

INSTITUTIONAL HISTORY OF PRESCRIBED FIRE IN THE FLORIDA DIVISION OF FORESTRY: LESSONS FROM THE PAST, DIRECTIONS FOR THE FUTURE

E. Dennis Hardin¹

Florida Division of Forestry, Department of Agriculture and Consumer Services, 3125 Conner Boulevard, Tallahassee, FL 32399-1650, USA

ABSTRACT

As landscapes are protected for conservation through public ownership or by agreement, there may be some benefit to the study of how public land managing agencies address questions and concerns about increasing prescribed fire responsibilities. The Florida Division of Forestry began managing public land in 1934. With the advent of Florida's active conservation land acquisition programs in 1980s, the state forest system more than tripled in size. Extant historical prescribed fire data at the state forest level includes acres planned and accomplished and acres of wildfire for each year since 1982. A recent effort to map potential natural vegetation on the state forests suggests that about 70% of these acres should be managed with prescribed fire to achieve desired future conditions. Consideration of preferred fire return intervals in various upland ecosystem types suggests that expected prescribed fire goals for 2007 should be between 189,606 acres (76,731 ha) and 485,398 acres (196,434 ha), up from between 70,896 acres (28,691 ha) and 198,599 acres (80,370 ha) in 1982. This rapid increase in prescribed fire responsibility brings many operational, logistical, and social challenges to a public conservation institution. Prescribed burning is shifting from the use of traditional, more experiential methods to those more characteristic of adaptive management. Internal reviews have been successfully used to promote communication and cooperation among multifunctional staff and to address such issues as accountability, tree mortality, training, equipment usage, planning, and post-burn evaluations. Examination of long-term trends at the unit and institutional level are critical to determining the effectiveness of prescribed fire programs. The long-term data show that, with the cessation of private management following public land acquisition, there is a variable lag time until staffing and planning levels reach the point where prescribed burning can resume; a time during which fuels continue to accumulate. This lag time may also be due to other reasons, including the fire management history under the previous owner. Analysis of these data show where particular units need to increase planning goals, where underperforming units are more susceptible to wildfire, and where overall accomplishments can be increased by increasing the area burned in certain months. The movement of highly motivated individuals within the system has a significant impact on accomplishment of prescribed fire objectives. Historical data at these levels have been used to develop institutional policies that have begun to increase the level of planning and accomplishments, and decrease the lag time for new properties. The next steps of assessing our initial post-burn evaluation project and of developing stand-specific desired future conditions, objectives, and prescriptions will help to continue this process.

Keywords: adaptive management, fire history, fire return interval, Florida, natural communities, planning, policy, state forests.

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INTRODUCTION

The Florida Division of Forestry (DOF) or its predecessor, the Florida Board of Forestry, has been managing fire-maintained ecosystems on public land since 1934. The amount of land in the state forest system was relatively stable until 1982, when lands acquired under Florida's several conservation land acquisition programs began to enter the state forest system for management. Over the subsequent 25 years the state forest system more than tripled in size (Figure 1).

Traditionally, the approach to fire management in DOF involved conventional wisdom and response to external social and political pressure (Johnson 1999). Managers relied on historical knowledge of their situation and resources, and conducted fire management as it had been done in the past on the property. Managers were also influenced by pressures to burn or not burn from surrounding neighbors and user groups, such as hunters.

The growth of the state forest system and a major drought led to many questions and concerns by DOF staff about the

impacts of these changes on prescribed burning. There were also questions about the number of acres that should be prescribed burned, the seasonal aspects of prescribed burning, whether all appropriate stands and units were being burned, and whether or not the appropriate fire return intervals for different forest types were being used. The DOF is now in the process of shifting from a purely traditional approach to one based more on adaptive management.

This paper describes and evaluates key actions taken by a large state land management agency in response to rapid increases in state land holdings and associated prescribed burning responsibilities. The approach was to synthesize information from recent planning meetings, wildfire and prescribed fire records, and efforts to develop desired future conditions. Potential directions in the agency's response to its new management challenges are discussed.

STUDY AREA

The DOF is part of the Florida Department of Agriculture and Consumer Services under an elected Commissioner of Agriculture. The Commissioner, the State Attorney General,

¹ Corresponding author (hardind@doacs.state.fl.us).

