Chapter 10 A. Habitat Management Tools: Using Prescribed Fire to Manage Habitats in the Northeast

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Fire is a natural phenomenon that is complex, dangerous, and absolutely critical to the conservation of biological diversity in our region. However, for the vast majority of private landowners, prescribed fire as a habitat management tool is not currently an option. Prescribed burning programs are simply not yet advanced in most states because there has been a long hiatus in burning since the federal Clean Air Act was passed in 1962. In this chapter, I present some basic information required to evaluate the need for fire as a management tool. Included are sections on reconstructing fire histories, the rationale for using fire, and the essential ingredients of planning and conducting fire in a safe and productive manner.

Fire history in the Northeast

Other sections of this book discuss fire as a historical influence on northeastern habitats, so this discussion focuses on obtaining fire history specific to the land you manage. The first step in thinking about applying fire is to research the historical role fire has had on the ecology of your area. There are numerous methods used to reconstruct fire histories. No single tool can tell the fire story of a landscape by itself, so one should always apply as many sources of information as possible. The goal is to reconstruct the frequency of historical fires and their influences on the landscape and help understand the potential role of fire in structuring ecosystems. Knowledge of prehistoric fire occurrence may be useful, as well as the ecological affinities that many species evolved over a long period of time in response to fires that were occasionally a component of their habitat.

Further discussion can be found in scientific journals and textbooks, but methods frequently employed include charcoal and pollen analyses, researching town, county and state histories, newspaper accounts, interviews with fire departments, and other sources as practical. Town, county, and state histories with descriptions of historical land use practices and vegetation or habitat types are good sources of information. Often you must read hundreds of pages to glean two that are relevant to fire history or fire ecology. In many parts of the Northeast, the use of fire was historically so common that only catastrophic conflagrations that damaged structures or took human lives were reported, while most wildfires were unreported in local newspapers or historical accounts.

An excellent source of local fire history is the local fire department. Many fire departments possess written logs of fires, their locations and dates, sizes of the fires and the time and equipment that were necessary to contain and suppress them. Similarly, interviews with members of the local fire departments can yield valuable information. Old photographs can be used in reconstructing fire histories. Sometimes placing an ad in the local paper asking residents to look for old photographs of an area can yield abundant evidence not only of fire history but also of other events that helped shape current habitat conditions.

Ice storms, tornados, and hurricanes that snap large numbers of trees are often precursors to large, intense fires due to the abundant dry fuels left in their wake. Photographs taken of post-storm damage can provide clues to vegetation conditions prior to some severe fire events. Aerial photographs available from federal, state, and other planning agencies can be sources of pertinent information if the images were taken at times coinciding with fire or storm events. Local history is avidly pursued by many who may have little interest or knowledge of fire ecology, but who enjoy applying their interests to practical conservation issues, so check with the nearest historical society for sources of information. Some projects have had great success having fire history research done by volunteers or interns.

The biology and ecology of species dependent on fire-influenced habitats can provide hints about a region's fire history. Museums and herbaria are invaluable as records of historical flora and fauna. Fire scars on tree trunks and the stems of resprouting trees are good determinants of recent fires and some trees bear the evidence of previous fires for decades and even centuries.

Figure 1. The village of Lake Pleasant in Montague, Massachusetts is embedded in a pitch pine scrub oak barrens and has lost homes to wildfires on several occasions. A program using fuel reduction techniques including prescribe fire is benefiting wildlife habitat and improving public safety.

Some of these methods are significant at a regional scale, some apply only at a very local scale, and all are subject to the interpretation of the land manager. Contrary to popular belief, fire has had very significant impacts on the Northeast region's ecology, but one rule that emerges from all the investigations is that few generalizations apply. The nature and influence of fire varies from place to place and from time period to time period. Interpretations by fire ecologists of a state's fire history will change as information accumulates.

