burns

Prescribed fire in the Ossipee Pine Barrens
Photo courtesy of The Nature Conservancy

Last Revised: March 5, 2019

NH Prescribed Fire Council
Concord, NH

NH PRESCRIBED FIRE COUNCIL

The New Hampshire Prescribed Fire Council is a coalition of members from a variety of agencies and organizations throughout the state. The council was formed in 2010 to promote the safe use of prescribed fire on the New Hampshire landscape by:

- Promoting public understanding of the benefits of prescribed fire.
- Promoting the development and utilization of prescribed fire practices to achieve desired environmental and ecological resource management goals.
- Anticipating prescribed fire issues and concerns and suggesting courses of action.
- Providing a framework for communication and cooperation related to prescribed fire objectives, techniques and issues.
- Disseminating technical information and training on prescribed fire and its application.
- Promoting the long term viability of prescribed fire as a management tool in New Hampshire.

The Council is currently composed of the following members:

NH Adjutant General's Department
NH Department of Natural and Cultural Resources - Division of Forests and Lands
NH Fire Academy
NH Fish and Game Department
The Society for the Protection of New Hampshire Forests
The Nature Conservancy in New Hampshire
University of New Hampshire
University of New Hampshire Cooperative Extension
USDA Natural Resources Conservation Service
US Air Force 23rd Space Operations Squadron
US Forest Service – White Mountain National Forest
US Fish and Wildlife Service – North Country Fire Management

Other technical resources include:

NH Department of Environmental Services - Air Resources Division
NH Fire Academy

PURPOSE OF THIS GUIDE

This document sets forth minimum recommended standards for crew training and fire planning for state, federal, and non-governmental organization partners who desire to use prescribed fire in the stewardship of conservation lands across the state. Some recommendations in this guide may not be appropriate for agricultural producers or private landowners. If you are a private landowner who is new to prescribed fire and would like help planning a burn on your land, please contact a qualified person for technical assistance such as those listed in Appendix A.

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RECORD OF REVISIONS

August 17, 2012

- Position titles, NH Prescribed Fire Leader I and II were changed to NH Prescribed Fire Burn Boss 3 and 2, respectively in Chapter 6 to coincide with National Wildfire Coordinating Group designations for comparable positions.

- Individuals participating in a prescribed fire as a practicum to become a NH Basic Prescribed Firefighter or NWCG Firefighter Type 2 are exempt from the moderate "Pack Test" requirement in Chapter 6. Participating in a prescribed fire is a requirement of these courses and typically occurs before a pack test is given.

January 10, 2019

- Council membership was updated

- In Chapter 6, tables and text were updated to reflect revised course numbers and required training for positions.

- Some minor typos and links were corrected.

- Fire permits were updated to reflect new NH DNCR name

- Technical and financial assistance contacts were updated including deleting Nort Phillips who retired and adding Simmons Stewardship and Conservation Ecology and Wildland Restoration International to the list of potential contractors.

INTRODUCTION

Chapter 1. Historical Importance of Fire in New Hampshire

Our knowledge about the frequency and importance of prescribed fire across the New Hampshire landscape continues to evolve. Presently, the role of fire can be viewed through three distinct time periods. They include the presettlement era, European settlement to modern fire exclusion era, and present day. Depending on the time period, different conclusions can be reached about the historical importance of fire and prescribed burns in New Hampshire.

When natural or intentionally set fires move through the landscape, they affect species composition and structure of grasslands, woodlands, and forests. Generally, species that are more resilient to a fire's effects become more abundant while those more vulnerable species decline in number. However, fire ecology is dynamic and there are many environmental (e.g., weather and season), site (e.g., species composition and fuel), and fire (e.g., intensity, severity, and frequency) attributes that influence the effect of fires.

Presettlement Era

Based on vegetation and early historical records, we know that Native Americans used fire for cooking, hunting, improving habitat for wild game, communication, and site preparation. There is some disagreement whether fire was used in a widespread manner (Day 1953) or had more limited use with localized effects around villages and inhabited areas (Russell 1983). In either case, it is believed human caused fires did increase fire frequency on the landscape from the relatively low incidences resulting naturally. It is likely that the role of human-set fires varied in different regions of the Northeast.

Vegetation reflects the scale, frequency, and intensity of various disturbances over a given time period. Cogbill et al. (2002) reviewed vegetation from presettlement surveys in New England. Based on vegetative composition, they concluded that the central and southeastern portion of New Hampshire, in addition to the southern portion of New Hampshire's Connecticut River Valley, were influenced by fire.

Another interpretation is possible through the LANDFIRE program, a national collaborative effort between agencies and organizations to map vegetation, fire, and fuel characteristics across the United States. Table 1 and Figure 1 exhibit LANDFIRE data representing fire regime groups that are predicted to occur in New Hampshire in the absence of fire suppression. Although fire was not a common occurrence across most of New Hampshire, there are some areas of the state with vegetative communities that depend on fire on a recurring basis (e.g., every 50 years or less; also see Table 3 in Chapter 2).

It is important to emphasize these data are modeled at a landscape scale. The LANDFIRE information can act as a point of departure for discussion about fire and prescribed fire in New Hampshire and can aid in landscape level planning. Other studies documenting the occurrence and impact of fire both locally in New Hampshire and in the larger region further clarify the historic role of fire in the Northeast.

Table 1. Fire regime groups in New Hampshire by acreage and percent of the state's landmass.

Fire Regime Group	Fire Regime	Acres	% Acreage*
Fire Regime Group I	<= 35 Year Fire Return Interval, Low and Mixed Severity	91,009	1.54
Fire Regime Group II	<= 35 Year Fire Return Interval, Replacement Severity	236	0.00
Fire Regime Group III	35 - 200 Year Fire Return Interval, Low and Mixed Severity	1,954,123	33.12
Fire Regime Group IV	35 - 200 Year Fire Return Interval, Replacement Severity	43,209	0.73
Fire Regime Group V	200 Year Fire Return Interval, Any Severity	3,576,904	60.63
Water, Barren or Indeterminate Fire Regime Characteristics		234,180	3.97

*Based on 5,899,661 acres

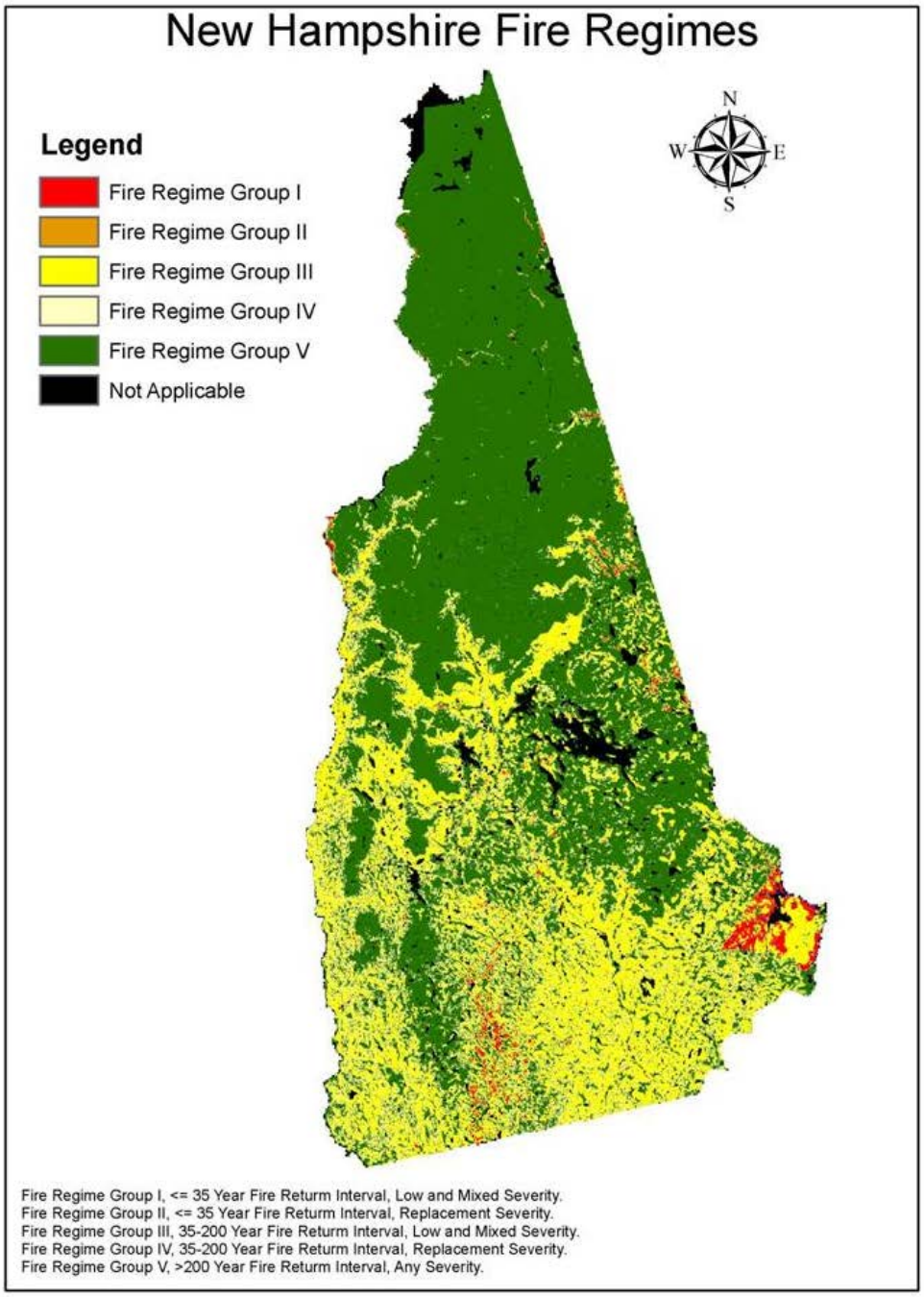

Figure 1. Mapped distribution of fire regimes across New Hampshire.

European Settlement to Modern Fire Exclusion Era

When European settlers arrived, incidences of fire, in some cases intentionally set, increased reflecting greater populations and changes in land use (i.e., land conversion). Over the last century, populations have continued to increase and incidences of fire have mirrored this increase, but the average fire size has decreased as a result of active suppression (Fahey and Reiners 1981). There are some intentionally set fires for specific purposes, but efforts have largely focused on discouraging the use of fire and extinguishing fires when they occur.

Present Day

Over the last few decades, there is increasing recognition that fire is a natural process, in some cases an integral part of restoring or sustaining natural communities, and can be used to meet specific management objectives (see Chapter 2). Many natural resource managers using prescribed fire have embraced adaptive management – regularly modifying management and practices based on the dynamic effects of prescribed fire interacting with a given site.

Legitimate questions exist about when, how often, and why fire should be used in certain situations in this state and elsewhere. The NH Prescribed Fire Council strives to increase technical and public understanding of fire and its benefits in New Hampshire so it can be used safely and effectively.

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Chapter 2. Why Use Prescribed Fire in New Hampshire

Introduction

State, federal, and private non-profit groups have a variety of reasons for owning conservation land. Some include the protection and enhancement of wildlife habitat, rare plant species, and/or exemplary natural communities; to support the state's forest products industry through sustainable forest harvesting; and to provide outdoor recreational opportunities to the public. A hands-on approach is required to accomplish most of these goals.

A variety of tools exist for accomplishing these goals. They include hand tools to clear recreational trails, brush hogs to maintain the pastoral beauty and wildlife habitat that an old agricultural field can provide, large feller bunchers and skidders used to carry out a forest harvest prescription to enhance timber production on a woodlot, among others. Another land management tool that has been used relatively sparingly in New Hampshire is prescribed fire. Prescribed fire can accomplish or enhance some objectives when used in conjunction with traditional tools. In some cases, fire is critical to meeting management goals. Some examples of the benefits of using prescribed fire in New Hampshire are described below.

Hazard Reduction

Wildfires exacerbated by high fuel loads in especially flammable forest types such as pine barrens and dry oak-pine forests, which occur in the Lakes Region and parts of southern New Hampshire, can put nearby homes and businesses at risk. Aggressive fire fighting policies over the past 50 years has caused an increase in hazardous fuels in areas with these forest types. Dry pine needles and oak leaves that build up on the forest floor over time or get caught up in the branches of scrub oak trees and shrubs, and even some live plants that contain particularly volatile compounds, can ignite readily and swiftly carry a fire into tree tops and adjacent developed areas. The 1995 wildfire on Long Island, which burned 9,500 acres and a number of houses and businesses is an example of the fire hazard associated with un-managed pine barrens and dry oak-pine forests. A second example is the 1957 Plymouth County, MA wildfire that burned over 15,000 acres in less than two days and jumped a four-lane highway. Prescribed fire, sometimes combined with selective tree harvesting and/or mowing during the initial phases, is an effective means to reduce the amount of flammable fuels near homes and businesses. Reducing fuels can have multiple benefits including natural community restoration, improving habitat for wildlife, and enhancing wild blueberry production.

Improve Wildlife Habitat & Maintain Rare Natural Communities

Pine barrens

Pine barrens, characterized by pitch pine (*Pinus rigida*), scrub oak (*Quercus ilicifolia*), and ericaceous shrubs such as lowbush blueberry (*Vaccinium angustifolium*) and black huckleberry (*Gaylussacia baccata*), occur on dry sandy soils. These barrens depend on fire to maintain species composition and structure and are among the most imperiled natural communities in New Hampshire and the world. Pine barrens support a suite of species that are regionally and globally rare. These include the federal and state endangered karner blue butterfly (our state butterfly), two other state endangered, and one additional state threatened species of moths and butterflies, plus eight species of special concern.

According to the NH Wildlife Action Plan, pine barrens also serve a critical role for approximately 50% of northeastern birds, almost 60% of northeastern mammals, and a number of reptiles and amphibians. Sediment cores taken from lakes near present-day pine barren ecosystems contain large amounts of pitch pine pollen, indicating that these habitats have been around for thousands of years. Development and fire suppression are considered the biggest threats to pine barren habitats. Periodic fire is required to perpetuate pine barrens, given that pitch pine, the dominant tree species in this community, requires bare mineral soil for seed germination and establishment, have cones that open and disperse seeds after fire, and possess adaptations to survive fire such as thick bark. Prescribed burning is a critical strategy, highlighted in both the NH Wildlife Action Plan and the NH Forest Resources Plan, to successfully restore this rare woodland community and its associated wildlife.

Figure 3. Pitch pine habitat. Photo by Ben Kimball, NH Natural Heritage Bureau.

Rocky Ridges

Rocky ridges are sparsely wooded to woodland natural communities that occur on ridgelines and some mountain summits. There are several types of rocky ridge natural communities in New Hampshire. Those at mid-elevations (~1,300 to 3,000 feet), generally occur in the White Mountain region and are dominated by some combination of red spruce (*Picea rubens*), red pine (*Pinus resinosa*), and red oak (*Quercus rubra*). Those that occur below 1,300 feet are generally found in southern New Hampshire and are dominated by red oak; southern oaks such as white oak (*Quercus alba*), chestnut oak (*Q. prinus*), scrub oak (*Q. ilicifolia*), and scarlet oak (*Q. coccinea*); and pines including pitch pine (*Pinus rigida*) and red pine. Beneath the woodland canopy, exposed bedrock and patches of shrubs and herbs are characteristic. Fire plays an important role in returning nutrients back into the thin and usually impoverished soils, in maintaining an open woodland structure, and in maintaining species more adapted

to fire (e.g, chestnut oak and pitch pine). For more information on rocky ridge natural communities in New Hampshire, please visit the NH Natural Heritage Bureau website (www.nhnaturalheritage.org).

Figure 4. Appalachian oak - pine rocky ridge at Dumplingtown Hill in Raymond. Photo by Ben Kimball, NH Natural Heritage Bureau.

Figure 5. Jack pine rocky ridge on Mt. Chocorua's Carter Ledge. Photo by Ben Kimball, NH Natural Heritage Bureau.

Grasslands

Grasslands have become increasingly rare in New Hampshire. Their decline in the Northeast has led to a precipitous drop in grassland bird populations, a group of birds disappearing faster than any other in this region. Additionally, more than 70 species of wildlife use grasslands for food, cover, and/or breeding.

Historically, intentionally set fires, lightning strikes, and flooding were responsible for creating and maintaining much of the grassland habitats in New England. Native Americans created grasslands when they burned the land for agriculture and to improve forage for game species such as white-tailed deer. More recently, fire suppression and beaver management have decreased the cover of naturally occurring grassland. Now, most grasslands are restricted to agricultural areas such as hayfields, pastures, and fallow fields that are dominated by non-native grasses introduced by humans. Burning fields can release nutrients trapped in above ground vegetation resulting in better foraging opportunities for wildlife, and can reduce the prevalence of shrubs and late season perennials that take over fields and render them less usable by grassland-dependant wildlife. At some sites, especially in open areas with sandy and infertile soils, burning can also help spread on-site native grass species. Mowing cool-season grasses is generally sufficient to maintain them for grassland-dependent wildlife. However, occasional burning (e.g., once every 4 years or so) of fields dominated by cool-season grasses can help reduce the litter that accumulates from mowing, which may deter some species (e.g., bobolinks) from using fields over time.

Shrublands

Shrubland habitats are dominated by shrubs with a low tree cover and a various cover of graminoids, forbs, and ferns. Typical plants in shrublands include dogwoods (*Cornus* spp.), alders (*Alnus* spp.), viburnums (*Viburnum* spp.), winterberry (*Ilex verticillata*), and many others. Large shrublands, those greater than five acres, are becoming increasingly rare in New Hampshire and so are the wildlife species associated with them. For instance, twenty-two of our forty shrub-dependant birds show population declines. The New England cottontail, another shrub-dependent animal, occurs in less than 25% of its historic range. It is listed as an endangered species in New Hampshire and may become listed on the federal endangered species list.

Shrubland habitats are almost always temporary in the absence of disturbance or stress. When absent, young trees increase in height and cover, eventually shading out shrubs and herbs. Shrublands associated with human activities most often occur in old fields and pastures, powerline corridors, gravel pits, and in recent clearcuts.. Naturally-occurring shrublands are found in riparian corridors, abandoned beaver ponds, shrub swamps, and in upland settings such as dry oak and pine barrens. These dry barrens are kept open and shrubby by periodic fires. Absent fire, dry barrens revert to woodlands and forests.

Mowing is commonly used to maintain shrublands associated with old fields and pastures. Although this can be effective, mowing cuts above ground vegetation reducing wildlife cover. It takes a few years for the vegetation to recover and provide sufficient habitat for wildlife. Fire, on the other hand, top kills shrubs but the dense tangle of stems remain. Fire is also spotty, which results in some patches of live shrubs also being retained. As such, fire can be more effective at maintaining shrublands for wildlife. This is especially true for small shrublands where it is not feasible to set up a mowing rotation that does not cut back all of the shrub cover. Prescribed fire can also help to maintain and enhance berry

production and nutrients available to plants that occur in old field and pasture shrublands, resulting in improved food and cover for wildlife.

Rare plants & Other Unique Natural Communities

Ninety-five of New Hampshire's 397 endangered or threatened plant species occur in dry to semi-dry soil conditions. Natural communities on these well to extremely well-drained soils require periodic fire to maintain their structure and species composition. Plants in these communities are adapted to periodic fire. Adaptations include increasing resource allocation to root growth to facilitate the uptake of limited water and soil resources; ability to re-sprout from roots or root crowns; and the development of thick, protective bark on woody species. Examples of fire-dependant rare plant species include wild lupine (*Lupinus perennis*), northern blazing star (*Liatris novae-angliae*), and bashful clubsedge (*Trichophorum planifolium*). Lack of fire in natural communities with dry to moderately dry soil conditions leads to a decrease in fire-dependant species, an increase in species less tolerant of fire (e.g., birches, maples, beech, and hemlock), and a change in vegetation structure (e.g., increasing canopy cover). These changes often lead to a corresponding shift in natural community type, and potentially a shift in a region's overall biodiversity.

