Prescribed Burning in the South: Trends, Purpose, and Barriers

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ABSTRACT: *The results of a survey of fire management officials concerning historical and projected prescribed burning activity in the South is reported. Prescribed burning programs on USDA Forest Service and private and state-owned lands are described in terms of area burned by ownership and state, intended resource benefits, barriers to expanded burning, and optimum burning area needed to achieve resource management goals. More than 4.1 million ac/yr of pine-type forest were burned between 1985 and 1994, about 6.5% of the area in pine-type forest per year. South. J. Appl. For. 25(4):149–153.*

Key Words: Air quality, endangered species, hazard reduction, ecosystem management, reforestation.

Prescribed burning is a valuable silvicultural tool that has been well accepted by professional forest managers. More than 4.1 million ac/yr of pine-type forest were burned between 1985 and 1994 in the South, about 6.5% of the area in pine-type forest per year. However, despite its ecological and protection benefits, the use of prescribed fire is increasingly subject to constraints such as urban expansion, air quality and other environmental regulations, and liability for smoke intrusions and escaped fires (Craig 1990, Mobley 1990, Cleaves and Haines 1997). The objective of our study was to assess prescribed burning programs on USDA Forest Service and private and state-owned lands in the South.[1] Annual area and trends in burning for two types of prescribed fire—slash reduction(for site preparation or other postharvest management activity) and underburning of natural fuels beneath an existing overstory, are reported. Forest managers' purposes for burning, barriers to increased burning, and future levels of burning, needed to meet forest management goals are also assessed.

Methods

A questionnaire was mailed to the forest supervisor of each national forest in the South and one representative from each of the 12 southern states' forestry agencies asking them to characterize their respective prescribed burning programs. The questionnaire was reviewed by USDA Forest Service regional fuels managers nationwide prior to distribution to survey respondents in the South.

National forest questionnaires were completed by the national forest fuels management officers. The Ouachita National Forest responses were completed by each of the districts in Oklahoma and Arkansas which we aggregated for the two states response statistics. Otherwise, the forest supervisors distributed the surveys based on their forest's administrative structure. In some cases, forest supervisors distributed the surveys to districts. In others, the fuels manager completed the questionnaires for two national forests which are located within the same state and share the same supervisor's office. National forest fuels managers obtained data from internal prescribed fire activity reports—such as annual prescribed burning accomplishment reports, project work plans, and regional prescribed fire activity reports; some responses were based on personal knowledge.

State agency officials reported data for private and state-owned land. Fuels managers' response data were based on permit and landowner assistance records and personal knowledge. In three states, where data for burning on private lands were not available from the state agencies, telephone contacts were made with prominent industrial and nonindustrial private forest (NIPF) landowners to arrive at an estimate that could be extrapolated.

Survey respondents were asked to provide estimates for the following variables: (1) the average burned area over the period 1985–1994 for two burn types—slash reduction and natural fuels underburning; (2) major intended resource benefits for burning —rated on a scale of importance from 0 (no importance) to 5 (highest importance); (3) historic trends

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[1] Southern states include Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

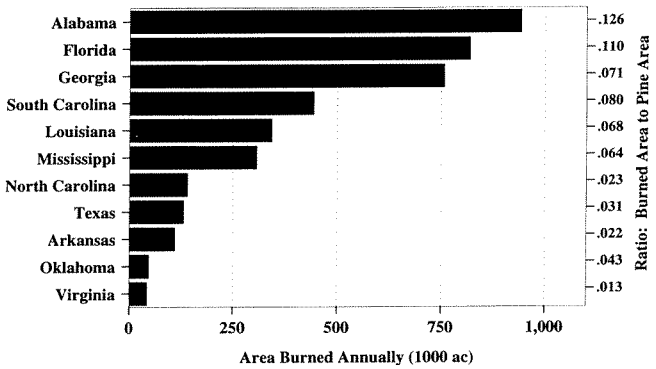

Figure 1. Average annual forestland area burned and ratio of burned area to pine area by state for all ownerships, 1985–1994.

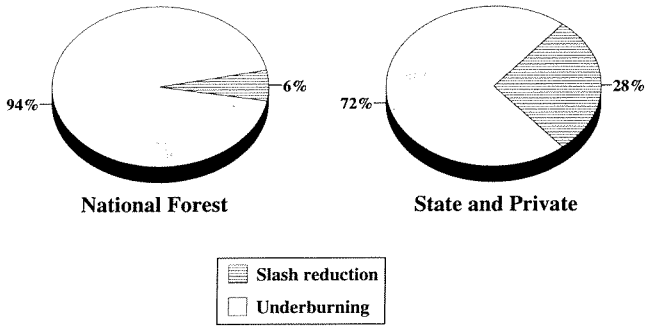

Figure 2. Percent of total area burned annually by ownership and purpose of burn, 1985–1994.