Pre European settlement (prior to 1600)

Evidence from all the sources listed above strongly supports the conclusion that fire was an important tool used liberally in some parts of the Northeast. Unlike the western U.S., lightning fires are much rarer, though by no means absent, in the Northeast. The Algonquian peoples of the region used fire as the tool of choice in modifying their environment. Fire was used to clear trees, to open up the shrubby understory of forests, to promote fruit bearing shrubs such as blueberries, to make travel easier, and to attract game. Large grasslands and savannahs were described throughout much of Virginia by early explorers. The pine barrens of New Jersey would not exist without the consistent periodic influence of fire. Early settlers on Long Island, New York encountered large grasslands. Southern New England was described by many early explorers as supporting large open areas, smaller grasslands, and extensive areas of burned forests. Immigrants built the early settlements in the Northeast directly upon the areas that had been opened by native peoples, thus saving the new arrivals the labor of clearing new land for cultivation and habitation.

But fire was not of equal importance everywhere in the region. Although portions of the Northeast were described by early explorers as having open grasslands, park-like woodlands, and low shrubby areas that could only result from frequent fires, other parts appear to have experienced less frequent fire. Most states within the region have a rich history of supporting fire-dependent habitats prior to European settlement. Yet, some areas, especially in northern New England, have much less evidence of fire. This is not surprising as forest vegetation types differ in northern and interior areas from those found from southern New England to the Virginias. The effects of fires are not as obvious in spruce forests and northern hardwoods as in oak-dominated landscapes, although large fires did occasionally burn in these types, especially after insect outbreaks.

Post settlement

Depending on their region of origin, immigrants brought different attitudes about fire to this continent. They sometimes used fire for different reasons than had the Algonquians, but they continued to use fire to manage land. Local histories of the17th, 18th, and 19th centuries include frequent references to fire in the Northeast. Large catastrophic fires followed clear-cutting of forests and agricultural activities continued to require fire as a means of rejuvenating forage lands for stock. In some areas, a regime of frequent fire was imposed on ecosystems that had evolved with infrequent fire. In other areas, a historical regime of frequent fires was, by the 20th century, replaced by the near absence of fire.

Current conditions

Attitudes about fire have undergone drastic changes since the early 20th century. Increased technological advances and a highly successful fire prevention campaign embodied by Smokey the Bear have resulted in nearly total exclusion of fire from northeastern ecosystems. This has led to the degradation or elimination of some habitats critical to the survival of the region's biodiversity. Many of these habitats are discussed in other chapters in this book and include burned forests, savannahs, scrubby plains, meadows, and grassy shrub habitats.

Figure 2. Smokey the Bear fire prevention campaign symbol

Air quality

Since the 1960s, recognition that excessive smoke represents a public health hazard has resulted in federal, state, and local laws curtailing or eliminating the use of fire by citizens. While prescribed fire was curtailed nationwide following the passage of the Clean Air Act in 1962, it continued to be applied in the Southeast, Southwest, and the West, but in the Northeast only wildfires continued to burn and these, with a few major exceptions, were usually small.

The exceptions include the 200,000 acres that burned in Maine in 1947. Towns were devastated and several never recovered. In 1957, 15,000 acres burned with extraordinary intensity and speed in Plymouth, Massachusetts. Observers recorded that the fire burned at a rate of 18 acres per minute! Nineteen sixty-three was a remarkable fire year throughout the region and in New Jersey in particular, where 200,000 acres burned and 450 houses were destroyed. Similar fires could burn again in all of these areas, and with increased residential and industrial development, the results could be catastrophic. Property losses could easily exceed $1 billion dollars if large fires burned in portions of southeastern Massachusetts, on Long Island, or in the New Jersey pine lands.

In these and other areas, current conditions are untenable from both a public safety and a habitat conservation perspective. Highly flammable vegetation has accumulated in areas subject to periodic high intensity fires, while dozens of plants and animal species are imperiled in the region due to the loss of habitats that vanish in the absence of fire.

In contrast to prescribed fires, where the timing and conditions of management actions are carefully selected, wildfires often occur at times when adjacent human resources are at greatest risk and adverse impacts on air quality are greatest. It is far wiser to choose the conditions under which prescribed fires will occur and, by doing so, air quality concerns will be enormously reduced.

