The Role of Non-industrial Private Forest Lands in the Conservation of Southern Fire-dependent Wildlife

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Abstract.—Although scientific support for fire as a land management tool has grown, non-industrial private forest (NIPF) landowners often fail to burn on their properties. These lands comprise approximately 70 percent of southern forests, making them critical to the long-term conservation of wildlife and plant species. Natural resource professionals must overcome key constraints to use of prescribed fire on NIPF lands if certain fire-dependent wildlife are to thrive on private forests. Results from two surveys suggest that fear of an escaped fire and related liability issues are the greatest landowner and manager concerns in North Carolina. Pro-fire media events and public education may be the best long-term solutions to increase southern NIPF landowner use of prescribed fire.

Introduction

Anthropogenic fire has a long history in the southern United States (Hudson 1982; Pyne 1982). Since their arrival over 10,000 years ago, Native American Indians burned southern forests and grasslands to drive game, improve grazing habitat, clear land, and reduce the chance of wildfire (Hudson 1982; Pyne 1982; Buckner 1989; MacCleery 1993). European immigrants readily adopted the Indians' woodsburning practices to improve range for cattle, reduce fuel loads, kill chiggers and ticks, increase visibility of snakes and large predators, and improve access (Stoddard 1962; Pyne 1982). Much of the Southeast burned every 1-6 years either at the hands of humans or from natural lightning ignitions (Frost 1998). These high frequency fires helped form the plant communities now present in the South (Christensen 1981; Buckner 1989; Frost 1998).

Because of its influence on plant communities, fire has played a central role in shaping the animal communities of the South as well. The value of fire as a tool to improve habitat for game species, such as the northern bobwhite (*Colinus virginianus*) has long been recognized (Stoddard 1935). However, fire protection policies, implemented in the 1920s, facilitated the decline of southern fire-dependent plant communities, such as the longleaf pine (*Pinus palustris*) forest, and the animals therein (Brockway and Lewis 1997; Brennan 1991; Engstrom et al. 1996).

Following declines in wildlife populations, much research was conducted, that highlighted the importance of fire to non-game species. Pine-dominated stands burned on short fire rotations (2-3 years) generally have a more diverse avian community than pine stands burned using less frequent fire (Wilson et al. 1995; Burger et al. 1998). Most bird species present in open pine-grasslands maintained by frequent fire are of equal or greater management concern than those that occur in the absence of fire (Sauer et al. 1996; Brennan et. al.1998; Burger et al. 1998). Declines in herpetofaunal abundance and diversity can occur following replacement of fire-adapted vegetation by fire-intolerant associations (Russell et al. 1999). Most reptile and amphibian species of conservation concern in the South, including gopher tortoise (*Gopherus polyphemus*), flatwoods salamander (*Ambystoma cingulatum*), indigo snake (*Drymarchon corais*) and pine barrens treefrog (*Hyla andersonii*), prefer habitats maintained by frequent fire (Means and Moler 1979; Brennan et al. 1998; Russell et al. 1999). Many southeastern small mammal species thrive in early- to midsuccessional habitats, many of which historically were created or maintained by periodic fire.

Although prescribed fire is recognized as a necessary habitat management tool for many non-game wildlife species, acreage burned in the South remains relatively stable and fire continues to be used on only a small fraction of NIPF lands (Brennan et al. 1998). Furthermore, NIPF lands that are burned may be done so only once in the length of a rotation or using fire frequencies longer than is desirable for maintenance of quality wildlife habitat (Brennan 1991; Drake 2000). Prescribed burning on NIPF lands is hampered by increasingly restrictive federal air quality standards, high equipment costs, liability risks, multiple ownership patterns or small tract sizes, financial limitations, and lack of landowner understanding of fire's value (Johnson 1984; Brennan 1991; Brennan et al. 1998; Izlar 2000). Public attitudes about fire have been greatly influenced by decades of fire prevention messages (e.g., Smokey Bear) emphasizing the destructiveness of wildfire (Gruell 1991). Although the anti-fire message excluded prescribed burning or natural fires, most citizens were unable to distinguish between good or bad fire (Little 1993). Media coverage has exacerbated the problem by dwelling on the sensational aspects of wildfire and doing little to educate the public on the benefits of prescribed burning (Gruell 1991).