Figure 6. Fire-dependant northern blazing star, a state endangered plant, growing in a remnant pitch pine sandplain system in Amherst, NH. Photo by Melissa Coppola, NH Natural Heritage Bureau.

In New Hampshire, fire plays an important role in 27 natural community types (Table 3), including some of those already mentioned. Around half of those are dependant on fire and are rare or uncommon in the state. Fire return intervals necessary to perpetuate fire-dependent communities range from less than 50 years to 200 years depending on the community type and its associated species composition. For example, pitch pine - scrub oak woodlands in southern New Hampshire require a return interval of 50 years or less to maintain the community although more frequent fire may be needed if attempting to restore a natural community that has been fire suppressed for many decades. Dry Appalachian oak forests occurring in south-central New Hampshire usually on south-facing slopes have a fire-return interval of less than 200 years. To the north, in mountainous parts of the state, red pine rocky ridge communities occur at elevations of 1,400 to 2,700 feet where fire return intervals are typically 70 to 100 years. As red pine trees approach 70 years in age, their bark has thickened enough to resist fires. The return interval may be considerably less when attempting to restore any of these natural communities after decades of fire suppression.

The remaining natural communities listed in Table 3 are moderately fire prone. These communities have fire histories due to their dry soils but fire itself is typically not the only type of disturbance important in maintaining species composition and vegetation structure. Stressors such as rock fall (Appalachian wooded talus), wind throw (oak - mountain laurel forest), shifting sands (maritime wooded dune), and salt spray (bayberry - beach plum maritime shrubland) may be just as or more important disturbance agents.

Forestry

Enhance oak regeneration

Oaks are an important group of trees in New England. They not only garner high prices at wood mills, but they also provide firewood to heat our homes and are important to wildlife for food (e.g., acorns) and cover (e.g., cavities). Regenerating oaks on good quality sites has been a difficult problem throughout the eastern United States for many decades. Oak regeneration failures are generally attributed to either poor seedling establishment and/or growth caused by competition with other hardwoods. Prescribed fire is an effective means of reducing competition with other hardwoods and, in fact, may be essential in developing suitable oak regeneration on some sites. Oak is better able to withstand the effects of fire because mature stems have thicker bark than most other hardwoods and seedlings are better able to resprout after being top killed. Fire can also be beneficial by burning away the duff layer, thereby creating a suitable seed bed for falling acorns or those cached by squirrels and blue jays. Fire also destroys insect predators of acorns and seedlings. Based on research completed in the Northeast and elsewhere, the low incidence of fire compared to that of a century ago may be a significant factor in the reduced occurrence of oak in New England forests.

Invasive Exotic Plant Management

About 1/3 of the more than two thousand plant species in New Hampshire were introduced from some other country or region of the U.S. Most are benign and are enjoyed by many as landscape and garden plants. However, free from the diseases and organisms that keep a plant species in check in their land of origin, more than two dozen have aggressively spread in the state since their introduction and have become difficult to control. These species include common reed (*Phragmites australis* ssp. *australis*), Japanese knotweed (*Fallopia japonica*), multiflora rose (*Rosa multiflora*), glossy buckthorn (*Frangula alnus*), and many others. Invasive exotic plants can degrade natural communities, impact endangered or threatened species, impede forest regeneration and agricultural crop production, and damage personal property. Collectively, they have cost millions of dollars to control.

Fire alone will not control invasive exotic plants. However, in combination with other management techniques such as mowing and/or herbiciding, fire can play an important role in controlling some invasive exotics (e.g, multiflora rose) or at least create conditions suitable for recolonization by native species. Multiple treatments within and during successive growing seasons will be required and care should be taken to match control techniques with the target species given that fire can end up promoting invasive exotics in some cases.

Table 3. Fire-prone natural communities in New Hampshire with state ranks* in parentheses. Read Sperduto and Nichols (2012) for more information.

Fire Dependent	Moderately Fire Prone
Appalachian oak - pine rocky ridge (S3)	Appalachian wooded talus (S1S2)
Chestnut oak forest/woodland (S1S2)	Bayberry - beach plum maritime shrubland (S1)
Circumneutral rocky ridge (S1)	Maritime meadow (S1)
Dry Appalachian oak forest (S1S3)	Maritime shrub thicket (S1)
Dry red oak - white pine forest (S3S4)	Maritime wooded dune (S1)
Jack pine rocky ridge (S1)	Oak - mountain laurel forest (S3)
Mixed pine - red oak woodland (S1S2)	Pitch pine - heath swamp (S1S2)
Pitch pine - Appalachian oak - heath forest (S1)	Red oak - black birch wooded talus (S3S4)
Pitch pine - scrub oak woodland (S1S2)	Red oak - ironwood - Pennsylvania sedge woodland (S2)
Red oak - pine rocky ridge (S3S4)	Red spruce - heath - cinquefoil rocky ridge (S3S4)
Red pine rocky ridge (S2)	Rich Appalachian oak rocky woods (S2)
Red pine - white pine forest (S2S3)	Rich red oak rocky woods (S2S3)
Riverwash plain and dunes (S1)	Semi-rich oak - sugar maple forest (S2S3)
Subalpine rocky bald (S2)	

*State ranks describe rarity of the natural community within NH.

S1 (Critically Imperiled): At very high risk of elimination due to extreme rarity (generally one to five occurrences), very steep declines, or other factors.

S2 (Imperiled): At high risk of elimination due to a very restricted range, very few examples (generally six to 20 occurrences), steep declines, or other factors.

S3 (Vulnerable): At moderate risk of elimination due to restricted range, relatively few examples (generally 21 to 100 occurrences), or vulnerable to elimination because of other factors.

S4 (Apparently Secure): Occasional to somewhat widespread but not uncommon or rare; possible cause for long-term concern due to declines or other factors.

S5 (Secure): Demonstrably common, widespread, and abundant.

Agriculture

Blueberries

There are over 40 farms in New Hampshire that grow blueberries as either pick your own or wholesale operations. Most grow high bush varieties, but some in central and northern New Hampshire maintain large wild low bush blueberry barrens that benefit from periodic burns. Wild blueberry growers have found by experience and research that periodic pruning via fire can stimulate higher yields and can reduce certain insects and diseases.

Traditionally, fields were pruned by free-burning (controlled burns using whatever accumulated leaves and duff was available to carry the fire). Free-burning is inexpensive, but often does not result in complete coverage of the field. To get better coverage, some larger commercial farming operations have resorted to spreading an even layer of straw over the field or use oil burners. Others use a flail mower to prune, which has also proven successful at increasing yields but is not effective at controlling insects or disease. Some of the smaller blueberry farming operations

in New Hampshire still use the more inexpensive technique of free burning to manage their fields.

Pastures

Prescribed burning has been used for centuries to improve pasturage in New England, first by Native Americans and then European settlers who used burning in the Old World for the same purposes. Burning can improve pasture land in the short term by making some nutrients that are sequestered in live or dead plants available to plant roots in the soil. Burning can also control some plant diseases, and helps control the spread of woody vegetation that can take over a pasture.

Aesthetics & Outdoor Recreation

Although visitors may not realize it, their hiking experience at Blue Job State Forest is significantly enhanced because of prescribed fire. The panoramic views from atop Blue Job Mountain have been maintained for many years through periodic fires set by state lands management staff. Although the primary purpose of the burns is to enhance blueberry production for wildlife, visitors also take full advantage of the increased number of blueberries produced after the burns. After collecting the ripened fruit in pails and plastic bags, visitors enjoy the blueberries as they continue their hike or take them home to make blueberry pancakes or muffins.

Fire can be used to maintain aesthetic views in other settings as well. Even if you are not interested in maintaining your field for hay production, pasturage, or wildlife, you may be interested in maintaining it solely for its beauty or to maintain your view of a nearby mountain range. Burning can be used for this purpose and in some cases it can be more cost effective than mowing, especially if you can get a local fire department interested in using the opportunity for training purposes.

Wildland Fire Training

All members of local fire departments require a significant amount of training to combat fires, both structural and wild fires. Prescribed burns provide an excellent opportunity for firefighter trainees to get first hand experience on how to control fire in wild land settings. Participating in prescribed fires can also help local firefighters maintain their knowledge and proficiency with dealing with wild fires once their initial training has been completed.

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PLANNING A PRESCRIBED BURN

Chapter 3. Determining Prescribed Burn Objectives

Recommended Standard

- Prescribed burn plans will identify both short and long terms goals and objectives for the areas to be treated with fire.

Determining goals and objectives for using prescribed burning as a management tool is a key step in the process of planning for fire. Because of the complexity, cost, and risk associated with implementing prescribed fire, it is important to be clear about what is trying to be achieved, and how to monitor progress (also see Chapter 15).

Goals should identify the big picture of what is trying to be accomplished, while objectives should focus on the smaller, more measurable, individual steps that will help in meeting the goal. The following is an example of a set of goals and objectives for using prescribed fire on The Nature Conservancy's Ossipee Pine Barrens Preserve in the east-central part of the state.

Goals:

- Maintain the exemplary pitch pine - scrub oak woodland natural community and associated rare species populations.
- Reduce fuel loads to minimize the risk of catastrophic wildfire that could threaten life and property, and result in undesirable ecological effects.

Objectives for the Burn Unit:

- Consume duff sufficient to expose mineral soil across 20% of the burn unit.
- Top kill > 75% of the scrub oak within the burn.
- Top kill > 90% of the hardwood tree species within the burn unit.
- Reduce 10 hour fuel loads by at-least 70%.

In this example, the four objectives support the two bigger picture goals. Duff consumption and mineral soil exposure both promote and help to maintain the pitch pine - scrub oak woodland, and reduce fuel loading to decrease the risk of catastrophic wildfire. Again, it is important to develop measurable objectives when possible. Monitoring protocols can then be used to measure and document progress toward objectives and goals, helping to inform our understanding of prescribed fire as an effective management tool.

Some questions that should be considered when determining goals and objectives for a prescribed burn include:

- What is the purpose of the burn? Answering this question will help set your goals. Some goals may include maintaining unique natural communities or vegetation types, maintaining rare species populations, reducing concentrations of hazardous fuels, timber management (e.g., regeneration of oak species), aesthetics, etc. Refer to Chapter 2 for more examples.

- How will fire be used to meet the stated purpose? Answering this question will help define objectives needed to meet your goals. Exposing mineral soil for tree species

regeneration, burning off certain fuel categories, removing “fire intolerant” species are some examples of objectives that should be stated in a measurable way.

- How long will it take to achieve the stated purpose? Will a single fire be enough, or will you need to “peel back the layers” to be successful. This is important as it will help to determine quantitative objectives, like the percent of duff that may be realistically removed in a single burn.

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Chapter 4. Developing Prescribed Burn Prescriptions

Recommended Standards

- The burn plan will include:
  - Estimates of minimum and maximum flame lengths and rates of spread for the fuel types in the proposed burn unit and adjacent areas. Estimates can be derived from experience, literature, or fire modeling software such as Behave Plus.
  - A description of fuel types in and adjacent to the burn unit.
  - The ranges of wind, relative humidity, days since rain, and temperature that the burn will be conducted under.
  - Season (growing or dormant) in which the burn will occur.

Once you have determined your prescribed fire management goals and objectives, the next step is to develop a burn prescription. ***Prescriptions*** describe a range of factors needed to achieve the objectives in your management plan. The ***burn plan*** describes how you will implement the prescription using fire. Basic elements of a prescription include fuels, weather, and fire behavior. This chapter will discuss fire behavior and fuel prescription development and how factors, such as topography and timing, can affect them.

Fire Behavior Prescriptions

Considerations when developing a fire behavior prescription include:

- What kind of fire behavior is needed to meet management objectives?
- What kind of fire behavior will meet holding and control objectives?
- What environmental conditions are needed to produce desired vs. undesired behavior?

Prescriptions display the range between desired and undesired fire behavior with optimal conditions usually in the middle to high end of the scale. Common fire behavior prescriptions in a burn plan include flame length, rate of spread, and fireline intensity; but others like spot fire containment time, tree species mortality, and spotting distance are also commonly used.

Flame Length is generally defined as the distance between the tip of a flame and its base. Flame length is a measure of fireline intensity. Flame lengths can be manipulated through ignition techniques (see Chapter 9 for more on ignition techniques and how they influence flame length).

Rate of Spread refers to how fast a fire moves through the burn area usually expressed in chains or acres per hour. Rate of spread can help estimate ignition duration and holding needs. As with flame lengths, rate of spread can be manipulated through ignition techniques (see Chapter 9 for more on ignition techniques and how they influence flame length).

Fireline Intensity measures the rate of energy or heat released by a fire front. Fireline intensities vary depending on fuel types. For example, under similar burning conditions, a grassland will have lower fireline intensities compared to a slash or timber litter fuel.

Developing a fire behavior prescription on a new piece of ground or fuel type can be a trial and error process at first. Without prior knowledge of the reaction between fuels, weather, and

topography it can be hard to tell if your fire is meeting the stated objectives. Early burns should concentrate on safety and containment. Frequent observations of fire behavior and weather should be taken to determine if prescription parameters and burn objectives are being met. Software like Behave Plus and FOFEM (First Order Fire Effects Model) help guide the process of developing a fire behavior prescription. Additional information on fire effects to plants and animals, which can also be helpful in developing prescriptions, can be found at the Fire Effects Information System (FEIS) website.

Fire behavior is directly and indirectly affected by fuels, weather, and topography. The remainder of this chapter will describe how these and other environmental variables will influence fire behavior and fire prescriptions, provide examples of how to develop your own prescription, and provide examples of common prescriptions used in the Northeast.

The Fire Triangle

Before a discussion on how fuels, weather, and topography can influence a fire, one must first understand the basics of fire behavior or 'The Fire Triangle.' The interaction of the three equal sides of the fire triangle (i.e.,, heat, fuel and oxygen) are required for the creation and maintenance of a fire. When there is not enough heat generated to sustain the process, when the fuel is exhausted, removed, or isolated, or when oxygen supply is limited, then a side of the triangle is broken and the fire is suppressed.

Fuels

Fuels in the wildland fire environment refer to any combustible material. Fuels are further classified by size, amount, continuity, quality, type, and moisture content. These classifications help determine how fuels will respond to prescribed fire, and if prescribed fire objectives can be met. Dead fuels are divided into size classes based on the amount of time it takes them to gain and lose moisture.

- 1 hour fuels are 0 to 0.25" in diameter
- 10 hour fuels are 0.25 to 1.0" in diameter
- 100 hour fuels are 1.0 to 3.0" in diameter
- 1000 hour fuels are 3.0" and greater in diameter.

One and 10 hour fuels are also known as *fine dead fuels* and often carry the fire. These fuels react quickly to changes in moisture, wind, and topography and can support fires that exhibit rapid rates of spread. One hundred (100) and 1000 hour fuels are slower to react to changes in moisture, but burn with greater intensity. Live fuels are classified by stage of development, which corresponds to moisture levels in the fuels.

When considering fuels in your prescription the most important element is to correctly identify what fuel will carry the fire. Fuel characteristics can be described in several ways, (e.g., natural vs. activity fuels and dead vs. live fuels). Natural fuels are those that have accumulated on the forest floor from storm damage, wind, or other events of nature. Activity fuels are accumulated

via man-made activities such as logging and land clearing (often referred to as slash). Dead fuels are herbaceous or woody materials, generally low in moisture and close to the ground. These can include leaves, twigs, needles, draped materials, and snags. Comparatively, live fuels are generally above the forest floor, stable in moisture content, and have protective structures. The vertical and horizontal arrangement of fuels should also be considered because they will determine a fire's intensity inside and outside the burn area. For example, a pine overstory that has shed dry needles that get caught up in a well-developed shrub layer will create more intense fire behavior compared to a grassland fire.

Various fuel model systems have been developed to help simplify the description and classification of fuel types and resulting fire behavior. We recommend models developed by Scott and Burgen (Scott and Burgen 2005). Fuel models are generally divided into four broad model types: grass, shrub, timber litter, and slash/blowdown. These types are also used in developing burn prescriptions in Behave Plus. Within each model are sub models that better approximate specific fuel types. Because each model responds differently to fire, you have to know which model most closely approximates the vegetative characteristics in your burn unit.

For example, if you plan to burn a grassland and received 0.25" of rain the night before, it might not be a problem because the 1 hour fuels that comprise a grassland are quick to gain and lose moisture. You could be burning by early afternoon. If you plan a burn in a shaded understory with slash and timber litter as fuels you might be out of luck the next day, no matter how hot the sun shines. These fuels are slower to gain and lose moisture, and a shaded understory will slow the drying process even more.

A control line around a grassland may only need to be 18" wide, just enough so the first flaming front is unable to ignite fuels across the line. Try that with a heavy slash fire and the intensity and resonance time of the flames will cross easily, and it will be too hot for firefighters to try and suppress. A control line in heavy fuels needs to be much wider.

When planning a prescribed burn it is also crucial to model the fuels adjacent to the burn unit. What might burn if a spot fire occurs outside the burn unit? Again, the Scott and Burgen models can be used for this purpose.

Topography

It is important to plan for the direct and indirect effects of topography on fire behavior and prescription logistics before, during, and after a burn. Wind speed and direction as well as humidity levels can be influenced by topography. Equipment needs, mobility of fire crews, and smoke management all can be affected by burn site topography. Slope and aspect can affect ignition strategies and crew placement. A simple USGS quadrangle map will aid in planning for these topographic variables.

Weather

Weather is a critical consideration when planning a prescribed burn, and choosing the correct weather parameters is a key step in the process. Prescriptions are often based on ranges of desired fuel moisture content for the time lag classes described above (1 hour, 10 hour fuels, etc.), as well as live fuel moisture content. Yet these are not easily measured in the field. Fortunately, real time weather conditions can be easily measured in the field using any number of relatively inexpensive and accurate weather instruments (see Chapter 12). The weather data collected during a burn can then be used as surrogates for fuel moisture content, and/or easily

converted to fuel moisture content using various tables in the fireline handbook. This enables an implementation team to ensure that the prescription parameters are being adhered to during the course of a burn.

When planning a burn, the most important weather factors to consider are days since rain, wind, and relative humidity. Temperature can also be important, but has less bearing on fire behavior than the previous three factors.

The number of days since rain and rainfall amounts have an influence on moisture content of fuels, and therefore affect what will be available to burn. If a burn is planned too close to the most recent soaking rain event, available fuels are not likely to burn as desired. If it is planned too far from the most recent soaking rain event, the fire intensity and severity, and resulting fire effects may be undesirable as well.

Number of days since rain influences soil moisture and a fire's ability to burn the duff layer (the semi-decomposed organic soil layer just below leaf litter). If a fire planner is concerned about the fire burning too deeply into the duff and potentially causing root damage, or becoming unsafe given fuel conditions, it may be prudent to tighten this prescription parameter (e.g., no more than four days since rain). In some instances however, a planner may want to ignite and burn off some of the duff layer (e.g., to enhance germination of wild lupine or other rare plants). In this case, the prescription may need to be based on a greater number of days since rain (e.g., a minimum of four days since rain). Setting this parameter depends on the burn planner's objective and burn unit conditions. A helpful tool for evaluating soil moisture in the duff layer is the Keetch-Byram drought index (KBDI), which provides a numerical rating (0-800) of the net effect of evapotranspiration (evaporation of water from plants) and precipitation. The higher the numerical rating, the more intense and deeper a fire will burn. Current KBDI ratings for any part of the country can be obtained by visiting the U.S. Forest Service's Wildland Fire Assessment System website.

Table 4. Fire intensity related to Keetch-Byram drought index ratings.

0 - 200	Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. Typical of spring dormant season following winter precipitation.
200 - 400	Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity.
400 - 600	Typical of late summer, early fall. Lower litter and duff layers actively contribute to fire intensity and will burn actively.
600 - 800	Often associated with more severe drought with increased wildfire occurrence. Intense, deep burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels.

Wind is a very important factor to consider in planning a burn, primarily for three reasons: smoke management, fire intensity, and the potential for long range spotting. For directing smoke away from smoke sensitive areas, both surface winds and transport winds need to be considered. Generally, sustained surface winds in excess of eight mph combined with dry conditions can result in high fire intensity and burns that may be difficult to contain.