Rationale

The following is a rule of thumb when contemplating fire's ecological benefits: fire can simultaneously have immediate benefits for some species and negative consequences for other species. For example, using fire to restore grassland bird habitats can have negative consequences for certain reptiles and butterflies if proper precautions are not taken. However, short-term effects should not be used to gauge long-term benefits. In most habitats, the timing, frequency, and size of fires can be adjusted so that minimal damage is inflicted on populations of rare and endangered plants and animals and their habitats. It is imperative that fire managers be able to clearly articulate and defend the reasons they use fire.

Every state in the region harbors plants and animals that benefit from the conditions created and maintained by fire. Similarly, every state in the region contains communities of high conservation priority that will vanish without the conditions created or maintained by fire.

Seasonal fire effects

Many of the early descriptions of fire-influenced habitats describe fires in the spring and fall seasons. Currently, most prescribed burns are conducted in the spring and fall but under conditions that minimize smoke impacts and the possibility of a burn escaping the burn unit boundaries. This means that most burns are set in relatively moist conditions. Historical fires had no such constraints and fire effects were likely more severe than prescribed burn effects are now.

These spring and fall burns occur primarily in the dormant season for most plants. Under prescription conditions burns are low in severity and intensity. Generally, fire severity refers to the amount of available fuels consumed and a severe fire leaves bare soil, having consumed all available dead wood, leaf litter, and duff. Fire intensity refers to the amount of heat released by combustion. Generally, fire managers cannot safely conduct a severe and intense fire.

Many imperiled plant and animal species depend on the effects of severe and intense burns. One way to achieve better ecological results is to apply growing season fires. In fuels that support intense fire behavior such as pitch pine and scrub oak, growing season fires achieve fuel reduction and habitat restoration more quickly and, under appropriate conditions, are more easily managed than are dormant season fires. One reason is that plant nutrients are above ground in the growing season and below ground in the dormant season. Fire may be more efficient if performed during the growing season and managers must balance growing season burns with habitat needs of breeding animals.

Is fire necessary?

When contemplating using prescribed fire as a management tool, you must first ask yourself, "Is fire necessary to achieve desired habitat management goals?". To begin to answer this question you must consult professionals at universities, as well as public and private conservation agencies. Mechanical treatments such as logging, brush hogging, mowing, and disking all perform as disturbance agents capable of creating suitable conditions for many species and communities addressed in this volume. Herbicide applications are also quite effective at modifying and managing vegetation. However, fire performs some functions that these other tools cannot. Fire removes some dead vegetation and turns it into ash, smoke, and steam, and provides nutrients that are immediately available to plants. Dead grass, thatch, and leaf litter are often completely consumed and serve to carry fire throughout the habitat patch. The removal of thatch and litter allows sunlight to penetrate to the ground surface and prepares a seed bed for colonizing grasses and wildflowers. Some seeds require scarification by fire for germination to occur.

Planning

Prescribed fire requires significant consideration for safety issues, and the goals must be worth the risks. The key to success in prescribed burning is careful and systematic planning. There are several definitions of prescribed fire, but all include reference to a plan with measurable and achievable objectives, preferably one that is reviewed and approved by other fire planning professionals. Of course, economies of scale do apply. A manager needs a less complex plan to conduct a prescribed fire in a rural pasture with no nearby structures than in a large forest tract composed of highly flammable vegetation near roads and residential areas. Both situations require an assessment of several critical features discussed below. But first, some definitions are required.

Wildland fire - any fire burning in vegetation, planned or unplanned.

Prescribed fire - a fire conducted for specific, clearly stated purposes that is confined to a predetermined area under specific weather conditions and conducted by personnel with the required training and experience. The term "controlled fire" has been used as a synonym. However, this term is better applied to brush pile fires and the controlled burning of unwanted structures.

Burn prescription - the conditions under which a fire will be conducted, usually dominated by weather parameters. Fire behavior is influenced primarily by wind speed and direction, relative humidity, and fuel moisture levels. Each of these weather conditions have a range under which a prescribed fire is acceptable and ranges under which prescribed burning cannot be attempted because they represent an unacceptable, unsafe hazard.