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Despite the barriers to prescribed burning on NIPF lands, there are many reasons why management of these forests must complement efforts to sustain fire-dependent ecosystems and their associated wildlife populations on public lands. Non-industrial private forests comprise a significant percentage (70%) of all timberlands in the South (Alig et al. 1990). Therefore, management efforts limited to public lands may not provide sufficient area to prevent fire-dependent species from declining or becoming extinct (Brennan et al. 1998). Populations of fire-dependent wildlife on public lands isolated by adjacent unburned private forests may experience negative effects (e.g., reduced access to resources, genetic deterioration, increased susceptibility to environmental catastrophes) commonly associated with habitat fragmentation (Harris 1984; Soulé 1987). Furthermore, private lands adjacent to public forests may have dangerously high fuel loads and neighboring landowners may harbor anti-fire sentiments. Either could eventually limit the ability of public land managers to burn. In response to relegating too large a conservation role to government (i.e., public lands), Aldo Leopold (1949) wrote, "An ethical obligation on the part of the private owner is the only visible remedy for these situations." Now, more than ever, Leopold's words ring true.

We use North Carolina as a case study to help clarify NIPF landowner attitudes pertaining to prescribed fire. We synthesize several surveys of North Carolina landowners and certified burners. Then, using literature accounts and survey results, we identify obstacles to burning in the South and the possible implications for southern fire-dependent wildlife. Finally, we discuss ways to increase both burning on NIPF lands and public support of prescribed burning as a tool to maintain and restore critical non-game wildlife habitats in the South.

North Carolina: a Case Study

Surveys of NIPF Landowners

Seventy-nine percent of North Carolina's forest occurs on NIPF lands (Alig et al. 1990), making it imperative that natural resource managers understand NIPF landowner attitudes related to forest management issues and what factors impact their land-use decisions. In North Carolina, 9% of landowners view wildlife (i.e., hunting and fishing) as a primary goal for owning and managing land, whereas an additional 25% manage their land for timber while protecting the environment or improving wildlife habitat and recreational opportunities (Megalos 2000). However, many North Carolina NIPF landowners neglect management of their forests because they own small tracts, they do not know where to start, or they do not rank forestry as a priority (Megalos 2000). Ninety-one percent of private landowners in North Carolina own tracts <50 acres, but these lands comprise only 28% of the total acres of private lands in North Carolina (Birch 1997).

Table 1.—Prescribed fire frequency on non-industrial private forest lands in the Sandhills of North Carolina (Drake 2000)

Frequency	Sample Size	Percent
Never	847	68.4
1-3 Years	847	9.4
4-6 Years	847	5.0
7-9 Years	847	1.8
³ 10 Years	847	2.8
Never, But Plan To In Future	847	13.1

A survey conducted in the Sandhills region of North Carolina identified reasons NIPF landowners fail to burn (Drake 2000). Of 873 landowners owning ³30 acres, 81.5% had never burned their forests, and 68.4% never plan to burn (Table 1). Fire is a relatively popular management tool in the Sandhills region, meaning that even fewer landowners are likely to burn in other areas of North Carolina. Fear of escaped wildfire (41.5%) was the primary reason most landowners failed to burn, and 29% of those responding did not ever want fire on their property (Table 2). These reasons may be related to liability risks associated with prescribed fire and lack of understanding of the importance of fire in forest and wildlife management. The cost of burning was not included as a choice for landowners and may be an additional inhibitor to burning activities.