Relative humidity (RH) has the most direct and important influence on the availability of fine dead fuels (1 and 10 hour time lag classes), and can change significantly throughout a burn period. Generally, a preferred range of relative humidity for burning is between 35% – 55%. Depending on the fuel type, there may be intense fire behavior at the low end of the range (35%), so the correct range for the prescription needs to be suited to the fuel model.

A final weather factor that is important to consider is ventilation rate – the forecasted transport wind speed multiplied by the mixing height. Ventilation rate helps determine how well smoke will disperse from a burn.

Timing

The timing of a prescribed burn depends on your objectives. Two primary considerations associated with timing are season and time of day. Prescribed burns are done either during the growing season when live vegetation is green, or the dormant season when the water content in live vegetation is lower. In the Northeast, dormant season burning is generally done in the spring, but sometimes is also done in the fall after leaf drop. Since weather conditions change throughout the day, the time a burn is done during the day is important to consider.

One important seasonal consideration is the extent to which certain kinds of vegetation are trying to be controlled with the burn. For example, knocking back hardwood species is believed to be more effectively done during the growing season when the plants have fewer root reserves, decreasing the likelihood that they will be able to resprout. However, if the objective is primarily to burn off down and dead woody fuels and leaf litter while retaining all live tree species, dormant season burns may be the best approach, especially with higher soil moistures (i.e., lower KBDI ratings).

It is important to note that fire behavior can be dramatically different depending on the season. Dormant season fire behavior are often much more intense compared to growing season burns. This is particularly true if burning at sites with dense, shrubby fuels where live shrubs are more available to burn. Additionally, pine crowns can be at their driest in the spring, and therefore more prone to torching and generating crown fires if the ladder (i.e., vertical) fuels are available.

As weather changes over the course of a day, fire behavior will change as well. In many situations, choosing the correct time of day to burn will be centered on starting late enough in the day to ensure fuels are available to burn. As temperatures lower over night, the RH often recovers to 100% (reaching the dew point) leaving fuels damp by morning. Then, it often takes until mid-morning for fuels to dry out enough to burn. However, there may also be instances where it is desirable to avoid the driest time of day or a forecasted change in winds. In this instance, the burn may need to begin and end early.

Example of How to Develop a Prescription

The example below will use the information presented throughout this chapter to illustrate how to develop a basic burn prescription using Behave Plus software. The inputs required by Behave Plus are listed in Figure 8. Some inputs can be easily derived from calculations taken from within the burn unit (e.g., tree height and slope). Others will require consulting prescribed fire literature and/or prescribed fire experts.

You would like to burn a level 20 acre field that has begun to revert from grass and blueberry to grey birch and white pine. After reviewing information on FEIS you learn that blueberry responds well to surface fires in the spring and fall and rapidly sprouts after fire from rhizomes. You also learn young grey birch and white pine stems are susceptible to surface fires, although they may re-sprout later. You know that there is a continuous layer of grass and blueberry throughout the field, and you feel confident that when these fuels are dry and cured they will burn readily. You would like the dead grass and blueberry stems to produce enough heat to kill the birch and pine without damaging the root systems of the grass and blueberry. Based on the information you collected, you decide to burn in the spring, when surface fuels are dead and dry but soil moistures are still high.

The next step is to consult fuel models, which will help you estimate fire behavior based on the type and amount of vegetation in your field, and will be used as an input in Behave Plus. A review of the Scott and Burgen fuel models indicates that your field is best represented as a moderate load, humid climate shrub type (SH3). This fuel model is described as,

> *"The primary carrier of fire in SH3 is woody shrubs and shrub litter. Moderate shrub load, possibly with pine overstory or herbaceous fuel, fuel bed depth 2 to 3 feet. Spread rate is low; flame length low."*

The graphs provided for the model give you some sense of the likely rate of spread and flame lengths in varying wind speeds (Figure 7) but more specific calculations of these and other parameters will be derived using Behave Plus.

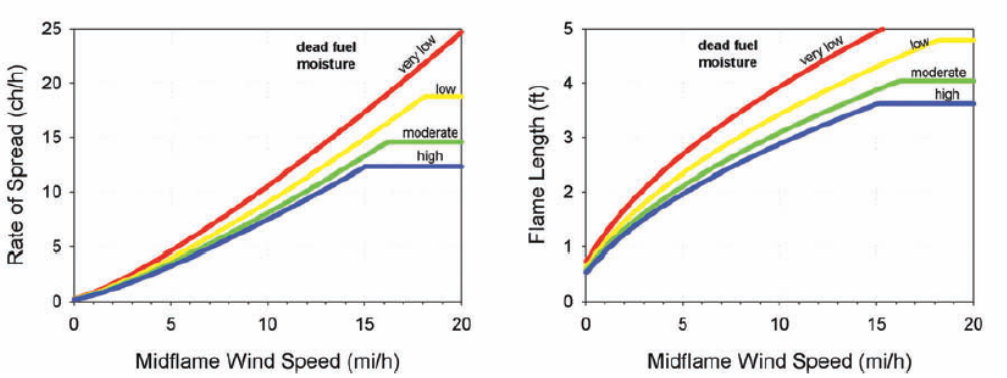
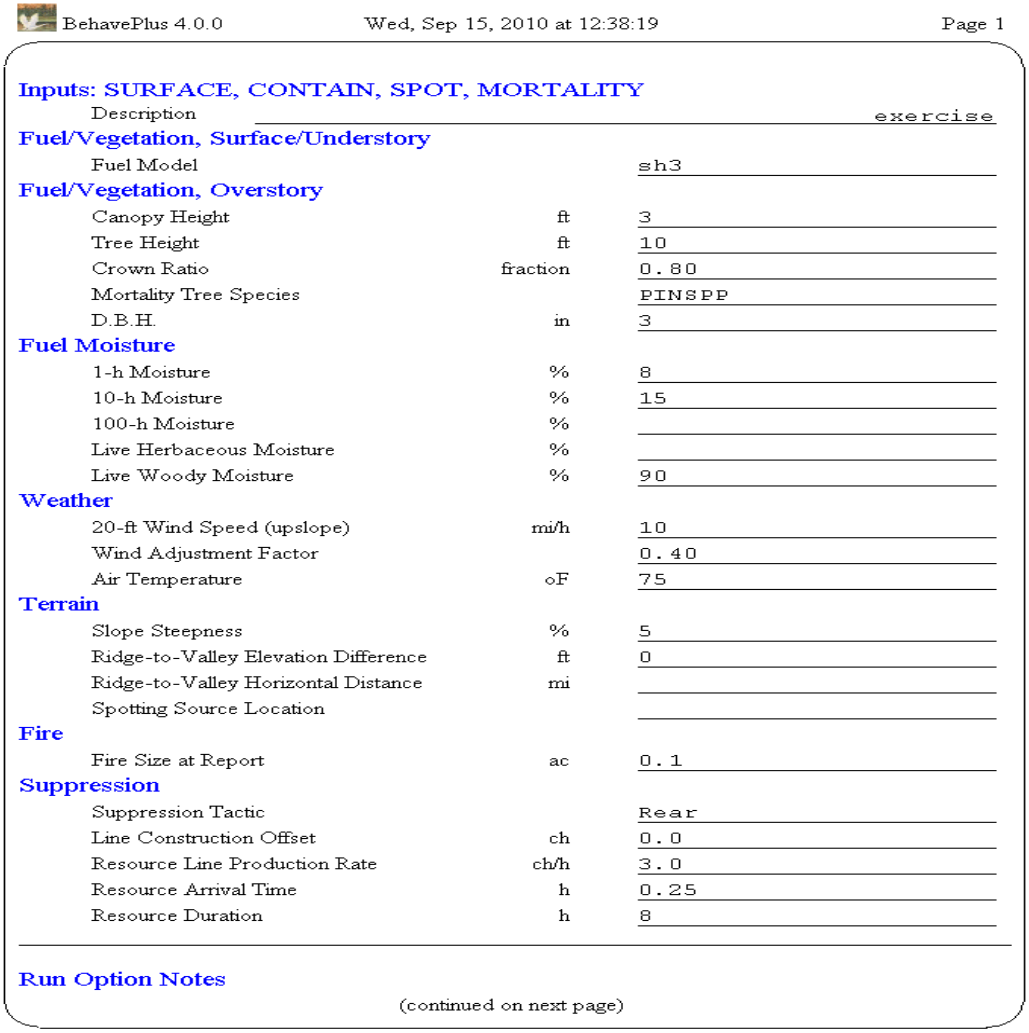


Figure 7. Rate of spread and flame length charts for moderate load, humid climate shrub type (SH3) fuel model (from Scott and Burgen 2005).

You learn from discussions with your County Forester that during the spring, optimal burning conditions for blueberry occur when the relative humidity is between 20 – 50% and fine dead fuel moisture between 6 – 25%.

When you enter the fuel types, fuel moistures, and other environmental conditions that will be present when you plan to burn (Figure 8), Behave Plus will produce estimates of flame length, rate of spread, fireline intensity, tree mortality, and time and resources needed to extinguish a spot fire (Figure 9).

By revising inputs like wind speed and fuel moisture, you can develop a range of optimal burning conditions for your field. You will have developed a prescription for optimal fire behavior that will keep the fire under control while achieving your objectives.



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Inputs: SURFACE, CONTAIN, SPOT, MORTALITY

Description		exercise
Fuel/Vegetation, Surface/Understory		
Fuel Model		sh3
Fuel/Vegetation, Overstory		
Canopy Height	ft	3
Tree Height	ft	10
Crown Ratio	fraction	0.80
Mortality Tree Species		PINSPP
D.B.H.	in	3
Fuel Moisture		
1-h Moisture	%	8
10-h Moisture	%	15
100-h Moisture	%	
Live Herbaceous Moisture	%	
Live Woody Moisture	%	90
Weather		
20-ft Wind Speed (upslope)	mi/h	10
Wind Adjustment Factor		0.40
Air Temperature	oF	75
Terrain		
Slope Steepness	%	5
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	
Spotting Source Location		
Fire		
Fire Size at Report	ac	0.1
Suppression		
Suppression Tactic		Rear
Line Construction Offset	ch	0.0
Resource Line Production Rate	ch/h	3.0
Resource Arrival Time	h	0.25
Resource Duration	h	8

Run Option Notes

(continued on next page)

Figure 8. Behave Plus input screen with examples of possible inputs.

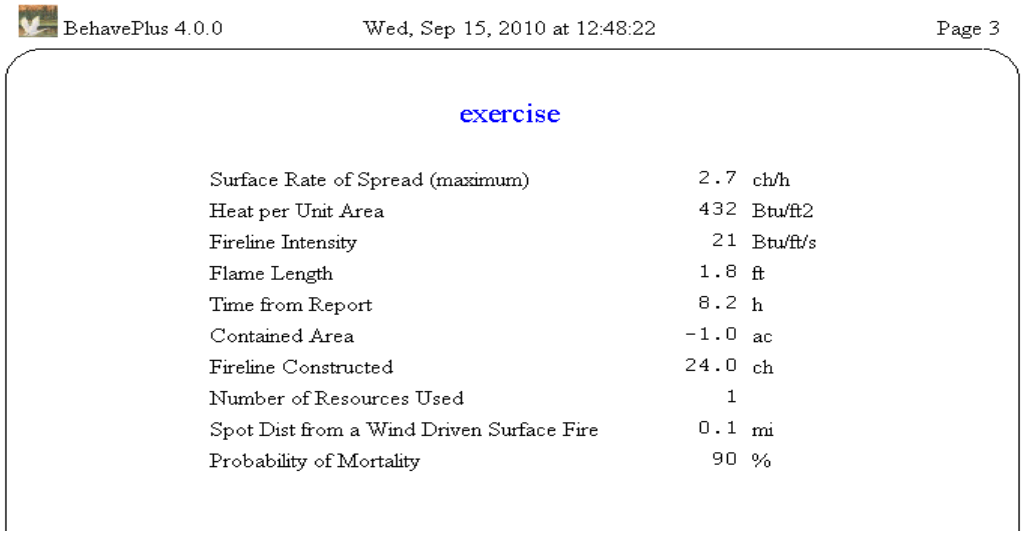

Figure 9. Behave Plus output screen with calculations for fire rate of spread, flame length, etc. based on inputs used in Figure 8.

Examples of Prescription Parameters Used in the Northeast

Fire management carries inherent risks. These risks can be largely reduced by 1) relying on experienced fire personnel to carry out a prescribed burn and 2) burning under environmental conditions that minimize risk of escaped fire and threats to people or property.

Identifying appropriate prescription parameters is one of a number of elements that should be addressed to ensure a safe and successful prescribed burn. While prescriptions are essential, they are one complementary component of a complex process. Other important elements, such as having trained, experienced and qualified fire personnel, are just as important to ensuring a safe burn. In addition, prescription parameters can help predict fire behavior, but other factors such as the fuels present and ignition techniques can dramatically alter fire behavior.

As previously outlined, there are a number of environmental (e.g., relative humidity, temperature, days since last rain, and fine fuel moisture) and fire prescription parameters (e.g., flame length and rate of spread) that are adhered to in order to conduct a safe prescribed burn. Table 5 provides examples of common prescription parameters (median numbers based on 31 burn plans from different agencies and sites) used for different fuel groups in the Northeast. Each site should develop prescriptions based on local knowledge and experience, but the table below gives an indication of common practices across the Northeast. It is a baseline to further inform prescription development.

Prescriptions can be modified to encourage more extreme or modest fire behavior depending on desired fire effects.

Table 5. Examples of common prescription parameters (median numbers based on 31 burn plans from different agencies and sites) used for different fuel groups in the Northeast.

Environmental Prescription Parameters	Fuel Group							
	Grass		Shrub		Timber		Logging Slash	
	Max	Min	Max	Min	Max	Min	Max	Min
20' wind speed (mph)	20	5	20	5	20	4.5	20	5
Mid flame wind speed (mph)	10	2	8	1	8	2	10	0
1 HR Fuel Moisture (%)	12	6	15.5	6	13	6	14	6
10 HR Fuel Moisture (%)	18	8	25	8.5	20	8	18	8
100 HR Fuel Moisture (%)	22	12	28	10	22	12	25	11.5
Live Fuel Moisture (%)	120	60	300	30	90	30	120	60
Air Temp. (%)	90	35	90	35	87.5	35	79	40
RH (%)	65	26	65	35	67	30	60	30
Days Since Last Rain	6.5	1	5	1	7	1	7	1
KBDI	400	0	300	0	299	0	350	0
Atmospheric Mixing Height (feet)	--	1500	--	1500	--	1500	--	1500

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Chapter 5. Burn Complexity Assessment

Recommended Standard

- Conduct at least one prescribed burn complexity analysis for each burn unit using an established rating system such as The Nature Conservancy's Prescribed Fire Complexity Rating Worksheet, NWCG Prescribed Fire Complexity Rating System Guide PMS 424 July 2017, or NH Prescribed Fire Council Complexity Rating (Appendix B); attach prescribed burn complexity analysis to the burn plan.

The complexity of a prescribed burn dictates the number of qualified personnel and types and amount of equipment necessary to conduct a prescribed burn with minimal risk (see Chapter 6 and Chapter 7). Prescribed burns are usually evaluated during the planning process to determine their complexity using an evaluation system or rubric. Factors such as safety, potential for escape, fuels and fire behavior, burn objectives, on-site and off-site values, management organization, air quality or smoke management, inter-agency coordination, safety, and logistics are assessed. A burn complexity rating of low, moderate, or high is determined and then planned for in the burn plan. Prescribed burn complexity is often reassessed after the burn plan is written to determine if mitigating actions outlined in the plan will reduce risks, which potentially will lower the complexity rating for the burn.

NH Prescribed Fire Complexity Rating

The NH Prescribed Fire Council Complexity Rating System is comprised of two parts: an evaluation worksheet and a complexity value evaluation rubric. The system evaluates 12 elements: safety; difficulty of containment; fuels and fire behavior; wildland/urban interface; objectives; management organization; contingency planning and resources; natural, cultural and social values; air quality values; logistics; tactical operations; and cooperator coordination. Each element is evaluated by comparing the burn unit conditions and other operational considerations with the element Complexity Value Evaluation Examples in the rating rubric. Each element is then given the complexity value that most closely meets the burn condition as described in the rubric or an intermediate value between two examples. Each element is also assigned a weighting factor from 1-5. The weighting value is then multiplied by the element complexity value to determine the element total points. Once each of the elements has been rated, a final score is calculated and compared to the ranges for Low, Moderate and High Complexity prescribed burns at the top of the worksheet. Going through such an exercise will help the burn planner identify potentially hazardous conditions that should be mitigated for, and will help determine crew and equipment levels.

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Chapter 6. Crew Levels & Qualifications

Recommended Standards

- The minimum crew size for a prescribed burn is six including the burn boss.
- The minimum level of training for anyone assisting on a prescribed burn is NH Basic Prescribed Firefighter, which is equivalent to NWCG Firefighter Type 2. Required courses include NWCG I-100, S-130, S-190, and L-180. Prescribed fire positions that involve performing more advanced tasks require additional training and are further described in this chapter.
- The minimum fitness standard for crew personnel on a prescribed burn is moderate (i.e., pack test that includes a 2 mile hike with a 25 pound pack completed in less than 30 minutes OR a running test 1.5 miles in length, completed in 12 minutes, 45 seconds or less).

Crew Qualifications

Prescribed fire crew qualification involves training, performance verification, and physical fitness standards. The NH Prescribed Fire Council recommends standards for training, position performance verification, and physical fitness testing for positions on a prescribed fire in New Hampshire. The NH Prescribed Fire Council recommends utilizing existing NWCG Training Courses and use of NH-specific prescribed fire positions and performance verification (position task books).

The National Wildfire Coordinating Group (NWCG) has standards for personnel qualification for wildland fire positions that are also used for prescribed fire positions by federal agencies. NWCG qualified personnel could also be utilized if available. A number of NWCG positions are applicable to prescribed fire (Table 6).

The Prescribed Fire Council recommends utilization of NH-specific prescribed fire positions, performance verification or task book completion, and physical fitness standards. The six NH-specific positions include Basic Prescribed Firefighter, Advanced Prescribed Firefighter, Fire Effects Monitor, Prescribed Fire Burn Boss 3, Prescribed Fire Burn Boss 2, and Prescribed Fire Planner. Basic descriptions for the position and required training are presented below and in Table 8. Performance verification utilizing NH-specific task books for Advanced Prescribed Firefighter and Prescribed Fire Burn Boss 2 and 3 are recommended.

Table 6. Position titles and training required to meet National Wildlife Coordinating Group qualifications.

Position Title	Position Abbreviation	Task Book	Pre-Qual	Required Training
Fire Fighter Type 2	FFT2	N	N	ICS-100, L-180, S-190, S-130, IS-700
Fire Fighter Type 1/Squad Boss	FFT1	Y	FFT2	S-131, RT-130
Crew Boss, Single Resource	CRWB	Y	FFT1	ICS-100, S-290, S-230, RT-130
Firing Boss, Single Resource	FIRB	Y	FFT1	ICS-100, S-290, S-230, RT-130
Engine Boss, Single Resource	ENGB	Y	FFT1	ICS-100, S-290, S-230, RT-130
Fire Effects Monitor	FEMO	Y	FFT2	S-290, RT-130
Rx Fire Burn Boss, Type 3*	RXB3	Y	FFT1 or ICT5	ICS-100, S-290, TR-130, S-290
Rx Fire Burn Boss, Type 2	RXB2	Y	FIRB, ICT4	RX-410, S-390, RT-130
Rx Fire Burn Boss, Type 1	RXB1		RXB2	S-490, RT-130

Note: RXB3 is included in the "Federal Wildland Fire Qualifications Supplement"

NWCG courses that would be utilized for NH Prescribed Fire Positions are listed in the table below.

Table 7. NWCG and FEMA courses to be used in prescribed fire training in New Hampshire.