Burn plan - describes the conditions under which a prescribed fire can be conducted and includes necessary features such as site descriptions and maps, descriptions of the steps that will be taken by assigned personnel to conduct the burn, and methods for evaluating the burn during and after the burn.

Components of a burn plan

At a minimum, burn plans should include the following:

- Site name.
- Location - state, county, town, USGS topographic quadrangle, and street address if applicable.
- Site ownership and abutting tract ownership.
- Unit description(s) – description of the current vegetative state of the site, which would include unit size (acreage).
- Required regulatory agency notifications - depending on the state in which the burn is planned, air quality agencies, wildlife agencies, forestry departments, conservation commissions, and/or other entities may need to be informed, and perhaps written approval obtained, prior to a prescribed fire.
- Fuel model and proportions - fuel models, developed by the U.S. Forest Service, categorize vegetation types according to fuel properties (e.g., fuel size and depth among others), and help fire managers realistically estimate fire behavior or fire danger.
- Safety hazards - a description of items/objects that may pose a hazard to individuals participating in the prescribed burn (e.g., fences, holes, foundations, snags located near firebreaks, etc.).
- Safety zones - a description of areas that someone attending or participating in the burn can go to should the fire threaten the crew's personal safety in the event of an unplanned weather change or other event.

- Site management goals - a description of what the manager is trying to accomplish with the use of fire.
- Burn objectives - a description of how the burn will help meet site management goals.
- Smoke management hazards - an evaluation of potential impacts to downwind areas especially those particularly sensitive to smoke (e.g., schools, health care facilities, churches, highways, etc.).
- Crew size and qualifications - description of the crew size and crew qualifications necessary to conduct the burn safely.
- List of equipment - hand tools, power tools, fire trucks, radios for communications, and anything else necessary for the completion of a burn that meets management goals and objectives safely.

Federal agencies have adopted National Wildfire Coordinating Group training standards for crews, burn bosses, and other fire crew positions, and some state and private agencies have adopted similar standards. Crew qualification requirements are determined by evaluating the complexity and difficulty of the planned burn. In many states, assembling a qualified crew requires participation of multiple agencies. Building public/private multi-agency partnerships strengthens fire management programs and solidifies interagency cooperation that is uniquely necessary for conducting prescribed fire in the Northeast. Cooperation and commitment are important because the ecological effects of fire are rarely achieved in short time periods or with individual fires.

Burn plan review

All burn plans should be reviewed by at least one person with the experience necessary to determine if a plan adequately and thoroughly addresses all the information appropriate for the site. This could include prescribed fire managers and/or wildfire control officers for federal or state natural resources departments, or conservation organizations.

Liability

Perhaps the greatest constraints on successfully managing habitats with prescribed fire are the questions of legal responsibility and accountability. Few private entities carry the insurance policies that would cover the many potential liabilities associated with prescribed fire. While escaped fires burning off-site are easily identified as potential liabilities, there are many other potential problems. Individual injuries while en route to or during a fire, smoke damage to adjacent property, and decreased visibility on highways due to smoke are just a few examples of liability issues that should be addressed prior to embarking on a fire management program.

Safety

The foundation of fire crew training is personal and crew safety in all aspects of fire operations. Protecting public safety is an equally important ingredient in all burn plans. However, residents of fire-prone landscapes need to learn to protect themselves from inevitable wild fires. As a general rule, if an area has experienced fires in the past, it is highly likely that it will experience fires in the future. Due to years of inattention, large accumulations of fuels create the conditions for catastrophic wildfires. The boom in rural residential housing places many homes in direct contact with highly flammable vegetation. Most of the newly arrived homeowners have never experienced a conflagration in which thousands of acres burned in day or two. Fortunately, there is a nationwide program, Firewise, that advises homeowners on managing vegetation on their land to reduce the likelihood that their structures will be destroyed the next time a wildfire burns the area. *It is in the best interest of all fire managers to encourage an active Firewise program in any town where prescribed fire is planned or conducted*. Reducing the likelihood that private property will be damaged in wildfires reduces opposition to

the use of prescribed fire. Land managers should consider assigning high priority to fire and fuel management to areas that, after treatment, will provide the greatest protection to public health and safety. Often ecological goals and public health and safety goals can be achieved simultaneously.