Survey of Certified Burners

In an effort to collect additional information on NIPF landowner attitudes related to prescribed fire, we mailed a 5-question survey to 292 burners certified through North Carolina's training program. Currently, most certified burners are employed by the North Carolina Division of Forest Resources, but some work for other state agencies (e.g., North Carolina Wildlife Resources Commission, Corps of Engineers) or conservation organizations (e.g., The Nature Conservancy). Many of these professionals are in contact with NIPF owners and were surmised to have excellent insights into the reasons landowners do or do not burn.

Sixty-four burners responded with partial or complete surveys. In the opinion of the burners, site preparation and fuel hazard reduction were the primary motivations for NIPF owners to burn (Table 3). Conversely, burning to increase biological diversity was an unlikely motivation ranked near the bottom of choices (Table 3). Certified burners ranked liability and smoke management concerns as the first and third most important reasons NIPF landowners fail or hesitate to burn (Table 4). Interestingly, the fear of losing control of a prescribed fire, which was the primary reason NIPF landowners in the Sandhills did not burn, was ranked second out of 11 choices by certified burners (Table 4).

Table 2.—Reasons non-industrial private forest landowners failed to burn their forests in the Sandhills Region, North Carolina (Drake 2000)

Reason for Not Burning	Sample Size	Percent
Worried About Fire Getting Out Of Control	626	41.5
Don't Want Fire On Property	627	29.0
Don't Know Where To Get Assistance	626	22.8
Don't Like the Looks	626	10.7
Developed Area Nearby	626	3.4
Other	626	24.0

Table 3.—Motivation for non-industrial private forest landowners to burn their woodlands in North Carolina, 2000 (scale ranges from -2 to 2: -2 = highly unlikely; -1 = unlikely; 0 = average; 1 = likely; 2 = very likely)

Reasons	Sample Size	Weighted Average (-2 - 2)
Site Preparation	61	1.21
Fuel Hazard Reduction	62	0.92
Hardwood Competition Control	62	0.63
Manage Game Animal Habitat	59	0.57
Aesthetics	62	-0.25
Increase Biological Diversity	62	-0.63
Pine Straw Production	61	-0.73

Certified burners recommended reducing landowner and burner liability, increased cost sharing, and more flexible smoke management guidelines as the government actions most likely to increase the use of prescribed fire on NIPF lands (Table 5). Development of a pro-fire media campaign, which likely would require less political activity than the top four approaches, was ranked fifth (Table 5). Thirty of the 44 burners that responded to a final open-ended question (What would you recommend in a more specific way to increase the use of prescribed fire on NIPF lands?) recommended either a pro-fire media campaign or landowner education programs to improve the general public's understanding and acceptance of prescribed fire.

Discussion

Implications for Wildlife Conservation

With liability and smoke management concerns identified as the primary barriers to burning, the future of prescribed burning, which likely will include equal or greater regulatory and legal restrictions, is uncertain. Increasingly restrictive air-quality guidelines in the future may further discourage NIPF landowner use of fire and may cut short recovery efforts for endangered species like the red-cockaded woodpecker (*Picoides borealis*) (Achtemeier et al. 1998).

Because ecosystems rarely conform to property lines, their maintenance or restoration generally requires coordination among multiple entities, including public land managers and private landowners (Brunson et al. 1996). Although habitat management on private lands is critical to the sustainability of all wildlife species, NIPF lands play an especially prominent role in maintenance of populations of rare and specialized wildlife species (e.g., fire-dependent species). Fifty percent of the country's threatened and endangered species are found only on private lands and an additional 20% spend approximately half of their time on private lands (Hunt 1997). Presently, the diversity of NIPF landowner backgrounds and objectives results in an extremely variable forest landscape across the South (Sheffield and Dickson 1998). Habitat specialists that are dependent upon fire-maintained habitats are especially vulnerable to habitat fragmentation (Hunt 1997). Therefore, the current pattern of constant change in forest condition from one landholding to the next most likely favors generalist wildlife species.