NWCG Course Number	Course Title
S-130	Firefighter Training
S-190	Introduction to Wildland Fire Behavior
S-131	Fire Fighter Type I
S-133	Look Up, Look Down, Look Around
S-211	Portable Pumps and Water Use
S-219	Firing Operations
S-230	Crew Boss (Single Resource)
S-231	Engine Boss (Single Resource)
S-290	Intermediate Fire Behavior
S-390	Introduction to Wildlife Fire Behavior Calculations
L-180	Human Factors in the Wildland Fire Service
RT-130	Annual Fireline Safety Refresher
RX-301	Prescribed Fire Implementation
RX-341	Prescribed Fire Burn Plan Preparation
RX-310	Introduction to Fire Effects
FEMA Course Number	Course Title
IS 100.C	Introduction to Incident Command System (ICS 100)
IS-200.B	ICS for Single Resources and Initial Action Incidents (ICS 200)
IS-700.B	An Introduction to the National Incident Management System

NH Prescribed Fire Fighter Categories

Basic Prescribed Firefighter

This category is equivalent to NWCG Firefighter Type 2. Basic Firefighters may be used to assist in prescribed burn operations such as preparing line, holding line, assisting with water transport, traffic control etc. There are no supervisory duties.

- Required Training: S-130, S-190, ICS-100, and L-180.

Advanced Prescribed Firefighter

Advanced Prescribed Firefighter may be used in a variety of prescribed burn tasks including preparing, firing, and holding lines. They may also perform duties in support of engines, pumps and other suppression equipment, and hold supervisory duties but must have demonstrated experience for all necessary equipment by task verification on active burns.

- Required Training: S-131, S-133, and either S-211 or S-231.
- Pre-qualification: See Table 8.

Prescribed Fire Burn Boss 3

NH Prescribed Burn Boss 3 would direct prescribed burns of low complexity on state or other non-federal lands. They have demonstrated a proficiency in the fuel types they are burning. Typically a Burn Boss 3 would execute small to medium grassland or hardwood understory burns.

- Required Training: S-219 and S-290.
- Pre-qualification: See Table 8.
- Optional Training: S-230.

Prescribed Fire Burn Boss 2

NH Prescribed Fire Burn Boss 2 would direct a prescribed burn of medium to high complexity on state or other non-federal lands. They have demonstrated a proficiency in the fuel types they are burning. Typically a Burn Boss 2 would handle medium to large grassland, hardwood understory, slash, and pine understory burns.

- Additional Required Training: RX-410, ICS-200, S-230 and S-390.
- Pre-qualification: See Table 8.
- Optional Training: RX-301, RX-341, and RX-310.

Fire Effects Monitor (FEMO)

Trained to collect information during prescribed burn implementation to monitor prescription parameters and fire behavior.

- Recommended Training: S-290.
- Pre-qualification: See Table 8.

Prescribed Fire Burn Planner

The Prescribed Burn Planner is the primary person developing fire management plans and site-specific burn plans. Knowledge of fire behavior, fire effects, and ecological objectives is important. Personnel qualified as a NH Burn Boss or NWCG Burn Boss would be qualified to be a Prescribed Fire Burn Planner.

- Recommended Training: NH Burn Boss 3 or RX-341 and RX-301.
- Pre-qualification: See Table 8.

Table 8. New Hampshire prescribed fire position titles and required training.

Click here for a NWCG course guide.

Position Title	Position Abbreviation	Task Book	Pre-Qual	Required Training
NH Basic Prescribed Fire Fighter	RXFF1	N	N	ICS-100, L-180, S-130, S-190
NH Advanced Prescribed Fire Fighter	RXFF2	Y	RXFF1	S-131, S-133, S-211 OR S-231
Fire Effects Monitor	FEMO	N	RXFF1	Recommended: S-290
NH Prescribed Fire Burn Boss 3	NHRXB3	Y	RXFF2 OR FFT1	S-219, S-290
NH Prescribed Fire Burn Boss 2	NHRXB2	Y	NHRXB3	I-200, S-230, S-390 Optional: RX-301, RX-310 RX-341
Prescribed Fire Burn Planner	RXP	N		RX-341 or other

Recurrent Training

The NH Prescribed Fire Council suggests the use of NWCG course RT-130 (Annual Fireline Safety Refresher) be used as a minimum for all positions.

Qualification Currency

The NH Prescribed Fire Council recommends that personnel qualifications remain current by successful performance within a specific position or higher within the last three years plus participation in RT-130.

Physical Fitness Standards

To ensure personnel safety and that tasks on a prescribed fire are performed to a necessary minimal level, physical fitness standards should be established and followed. NWCG established light, moderate, or arduous physical fitness requirements for positions on the fireline. NWCG positions are geared towards deployment of wildland firefighting crews for multiple days in a variety of conditions and as such require arduous fitness standards for most of the low level positions including FFT2, FFT1, and Crew Boss. For most prescribed fire situations a moderate level of fitness should be sufficient. The moderate fitness "Field Test" involves a 2-mile hike with 25 pounds in 30 minutes or less. If individual unit conditions are either extremely remote or exceptionally steep, an arduous level of fitness could be required. The arduous "Pack Test" involves a 3-mile hike with a 45 pound pack in 45 minutes or less. Both of these tests are on flat terrain. Fitness requirements must be tested and met annually. Individuals participating in a prescribed fire as a practicum to become a NH Basic Prescribed Firefighter or NWCG Firefighter Type 2 are exempt from the "Pack Test" requirement.

Recommended Prescribed Fire Crew Levels

The NH Prescribed Fire Council recommends crew levels and positions for low and moderate complexity burns in Table 9. Refer to Chapter 5 and Appendix B for instructions on how to determine the complexity of your prescribed burn.

Table 9. Recommended crew levels and qualifications for low and moderate complexity burns. NWCG positions are provided for comparison to NH Prescribed Fire Council positions.

LOW COMPLEXITY

National Wildfire Coordinating Group		NH Prescribed Fire Council	
Position	**# People**	**Position**	**# People**
Prescribed Fire Burn Boss 3 (RXB3)	1	NH Prescribed Fire Burn Boss 3 (NHRXB3)	1
Fire Fighter Type 2	1	NH Basic Prescribed Fire Fighter (ignition)	1
Engine Boss, Single Resource or Firefighter Type 1, Squad Boss	1	NH Advanced Prescribed Fire Fighter	1
Fire Fighter Type 2	3	NH Basic Prescribed Fire Fighter (holding)	3

MODERATE COMPLEXITY

National Wildfire Coordinating Group		NH Prescribed Fire Council	
Position	**# People**	**Position**	**# People**
Prescribed Fire Burn Boss 2 (RXB2)	1	NH Prescribed Fire Burn Boss 3 (NHRXB3)	1
Fire Fighter Type 2 (Ignition)	2	NH Basic Prescribed Fire Fighter (Ignition)	2
Fire Fighter Type 1 (Squad Boss)	1	NH Advanced Prescribed Fire Fighter (Holding)	1
Fire Fighter Type 2 (Holding)	3	NH Basic Prescribed Fire Fighter (Holding)	3
Engine Boss, Single Resource	1	NH Advanced Prescribed Fire Fighter (Engine)	1
Fire Fighter Type 2 (Engine)	1	NH Basic Prescribed Fire Fighter (Engine)	1
Fire Effects Monitor	1	Fire Effects Monitor	1

These recommendations should be evaluated and adjusted based on available resources and equipment and on-site burn unit conditions. Crew levels and qualification for high complexity burns should be evaluated on a case-by-case basis.

Documentation of Qualifications

All prescribed fire personnel must maintain written documentation of their training, experience, and performance qualifications. This includes copies of their training certificates, a log of their fire experience, and completed task books. The NH Burn Boss or NWCG-qualified Burn Boss is responsible for insuring that personnel participating in each prescribed burn meet the recommended qualifications for the position assigned.

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Chapter 7. Equipment Needs

The NH Prescribed Fire Council has suggested guidelines for equipment on low complexity burns (see Table 10). Review of these guidelines and evaluation of specific burn unit conditions may dictate different equipment requirements. Equipment requirements for moderate and high complexity burns should be individually evaluated and increased depending on specific needs.

Table 10. Equipment recommendations for low complexity burns in New Hampshire. Refer to Chapter 5 for information on how to analyze the complexity of your burn.

Equipment	Type	Justification	Minimum Number	Amount
Engine	Type 6	Back up for holding crew or for use as primary holding tool.	1	
Water Source	Hydrant, Pond, Stream	Availability of a water source will reduce the need for storage.		
Water Storage	Fold-a-Tank, Rigid Tank, etc.	Enough capacity to refill engine immediately and for routine holding.	1	300 gallons
Pumps	Mark III Pump or Other	Pump for reloading storage tanks, engine, backpack pumps, and to supply hose lay.	1	
Hose	¾", 1", 1.5", etc.	Enough to reach interior of unit and water source.	1,000 ft	
Ignition Source	Drip Torch		2	
Drip Torch Fuel			20 gallons	
Hand Held Tools	Multiple	One for each crew member.	6	
Hand Held Radios	High Band	One for each crew and for the burn boss.	2	
Backpack Pumps		Four – one for each member of the holding crew and one for the igniter.	4	
Weather Kit		Monitor fire weather.	1	
Prescribed Fire Signs	Roadside or other	One for each approach to burn unit.	4	
Lighter/Matches		Ignite drip torch.	1	
Flagging	Rolls	Mark hazardous and other points of interest.	2	

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Chapter 8. Crew Safety

Minimum Recommended Standards

- Minimum standards for ensuring crew safety:
  - Provide a crew briefing on the day of the burn.
  - Meet the crew qualifications identified in Chapter 6.
  - Ensure the use of personnel protective equipment.
- All prescribed fire personnel actively involved on a burn must wear Nomex clothing, hard hat, leather gloves, fire/heat resistant boots, and eye protection.

Crew Briefing on Day of Burn

The daily crew briefing is a standard practice on prescribed burns and wildfire suppression incidents. The briefing explains to the burn crew what is planned, what might happen, and what their roles will be. A thorough briefing to all personnel involved with the burn is extremely important. A key point that often comes up during investigations of prescribed fire and wildfire accidents is that the briefing was insufficient, or not attended by everyone, or not understood by everyone.

Figure 10. Prescribed burn crew briefing, Massabesic Experimental Forest, Maine. Photo courtesy of White Mountain National Forest.

An excellent Briefing Checklist that can be used for both prescribed and wildland fires is found below or on the inside back cover of the Incident Response Pocket Guide, a publication of the National Wildfire Coordinating Group.

Briefing Checklist

Situation

- Fire name, location, map orientation, other incidents in the area
- Terrain influences
- Fuel type and conditions
- Fire weather (previous, current, and expected), time of day, alignment of slope, aspect and wind, etc.

Mission/Execution

- Command

Incident Commander/immediate supervisor/burn crew designations

- Leader's intent

Overall objectives/strategy

- Specific tactical assignments
- Contingency plans/wildfire conversion plan

Communications

- Communications plan- tactical, command, air to ground frequencies, cell phone numbers
- Medevac plan

Service/Support

- Other resources working adjacent and those available to order/Aviation resources available
- Logistics: transportation, supplies, and equipment

Risk management

- "Go/No Go" checklist
- Identify known hazards and risks
- Identify escape routes, safety zones, and lookouts
- Identify control measures to mitigate hazards/reduce risks
- Identify trigger points for reevaluating operations

Questions or Concerns?

It is important at the end of the briefing to get feedback from the crew, a final question like "what do you see that concerns you?" or "what haven't I covered?" can help people to respond and contribute.

The Incident Response Pocket Guide also provides a number of other tools to ensure safety of a wildland fire crew that can also be helpful in a prescribed fire such as a process for assessing and reducing risk. The guide also provides guidance on Lookout(s), Communications, Escape Routes, and Safety Zones (LCES). Use of LCES will minimize the potential for fire fighter entrapment. The IRPG also include the 10 Standard Fire Orders and 18 Watch Out Situations on the back cover. The IRPG is an excellent resource to help ensure that prescribed fire operations are conducted with minimal risk to the safety of the crew.

Personnel Protective Equipment

Crew members should come to a prescribed burn with all specific PPE identified in the burn plan. All prescribed fire personnel actively involved on a burn must wear Nomex clothing, hard hat, leather gloves, fire/heat resistant boots, and eye protection. Personnel should be trained in the uses, advantages, and drawbacks of their personal safety equipment. A first aid kit must be available on all burns.

A number of different boot types may meet the fire/heat resistant boot requirement, including those with leather or leather/kevlar uppers and soles made of some heat-resistant material such as Vibram. In some instances, such as when burning wetlands, fire-resistant rubber boots are permissible. This should be noted in the prescribed burn plan.

Fire shelters should be available to and worn by all crew members unless the prescribed burn plan states otherwise and justifies that they are not necessary. Everyone carrying a shelter must be trained in its use. Even on burns where their use is waived, a shelter should be available to any crew member who desires one.

If a burn is expected to begin or continue after dusk, it must be so stated and approved in the prescribed burn plan. No burn operations should continue after dark unless each crew member has a headlamp or other light source.

Further detailed recommendations for crew member PPE have been adapted from the U.S. Forest Service Health and Safety Code Handbook, FSH 6709.11. Effective 12/01/1999 Section 25-12, Page 20-81.

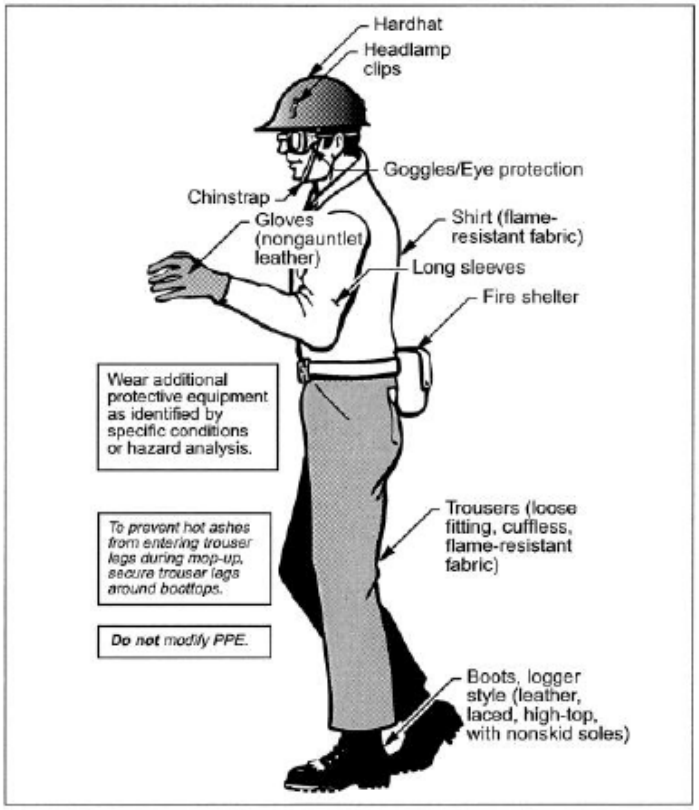

Figure 11. Properly attired prescribed fire fighter. Graphic taken from U.S. Forest Service Health and Safety Code Handbook, FSH 6709.11.

1) **Fire Shelter.** All persons required to carry fire shelters shall be trained in their use prior to assignment and shall receive annual refresher training.

   - Always inspect a fire shelter when it is issued to you. Follow the inspection guidelines in the latest issue of "Your Fire Shelter" to determine shelter serviceability (sec. 25.06).
   - Inspect shelters at the beginning and end of each fire season.
   - During fire season inspect your personal shelter every 14 days when carrying it on your person, in a vehicle, or on heavy equipment.

- Carry the fire shelter in its original case or in an external pocket of a pack. Ensure that removal can be accomplished with one hand while wearing gloves and while walking at a brisk pace.

2) **Hardhat.** All personnel shall wear approved hardhat**s** on the fireline. They must be:
   - Constructed of material with a melting point greater than 350°F (177°C).
   - Equipped with a chinstrap.

3) **Eye Protection.** Wear approved eye protection on the fireline.

4) **Hearing Protection.** Use hearing protection whenever sound levels exceed 85 dB.

5) **First Aid Kit.**

6) **Clothing.** Wear loose-fitting long-sleeved shirts of U.S. Forest Service-approved flame-resistant (FR) fabric on the fireline. Keep sleeves rolled down. Wear loose-fitting, cuffless pants. Shirt and pant designs shall be U.S. Forest Service-approved fabrics. Avoid undergarments and socks made of 100% (or high percentage) polyester, nylon, or acrylic. It is recommended that employees wear a short sleeved t-shirt, underwear, and socks under fire clothing and boots. T-shirts and underwear should be 100% cotton or 100% blend of flame resistant fibers. Socks should be cotton, wool, or a blend of flame-resistant fibers.

7) **Gloves.** Wear non-gauntlet heavy-duty leather gloves that are U.S. Forest Service-approved on the fireline.

8) **Boots.** Wear heavy-duty, leather, laced boots with nonskid soles and tops at least 8 inches (204 mm) high. Steel-toe (metal cup) footwear is not recommended for fire suppression.

9) **Specialized PPE.** Wear additional PPE as identified by local conditions, or the burn plan. PPE for Mixing Fire Retardant Chemicals. Take necessary precautions to avoid direct contact with or inhalation of fire retardant chemicals. Ensure that MSDSs are available and have been discussed with all employees involved in the handling and mixing process. Install engineering controls that minimize and control dust at the mixing station. The recommended or required PPE is prescribed in the retardant chemical product MSDS.

Finally, having adequately trained and qualified personnel on your burn will ensure their safety, as well as the safety and property of your neighbors. Chapter 6 further describes training and qualification recommendations.

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Chapter 9. Ignition, Containment, & Mop Up Techniques

Recommended Standards

- The burn plan will include a description of the following:
    - Predominant ignition techniques you plan to use during a prescribed burn.
    - The methods you will use to prevent a prescribed fire from spreading outside the burn unit.
    - Trigger points, additional forces or actions needed, and maximum allowable response time needed in case a prescribed fire does spread outside of the burn unit.
    - How a prescribed fire will be mopped up once completed.

Ignition Techniques

Prescribed fires can be lit using a variety of devices, from matches to aircraft. The most common tool is the handheld drip torch. In all cases however, the techniques are the same and based on fire's response to fuels, weather, and topography. Fires move faster with the wind and upslope (head fires), slower against the wind and downslope (backing fires), and at intermediate rates of spread at right angles to the wind/slope (flanking fires). Head, backing, and flanking fires each have different characteristics and different effects on the landscape. Ignition techniques are used to reproduce head, backing, or flanking fires depending on the goals and objectives for the burn unit. Five basic techniques are used to ignite prescribed fires: strip heads, backing, flanking, point source or spot, and ring firing.

Strip heads

A head fire pushed by the wind will quickly gain energy and speed and could climb into tree crowns, throw embers that start spot fires, and produce large amounts of smoke. A prescribed fire lit upwind and allowed to travel across a burn unit unchecked could present serious control problems when it reaches the other side. For that reason, it is unusual to light a fire upwind and let it run to the other side unless managers are confident that barriers exist to stop the fire. Strip head firing creates a series of controllable head fires, by first setting a backing fire along the downwind control line then setting progressive lines of fire on the upwind side of the now secured control line. Strip head line distances can be determined depending on desired fire effects and flame lengths. Advantages to strip head fires are faster ignition times, relative humidity and fuel moisture can be higher, and cost effectiveness. Disadvantages are incomplete combustion of fuel creating more smoke and may not achieve burn objectives.

Figure 12. A final strip head fire set off an anchor point (road) in the White Mountain National Forest. The wind will carry the fire into the woods until it meets the next strip. Photo courtesy of White Mountain National Forest.