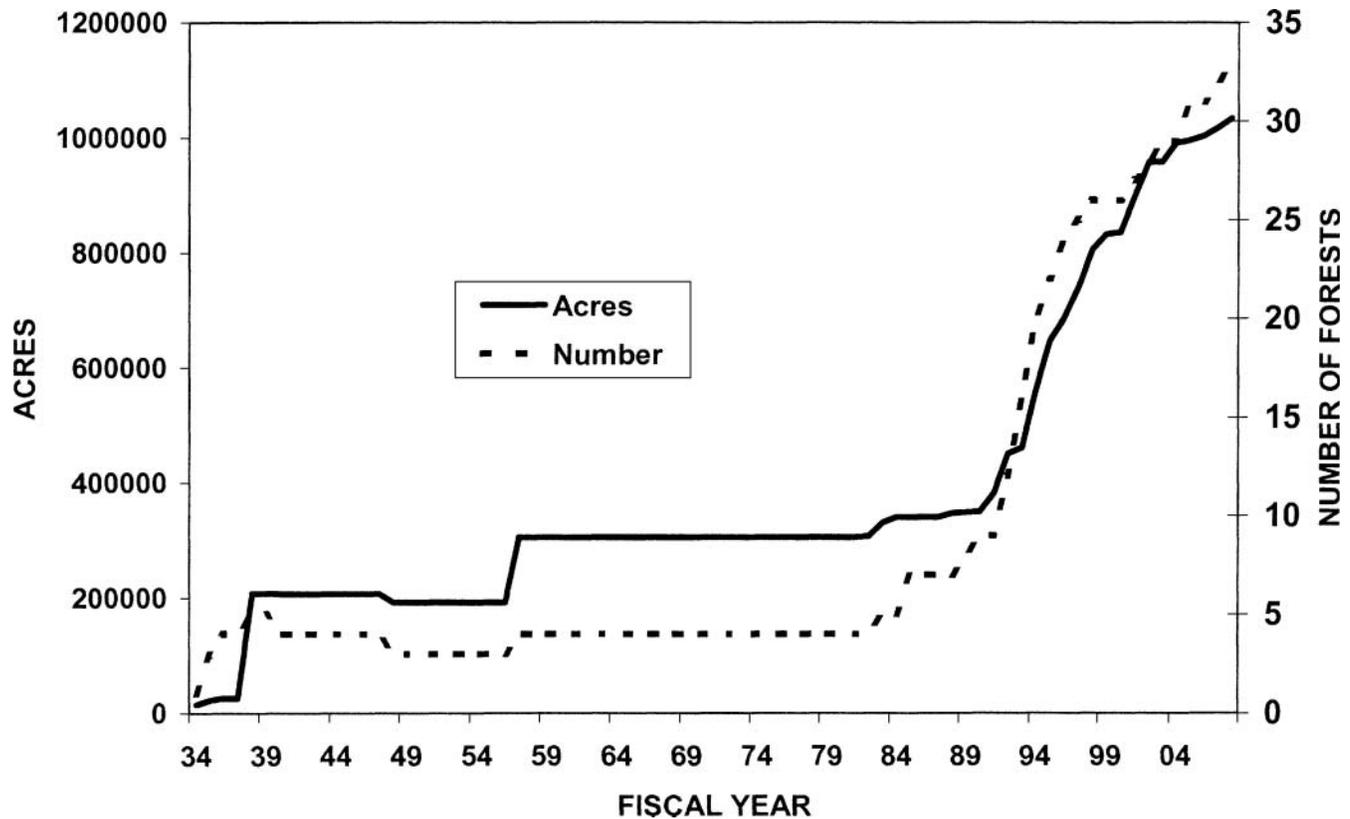


Figure 1. Annual change in the number of Florida state forests and the total size of the state forest system (in acres) in Florida, 1934–2008. The numbers used are those at the start of the fiscal year.

the Chief Financial Officer, and the Governor compose the Cabinet and serve as the Trustees of the Internal Improvement Trust Fund and the Land Acquisition Trust Fund overseeing all state land acquisition and management.

The current mission of the DOF is to “Protect Florida and its people from the dangers of wildland fire and manage the forest resources through a stewardship ethic to assure they are available for future generations.” The DOF has three core programs—wildfire prevention and suppression, private landowner assistance, and state lands management—all under a Director, the State Forester. The wildfire program provides training in wildfire suppression and prescribed burning and is involved statewide with wildfire prevention, detection, and suppression. The private lands program is carried out by 42 County Foresters who provide Cooperative Forestry Assistance for private landowners in Florida’s 67 counties. The public lands program manages 34 state forests and provides silvicultural expertise to other public land managing agencies.

State-level bureaus provide program development, technical assistance, long-term planning, and leadership and budgeting, while field units are responsible for program implementation. The field units participate in long-term planning and develop shorter term (1- to 5-year) operational plans. Most field units have a Resource section of foresters, biologists, park rangers, and administrators who are responsible for developing and monitoring the detailed plans of timber, ecological, and prescribed burning and recreational programs. The companion Operations section of forest area

supervisors and forest rangers is responsible for implementing or assisting in the implementation of these programs. Prescribed fire planning takes place in the field units, where priorities are assigned to burn units based on experience, ecosystem fire cycles, timber sales, restoration, and other factors. Burn units are assigned to appropriate supervisors. The Resource section typically fills out that portion of the burn prescription which includes the unit description, burn objectives, firing techniques, smoke screening, and other sections. The Operations section may also be involved in these sections and typically fills out the remainder of the prescription, which includes preferred and actual weather conditions along with the burn and crew briefing checklists. Operations staff then prepare the units and implement the burn. Burn evaluations, not a traditional part of the process, have been assigned to the Resource staff.