Brennan et al. (1998) predict continuing decline of prescribed burning on NIPF lands and refer to the impending isolation of fire-maintained habitats as an ongoing land use experiment. Such uncertainty does not bode well for fire-dependent wildlife. If suitable habitat

Table 4.—Reasons that best explain why non-industrial private forest landowners hesitate or fail to burn in North Carolina, 2000 (ranked from 1 = major reason to 11 = least important reason)

Reason	Sample	Average
Liability Concerns	61	3.23
Worried About Losing Control (Wildfire)	60	3.60
Smoke Management Concerns	61	3.74
Neighbor's Opposition	61	5.16
Cost	61	5.52
Conflict With Local Development	60	5.75
Limited Burning Days (Weather)	60	6.97
Doesn't Recognize Ecological Value	60	7.05
Doesn't Know Where To Get Help	61	7.56
Fire Line Considerations	61	7.80
Doesn't Like The Looks	61	8.84

Table 5.—Government actions most likely to increase the use of prescribed fire on non-industrial private forest lands in North Carolina, 2000 (ranked from 1 = major action to 7 = least important action)

Reasons	Sample Size	Average
Reduce Landowner Liability	61	3.75
Make Smoke/Fire Regulations More Flexible	61	3.90
Increase Cost Sharing	61	4.11
Reduce Certified Burner Liability	61	4.18
Develop A Pro-fire Media Campaign	61	4.48
Increase Landowner Education On Fire	61	4.62
Increase Direct Professional Assistance	61	4.67
More Proactive State Agencies	61	5.93

is present only as isolated pockets, dispersal by individual animals is limited and viable populations of many species may not be maintained over the long term (Noss 1991). Many fire-dependent wildlife species already are in decline or are listed as threatened or endangered (Brennan et al. 1998). As wildlife habitats are continually lost to population growth and urbanization, it will be imperative that NIPF landowners improve management of their forests for wildlife.

Possible Solutions

The problems confronting prescribed burners across the South are similar to those facing North Carolina's land management professionals. Average private landholding size continues to decline (Birch 1997) and forested tracts are progressively more isolated from one another by urban sprawl. Southern NIPF landowners increasingly are urban and absentee and have multiple management objectives (Boyce et al. 1986; Izlar 2000). Frequent changes in parcel ownership inhibit formation of productive relationships between local professionals and landowners and make aggressive marketing of state cost-share and assistance programs imperative. Smoke management regulations and tort liability add fuel to the problem by helping to deter NIPF landowners that otherwise might consider fire as a management tool (Brennan et al. 1998; Izlar 2000).

Southern resource professionals and landowners agree that liability concerns and increasingly restrictive air quality and smoke management guidelines are the greatest barriers to prescribed burning. Many southern states, including North Carolina, have passed legislation that in combination with certified burner training helps reduce burner liability (Achtemeier et al. 1998). Further

reduction of burner liability may be unrealistic for accountability and legal reasons. Rather, legislators, resource managers, stakeholders and the Environmental Protection Agency should work jointly on legislation to exempt prescribed fire smoke emissions from air quality standards developed to reduce emissions from cars and industrial smokestacks. Additionally, continuing education and updates on new technologies (e.g., fire behavior models, weather prediction models and risk indices) should lessen the chance of negligent decisions by burners while widening the prescription window and increasing the number of acceptable burning days (Johnson 1984; Lavdas 1996; Achtemeier et al. 1998).

Divisions within and among agencies often arise between those who suppress fire and those who use it (Johnson 1984). To eliminate this dichotomy, the heads of state agencies must cooperatively lead a more proactive approach in marketing the benefits of prescribed fire to those that oppose it and budgeting sufficient resources to support prescribed burning efforts. Furthermore, the formation of a prescribed burning task force in every southern state would allow transfer of current information among resource professionals from different agencies and organizations while promoting constructive discussions on the current limitations (e.g., air quality guidelines) to use of prescribed fire on NIPF lands. Task force partners should include employees of the state agency in charge of fire suppression, members of the state wildlife agency including both game and non-game biologists, local Environmental Protection Agency (EPA) staff, legislators, and other stakeholders.