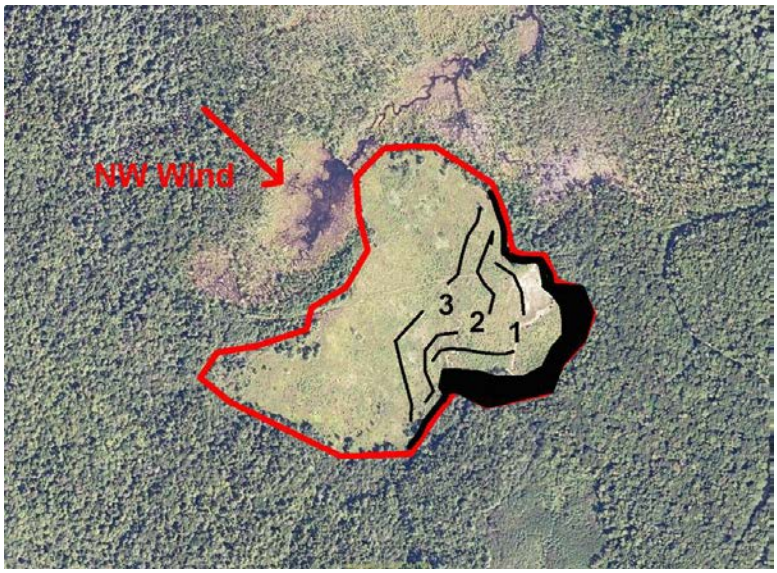

Figure 13. An example of a strip head pattern in a grassland at the White Mountain National Forest. Winds are from the NW. Once the downwind section has been secured with a backing fire (black section in photo) ignitors can begin lighting strips in succession - 1, 2, 3, etc. The strips are spaced 1-3 chains apart. It is crucial that the blackline along the unit's edge stay ahead of the strips, in case of a sudden wind shift. Graphic by John Neely, U.S. Forest Service.

Backing Fires

Backing fires are started along a downwind anchor point and allowed to back into the wind. These fires are the easiest to control and produce the lowest flame lengths and rates of spread, as

well as lower amounts of smoke due to more complete combustion. Backing fires move slowly through a stand, rarely scorching tree crowns. Backing fires do a good job of consuming ground fuels and girdling understory species. Disadvantages include slower fire speed, and while they produce less smoke due to more complete combustion, the smoke remains in the area for longer periods.

Figure 14. Backing fire in an oak-pine stand in the White Mountain National Forest. The winds push flames back towards already burned material. Photo courtesy of White Mountain National Forest.

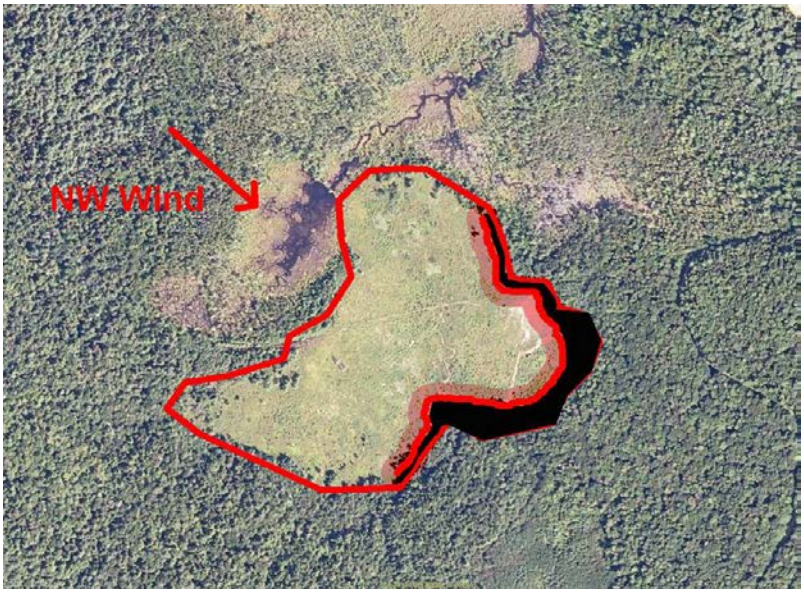

Figure 15. A true backing fire would be allowed to move slowly against the wind through the burn unit. This is an effective but time consuming method of reducing surface fuels. Graphic by John Neely, U.S. Forest Service.

Flanking Fires

Flanking fires are set into the wind along anchor points. The wind then pulls the fire into the unit's interior. These fires are often used to secure control lines in conjunction with strip head firing. Flanking fires can also be effective if access into the interior of a unit is too rough and

compromises the safety of igniters. Steady winds are needed to keep flanking fires from turning into head fires and running across a unit.

Figure 16. Setting a flanking fire off a control line to burn out fuels ahead of strip-head firing operation at the White Mountain National Forest Photo courtesy of White Mountain National Forest.

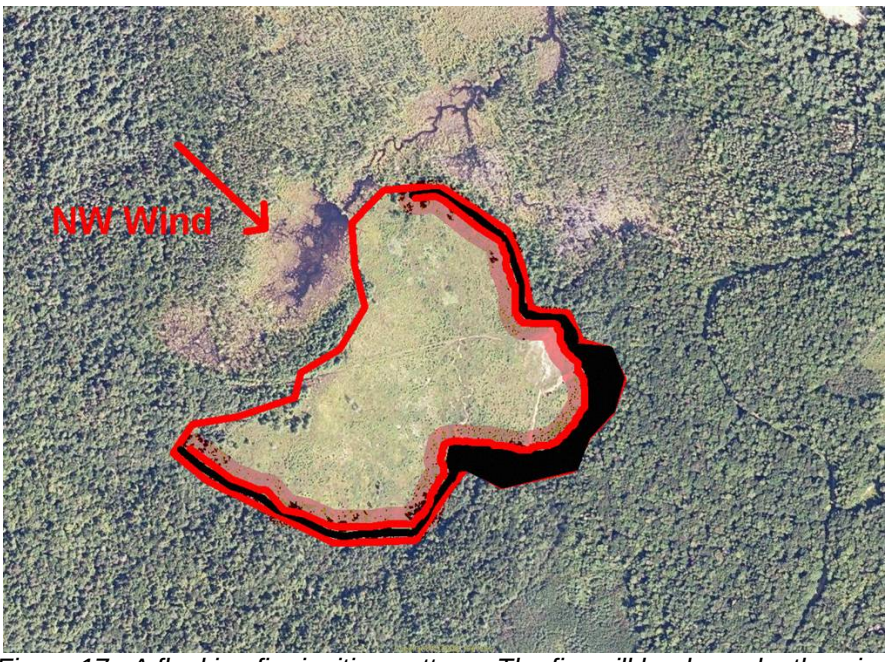

Figure 17. A flanking fire ignition pattern. The fire will be drawn by the wind into the interior of the unit. Graphic by John Neely, U.S. Forest Service.

Point Source Fires

Point source fires, also known as spot or dot firing is an ignition technique that is used to control fire intensity. Instead of a continuous line of fire, a series of dot fires are placed at intervals.

The dots then burn together. This method is used to reduce flame lengths and intensities when head firing, and to increase flame lengths and intensities in back fires.

Figure 18. Point source fires burning together in a pine plantation in the White Mountain National Forest. This method was used here to reduce the chance of crown fires in a tightly packed stand. Photo courtesy of White Mountain National Forest

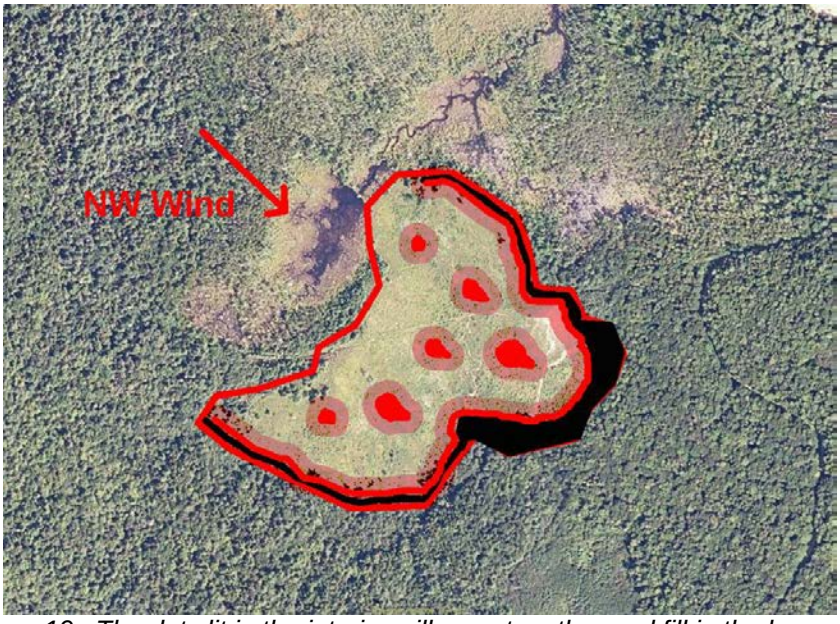

Figure 19. The dots lit in the interior will grow together and fill in the burn unit. This method will reduce fireline intensities compared to a head fire. It is also a time saver if continuous fuels can carry the fire. Graphic by John Neely, U.S. Forest Service.

Ring Firing

This method is used to burn logging slash and to eliminate unwanted vegetation, especially coniferous species. A line of fire is placed around the burn unit perimeter and the flame fronts converge. A point source fire is usually lit in the interior of the unit and allowed to develop before the ring fire is completed. The point fire helps develop a convection column that will

draw the ring fire into the interior and increase intensities. Ring firing should not be used in areas where crowning and torching can cause problems. This type of fire can develop strong convection columns that cause downwind spotting.

Figure 20. Ring firing technique used to remove undesired vegetation in the White Mountain National Forest. When the flaming fronts converge, energy is concentrated upwards into a tree's crown. Photos courtesy of White Mountain National Forest.

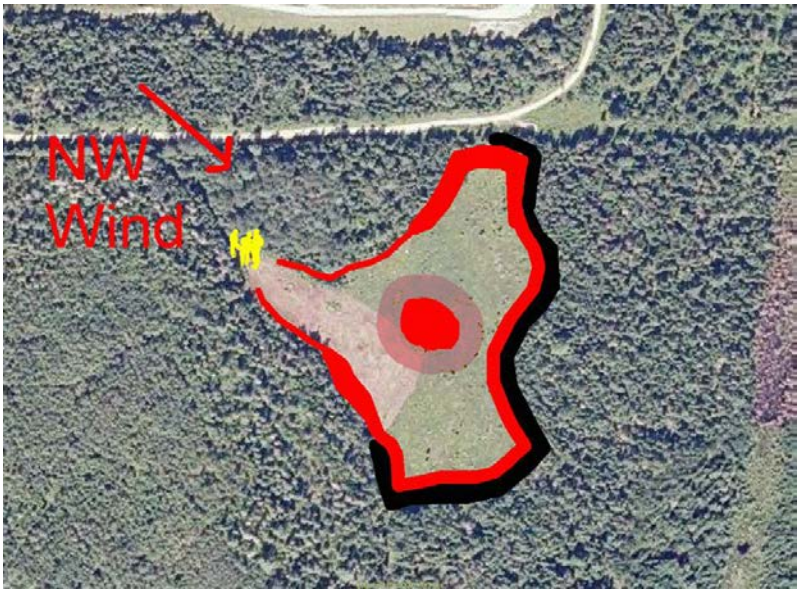

Figure 21. The unit perimeter has been lit and a point source fire will help create indrafts to draw the ring fire to the unit's center. Light or no wind works best with this method. Graphic by John Neely, U.S. Forest Service.

Containment Techniques

Containment techniques refer to the methods used to prevent prescribed fires from escaping their boundaries and burning in undesirable areas. Prescribed fires usually escape control lines in three ways: 1) an ember is thrown across the line by convective currents or winds and starts a

spot fire; 2) a fire front is driven across the control line by radiant heat and winds causing a slop over; and 3) a creeping or smoldering fire burns across or under a control line. As opposed to a wildfire, prescribed burns are ignited under your control and choosing, so containment methods should be in place before you light the fire. Direct containment methods seek to break the fire triangle by depriving it of heat, fuel, or oxygen. A road, hand line, or natural barrier (e.g., stream) can be used as a containment line. Prior knowledge of expected flame lengths, rates of spread, and potential for spot fires will help determine the width needed for the containment line. In general, the width of your containment line should be 1.5 times the expected flame lengths in your fuels. This rule of thumb does not take into account spot fire potential. A pump and hose lay around the perimeter of the burn unit is an effective method of containment. Engines and ATVs are used frequently on prescribed burns. Burning out fuels near the control line, commonly using a backing combined with a flanking fire, is also a key method to securing the line.

Contingencies and Wildfire Conversion

A contingency plan is a pre-planned response to an unplanned event. Addressing worst case scenarios during the formulation of your burn plan will create a safer plan. Questions to answer in a contingency plan include:

- What will our actions be if "this" happens?
- What resources will be needed to solve the problem?
- Will the resources be available on the day of the burn?

For example, escaping fires are a constant concern during a prescribed burn. A contingency plan should identify members of the burn crew who are responsible for suppressing spot fires, as well as the outside assistance that would be called in if spot fires escape initial suppression attempts. A map depicting roads, water bodies, and other features and explains methods for control using these features is also helpful.

Contingency Trigger Points

Clearly defined trigger points that spell out when a contingency plan will be activated should be in a burn plan. Examples of trigger points include:

- Multiple spot fires that cannot be contained by the burn crew.
- A large slop-over that cannot be contained by the burn crew.

Wildfire Trigger Points

If an escape occurs and the contingency plan is not successful, the prescribed fire may need to be designated a wildfire. Again, a series of trigger points should be established to determine when this point is reached. Some common trigger points include:

- The fire has escaped initial attack and is burning outside the parameters established in the burn plan.
- The potential exists to negatively impact resources like houses, air, water, etc.
- The contingency resources are unavailable to assist when needed.

The prescribed fire is usually declared a wildfire by the burn boss, and it is their responsibility to contact state or federal authorities to begin the extended suppression attack needed to control the fire.

Until relieved of command, the burn boss should continue to manage the fire to the best of their ability, and document the events leading up to the escape, as well as actions taken during initial suppression attempts. A prescribed fire that becomes a wildfire is now a legal issue, and the burn boss and crew may find themselves liable for damages if found at fault for the incident. This is another reason why a contingency plan is a very important element of the burn plan.

Mop Up

Mop up is the final stage of the prescribed burn operation and refers to activities used to suppress any remaining fire after burn objectives have been met. A burn plan should include some guidance on mop up standards. The greatest concern immediately after the fire is securing the edge of the unit. Hand tools, pumps and hose, and engines are used to suppress fire along the perimeter of the burn unit, usually 10 to 50 feet inside the unit. Fuel type affects mop up standards. Light fuels, such as grass and blueberry usually burn thoroughly enough that mop up is completed the same day as the burn. Mop up of heavier fuels such as logging slash and timber litter can take days.

Figure 23. Mopping up a backing fire along a mowed fire break with a back pack pump (photo by David Cappaert, Michigan State University, Bugwood.org).

Important factors to consider when planning mop up:

- Is the weather getting hotter and drier?
- Will winds pick up?
- Is rain expected?
- Are there homes or businesses nearby that may be affected by smoke?
- How many people are available to monitor the fire?
- Are there hazards like snags and stump holes that the mop up crew needs to know about?

Mop up and patrol of a prescribed burn is considered complete after the crew has not seen smoke in at least two days.

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Chapter 10. Smoke Management & Air Quality

Recommended Standard

- The burn plan will screen for all smoke sensitive features within one and five miles of the planned burn, and identify measures for minimizing negative impacts of smoke to these features.

Managing smoke is one of the most challenging aspects of prescribed burning, and there are two important considerations. The first is minimizing the negative impacts of smoke to nearby neighborhoods, community centers, hospitals, schools, elderly housing complexes, roads, and other smoke sensitive features. A second and equally important consideration is minimizing negative impacts of smoke to personnel implementing a burn.

Smoke from a prescribed burn can pose numerous risks to human health and safety, and it is critical for those conducting burns to be aware of these risks. Some of the risks include:

- **Loss of visibility on nearby roads.** Although managers may take all the necessary precautions and steps to direct smoke away from roads, smoke will often go in unanticipated directions during a burn. If burning close to roads, it should be expected that smoke may drift into the road for at least short durations. Even if the smoke only briefly obscures visibility on a road, the result can be a vehicular accident, especially on busy roads with fast moving traffic. It is critical to anticipate this, and have a plan for managing traffic in the event visibility on a road is significantly obscured by smoke from a prescribed fire. If burning alongside major roads, coordination with the local or state police may be required.

- **Negative impacts to air quality and health.** Smoke created during a prescribed burn is made up of a complex mixture of gases, water vapor, fine particles, and trace amounts of hazardous air pollutants produced when wood and other organic material are combusted. The major pollutant of concern during a prescribed burn is fine particulate matter smaller than 2.5 micrometers in diameter (also known as PM 2.5). These microscopic particles can get into your eyes, lungs, and even your blood stream when you are exposed. Symptoms from short-term exposures (hours or days) to PM 2.5 can range from scratchy throat, cough, irritated sinuses, headaches, runny nose, and stinging eyes. Far more serious reactions can occur to those with asthma, emphysema, heart disease, and other existing medical conditions. Personnel in close proximity to smoke from prescribed burns are at the highest risk for exposure to carbon monoxide and toxins such as acrolein, formaldehyde, and acetaldehyde. Children and older adults are also at a greater risk of serious health impacts. Therefore it is important to try to minimize the amount of smoke produced during a prescribed burn and avoid exposing people in the immediate area as much as possible.

To minimize negative impacts from prescribed fire smoke, the following should be considered when planning and implementing prescribed burns:

- **What winds will be needed to direct smoke away from smoke sensitive features?** The most fundamental element of smoke management is choosing the correct winds for a given burn. It is important to consider both surface winds and transport winds. While

surface winds will largely dictate the smoke behavior near the ground, the transport winds will determine the long-range direction of smoke dispersal. Generally, it is important to have both surface winds and transport winds that direct smoke away from smoke sensitive features.

- **What fuels will be available during the burn?** Prescribed burns can produce smoke for long periods of time depending on fuel type and loads. For example, if the duff layers are available to burn, smoke can be emitted from a burn unit for several days, or until a soaking rain arrives. The Keetch Byram Drought Index (KBDI) provides a means to gauge the extent to which duff layers may be ignited during a burn. Generally, when the KBDI is above 300, duff layers may be ignited and burn until soaked by significant precipitation. While the vast majority of the smoke will be emitted during the initial flaming phase of the burn, continued monitoring of smoldering duff is needed, especially if burning in close proximity to smoke sensitive features.

- **What may happen with smoke dispersal after sunset?** Depending on the time of year, if smoke continues to be emitted from a burn unit after dark, it is important to anticipate where it will travel. If burning in the spring or fall when temperatures after dark may drop below 50 degrees, smoke may be pushed to the surface by cold air and go in unanticipated directions. In this case, night time winds will have limited ability in directing the smoke towards desired areas. Instead, the smoke will follow cold air drainages (low spots on the landscape), like stream beds, and open areas.

Screening for smoke sensitive features can be accomplished in a number of ways. For detailed planning of larger and more complex burns, smoke sensitive features within 0.5, 1, and 5 miles should be mapped using GIS or similar mapping software. Generally, smoke sensitive features can be readily identified on air photography by an individual familiar with the area. Features not readily visible on air photography, such as point locations for schools or individuals with particular sensitivities to smoke, can be mapped by hand. Below is an example of a smoke screening map for a prescribed burn planned for the Ossipee Pine Barrens (Figure 24).

If mapping software is not available, smoke screening can also be done on a simple USGS topographic map. The smoke sensitive features can be hand drawn onto a paper copy of the map in their general location. This map can then help to inform the burn planning and determine the correct winds and other factors for burning.

For further information on the laws governing smoke from prescribed fire, please see Chapter 13 (Permitting and Other State Environmental Regulations).