METHODS

Internal Review

Following the preparation of a preliminary internal report by the author on prescribed burning in DOF, two internal review meetings were held to collect input from program participants within DOF. The first of these, in September 2000, consisted of upper level managers from the state office bureaus and some field units. This meeting asked such questions as: How can we meet needed burning goals with existing resources? Is there too much pressure to meet

prescribed burning quotas? Are we losing too much timber? When should we stop burning during droughts? Are we doing the right amount of lightning-season burning? Are existing Prescribed Fire Standards still satisfactory?

In October 2000, a second meeting on prescribed burning within DOF was held during an annual meeting of state forest management field staff. This meeting focused on three questions: What has been going well? What needs improvement? What support do you need to get the job done?

In October 2002, a follow-up group was established to review historical prescribed fire data, discuss recommendations, and review comments from the previous meetings. A set of recommendations to the Director was developed, resulting in the preparation of a white paper, *Prescribed Fire on Florida State Forests*, that was presented to the inter-agency land Acquisition and Restoration Council in the spring of 2003. This council oversees land acquisition and management on behalf of the Board of Trustees.

Historical Prescribed Fire Data

Prescribed fire data were compiled by the author beginning in 1999 from archived monthly, quarterly, and annual accomplishment reports submitted by the state forests to the Forest Management Bureau. These data extended back to 1982 and provided the number of acres planned for prescribed fire on an annual (fiscal year) basis, as well as the acreage of prescribed fire actually accomplished and the acreage of wildfires. These data were used to track prescribed burning planning and accomplishments in relation to changes in acreage in order to evaluate performance of the prescribed fire program over time. Analyses of these data were conducted for both the state forest system as a whole and for each individual state forest. The total acreage has changed frequently for some state forests. Thus, the number of acres for state forest size herein is the number of acres at the start of each fiscal year, which should also be the number of acres subjected to annual prescribed fire planning.

Historical Vegetation Data

In 2002, a 5-year project to map vegetation types on all state forests began with the goal of comparing potential natural vegetation to existing conditions so that stand-level desired future conditions and burn plans could be developed. The Florida Natural Areas Inventory (FNAI) located the oldest aerial photographs for each state forest and used them to map polygons of natural communities (ecosystems) into a Geographical Information System. A map of current conditions was developed from the most recent aerial photographs or from forest inventories gathered by DOF. Both maps were validated by field surveys. An accompanying report for each state forest provided natural community descriptions written as general desired future conditions, including recommended fire return intervals based on literature reviewed by FNAI with input from DOF staff. All of these data have been used to develop desired future condition descriptions for each natural community type and associated generalized prescriptions to achieve those conditions depending on current conditions.

RESULTS

Internal Review

The internal review meetings resulted in recommendations for immediate action, issues that needed to be resolved by a follow-up group, existing policies and practices that needed clarification, and research needs. An important recommendation was to give the state forest prescribed burning program a higher priority by ensuring that field units make planning, execution, and monitoring of prescribed fire their highest state forest management priority. A second recommendation was to increase prescribed burning capacity by utilizing and participating in both interagency and intra-agency prescribed fire strike teams, by using all-terrain vehicles more efficiently, by increasing night burning, and by better coordinating helicopter use. Other recommendations included increasing the availability of training, recovering the full cost of contract burning for other agencies and organizations, and continuing enhancement of prescribed fire public awareness programs.

The meetings identified the need to better determine the importance and causes of tree mortality related to prescribed burning, as well as acceptable levels of crown scorch and mortality, for communication with managers. A clear set of guidelines for when to shut down prescribed burning based on such factors as drought, insects, and smoke management was needed. Revisions to the statewide Fire Weather Standards were proposed to make them adaptable for specific regions. The need for development of more quantitative methods for setting prescribed fire objectives and for evaluating fire effects was identified. Participants also recommended confirmation that the "limited action" approach to wildfires was acceptable under certain conditions, but acreage thus burned would not count as prescribed burning.

Historical Prescribed Fire Data

Existing data from 1982 to 1994 showed relatively stable levels of planning ($80,221 \pm 6,474$ acres [$32,464 \pm 2,619$ ha] per year) and accomplishment ($69,952 \pm 13,211$ acres [$28,309 \pm 5,346$ ha] per year) (Figure 2). After 1994, planning acreage went up slightly to 105,866 acres (42,842 ha), while accomplishment levels declined to a low of 40,609 acres (16,434 ha) in fiscal year 2000. The years 1997 through 1999 showed the most significant increase in wildfires in the history of the state forest system.