Adequate information pertaining to the cost effectiveness of prescribed burning is not available (Hesseln 2000). Recent research on the economic income forgone as a result of declining populations of fire-dependent species, such as the northern bobwhite (e.g., Burger et al. 1999), is a step in the right direction. Most research on the cost effectiveness of prescribed burning, however, has focused on the economic costs of burning (e.g., cost per acre) while failing to address social costs (e.g., costs derived from the inconvenience of smoke emissions), economic benefits (both market and nonmarket), and risk (Hesseln 2000). The long-term benefits of prescribed burning, including reduced risk of catastrophic wildfire, increased forage and habitat quality for wildlife, and enhanced biodiversity, may exceed short-term costs like reduced air quality, decreased aesthetics, risk of escape, and inconvenience from smoke (Hesseln 2000). However, without research and documentation of its financial efficacy, large-scale use of prescribed fire will be difficult to market to NIPF landowners and the general public. Such analyses would aid government in defining appropriate funding levels for support of prescribed burning (Hesseln 2000) and determining the merit of alternative management styles like fire suppression.

Natural resources historically have been undervalued (McNeely 1992). Similarly, there are significantly more disincentives than incentives for NIPF landowner use of fire. New financial incentives will be required to offset costs to landowners not currently using prescribed fire and to help state agencies, already short on money and manpower, meet increased demands for burning. Expanded cost-share programs (e.g., free firelines) can aid resource-limited landowners wishing to burn. Larger support budgets for professional assistance would provide the resources (e.g., on-site equipment, burning crews available 7 days/week and manpower to oversee permit approval) necessary to meet anticipated demands. If budgets are limited, cost-share programs and professional assistance could be prioritized to fund only burns that improve wildlife habitat or expand ecosystem restoration projects. Hazard reduction would be indirectly achieved on these lands. The creation of the longleaf pine ecosystem Conservation Priority Area under the Conservation Reserve Program (CRP) is an example of cost-share program that indirectly increases the demand for prescribed fire. Landowners receiving financial assistance for reestablishment of longleaf pine forests are more likely to use prescribed fire as a management tool, and, in the case of CRP landowners, will be required to use fire to remain eligible for program payments and benefits.

Forest management plans offer plan writers the opportunity to interact with landowners and discuss sustainable resource management alternatives, including the use of prescribed fire (Megalos 2000). Proponents of prescribed fire from state land grant universities or conservation organizations could work with consultants, state foresters, and other plan writers to encourage the use of prescribed fire. Government support of professional assistance programs, such as the Forest Stewardship Program, may help increase the number of NIPF landowners with management plans, while indirectly increasing the number of landowners burning their forests.

Increasing the use of prescribed fire on small NIPF lands or on forests within the urban-rural interface will be difficult. Owners of large forested tracts are most likely to use governmental cost-share money and public or private technical assistance (Franklin 1990). These landowners also are more likely to have a written management plan for their forests than owners of small parcels (Birch 1997). NIPF landowners with small acreages often have non-traditional management objectives (e.g., non-game management, aesthetic improvement) and generally own lands nearer to urban areas where neighbor opposition to fire is common. Owners of forested lands in the urban-rural interface may prefer a less-intensive, preservationist approach to land management.

Although small NIPF landholdings may contribute little to large-scale restoration of fire-dependent ecosystems,

informing these landowners of the benefits of prescribed fire through extension education may improve the potential for future burning on public and larger private lands (Cortner et al. 1984; Taylor and Daniel 1984). In North Carolina, 42% of forest ownerships are between 20-100 acres (Birch 1987), making small tracts a necessary part of pro-fire programs. All voters and taxpayers, whether they own forestland or not, can influence fire-related policy, therefore they also should be targeted in outreach efforts. Workshops, bulletins, on-site visits, and land management demonstrations, traditionally administered by Cooperative Extension Service agents and specialists, should play a significant role in improving public understanding of fire-related issues. Many landowners agree to use of specific land management practices only after they have seen successful demonstrations (Brunson et al. 1996). Cooperative Extension provides a well-established link for information transfer among land grant universities, government agencies, and NIPF landowners across the South. Using modern technology, including the Worldwide Web and two-way video-teleconferences, foresters and wildlife biologists can reach a greater number of landowners more quickly and efficiently than ever (Bardon et al. 2000).