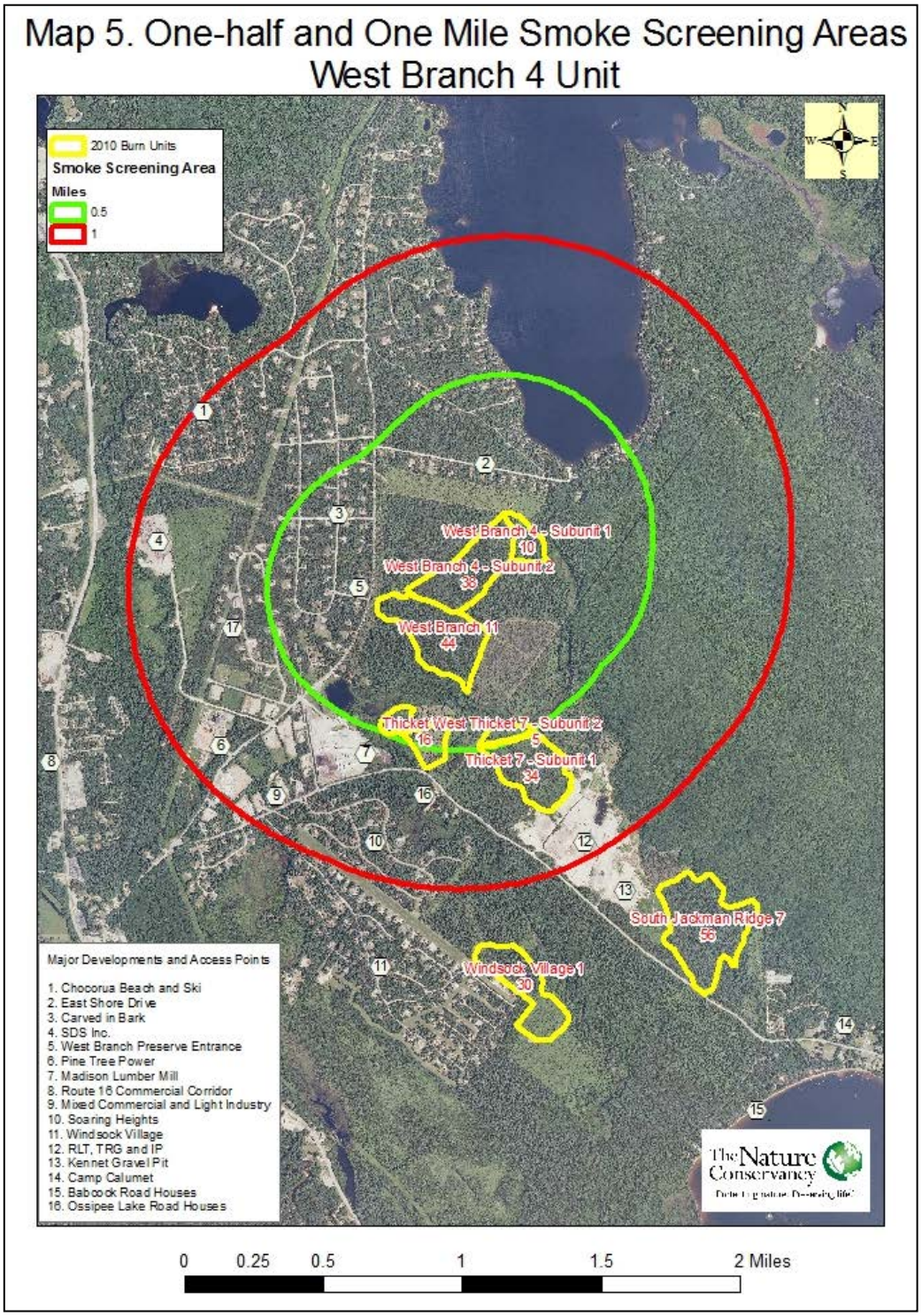

Figure 24. Smoke screening map for burn units at the Ossipee Pine Barrens.

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Chapter 11. Public Notification

Minimum Recommended Standard

- Prior to conducting a prescribed burn the Prescribed Burn Planner, Burn Boss, or other designated person will notify the following that prescribed burn activities are being conducted:
    - Abutters to the burn unit and other nearby property owners as conditions warrant (e.g., densely populated areas).
    - Smoke sensitive receptors within 1 mile of the property.
    - County or regional emergency service dispatch center on the day of the burn to notify local and state police and fire departments.
    - NH Division of Forests & Lands dispatch center on the day of the burn to notify forest rangers and fire towers.

Ensuring public safety is imperative and primarily a communication issue. Making people aware that a prescribed fire is going to occur will prevent inadvertent encounters that could jeopardize the public and your prescribed burn program. Announcements, public notices, targeted mailings, and public information meetings will not only help disseminate information about your prescribed burn activities, but will also provide a feedback loop to address concerns about your operations. Posting signs and personnel at key entrance points and nearby roads is also a good way of informing the public about your prescribed burn. Your ability to inform and educate the public also can be enhanced by talking with public safety officials such as local fire departments, police, and other government entities. Information provided to the public should include why you are burning, and when and where the burn is going to take place. The more information provided, the less likely unforeseen incidences will happen.

Burn Window Notification

The use of a burn window notification provides the public with background information about the prescribed burn. The notification should describe the general area of the planned burn, reasons for burning, timing of the burn, contact information for the burn planner in case an abutter wants to be notified the day of the burn or has other questions, and how to get more information (examples in Appendix C). The burn window notification should be provided to the broader community via mailings, newspaper, radio or television, or e-mail.

Day of Burn Notification

Day of burn notifications are much more focused on people who need to know. Names, affiliations, and contact information for these people should be included in your burn plan. Day of notifications ensure that people do not over react to the sight of smoke. It is important to reach out to abutters on the day of the burn as they are the most likely to see or smell smoke and call emergency services. Notification to the regional dispatch center and local fire and police departments will ensure that calls that do come in can be identified and dealt with appropriately. Smoke sensitive receptors (see Chapter 10) should also be notified because of their importance and to ensure that they have the ability to communicate directly with someone involved with the burn in the event if needed.

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Chapter 12. Monitoring Weather, Fire, & Smoke

Recommended Standard

- Weather, fire, and smoke will be regularly monitored by qualified personnel during the course of a prescribed fire to ensure the prescription is being followed.

Weather factors should be monitored before, during, and after implementing a burn to ensure the fire is burning within the planned prescription. Local and regional weather patterns and trends can be easily followed via the National Weather Service (NWS). The NWS website offers many helpful tools, including forecasting fire weather.

Figure 25. Basic fire weather kit: wind speed meter (two types; left center and top left), sling psychrometer to measure wet and dry bulb temperature (center), psychrometric slide rule to calculate relative humidity (bottom), and compass for wind direction (right). Photo by Dale Wade, Rx Fire Doctor, Bugwood.org.

Collecting on-site weather data can be a tremendous asset to managers, and help calibrate how on-site weather compares to NWS forecasts. There are a variety of instruments that can be used to collect on-site weather data, including:

- Kestrel pocket weather meter. There are a variety of relatively inexpensive digital weather meters made by Kestrel that can take quick and accurate measures of wind, temperature, relative humidity, and other weather factors. Measurements of relative humidity are often compared with those derived from using a sling psychrometer to ensure precision given the importance of this weather variable on fire behavior.
- Sling psychrometer. This is the standard instrument used to measure the wet and dry bulb temperatures needed to calculate relative humidity.
- Wind gauge. A number of inexpensive gauges are available to measure wind speeds provided a Kestrel is not available. In addition, a compass and piece of flagging tape on a writing utensil can be used to determine the wind direction.
- Fuel moisture sticks. While 1 hour fuels can often be readily assessed by feeling fuels with your hand, 10 hour fuel moistures are more difficult to assess in this manner. Ten (10) hour fuel sticks can be used for this purpose, and consist of a set of kiln dried sticks that have a dry weight of 100 grams. The fuel sticks can be placed in the burn unit and then weighed with a Pesola Medio-Line Spring Scale or similar instrument. The weight of sticks is then divided into 100 to determine percent moisture of the 10 hour fuel sticks.
- Rain gauges. While the NWS compiles data from rain gauges across the region, the patchy nature of some rain events can make it difficult to have an accurate sense of the rain received at a given site. On-site rain gauges are an inexpensive way to track moisture received at the site.
- Duff moisture reader. These are expensive instruments for precise measurements of moisture contained in duff layers.

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Chapter 13. Permitting & Other State Environmental Regulations

There are several laws and regulations that should be considered prior to conducting a prescribed burn. This is an integral part of the planning and implementation process. These laws and regulations relate to public safety, air quality, and smoke impacts.

Public Safety

Fire Permits are required to burn ordinary combustibles, including vegetation consumed during prescribed burns.

There are four categories of fire permits: category I, category II, category III, and category IV. Each sequential category is generally associated with larger fires and/or risk (see Figure 26 and 27).

Most prescribed burns would fall under a category IV burn permit since burning would be conducted during the daytime (between 9:00 AM and 5:00 PM; Table 11). Category IV burn permits are signed by a NH Division of Forests and Lands Forest Ranger in addition to the local forest fire warden (or authorized issuing agent). Category IV permits would also be required if burning for multiple days. Category III burn permits would be needed if burning during the evening and are signed by the local forest fire warden (or authorized issuing agent).

Table 11. Burn Permit Requirements Based on Time of Day.

Prescribed Burn Time Period	Permit Needed
9 am – 5 pm (Daytime)	Category IV
5 pm – 9 am (Evening)	Category III
Multiple Days	Category IV

For more information contact your local fire department or a Division of Forest and Lands Forest Ranger:

Division of Forests and Lands
172 Pembroke Road
Concord, NH 03301
Phone: 603-271-2214

Protection of Historic Resources

All federally funded, licensed, or assisted projects in New Hampshire are subject to the review requirements of Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470) and implemented by the procedures of the federal Advisory Council on Historic Preservation (ACHP), Protection of Historic Properties (36 CFR Part 800).
Federal agencies or their legal designees are required to take into account the possible impacts of their projects on historical resources, and to submit proposed projects to the Director/State Historic Preservation Officer (SHPO) of the Division of Historical Resources (NHDHR), for a

determination of potential effects on properties that are listed, or are eligible for listing, in the National Register of Historic Places.

Similarly, all state agencies are required to cooperate with the NH Division of Historic Resources in the conservation of historic resources regardless of whether the project area is listed or eligible for listing in the National Register of Historic Places (RSA 227-C:9). Proposed prescribed fires on state lands should be reviewed by NHDHR to determine the effect of such undertakings on historic resources. Archaeological surveys may be required, subject to personnel and budgetary limitations, to further assess impacts on historic resources.
If historic resources are known to occur in the burn unit, mitigating measures will likely be requested. These could include buffering the historic resource when installing a fire break, using low intensity backing fire in areas near historic features, or recording and collecting information that would be lost during a fire, among others.

Click here for more information on fire effects to historic resources or refer to Winthrop (2009) in the references section below.

Protection of Rare Species

The federal Endangered Species Act directs all federal agencies to participate in conserving federally listed species. Federal agencies, through consultation with the U.S. Fish & Wildlife Service, are to ensure that their activities are not likely to jeopardize the continued existence of listed species (either plant or wildlife) or adversely modify designated critical habitats.

Likewise, per RSA 212-A:9 and RSA 217-A:7, state agencies are to assist and cooperate with the NH Fish & Game Department (NHFG) and the Natural Heritage Bureau (NHB) in the conservation of state endangered or threatened wildlife and plant species, respectively. As with historic resources, proposed prescribed fires on state lands should be reviewed by NHFG and NHB to determine the effect of the fire on state-listed species and exemplary natural communities. Oftentimes, a well planned fire will enhance habitat for a state listed species or rare natural community (see Chapter 2). In other cases, some natural community habitats may be temporarily impacted (e.g., mesic forest or floodplain habitats), or a species and its habitat may be so rare, that mitigating measures may be required (e.g., raking around wild blue lupine plants that are the only food source for federally endangered Karner blue butterflies).

Wetlands

Wetlands protect water quality, help control floods, recharge groundwater, provide important wildlife and plant habitat, and provide recreational and scenic opportunities, among other important values. The NH Department of Environmental Services (NHDES) regulates activities in wetlands pursuant to RSA 482-A. Municipalities may further identify wetlands of significant value worthy of extra protection because of their uniqueness, fragility, or unspoiled character. These wetlands and the 100-foot buffer adjacent to the wetland are designated as “prime wetlands” and are afforded special protection under RSA 482-A. Click here for a list of towns that have designated prime wetlands. In addition, the impact to wetlands designated as being “exemplary” by the NH Natural Heritage Bureau should be considered prior to a prescribed burn.

Prescribed burns can impact wetland areas and water quality if not carefully planned and conducted. The installation of a bare mineral soil fire break within 100 feet of a designated

prime wetland or an area adjacent to a tidal area requires a wetlands permit from NHDES. No other wetlands permits are required for conducting a prescribed burn near wetlands.

For more information on wetlands permitting requirements contact:

NH Department of Environmental Services
Wetlands Bureau
29 Hazen Drive
Concord, NH 03301
(603) 271- 2147
Click here to visit the Wetlands Bureau website.

Additionally, the NH Prescribed Fire Council recommends following these guidelines when planning a prescribed burn near wetlands and waterways.

- Identify locations of wetlands within the burn unit to aid in burn planning.
- Avoid burning extensive portions of a wetland's buffer to minimize potential for erosion and sedimentation.
- Avoid intense burns that remove forest floor litter which may expose soil in wetland management zones and on slopes where eroded soil may drain to surface water.
- Avoid construction of fuel breaks for fire management that result in drainage directly into a water body.
- Provide adequate filter strips when constructing fuel breaks that expose bare soil near wetlands.
- Establish unburned zones containing no fuel breaks to protect water quality in situations where steep slopes, highly erodible soils, or the likelihood of substantial organic matter removal are present.
- Use natural or existing barriers (e.g., roads, streams, and lakes) where possible, or wet lines for firelines where bladed/plowed firelines will erode soil and degrade water quality.
- If using water from a natural water body to contain or mop up a fire, clean all components (intakes, pumps, and hoses) thoroughly before leaving the site or using in another water body, and never dump water from a tank into another water body to deter the spread of invasive exotic organisms (e.g., rock snot, milfoil, purple loosestrife, and Phragmites).
- When working with foam or retardants near lakes, streams, or wetlands:
    - Only use U.S. Forest Service approved Class A foam that is tested for environmental safety.
    - Follow manufacturer recommendations.
    - Prevent or minimize runoff of fire-retardant chemicals into water by keeping filter strip areas off-limits to retardant use.
    - Avoid cleaning fire-retardant application equipment in lakes or streams.

Air Quality

NH Department of Environmental Services (NHDES) Administrative Rule Env-A1000 specifically allows burning for frost prevention or agricultural, forestry, or wildlife habitat improvement without authorization from the Air Resources Division of NHDES. However, the

federal Clean Air Act does regulate the air quality impacts of prescribed burns. The Clean Air Act requires the Environmental Protection Agency (EPA) set National Ambient Air Quality Standards (NAAQS) (40CFR part 50) for pollutants considered harmful to public health and the environment. Those pollutants include fine particulate matter, ozone, and carbon monoxide. The State of New Hampshire monitors these pollutants to determine if concentrations of these pollutants are below the NAAQS.

There are "significant deterioration provisions" as part of the Federal Preventable Significant Deterioration Program (PSD) under the Clean Air Act that are intended to keep clean airsheds clean (referred to as Class I Airsheds). In New Hampshire, there are two Class I Airsheds, the Great Gulf Wilderness Area and the Presidential Range – Dry River Wilderness Area, both in the White Mountains. The EPA promulgated the Regional Haze Rule in 1999 to address visibility impairment in mandatory Federal Class I areas caused by manmade air pollution sources. Implementation of the PM and Ozone NAAQS in conjunction with the Regional Haze Rule is expected to improve visibility in these areas. If any prescribed fires take place that could affect Class I Airsheds, the New Hampshire Department Environmental Services Air Resources Division should be contacted early in the planning process:

NHDES Air Resources Division
29 Hazen Drive; PO Box 95
Concord, NH 03302-0095
(603) 271-1370

As part of its monitoring network, the NHDES Air Resources Division also maintains a website (airquality.nh.gov) that displays "real-time" air pollution monitoring data and air quality forecasts by county. This site may help prescribed fire planners to determine the optimal days to conduct burns in their area.

Although there are no longer any nuisance laws or regulations pertaining to burning, the town fire chief has ultimate authority on whether or not a burn can continue due to safety or health concerns.

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STATE OF NEW HAMPSHIRE
Department of Natural and Cultural Resources
Division of Forests and Lands
Forest Protection Bureau

Permit to
Kindle Fire

DNCR Form 5601A
Rev. 10/2018

PERMITTEE_____ ☐ Written Landowner Permission Received

LANDOWNER NAME & ADDRESS_____
(If Different than permittee)
LOCATION OF FIRE_____

INFORMATION ONLY

START DATE:____/____/____ END DATE:____/____/____

SEASONAL PERMITS – Expire Dec. 31st

PERMIT FOR: KINDLE TIME:	☐ Category I Any time	☐ Category II 5:00pm - 9:00am	☐ Category III (7 DAYS MAX) 5:00pm - 9:00am
SEASONAL PERMITS – Expire Dec. 31st	☐ Category I Any time	☐ Category II 5:00pm - 9:00am	

Category II and III Fires can be kindled between 9:00am and 5:00pm ONLY when there is sustained rain.

Refer to the synopsis on the back of this form for specific category requirements.

No trash, treated or manufactured wood, or material greater than 5 inches in diameter shall be burned at any time!

Burning under the authority of this permit will be valid only if it does not violate N.H. DES Air Resources Division regulations.
CAUTION - PERMIT SUMMARILY SUSPENDED: 1. If fire is kindled at unspecified date, time or place; 2. If weather is unfavorable or a proclamation closing woodlands is in force; 3. If help and equipment is inadequate to control fires; 4. If material not specified is burned. .

NO FIRES SHALL BE LEFT UNATTENDED AT ANY TIME WITHOUT BEING COMPLETELY EXTINGUISHED.
A BURIED FIRE IS NOT CONSIDERED EXTINGUISHED.

I, the undersigned permittee, am eighteen years of age or older, understand the law, regulations and my responsibilities under the terms of this permit **and have read the synopsis of the law and rules contained on the back of this permit.**

Director
Division of Forests and Lands
172 Pembroke Road
Concord, New Hampshire 03301
(603) 271-2214 www.nhdfl.org

Signature of Permittee:_____
Name:_____
Address:_____
Telephone:_____
e-mail:_____

Issuing Agent:_____
Town of:_____
Date Issued:____/____/____ Fire Dept. Tel.:_____

NO CATEGORY II OR III FIRE SHALL BE KINDLED BETWEEN THE HOURS OF 9:00 A.M. AND 5:00 P.M. UNLESS ACTUALLY RAINING.