During the period of increasing land in the state forest system, there were several significant regional weather events which correspond to low points in prescribed burning accomplishments and high points in wildfire occurrence. These include a drought in 1990 and a prolonged drought from the summer of 1998 to the summer of 2002 (Florida Department of Environmental Protection et al. 2007). This latter drought came at the end of a 10-year period during which the state forest system more than doubled in size, from about 349,245 acres (141,334 ha) in 1990 to > 835,823 acres (338,246 ha) in 2000. The drought and accompanying wildfires and insect outbreaks led to bans on prescribed burning in many portions of the state. Between droughts, the effects of hurricanes on state forests and their staffs were evident in 1992, 1995, and the period from 2002 through

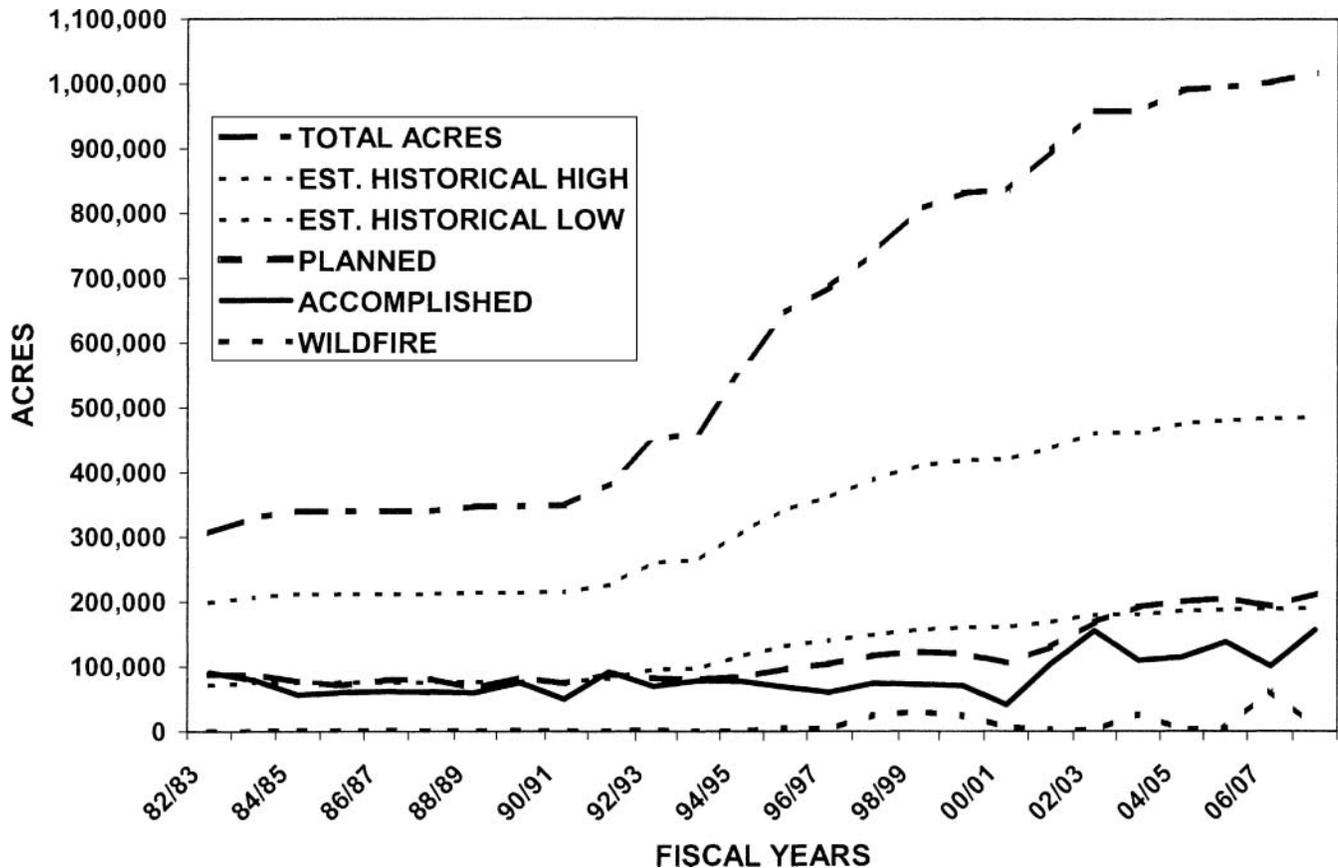


Figure 2. Florida state forest prescribed fire history, 1982–2008, by fiscal year, showing total state forest acreage, acreage planned for prescribed burning, acreage actually burned, and acreage of wildfires. Estimated (Est.) historical high and low planned acreage is based on number of acres in ecosystem types and fire return interval for the type.

2008. Mobilization of field staff to assist in hurricane recovery decreased the resources available for state forest management, including prescribed burning. During this latter period, state forest acreage increased to 1,033,888 acres (418,400 ha) (Figure 1).