(1985–1994) and expected trends (1994–2004) in burning by burn type; (4) barriers to expanding the use of prescribed fire—rated by importance on a scale of importance from 0 to 5; and (5) annual area of prescribed burning needed to achieve management goals. The response data for variables one through four from each state was weighted by that state's proportion of the total southwide burned area.

Results and Discussion

Activity Levels

Of the reported 4.1 million ac burned on average annually in the 12 southern states, approximately 12% was on national forest lands and 88% on state and private lands. Prescribed burning in four states, Alabama, Florida, Georgia, and South Carolina, comprised 70% of the Southwide area (Figure 1).

A ratio of burned area to the area in pine-type forest was computed for each state based on the state's total area in pine-type forests[2] and the total of the annual area burned as reported by the national forests and state agency officials in each state. The ratio ranged from 0.013 in Virginia to 0.126 in Alabama (Figure 1). Higher burn proportions occurred in the southern Coastal Plain states, Alabama, Florida, Georgia, South Carolina, Louisiana, and Mississippi, where topography and forest resource conditions are most conducive for prescribed burning.

On national forest lands, underburning of natural fuels comprised about 94% of the area burned annually; only 6% of burning was conducted for slash reduction (Figure 2). On private and state lands, about 72% of the area burned was for underburning of natural fuels and 28% slash reduction. Because clearcutting is seldom practiced on national forests in the South and softwood harvest levels have greatly decreased (from 1,162,384 MBF in 1987 to 695,623 MBF in 1994[3]), it is understandable that the national forests reported proportionally smaller slash burn areas. In addition, the prominence of nontimber resources enhanced by fire as a natural ecosystem process, such as longleaf pine restoration and threatened and endangered species would favor more underburning on national forest lands.

[2] USDA Forest Service, Forest Inventory Statistical Reports for each southern state published by the Southern Forest Experiment Station, Asheville, NC.

[3] USDA Forest Service's annual Cut and Sold Reports (internal document).

From 1985–1994, the Forest Service burned about 12% of its pine-type forestland annually. On private and state lands, only about 6% of the pine-type area was burned each year. Furthermore, based on our state respondents' estimates for area burned for NIPF and industrial ownerships and the USDA Forest Service statistics for area in pine-type forest for the two ownership classes, the ratio of burned area to pine-type area was determined. Industrial landowners burned 2.5 times the rate of NIPF owners across the South; 9% and 3.5%, respectively.[4]

Historical Trends in Prescribed Burning Activity

Because we did not have year-to-year data, we asked respondents to estimate the historical trend for burning over the 10 yr period (1985–1994) for the two burn types—slash reduction and natural fuels underburning; whether burning levels had increased, decreased, or remained constant. On national forest lands, 71% of fuels managers reported an increased use of underburning; conversely, 66% reported a decreasing trend in slash reduction burning (Table 1). On private and state lands, trends for both types of burns were fairly constant. About 66% of fuels managers reported that natural fuels underburning was at the same level over the survey period; 58% reported that the area for slash reduction burning had remained constant. Differences in trends in burning for the two ownership categories may be a result of changes in the mix of intended purposes for burning. As

Table 1. Historical trends in prescribed burning levels as reported by state agencies for state and private lands, and national forest fire managers for national forest lands in the South, 1985–1994, weighted by area.

	Burning purpose			
	Slash reduction		Natural fuels underburning	
Trend	State and private forests (n = 12)	National forests (n = 13)	State and private forests (n = 12)	National forests (n = 13)
	(% response)*			
Increasing	25	36	14	71
Decreasing	17	63	20	8
No change	58	1	66	21

* Weighted average based upon area burned.

[4] Excluding areas burned in Florida; state agency officials could not break out separate statistics for state, industrial, and other private lands or provide estimates.

Table 2. Resources benefiting from prescribed burning as identified by importance ratings (0 = no importance and 5 - highest importance) by fire managers in the South, 1985–1994.