White – Applicant Yellow – Issuing Agent

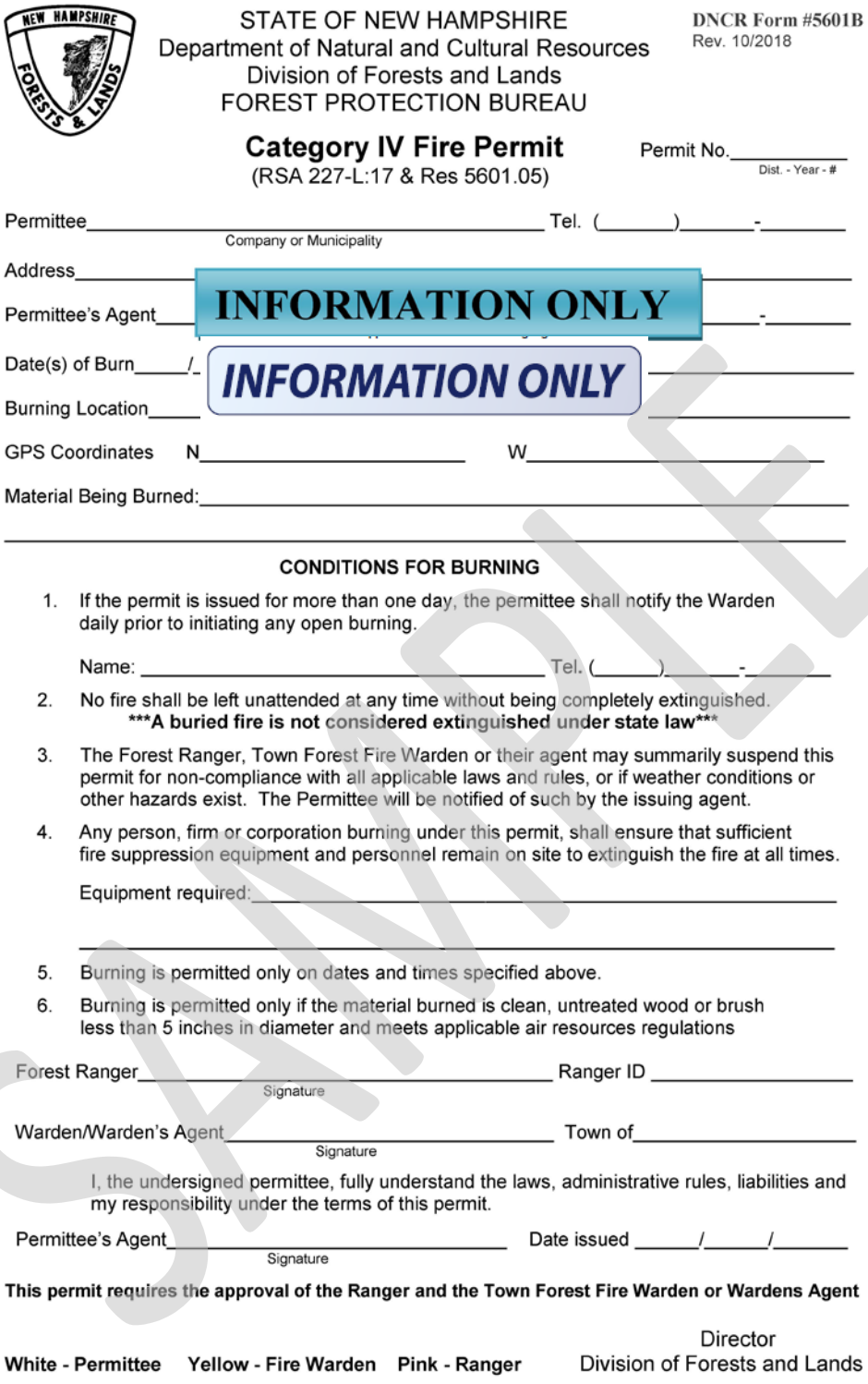
SYNOPSIS OF FIRE PERMIT LAWS AND ADMINISTRATIVE RULES
From RSA 227-L:17 and Res 5600

Liability - Any person, firm or corporation causing or kindling a fire without a permit, when a permit is required, and also any person by whose negligence or the negligence of his agents any fire shall be caused, is liable to the town for all expenses incurred in attending or extinguishing such fire. **If fire escapes from control you may be held liable for:** 1. Payment of damage to property of another; 2. Payment of suppression costs to the town; 3. Prosecution for failure to comply with regulations.
Penalty - Any person violating any provision of this section shall be guilty of a misdemeanor, and any person who causes or kindles a fire by any means, willfully or recklessly, which shall endanger a woodland shall be guilty of a misdemeanor if a natural person, or guilty of a felony if any other person.
Category I Fire - means a small controlled fire, such as a camp or cooking fire, **no greater than 2 feet in diameter** contained within a ring of fire resistive material or in a portable fireplace and, except for public & private campgrounds or picnic sites, **located at least 25 feet from structures.** A category I fire, conditions permitting, may be kindled with a permit at any time of day whether raining or not.
Category II Fire - means a controlled fire, such as a camp or cooking fire, **no greater than 4 feet in diameter** contained within a ring of fire resistive material or in a portable fireplace and **located at least 50 feet from structures.** A category II fire, conditions permitting, may only be kindled with a permit between the hours of 5:00 pm and 9:00 am unless it is actually raining.
Category III Fire - means any other fire, not a category I or category II fire or a fire greater than 4 feet in diameter or a fire not contained within a ring of resistive material and **located at least 50 feet from structures.** A category III fire, conditions permitting, may only be kindled with a permit between the hours of 5:00 pm and 9:00 am unless it is actually raining. May be issued for up to seven days.
Permittee - means a landowner or a person having written permission from the landowner. Permittee must be 18 years of age or older.
Permission - No person shall kindle a fire upon the land of another without written permission from the owner, agent or caretaker thereof.
Kindle - means from the point of ignition to the time of complete extinguishment.
Completely extinguished - means to extinguish so that it emits no smoke, heat or flames. The term does not include a buried fire.
Attended - means that an individual responsible for the fire and capable of extinguishing the fire is on the same property as the fire, is able to immediately extinguish the fire, and has the fire in plain view.
Raining - means sustained precipitation that is actively occurring of sufficient intensity and duration so as to prevent fire from spreading in woodland fuels.
Seasonal Permit - means a permit issued on an annual basis for a category I or II fire.
Specified Material – The Only material to be burned under this permit is clean, untreated wood or brush less than 5 inches in diameter, and meets applicable air resources regulations.

ONLY YOU CAN PREVENT WILDFIRES!

The NH Division of Forests & Lands is an equal opportunity educator and employer.

Figure 26. New Hampshire Category I-III burn permit provided for informational purposes only.



STATE OF NEW HAMPSHIRE
Department of Natural and Cultural Resources
Division of Forests and Lands
FOREST PROTECTION BUREAU

DNCR Form #5601B
Rev. 10/2018

Category IV Fire Permit
(RSA 227-L:17 & Res 5601.05)

Permit No._____
Dist. - Year - #

Permittee_____ Tel. (_____)_____-_____
Company or Municipality

Address_____

Permittee's Agent_____

Date(s) of Burn_____/_____

Burning Location_____

GPS Coordinates N_____ W_____

Material Being Burned:_____

_____

CONDITIONS FOR BURNING

1. If the permit is issued for more than one day, the permittee shall notify the Warden daily prior to initiating any open burning.

   Name: _____ Tel. (_____)_____-_____

2. No fire shall be left unattended at any time without being completely extinguished.
   A buried fire is not considered extinguished under state law
3. The Forest Ranger, Town Forest Fire Warden or their agent may summarily suspend this permit for non-compliance with all applicable laws and rules, or if weather conditions or other hazards exist. The Permittee will be notified of such by the issuing agent.
4. Any person, firm or corporation burning under this permit, shall ensure that sufficient fire suppression equipment and personnel remain on site to extinguish the fire at all times.

   Equipment required:_____

   _____
5. Burning is permitted only on dates and times specified above.
6. Burning is permitted only if the material burned is clean, untreated wood or brush less than 5 inches in diameter and meets applicable air resources regulations

Forest Ranger_____ Ranger ID _____
Signature

Warden/Warden's Agent_____ Town of_____
Signature

I, the undersigned permittee, fully understand the laws, administrative rules, liabilities and my responsibility under the terms of this permit.

Permittee's Agent_____ Date issued _____/_____/_____
Signature

This permit requires the approval of the Ranger and the Town Forest Fire Warden or Wardens Agent

Director
Division of Forests and Lands

White - Permittee **Yellow - Fire Warden** **Pink - Ranger**

Figure 27. New Hampshire Category IV burn permit provided for informational purposes only.

Chapter 14. Liability & Insurance Considerations

Recommended Standard

- Entities conducting prescribed fire should fully understand their options and legal exposure, determine an acceptable level of risk, and insure themselves to that level.

For private landowners, private non-profits, and public agencies alike, exposure to liability is one of the greatest issues impacting the decision to use prescribed fire as a management tool. At any one burn unit the rules that apply are a combination of federal, state, and local statutes, rules, and regulations. They may include rules set by a Tribal Nation.

New Hampshire is one of four states that employ a strict liability doctrine for prescribed fire, i.e., individuals or organizations are liable for the costs of extinguishing a fire and any damages incurred should the fire get out of control even if that individual or organization did not show negligence. Commercial General Liability Coverage responds to strict liability claims as well as negligence claims.

Similar to other states, in New Hampshire the Federal Tort and Civil Liability Act exempts federal, state, and municipal employees from most liability associated with injury or property damage – whether from prescribed fire or other actions. Government workers in general are provided a meaningful degree of immunity for work that they do within the scope of their employment by their respective employer. The key is whether the work is within the definition of their employment. There are cases involving federal fire suppression employees which were found to have not acted within the scope of their employment and were forced to defend themselves personally. Nonetheless, there is still ambiguity whether a public employee acting within his/her responsibility is personally liable for damages.

Private entities as well as state agencies that use prescribed fire may consider liability insurance as a way to "transfer" tort liability to a financially reliable entity. Coverage needs and costs may vary; commercial general liability insurance is the conventional coverage used to insure individuals and businesses while acting as prescribed fire practitioners.

Note: this information is intended as a general overview and not legal advice. Consult your insurance agent and attorney for coverage options and a better understanding of the legal implications of how prescribed fire can affect you.

This was written with the assistance of prescribed fire liability insurance provider Doug Rigdon, C.D. Rigdon & Associated Ltd.

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Chapter 15. Monitoring & Record Keeping

Although no recommended standards are provided here, keeping good records about a prescribed burn is an important part of maintaining an effective program. The records are needed to build institutional knowledge about unique aspects of a given site where fire is being used, as well as to determine if the application of fire is meeting the stated objectives for its use.

Two key aspects of monitoring and record keeping are evaluating first and second order fire effects, and writing After Action Reports (AARs). The following tables provide summaries of the key pieces of information that should be included with each.

Table 12. Components of an After Action Report	
Burn unit name and size	
Date	
Burn boss name	
Crew members, affiliation, and positions on burn	This information provides a valuable record of how burns are being supported, and can help crew members with record keeping of their experience.
Previous burn date(s)	
Weather conditions	Weather conditions leading up to and after the burn can be recorded, as well as the onsite weather taking during the burn.
Fuels	Typically, this information can be copies from the burn plan.
Key times	Some key things to record include, ignition time, when the unit or sub-units were rung, time when mop-up was completed.
Burn duration	This should include the total time active fire was on the ground, and the total amount of time (including the initial mop-up) that crews were onsite.
Equipment	Record the number and sources of engines and other equipment used on the burn.
Fire behavior observed	During the debrief, crew members can relay the fire behavior that was observed, and more detailed notes may be available if the burn had a fire effects monitoring (FEMO). This information should be included in the AAR so it can be compared to the predicted fire behavior included in the burn plan. This will help to "ground truth" the data being provided via BeHave calculation used for planning the burn.
Smoke behavior observed	As above, observations of smoke behavior can be noted during the debrief, and more detailed information may be available if the burn included a FEMO. This is very important information to build a long-term understanding of overall trends in smoke behavior at the site. Smoke behavior during all phases of the burn should be captured (e.g., during the burn, during the smoldering phase, and after dark). This will help to inform future managers how smoke behaves at the site.
Progress towards goals and objectives	This can be more thoroughly captured when recording fire effects data, but general notes can also be made in the AAR.
Lessons learned	This should be used to capture any key lessons learned during the burn. It should include details such as: "There is soft sand at the primary water point for the burn unit and one of the Type 6 engines got stuck when refilling during mop-up." "It was noticed that the forecasted south winds were actually felt as southeast winds in the burn unit. It is believed that this was due to topographical influences from the adjacent ridge." "Smoke being emitted from the burn after dark was observed following cold air drainages adjacent to the burn unit for up to ½ mile in both directions along the drainage (e.g., north and south)."

The following table provides an example of some of the key pieces of information that should be recorded with respect to fire effects. Generally, first order fire effects can be readily observed just after a burn has been completed. In the table below, some examples of first order fire effects include: canopy scorch, low midstory/brush scorch, and substrate. Hardwood, softwood, and exotics top-kill will likely be more secondary fire effects. Fire effects monitoring may need to wait until the following growing season to accurately assess secondary fire effects. The kinds of fire effects that are recorded for a given burn should be tailored to the individual burn, so the table below is primarily an example.

Table 13. Example of Fire Effects Summary						
Canopy Scorch	N/A	None	1 – 30%	31 – 60%	61 – 90%	>90%
% of Area						
Low Midstory/Brush Scorch	N/A	None	1 – 30%	31 – 60%	61 – 90%	>90%
% of Area						
Hardwood Top-Kill	N/A	None	1 – 30%	31 – 60%	61 – 90%	>90%
% of Area						
Softwood Top-Kill	N/A	None	1 – 30%	31 – 60%	61 – 90%	>90%
% of Area						
Exotics Top-Kill	N/A	None	1 – 30%	31 – 60%	61 – 90%	>90%
% of Area						
Substrate Burn Severity Class	Unburned	Scorched	Lightly Burned	Mod. Burned	Heavily Burned	
% of Area						

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BURN PLAN TEMPLATE

See Attached “Burn Plan Template.doc”

APPENDIX A: Prescribed Burn Planning Resources

Prescribed fire can be a useful way to manage a range of habitats. From initial assessments, to planning and conducting a burn, there is help available. UNH Cooperative Extension foresters and others can help you determine if fire is a tool that would work to achieve your objectives. Once you decide that fire management is the best tool to meet your management objectives, seek the expertise of a qualified burn boss to help plan and execute the prescribed burn. The appropriate regional Division of Forests and Lands Forest Ranger and your local fire department should also be contacted early in the planning process to provide necessary input.

The following describes the range of services available to conduct prescribed burns on private lands in New Hampshire. Each situation is unique and may require different resources and skills. Before any prescribed burn is conducted, use the full range of resources at your disposal to make informed decisions about the safest and most effective approach to meet your goals.

General Information

The New Hampshire Prescribed Fire Council is an affiliation of agencies, organizations, and groups working together to:

- promote public understanding of the benefits of prescribed fire
- promote the development and utilization of prescribed fire practices to achieve desired environmental and ecological resource management goals
- anticipate prescribed fire issues and concerns and suggesting courses of action
- provide a framework for communication and cooperation related to prescribed fire objectives, techniques, and issues
- disseminate technical information and training on prescribed fire and its application
- promote the long-term viability of prescribed fire as a management tool in New Hampshire

To learn more about prescribed fire in New Hampshire contact the New Hampshire Prescribed Fire Council at info@nhprescribedfire.org or visit us on the web at www.nhprescribedfire.org.

The University of New Hampshire Cooperative Extension has educators and specialists who can help you better understand your land and your options. Information is disseminated through fact sheets, meetings, and field visits. Often the best initial step is a visit with your local County Extension Forester to walk your property and discuss your interests in light of what is on the ground. Calling the UNH Cooperative Extension Forestry Information Center at 1-800-444-8978 will put you in touch with your local forester. The UNH Cooperative Extension staff members listed below can provide specific assistance with helping landowners better understand fire management options and tradeoffs.

Andy Fast
Extension Educator Forest Resources
UNH Cooperative Extension
36 County Drive
Laconia, NH 03246

603-527-5475
andrew.fast@unh.edu

Matt Tarr
Wildlife Specialist
UNH Cooperative Extension
Nesmith Hall
131 Main Street
Durham, NH 03824
603-862-3594
matt.tarr@unh.edu

Private Consultants

Private consultants who are qualified burn bosses (RXB1, RXB2, RXB3) to National Wildfire Coordinating Group standards or NH State Prescribed Fire Standards have specialized training and experience that enable them to safely conduct prescribed burns. They offer a range of prescribed fire site preparation, planning, and implementation services. The costs and specific services will depend, in part, on the management goals, complexity of the burn, and the site conditions.

As with any business relationship, use prudent practices before hiring: check references, ensure that the consultant is maintaining appropriate qualifications, ask for proof of insurance that will cover the services provided, and put your agreement in writing.

Qualified burn bosses to National Wildfire Coordinating Group standards who provide consulting services include:

Joel Carlson (RXB2)
Northeast Forest and Fire Management
29 Moody Drive
Sandwich, MA 02563
508-274-2234
joelcarlson@ne-ffm.com

Simmons Stewardship and Conservation Ecology
508-783-8229
tsesimmons@comcast.net

Wildlife Restoration International
56 Depot Street Unit 1983
Duxbury, MA 02331
781-361-9711
info@wildlandrestoration.org

Note: inclusion here doesn't imply endorsement. Other qualified individuals, should contact the New Hampshire Prescribed Fire Council at info@nhprescribedfire.org.

New Hampshire Division of Forests & Lands

New Hampshire Division of Forests and Lands Forest Rangers are responsible for fire suppression in the case of a wildfire. The Forest Ranger is a signatory for a commercial burn permit, which is required to conduct a prescribed burn (also signed by the local fire warden).

Forest Rangers may be contacted at:
Forest Protection Bureau
Division of Forests and Lands
172 Pembroke Road
Concord, NH 03301
603-271-2214

Fire Departments & Volunteer Fire Departments

Local fire departments work closely with the Division of Forests and Lands Forest Rangers. The local fire warden is a signatory for a commercial burn permit (also signed by the regional forest ranger). Some fire departments will conduct prescribed burns on private lands as a training exercise for the firefighters. Regardless of whether the local fire department is taking a central role in the prescribed burn itself, it is important to contact the fire department early in the planning process to inform them of your intent and ensure any concerns are addressed.

Financial Resources

Prescribed fire can be an expensive management option. Financial assistance to help private landowners offset costs may be available through the Natural Resources Conservation Service (NRCS) and New Hampshire Fish & Game.

To learn more about these options, you can contact your county UNH Cooperative Extension office, regional Natural Resources Conservation Service (NRCS) field office, or regional New Hampshire Fish and Game office. If you are not sure who to contact locally, the state offices can refer you to an appropriate local contact.

Natural Resource Conservation Service State Office
Federal Building
2 Madbury Road
Durham, NH 03824
603-868-7581

New Hampshire Fish and Game State Office
11 Hazen Drive
Concord, NH 03301
603-271-2461

UNH Cooperative Extension Forestry Information Center
1-800-444-8978

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APPENDIX B: Prescribed Fire Complexity Rating

Site:	Unit:	State:	Date:
Complexity Score (circle)			
Low (44-80 pts)	*Moderate (81-150 pts)*	*High (151-220 pts)*	

Weighting Factor x Complexity Value = Total points. Sum of Total points = Complexity Score

Complexity Element	Weighting Factor	Complexity Value (1-5)	Total Points	***Rationale and/or Mitigation Procedures*** (Use for clarification of rationale and/or actions.)
1. Safety	5			
2. Difficulty of Containment	5			
3. Fuels and Fire Behavior	5			
4. Wildland / Urban Interface	5			
5. Objectives	4			
Sub Total (Page 1)				

Complexity Element	Weighting Factor	Complexity Value (1-5)	Total Points	***Rationale and/or Mitigation Procedures***
6. Management Organization	4			
7. Contingency Planning and Resources	4			
8. Natural, Cultural, Social Values	3			
9. Air Quality Values	3			
10. Logistics	3			
11. Tactical Operations	2			
12. Cooperator Coordination	1			
Sub Total		Page 2		Additional Comments:
		Page 1		
Complexity Score				Rated by:

Complexity Element	Complexity Value Evaluation Examples		
	1	3	5
1. Safety Weighting Factor - 5	▪ All safety issues have been identified and mitigated.	• A number of significant issues have been identified and some of them are difficult to address through mitigation.	• Complex safety issues exist.
2. Difficulty of Containment Weighting Factor - 5	• Low threat of escape past unit boundaries. • Probability of Ignition <50%. • Boundaries naturally defensible or firebreaks easily installed and defended. • Secondary control lines strong and easily accessed by vehicles and/or crew.	• Moderate threat of escape from unit boundaries. • Probability of Ignition <70% • Moderate risk of slopover or spot fires. • Fuel type produces numerous firebrands. • Secondary control lines difficult to access or not secure.	• High threat of escape from unit boundaries. • Probability of Ignition >70%. • High risk of slopover or spot fires. • Secondary control lines non-existent or inadequate without significant resource commitment.
3. Fuels and Fire Behavior Weighting Factor - 5	• Low variability in slope & aspect. • Weather uniform and predictable. • Surface fuels (grass and/or needles) only. • No drought present or predicted within burn period. • Duff or organic soils will not ignite.	• Moderate variability in slope & aspect. • Weather variable but predictable. • Ladder fuels present and torching expected. • Fuel types/loads variable. • Dense, tall shrub or mid-seral forest communities. • Drought index indicates normal to moderate drought conditions; present expected within burn period. • Upper level of duff or organic soil will burn.	• High variability in slope & aspect. • Weather variable and difficult to predict. • Extreme fire behavior and/or stand replacement fire. • Fuel types/loads highly variable. • Altered fire regime, hazardous fuel /stand density conditions. • Drought index indicates severe drought conditions; present or expected within burn period. • Significant portions duff or organic soils will burn.
4. Wildland / Urban Interface Weighting Factor - 5	• No risk to people or property within or adjacent to fire, or values to be protected are easily mitigated. • Potential damage from escape low.	• Several values to be protected. • Mitigation through planning and/or preparations is complex. • May require some commitment of specialized resources. • Potential damage from escape moderate.	• Numerous values and/or high values to be protected. • Severe damage likely without significant commitment of specialized resources with appropriate skill levels. • Potential damage from escape high.