A noteworthy pattern revealed by analysis of the individual state forest prescribed fire histories is the lag time in implementation of prescribed burning that can follow acquisition. The pattern is typically 1 to 3 years between receipt of management authority by DOF and the first prescribed burning plans and the first burns. For a number of reasons, including fire and vegetation management of the previous landowner, the lag time can be as long as 7 years. Figure 3 shows a 4-year lag time at Goethe State Forest and the lowering of plans and accomplishments coincident with drought years. Some new forests begin their fire programs slowly while building up staff and expertise in prescribed burning. The John M. Bethea State Forest (BSF) (Figure 4) is such an example that was further complicated by the occurrence two major wildfire events during a 4-year period. The BSF was intensively managed for timber prior to state acquisition and shares boundaries with the Okefenokee Swamp National Wildlife Refuge, from whence the wildfires originated, and the Osceola National Forest. A significant portion of state land acquired for the project was to be transferred to the Osceola National Forest as part of a complex resource trade, thus the decline in acreage for 2004–2005 (Figure 4).

Uncertainty around the final outcome and boundaries also inhibited prescribed burning in the years following acquisition. An intensive planning and implementation effort is underway to make the BSF more resistant to wildfires through active preplanning and prescribed burning. Understanding the amount of prescribed burning that will be a necessary part of this effort is extremely important and has already led to an increase in the acreage planned for prescribed burning in 2008–2009 (Figure 4).

Personal knowledge by the author of the movement of particularly motivated and skilled individual prescribed burners within the state forest system suggests that measurable increases and decreases in prescribed burning accomplishments for particular state forests occur with their movement from assignments in one state forest to another.

Analysis of monthly burning patterns over the system as whole shows that most prescribed burning occurs during the winter months, e.g., December–February (Figure 5). The DOF has traditionally been a winter-burning agency, but as a greater appreciation of the ecological and logistical values of an all-season burn program has occurred, field units have begun to look for stands where field conditions will allow growing-season burning aimed at mimicking historical lightning-initiated fires. Because many units have fuel loads considered too high for lightning-season burns, efforts are being made to expand cool-season burns into December and March.