Monitoring

No burn is complete until monitoring has been completed. Describing site conditions prior to a burn, measuring fire behaviors during a burn, and measuring fire effects after a burn are all part of finishing the job you started when you began to think about using fire to meet your management objectives. While no one can monitor every aspect of every fire, everyone can monitor at least those aspects of burns that relate specifically to their objectives. The most efficient way to determine exactly what data you will need to collect depends on the specific goals and objectives set for the site. As an example, if an objective is to reduce fuel loads and in so doing reduce the hazard for wildfires, the amount of fuel in an area should be measured before and after a prescribed burn to quantify the extent to which fuel loads have been reduced. If the primary objective of a burn or series of burns is to provide habitat for grassland birds, the observations and data collected should reflect this and focus on grassland birds occupying or failing to occupy the habitat. Once appropriate variables have been sampled, the fire manager should then determine if objectives were met. Fire management is far too time-consuming and expensive to waste resources on tools and methods that do not achieve established goals and objectives.

How to get started?

Many state chapters of The Nature Conservancy have programs that can provide more information on fire ecology and management. Every state has at least one agency responsible for administering prescribed fire or open burning permits. Air quality agencies often have authority to issue permits. Many states have forestry departments and/or forest fire control bureaus responsible for controlling and preventing wildfires. These departments should be able to steer you in the right direction when initiating inquiries about using prescribed fire and training opportunities.

Is fire for you?

Establishing a prescribed fire program presents a formidable challenge. Planning, coordinating, and conducting a burn requires a significant time commitment, as does acquiring the necessary training and experience. But if you start small, in low complexity fuels such as old fields and grasslands and show authorities that fire can be a useful and safe tool, the ordeal is a challenge worth accepting. Indeed, failing to accept the challenge throughout the Northeast will result in a continuing downward spiral for too many plants and animals.

Fires alone, especially in the increasingly suburbanized Northeast, will never satisfy habitat restoration needs. Throughout the region, we are seeing successful experiments that involve pre-treating dangerous fuels by thinning and mowing followed by prescribed fire. The short-term expense of developing these programs is well worth the long-term benefits gained in habitat restoration and increased public safety.

Suggested reading

Pyne, Stephen J. 1982. Fire in America: a cultural history of wildland and rural fire. Princeton Univ. Press. This comprehensive treatment of fire throughout the U.S. is a must read for anyone beginning to explore fire as a historical feature of the landscape.

Pyne, Stephen J., P.L. Andrews and R.D. Laven. 1996. Introduction to wildland fire. 2nd Edition. John Wiley & Sons, Inc. NY. This book discusses all aspects of fire behavior, fire management, fire research and administration presented with case studies and abundant references.

Lewis, Henry and M. Kat Anderson (Editors) 2002. Forgotten fires: Native Americans and the transient wilderness. University of Oklahoma Press. This book serves as a comprehensive review of the use of fire by Native Americans.

Whelan, Robert J. 1995. The ecology of fire. Cambridge University Press. Cambridge, Great Britain. This book presents a balanced, international review of the effects of fire on plants, animals, and vegetation.

www.Firewise.org: The website for information on protecting homes and communities from wildfire disasters. It also presents information on funding sources.

Good sources for prescribed fire programs include the web sites for the National Park Service, U.S. Fish and Wildlife Service, U.S. Forest Service, and The Nature Conservancy.

Biography

Tim Simmons is a restoration ecologist with the Massachusetts Natural Heritage & Endangered Species Program within the Department of fish and Game. Previously he was Director of Science and Stewardship for the Massachusetts Chapter of the Nature Conservancy and their fire manager for the New England region.