State and private forests (n = 12)		National forests (n = 13)	
Resource benefit	Average rating	Resource benefit	Average rating
Hazard reduction	4.42	Hazard reduction	4.94
Reforestation	4.20	Threatened and endangered species	4.92
Vegetation control in established stands	4.03	Game birds and animals	3.72
Game birds and animals	3.70	Reintroduction of fire—ecosystem management	3.12
Nongame wildlife	2.68	Reforestation	2.60
Threatened and endangered species	2.63	Vegetation control in established stands	2.60
Pest protection	2.31	Nongame wildlife	1.84
Reintroduction of fire—ecosystem management	2.27	Pest protection	1.42
Grazing	2.01	Grazing	1.35

previously discussed, the decline in timber harvesting over the survey period could explain the decrease in slash reduction burning on Forest Service lands. Furthermore, the USDA Forest Service survey respondents' comments indicated that the increases in the use of natural fuels underburning on national forest lands reflects the Forest Service's management objective for increased emphasis on longleaf pine ecosystem management and threatened and endangered species habitat management. Private and state lands have not experienced the shifting in purposes for burning that has been occurring on national forest lands. However, a shift from prescribed burning on some industry lands to alternative silvicultural treatments as a result of changing management regimes was reported in one state agency respondents comments.

Resource Management Objectives

The agency representatives surveyed rated nine factors for their importance as resource management objectives from 0 to 5. Resource benefits included hazard reduction, reforestation, vegetation control, habitat enhancement for nongame wildlife, threatened and endangered species, and game bird and animals; insect and disease protection, grazing, and reintroduction of fire into the ecosystem. Hazardous fuels reduction was the highest rated objective for both national forest and private and state lands (Table 2). Game bird and animal habitat management were the third and fourth ranked purpose on national forest and private and state lands, respectively. Other than high ratings for these two purposes, the two ownership categories were more diverse in their purposes. Threatened and endangered species management and the reintroduction of fire into the ecosystem, the second and fourth most important purposes for burning on the national forest, were only of moderate importance for state and private ownerships. Conversely, reforestation and vegetation control, the second and third most important purposes on private and state lands, were only moderately important on national forest lands. The relative importance of burning for these purposes reflects the prominence of private landowners' timber production and harvesting objectives. Prescribed burning for insect and disease control and for grazing enhancement were of low importance in both ownership categories.

Anticipated Future Levels of Prescribed Burning

Survey respondents estimated future trends in burning for the period 1995–2004 for the two burn types by distributing 100 percentage points across three possible categories: "increased burning," "decreased burning," or "the same level of burning" based on the respondents' estimate of the likelihood of each trend. On private and state lands, the expectation for slash reduction burning was about equally split among the three trends; underburning was considered slightly (10 points) more likely to decrease than to increase or remain the same (Table 3).

On national forest lands, slash reduction burning had more than a 50% likelihood of decreasing; while respondents felt very strongly that natural fuels underburning would increase, with a likelihood of 78%. Thus, the shift in burning purposes—from postharvest slash management to fire-dependent ecosystem management and threatened and endangered species habitat improvement is expected to continue. A shift from burning for game habitat management to managing for threatened and endangered species, with an increasing emphasis on plant species recovery was anticipated in the future by several national forest respondents in their comments.

Barriers to Increased Prescribed Burning

Respondents rated 14 factors for their importance as barriers to the expanding the use of prescribed burning. These barriers included: (1) negative public opinion, (2) close proximity of residential development, (3) planning costs, (4)

Table 3. Predicted trends in prescribed burning levels as reported by state agencies for state and private lands, and national forest fire managers for national forest lands in the South, 1995–2004, weighted by area.

	Burning purpose			
	Slash reduction		Natural fuels underburning	
Trend	State and private forests (n = 12)	National forests (n = 13)	State and private forests (n = 12)	National forests (n = 13)
	(% response)*			
Increasing	31	20	33	78
Decreasing	35	55	43	7
No change	34	25	24	15

* Weighted average based upon area burned.

Table 4. Barriers to increased burning as identified by importance ratings (0 = no importance and 5 - highest importance) by fire managers in the South, 1985–1994.

State and private forests (n = 12)		National forests (n = 13)	
Barrier	Average rating	Barrier	Average rating
Public opinion	4.65	Air quality and smoke regulations	4.71
Risk of liability	4.54	Shortage of personnel	4.70
Air quality and smoke regulations	4.12	Risk of liability	3.91
Residential development	4.08	Narrow time frame in which prescribed burning is possible	3.45
Cost limitations	3.87	Lack of funding	3.42
Narrow time frame in which prescribed burning is possible	3.57	Residential development	3.06
Insurance availability	2.83	Public opinion	2.70
Shortages of personnel	2.79	Cost limitations	1.78
Lack of funding	2.65	Heavy fuel loading	1.53
Environmental regulations, not including air quality	2.58	Management policies that discourage risk taking	1.52
Heavy fuel loading	2.34	Environmental regulations, not including air quality	1.48
Management policies that discourage risk taking	2.33	Not certain about the benefits of prescribed burning	0.44
Alternative silvicultural methods are preferred	1.80	Alternative silvicultural methods are preferred	0.29
Not certain about the benefits of prescribed burning	0.86	Insurance availability	0.07