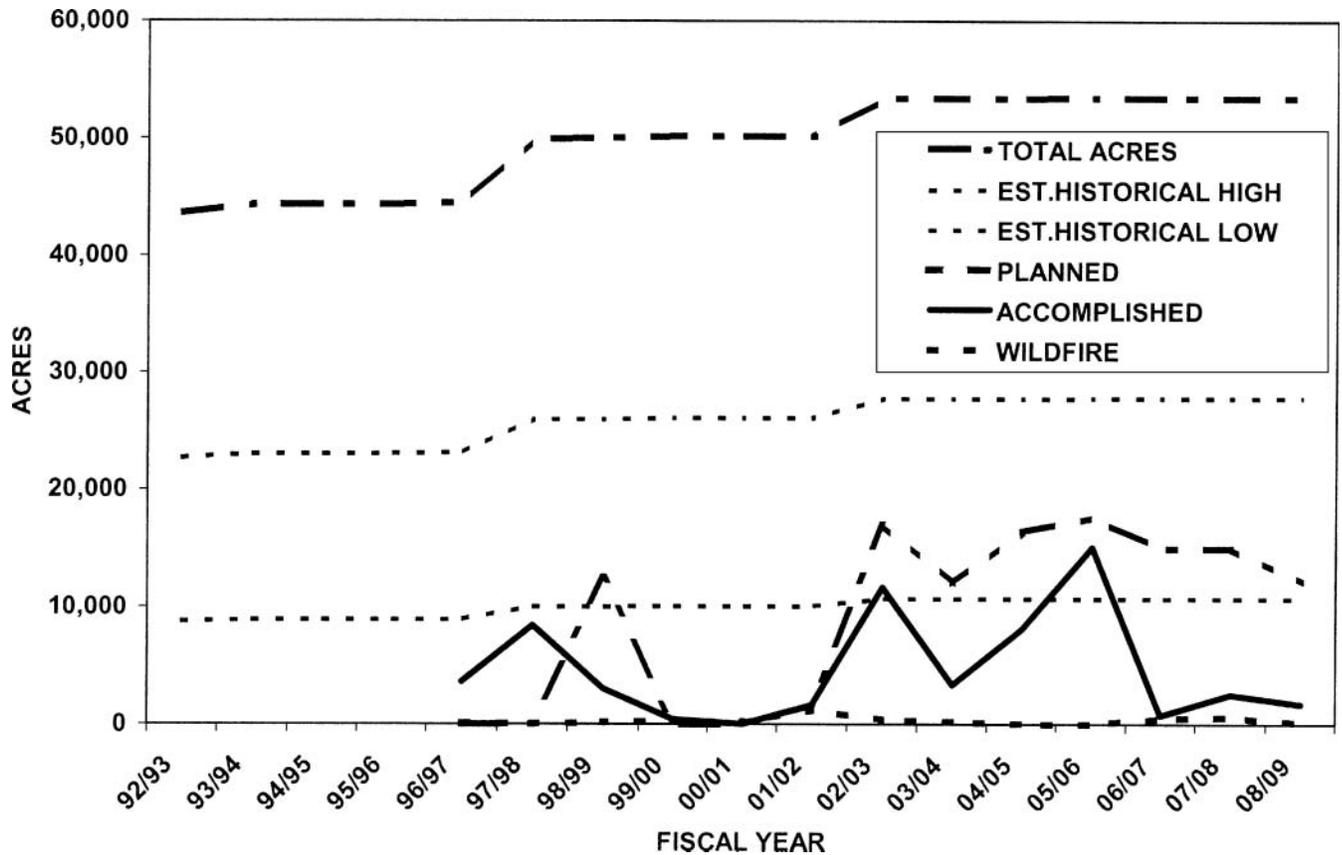


Figure 3. Goethe State Forest, Florida, prescribed fire history, 1992–2008, by fiscal year, showing total state forest acreage, acreage planned for prescribed burning, acreage actually burned, and acreage of wildfires. Estimated (Est.) historical high and low planned acreage is based on number of acres in ecosystem types and fire return interval for the type.

Historical Natural Vegetation

The effort to map potential natural vegetation on the state forests suggests a range of annual prescribed burning that should occur in the state forest system under maintenance conditions; that is, assuming restoration is complete and fuels are under control. The maps show the historical distribution and acreage of potential natural vegetation types. Each natural vegetation type was given a forest-specific fire return interval, e.g., 2 to 4 years, developed by FNAI in consultation with DOF staff. The acreage in a specific type can then be divided by the low number in the fire return interval to estimate the historical high end of the range of acres that have burned annually, while the acreage in a type divided by the high number in the interval estimates the historical low end of the range of acres that would have burned annually. The sum of this process across all state forests for all natural community types estimates the high and low ends based on historical conditions and can be used to estimate the scope of prescribed burning that would be expected in the state forest system, given the assumptions above. To simplify matters and avoid confusion caused by fire return intervals for some wetland types that were said to range from 5 to 150 years, these wetlands and their potentially long fire return intervals were excluded from the analysis. The result of this analysis is the two dotted lines labeled “est. historical high” and “est. historical low” in Figure 2.

For fiscal year 2007, the state forest system had 1,001,742 acres (405,391 ha) and the predicted high prescribed burn acreage was 485,398 acres (196,434 ha), while the predicted low was 189,606 acres (76,731 ha). The planned goal for that year, 211,603 acres (85,633 ha), and the prescribed burn acres accomplished, 156,143 acres (63,189 ha), were both the highest in the history of state forest system. In that year, there were 5,989 acres (2,424 ha) burned by wildfire.

DISCUSSION

Internal reviews and stakeholder meetings are a key component of adaptive management (Johnson 1999). Internal reviews facilitated a greater level of cooperation and communication among the state-level bureaus and field sections in DOF, initiated clarification of policies in internal handbooks and guidance documents, and improved communication avenues. The issues of crown scorch/tree mortality, accountability, and post-burn evaluations demonstrate how these reviews have influenced the DOF prescribed fire program.

Tree mortality and its interrelationships with prescribed burning parameters, crown scorch, weather, insect outbreaks, stress from hurricanes, and stress from intensive programs to treat exotic species with herbicides received much discussion.