Complexity Element	Complexity Value Evaluation Examples		
	1	3	5
5. Objectives Weighting Factor - 4	• Maintenance objectives. • Prescriptions broad. • Easily achieved objectives.	• Restoration objectives. • Reduction of both live and dead fuels. • Moderate to substantial changes in two or more strata of vegetation. • Objectives judged to be moderately hard to achieve. • Objectives may require moderately intense fire behavior.	• Restoration objectives in altered fuel situations. • Precise treatment of fuels and multiple ecological objectives. • Major change in the structure of 2 or more vegetative strata. • Conflicts between objectives and constraints. • Requires a high intensity fire or a combination of fire intensities that are difficult to achieve.
6. Management Organization Weighting Factor - 4	• Span of control held to 2 - 3. • 6 - 12 person crew and 1 - 2 engines.	• Span of control held to 4 - 5. • Multiple resources required (engines, dozers, aerial ignition, terra torch, etc.). • 8 - 20 person crew and 1 - 3 engines.	• Span of control greater than 5 - 7. • Multiple branch, divisions or groups. • Specialized resources needed to accomplish objectives. • Organized management team required (Fire Use or Incident Management).
7. Contingency Planning and Resources Weighting Factor - 4	• Adequate contingency resources on site.	• Contingency resources limited or have more than a 15 - 30 minutes response time.	• Contingency resources limited or have more than a 30+ minutes response time.
8. Natural, Cultural, and Social Values Weighting Factor - 3	• No risk to natural, cultural, and/or social resources within or adjacent to fire, or mitigation through planning and preparations is adequate.	• Several values to be protected. • Mitigation through planning and/or preparations is complex. • May require some commitment of specialized resources.	• Numerous values and/or high values to be protected. • Severe damage likely without significant commitment of specialized resources with appropriate skill levels.
9. Air Quality Values Weighting Factor - 3	• Few smoke sensitive areas near fire. • Smoke produced for less than 1 burning period. • Air quality agencies generally require only initial notification and/or permitting. • No potential for scheduling conflicts with cooperators.	• Multiple smoke sensitive areas, but smoke impact mitigated in plan. • Smoke produced for 2 - 3 burning periods. • Daily burning bans are sometimes enacted during the burn season. • Infrequent consultation with air quality agencies is needed. • Low potential for scheduling conflicts with cooperators.	• Multiple smoke sensitive areas with complex mitigation actions required. • Health or visibility complaints likely. • Smoke produced for greater than 3 burning periods. • Multi-day burning bans are often enacted during the burn season. • Smoke sensitive Class I air-sheds. • Frequent consultation with air quality agencies is needed. • High potential for scheduling conflicts with cooperators.

Complexity Element	Complexity Value Evaluation Examples		
	1	3	5
10. Logistics Weighting Factor - 3	• Easy access. • Duration of fire is 1 day (holding or monitoring).	• Difficult access. • Duration of fire support between 2 and 3 days. • Logistical position assigned. • Anticipated difficulty in obtaining resources.	• No vehicle access. • Duration of support is greater than 3 days. • Multiple logistical positions assigned. • Remote camps and support necessary.
11. Tactical Operations Weighting Factor - 2	• Simple ignition patterns with only one igniter inside the unit. • Ignition complete within one burning period. • Single ignition method used. • Resources required for 1 day. • Holding requirements minimal.	• Multiple firing methods and/or sequences with two igniters inside the unit at once. • Use of specialized ignition methods (i.e., terra-torch or Premo-Mark III). • Ignition continues for two burning periods. • Resources required for 2 to 3 days. • Holding actions to direct or delay fire spread.	• Complex firing patterns highly dependent on local conditions. • Simultaneous use of multiple firing methods and/or sequences, greater than 2 igniters inside unit. • Simultaneous ground and aerial ignition. • Use of heli-torch. • Resources required for over 3 days. • Multiple mitigation actions at variable temporal and spatial points identified. • Aerial support for mitigation actions desirable or necessary.
12. Cooperator Coordination Weighting Factor - 1	• Cooperators not involved in operations. • No concerns.	• Simple joint-jurisdiction fires. • Some competition for resources. • Some concerns.	• Complex multi-jurisdictional fires. • High competition for resources. • High concerns.

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APPENDIX C: Burn Window Notifications

Letters to Abutters

Neighborhood Door Hanger

Press Releases

Letters to Abutters

The Nature Conservancy
Protecting nature. Preserving life.™

Notice of Forest Management Activities and Prescribed Burns to be Implemented on The Nature Conservancy's Ossipee Pine Barrens Preserve.

TO: Neighbors and Abutters of the Ossipee Pine Barrens Preserve

FROM: Jeffrey Lougee, Director of Stewardship and Ecological Management

DATE: March 15, 2010

Dear Neighbor,

I am writing to inform you of our management plans for The Nature Conservancy's Ossipee Pine Barrens Preserve for the coming spring, summer, and fall of 2010. We are currently planning to conduct prescribed burns on up to 220 acres of the Preserve in several locations in Madison, Freedom, and Ossipee (please see the attached map). Prior to burning these areas, we will also be conducting mechanical treatments to reduce fuels and accelerate the restoration of the unique pine barrens ecosystem. Mechanical treatments will include:

- Mowing dense areas of scrub oak and other vegetation
- Creating firebreaks and access for personnel and equipment that will be used to implement the prescribed burns
- Creating Wildland Urban Interface (WUI) buffers to protecting neighboring homeowners from wildfires (e.g. fires ignited by careless activities of the public when the fire danger is high)
- Harvesting white pine/hardwoods from selected areas to promote the unique pine barrens ecosystem

Our mechanical fuel reduction activities are an important step in establishing the conditions necessary for safe implementation of prescribed fire, have the added benefit of reducing the risks of wildfire, and help to accelerate the restoration of the unique pine barrens ecosystem.

Mechanical fuel reduction activities will be completed in April and May. Prescribed burns will be conducted between mid-June and mid-October when weather conditions permit and qualified fire crew members and equipment are available.

The following provides additional detail for planned 2010 management activities:

Wildland Urban Interface (WUI) Buffers

Two WUI buffers will be created on the Preserve in April, one to the southeast of Windsock Village and one to the northwest of Babcock Road. Both of these buffers will entail harvesting timber within the area to a level where crown fires (e.g. fire sustained in the tops of the trees) are no longer possible. Following the timber harvest, mowing of scrub oak and other dense shrubs will be completed within these areas to further reduce the risk of fires in immediate proximity to the Preserve boundary.

White Pine/Hardwood Timber Harvests

In order to promote the unique pine barrens ecosystem, white pine and hardwoods will be harvested from approximately 90 acres of the Preserve. The areas being harvested have significant quantities of white pine and some hardwood species that will outcompete the unique pine barrens vegetation over time.

Other Important Information

Prescribed burns will generally be conducted between the hours of 11:00 a.m. and 5:00 p.m. In some cases, the areas burned will continue to smolder into the evening, and Conservancy staff will remain on site throughout this period and until the fire is fully extinguished.

While the Conservancy takes many precautions and measures to ensure that smoke from controlled burns is directed away from developed areas and neighboring homes, temporarily shifting winds, and smoldering after dark can direct smoke in unpredictable directions. **To minimize the chances of smoke entering your home, we ask that our neighbors keep their windows in their homes and vehicles closed during the burn operations, and until the burn areas are extinguished.**

Because the actual burn dates will depend on weather conditions and the availability of crew and equipment, we are not able to provide exact dates at this time other than the range of mid-June to mid-October. In order for the Conservancy to provide notification to our immediate neighbors on the days we are planning to burn in the vicinity of residences, **we request that you provide us with a means of contacting you prior to prescribed burns**, such as a cell phone number or e-mail. This information should be directed to:

Jeffrey Lougee, Director of Stewardship and Ecological Management
(603) 356-8833 – office
(603) 986-1976 – cell
jlougee@tnc.org

United States Department of Agriculture | Forest Service | White Mountain National Forest
Pemigewasset Ranger District | 71 White Mountain Drive,
Campton, NH 03223
Comm: (603) 536-6100
TTY: (603) 536-3665

File Code: 1900
Date: March 11, 2011

Dear Neighbor:

The Saco Ranger District is planning the 2011 prescribed burning program to maintain permanent wildlife openings, improve growing conditions for oak and pine, and reduce hazardous fuel build up. The enclosed map shows the location of areas that may be treated with the application of prescribed fire sometime from May through October.

You have been contacted because your land abuts, or is near a prescribed burn unit.

If you would like to be notified by our office the day before and morning of the burn please contact John Neely, Fire Technician (603) 536-6261 or email John at jneely@fs.fed.us and let him know your interest in the project.

Also, please feel free to contact me or John with any other questions you may have regarding this project.

Sincerely,

District Ranger

Enclosure
cc: John Neely

United States Department of the Interior
FISH AND WILDLIFE SERVICE
CHESAPEAKE MARSHLANDS NEW COMPLEX
BLACKWATER NATIONAL WILDLIFE REFUGE
2145 Key Wallace Drive
Cambridge, MD 21613
Phone: 410-228-2692

Fax: 410-228-3261

December 8, 2006

To: Adjacent landowner to Burton tract:

Blackwater National Wildlife Refuge will be conducting prescribed burns (weather permitted) adjacent to your property beginning in December. The primary objective of this phase of the prescribed burn is to reduce hazardous fuels from areas which threaten private residences and property on and around refuge lands. Early last year, 200 acres of young growth forest were thinned by contractors in a wooded area known as the Burton tract. A contractor has created fire breaks around the woodland units to facilitate burning and protection of these areas.

All prescribed fires will be coordinated through Dorchester Fire Control. During the burn you may see smoke and open flames. Be assured these burns are conducted utilizing very specific fire prescriptions and methods to minimize negative impacts to the environment and to ensure firefighter and your safety. These burns will take place under a West, Northwest, or North wind direction to keep fire and smoke from your residence. If the direction of the winds change (which can occur) the flames will be extinguished and any smoldering fuels will cooled off to prevent the smoke from lingering.

Additional information may be requested by contacting Fire Management Officer Joe Krish at (410) 228-2692 x 128.

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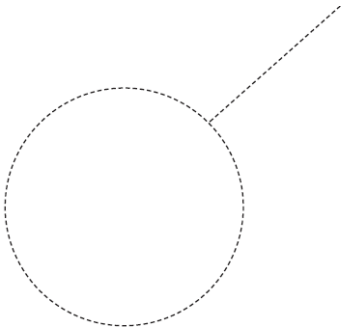
Neighborhood Door Hanger

Prescribed Fire Notice

Rachel Carson National Wildlife Refuge
321 Port Road
Wells, Maine 04090



The Rachel Carson National Wildlife Refuge is planning to conduct a prescribed fire near your property in the next few months.

Prescribed burns are carefully planned and conducted by trained fire technicians. A fire will be set only when weather forecasts, humidity, wind direction and speed are optimal. We minimize smoke by burning under conditions that will disburse it away from homes and businesses.

Prescribed fires help us improve grassland and wetland habitat for wildlife. Fire enriches soil by releasing nutrients. Removing woody debris brings sunlight to soil, enabling seeds to sprout.

Prescribed fires reduce the amount of dead wood and grass, decreasing the chances of an uncontrolled (wild) fire.

Prescribed fires control the spread of invasive, exotic plants such as common reed, Japanese barberry, and Japanese knotweed. These species compete with native plants and limit the diversity that supports a variety of wildlife.

The fires will generally last a few hours. You may not even realize that we have been burning nearby.

If you have any questions or would like more information, please contact the Refuge Manager by calling 646-9226 or drop by our office on Route 9 in Wells Monday through Friday between 8:00 a.m. and 4:00 p.m..

Working for Wildlife

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Press Releases

CONTACT:

Bryan Nowell, Forest Ranger: (603) 271-2217
Heidi Holman, Fish & Game: (603) 271-3018
Liza Poinier, Fish & Game: (603) 271-3211

FOR IMMEDIATE RELEASE
March 28, 2011

Prescribed Burn in Concord Airport Area to Improve Wildlife Habitat

CONCORD, N.H. -- New Hampshire Fish and Game and the N.H. Department of Resources and Economic Development Division of Forests and Lands, with support from the N.H. Army National Guard, U.S. Fish & Wildlife Service, and City of Concord, will be conducting a "prescribed burn" in areas on and near Concord Municipal Airport grounds during the spring. The prescribed burn may occur as early as April 1, or as late as May 14; the date will be finalized when the weather and atmospheric conditions are seen to be safe.

Prescribed burning, which is highly controlled and conducted by trained professionals, is an indispensable tool for safely managing the pine barren forests in the Concord community. While rare species are associated with both early and late successional stages of the Concord Pine Barrens, the most critically imperiled species occur in the grassy opening stage. Fire is a tool used in restoring or converting habitat conditions that are capable of supporting rare and important wildlife, including the federally endangered Karner blue butterfly -- New Hampshire's official state butterfly. The fire will also reduce dangerous accumulations of wood that could result in wild, unmanageable fires if left unchecked. The prescribed burn will take place within the Conservation Zones on the Concord Municipal Airport (see map, above left). It is allowed under a state-issued burn permit, which also serves as a smoke management permit (RSA 227-L17).

Precautions will be taken to limit smoke and to ensure that the prescribed burn stays within the distinct borders shown on the map. In addition, at least one fire vehicle with water tank will be available on-site at all times as part of the protocol to deal with any unexpected situations. However, neighbors should recognize that atmospheric conditions could change, and smoke may create temporary visibility hazards. The smoke poses no imminent threat to people's health or the community.

Press Release: Controlled Fire Prescribed for White Mountain National Forest

Spring burning in the White Mountain National Forest will begin this week as ground and weather conditions become right for safe and effective burning. Don Muise, a Zone Fire Management Officer with the national forest, is keeping a close eye on the weather and moisture levels in the various sites around the forest. "We have a site-specific burn plan for each area that describes the exact parameters and conditions we need before we'll ignite a fire. We wait for the right wind, weather, and moisture levels that will allow us to burn safely. The burn plans also spell out all the details for the kinds of equipment and the number of trained firefighters needed at the site, and spells out coordination procedures with local fire departments."

The Forest Service plans to burn areas in the New Hampshire towns of Chatham, Livermore, Albany, Easton, Milan, Berlin, and Lancaster. Burning in Maine is planned for Stoneham, Albany, Gilead, Mason, and Batchelders Grant.

The burn sites range from 2-14 acres in size. A total of about 81 acres of the 780,000-acre national forest are planned for burning this spring.

Prescribed fire is a management tool used to maintain wildlife openings in the forest to provide grassy meadows or shrubby areas – essential habitat for some forest dwellers. Wildlife openings add to the diversity and complexity of habitat in the national forest. "Periodic burning of these sites helps to maintain the open habitat for feeding, nesting, and cover for many wildlife species," says Lesley Rowse, Forest Service Wildlife Biologist.

Burning is also used to reduce the amount of accumulated forest fuels such as dead leaves, brush, and wood, reducing the potential for a wildfire. Prescribed fire can also prepare a seedbed on the forest floor for regeneration of certain tree species such as oak and pine. The burns are ignited and controlled by wildland firefighters with up-to-date training and gear. Firefighters stay prepared for assignments here and out west if needed for wildfire suppression.

Muise notes that the burn sites are mostly well away from populated areas and will cause little if any inconvenience to national forest visitors. For more information call your local White Mountain National Forest Ranger Station.

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News Release
Massasoit
National Wildlife Refuge
Eastern Massachusetts National Wildlife Refuge Complex
73 Weir Hill Road, Sudbury, Massachusetts 01776
(978) 443-4661 Fax (978) 443-2898
http://www.fws.gov/northeast/EasternMANWRComplex

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For Immediate Release.
Contact: Tom Eagle, Deputy Refuge Manager (978)443-4661 ext. 12 or Catherine Hibbard, Wildlife Refuge Specialist 413-531-4276

CONTROLLED BURN AT MASSASOIT NATIONAL WILDLIFE REFUGE TO PROTECT PEOPLE AND WILDLIFE

Sometime before May 15, firefighters from the U.S. Fish and Wildlife Service, The Nature Conservancy, State of Massachusetts, and Plymouth Fire Department, plan to light a controlled burn near the East Entrance to Myles Standish State Forest in Plymouth, MA, to reduce the risk of wildfire to nearby homes and to improve wildlife habitat. The 50-acre burn will be on Massasoit National Wildlife Refuge (NWR) next to the Patriot Properties subdivision immediately south of Wildcat Lane, Strawberry Hill Road, Jason's Lane, Evelyn Road, and Crabtree Road and west of the junction of Alden and Long Pond Roads. Residents and visitors in the area may see or smell smoke during the burn. The exact date of the burn depends on having the right weather conditions. A burn was scheduled last year, but the weather did not cooperate. If this happens again this spring, the burn will be scheduled between September 15th and November 30th. Firefighters last burned part of this area in 2007.

"The primary purpose of this controlled burn is to protect people and their homes from wildfires. A secondary goal is to improve wildlife habitat by mimicking natural fire conditions," said Tom Eagle, Deputy Refuge Manager of the Eastern Massachusetts National Wildlife Refuge Complex, the U.S. Fish and Wildlife Service office that manages Massasoit NWR. Burning in a controlled manner under predetermined weather conditions safely reduces build-up of leaf litter,

dead wood, and other plant material that could otherwise fuel a wildfire and make it burn dangerously fast. Plymouth is no stranger to destructive wildfires. In 1937 a wildfire in Pine Hills killed two firefighters and as recently as 1995, more than 100 homes were threatened by a fire in the Bourne Road area. Because of the high risk to communities from wildfire on federal lands, Plymouth was named a federal "Community at Risk" in 2001.

A team of trained wildland firefighters will keep the controlled burn safe. They will monitor wind direction and other weather statistics and will not start a burn if wind would blow smoke towards homes or roads or if conditions would not allow smoke to lift. They will post signs along Alden Road to warn motorists of a burn in progress and send a reverse 911 message the day of the burn to alert residents. Fire engines will be staged in the subdivision north of the burn, where pitch pine limbs were cut, white pines removed, and the ground mowed in a 100-foot buffer to reduce risk of fire spreading to homes. Firebreaks surround the entire burn area. Burning will be done under conditions of permits from The Massachusetts Department of Environmental Protection, Air Quality Division and Town of Plymouth.

Putting fire on the ground in a planned way also helps native pitch pines and scrub oaks of the Plymouth Pinelands. These trees thrive in fire prone areas and are habitat for an Endangered turtle, the Northern red-bellied cooter. Although animals have ways to survive fires, firefighters take precautions to avoid harming the turtles. They schedule controlled burns when cooters are in ponds, burn a safe distance from ponds, and do not burn during the June to July nesting season. For more information on Fire Management on National Wildlife Refuges in the Northeast visit: www.fws.gov/northeast/refuges/fire

Massasoit NWR is one of more than 550 refuges of the U.S. Fish and Wildlife Service. It is 209 acres and was established in 1983 to protect the Northern red-bellied cooter. It is closed to the public. The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. We are both a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals and commitment to public service. For more information on our work and the people who make it happen, visit www.fws.gov.

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