funding limitations, (5) availability of alternative silvicultural tools, (6) air quality and smoke management laws, (7) other environmental laws—excluding air quality and smoke management, (8) risk of liability for smoke intrusions and escaped fires, (9) high cost or lack of insurance availability, (10) agency or company policies that are risk-averse, (11) lack of qualified professionals and technicians, (12) excessive fuel loading, (13) a narrow prescription window for conducting burns, and (14) uncertainty about burning as an effect fuels management practice.

Two barriers, air quality and smoke management laws and risk of liability, were among the four most highly rated barriers by both the national forest and state fuels managers (Table 4). Negative public opinion and residential development in close proximity to areas in need of burning were among the top four barriers on state and private ownerships. On national forest lands, the shortage of qualified personnel was the second most important barrier. A narrow available burning window and inadequate funding were also highly rated barriers on national forest lands.

Comments provided by USDA Forest Service respondents provided additional insight regarding barriers to burning. A "Catch-22" situation was reported in some states due to a clash between USDA Forest Service burning objectives and state prescribed burning guidelines. For example, an objective of the USDA Forest Service fire program is to restore habitat for the red-cockaded woodpecker; however, smoke management guidelines are limiting managers' ability to approach their goals in some states. In addition, USDA Forest Service respondents comments included specific fire–related cost barriers for monitoring burns, conducting archeological surveys, and training employees. State agency respondents comments included the concern that liability issues and public perception are limiting private landowners willingness to burn (more so than on government-owned lands).

Desired Levels of Prescribed Burning

Fuels managers were asked to estimate the annual area that should be burned to achieve their goals based on the mix of resource management purposes described in the survey. The Forest Service burned about 63% of the fuels managers self-described optimum targets compared to 48% on private and state lands.

Projected prescribed fire treatment needed to achieve managers' goals on Forest Service lands was about 750,000 ac/yr. On private and state lands, nearly 7.5 million ac/yr would be burned.

Implications and Opportunities

The Forest Service fuel management budget increased from an average of about $10.5 million from 1985 to 1994 to $70 million in 2000.[5] Without fiscal constraints expected by the respondents, the Forest Service's goal of burning 750,000 ac annually in the South may be more feasible than respondents anticipate. Furthermore, this goal will likely be more attainable if funding is used to recruit and train qualified personnel; the second most important barrier to burning identified by national forest respondents. In fact, since 1997, fuels treatment (primarily prescribed fire) on national forests in the South has approached this goal; fuels treatment accomplishments have risen to 700,000 ac/yr. However, it is unclear to what extent burning levels can continue to increase or be maintained in light of other barriers such as regulatory and liability constraints, residential development, and narrow prescription windows for burning. Respondents comments indicated that these barriers were severe enough in some state's national forests as to diminish the likelihood of achieving managers' prescribed burning goals.

[5] Annual budget data from USDA Forest Service internal reports (Washington DC.).

Survey results indicate that there is a great unmet need for increased burning on state and private lands. State agency fuels managers reported that 7.5 million ac/yr; more than twice current burning levels, should be burned. State holdings comprise only a fraction of the pine-type forest in the South; therefore, activity on these lands would have little impact on the total state and private burning program. Furthermore, burning on industrial lands appears to be fairly aggressive; 2.5 times the rate of burning (burned area per pine-type area) on NIPF lands. In addition, the NIPF area in pine-type forest is almost twice that of industry holdings and ten times the pine-type area in the national forest.

Several factors may explain the gap for prescribed fire treatment on NIPF lands. State agency assistance is particularly important in areas where contractors are not available or willing to conduct prescribed burns. In some states, program funding is insufficient to adequately provide landowner assistance for burning. In other states, agency policies limit landowner assistance to burn plan development, plowing firelines and/or providing emergency equipment on site in the event of a fire escape; agency personnel will not execute the burn for the landowner. In addition, according to survey respondents, liability for escaped fires and smoke and public acceptance are also highly important influences to burning on NIPF lands.

Future research should more fully explore the social, legal, and economic barriers to prescribed burning identified by survey respondents. In addition, better data is needed to fully characterize the use of prescribed fire in the South. Some respondents did not have complete records for burned area over the survey period and in some states, ownership class was not a component included in their records. A uniform, comprehensive system of data collection for burned area, resource management targets, and other elements of burning would facilitate progress on national goals for fire protection and identification of treatment opportunities.

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