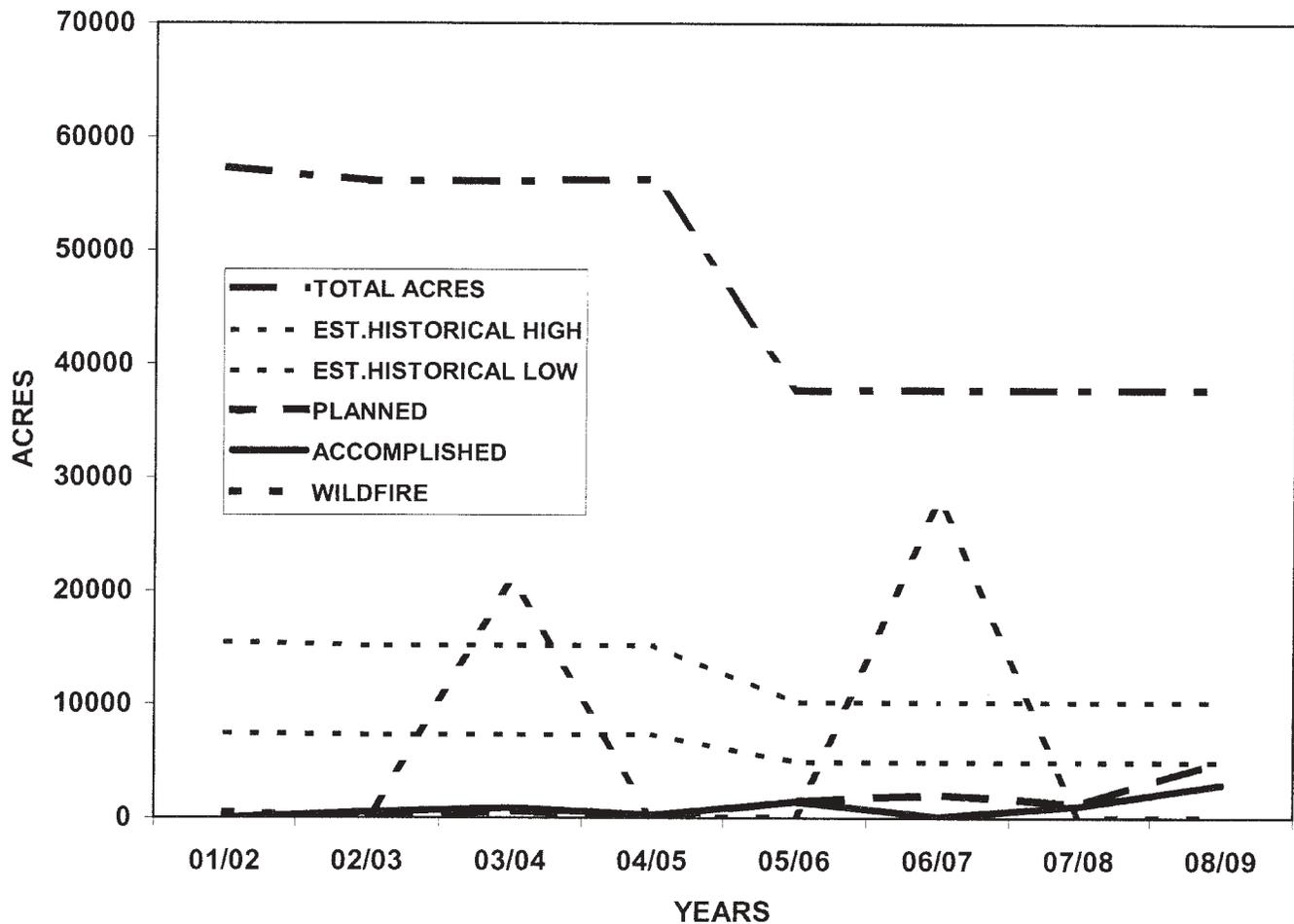


Figure 4. John M. Bethea State Forest, Florida, prescribed fire history, 2001–2008, by fiscal year, showing total state forest acreage, acreage planned for prescribed burning, acreage actually burned, and acreage of wildfires. Estimated (Est.) historical high and low planned acreage is based on number of acres in ecosystem types and fire return interval for the type.

The mistaken perception that a zero crown scorch/tree mortality policy was in place caused declines in prescribed burning in some units. Updates to prescribed burning and forest health training now explain that stem char and other factors may be better predictors of tree mortality than crown scorch and that low levels of crown scorch and tree mortality can be tolerated. While quantitative limits have not been established, it was made clear that repeated prescribed burning stress that reduces tree growth or results in large-scale mortality of mature trees is unacceptable. Avoiding additional stress from prescribed burning to trees already under stress from other factors can help reduce excessive tree mortality. Defining acceptable mortality levels and designing burns to minimize these levels are part of the ongoing process.

Establishing accountability in accomplishing prescribed burning objectives continues to be particularly challenging. Prescribed fire programs may be best judged by long-term trends rather than short-term objective achievements. Unreasonable demands to achieve annual objectives can lead to accidents, escapes, and resource damage that jeopardize the entire program. Accountability for long-term trends clearly lies with leadership at the state and field level and with the most experienced staff. If prescribed fire planning

is based more on specific goals and objectives, the pattern of movement of motivated individuals should not be as detectable as it has been in the past.

Although post-burn evaluation and monitoring in a formal and quantitative fashion are not a traditional part of the prescribed burning culture of DOF, the agency has increasingly recognized that these are essential to an adaptive management approach. A post-burn evaluation was required of all units for all burns in 2004. A form was recommended for use, but latitude was given to field units to modify the form to suit local needs and interests. A forthcoming evaluation of this initial effort will help determine how to implement a more formal method of post-burn evaluation. The post-burn evaluation should address a key concern of field staff—that too much emphasis was being placed on achievement of burn acreages and not enough attention was being paid to the quality of burns and whether they were achieving objectives.

Initiating these meetings with the “What is going well?” question resulted in a positive and productive focus so the meetings did not turn into gripe sessions. The DOF operates as a multifunctional agency, with most staff participating in all programs as needed. Continued efforts to improve