Public education pertaining to prescribed fire should focus on America's youth. Children generally are more open-minded than adults and are starved for new information on environmental issues. However, many live in urban areas and will be exposed to fire only through their classroom studies or what is seen on television. Proven environmental education programs offer a balanced, science-based source of information on the pros and cons of prescribed fire. Several existing environmental education curricula, including Project Wild and Project Learning Tree, contain activities related to fire ecology. Many conservation organizations and government agencies have completed or are in the process of developing similar programs. Natural resource professionals must aid environmental educators in distributing and teaching a proactive prescribed burning educational message in classrooms across the South.

Ultimately, television and news media must be used to balance the public's fear or dislike of fire with its positive effects. On-site telecasts, performed during a prescribed fire, could provide a dramatic background to capture viewer attention and allow burners the opportunity to discuss fire-related issues. Furthermore, an aggressive, pro-fire media campaign could help generate support for increased state agency burning budgets, exemptions to air quality guidelines, and legislation to reduce landowner and burner liability. Like firefighters, prescribed burners should be portrayed as heroes rather than villains (Murphy and Cole 1998). The old fire suppression message should be complemented with a new message relayed by new characters (e.g., Torchin' "Tom" Turkey and Burnin' "Bob"white) that promotes the use of prescribed fire for fuel hazard reduction, wildlife habitat improvement, and ecosystem restoration.

With the increasing popularity of herbicides, private industrial landowners continue to diminish the use of prescribed fire on their forestlands (Brennan et al. 1998). Herbicides applied for weed control and site preparation sufficiently fireproof plantations, and burning counters the value of industry's frequent fertilizations unless conducted ³3 years after application (Gerhardt 2000). Similar to NIPF landowners, industry foresters avoid prescribed fire because of smoke management and liability concerns (Gerhardt 2000). More importantly, forest industry's approach to pine silviculture often is adopted by local NIPF landowners and forestry consultants. Herbicides often are portrayed as valuable wildlife habitat management tools and adequate substitutes for fire (Brennan et al. 1998). Rather, herbicides are a potential complement to fire when habitat management is a primary objective (Brennan et al. 1998; Brockway and Outcalt 2000). We believe forest industry should include the use of fire on NIPF lands as an option in their landowner assistance programs and maintain parcels of burned forests within corporate landholdings. Judicious use of fire can be proof positive of their commitment to plant and wildlife diversity.

As advances in the use of prescribed fire continue, resource managers must sell its comprehensive value to each and every NIPF landowner. Aldo Leopold (1949) criticized conservationists' tendency to apply economic value to all things endangered rather than justify conservation of species as a "biotic right". Similarly, we question threats of potential wildfire as the primary mode to encourage private landowners to use prescribed fire. Why not sell prescribed fire based on its ecological values in addition to its role in fuel hazard reduction? The more scientific information that can be provided about the consequences of using or suppressing fire, the better the general public's political and social decisions will be regarding the use of prescribed fire (Van Lear 2000).

Prescribed burning on NIPF lands could significantly aid restoration and maintenance of fire-dependent plant communities and the wildlife therein while concurrently reducing hazardous fuel loads. However, burning must be conducted frequently and during the right times of year. As ownership tenure shortens and as tract sizes lessens and becomes more fragmented, proper use of prescribed fire as a wildlife management tool will become increasingly difficult. Overcoming the multitude of barriers to use of fire will require a joint effort by all those that will benefit, including the general public. We feel large-scale, collaborative efforts to educate the pubic and use of new predictive technologies to reduce risk of escaped fire are the most effective and efficient means to increase burning on NIPF lands in the Southeast.

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