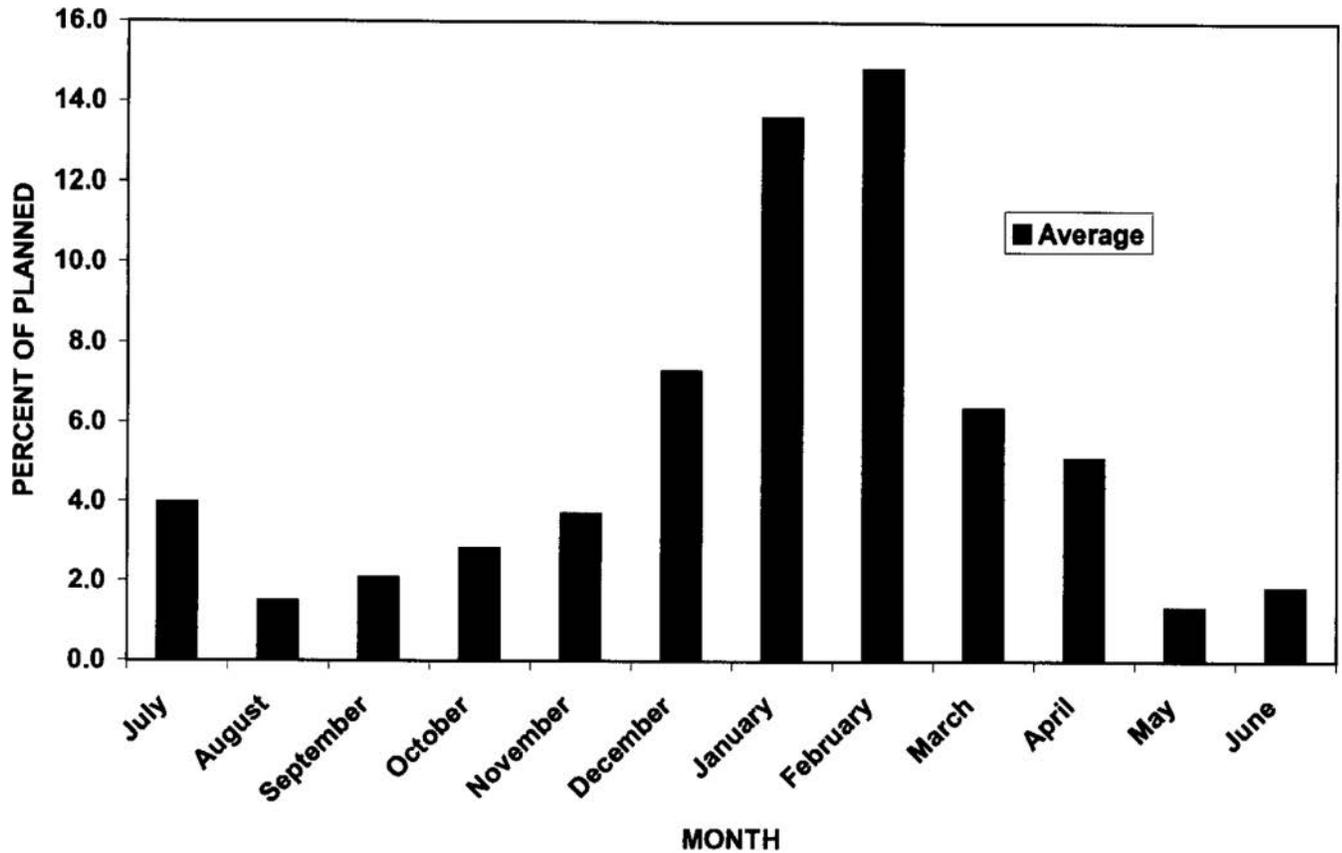


Figure 5. Prescribed burning accomplishments as a percentage of annual prescribed burning plans for Florida state forests, averaged by month, from fiscal year 2000–2001 to 2007–2008.

understanding, develop and clarify policies, and increase communication and cooperation will be a key to achieving our prescribed burning objectives.

Analysis of historical vegetation and prescribed burning data demonstrated that prescribed burning trends on the state forests were not keeping pace with the rapid increase in the state forest system acreage. Weather events such as droughts and hurricanes have increased the already great challenge of managing an ever-increasing number of state forest acres. Prior to vegetation mapping, the agency did not have a clear understanding of the scope of prescribed burning that would be necessary with the increase in state forest acreage. The analyses also bring into sharper focus issues specific to the individual state forests. Comparisons on some state forests between potential natural vegetation and current conditions document that stands historically composed of ecosystems characterized by frequent fire, e.g., flatwoods, have now become or are classified as hardwood systems. Other state forests show a fire history where burning below predicted lows over the long term is coincident with repeated wildfires.

Observations suggest that some stands are burned at expected frequencies while others are not, perhaps because of advanced successional states, high fuel accumulations, difficulty of burning by virtue of their location in the landscape, or obscure location. Now that desired future conditions have been expressed for general ecosystem types

and current conditions, the plan is to develop desired future conditions on a stand-by-stand basis with prescriptions for reaching these conditions. It is clear that some stands will not be restored to their historical ecosystem types due to technical or fiscal inability to conduct restoration, or due to their location. Isolated stands or stands with constrictions on prescribed burning may have a desired future condition that differs from their historical type, e.g., xeric hammock rather than sandhill, or pine (*Pinus* spp.) plantation rather than mesic flatwoods. This should facilitate better burning in units that can still be restored and burned because resources will be focused on the highest quality areas.

The involvement across all staff levels in internal review, analysis of historical prescribed fire data, mapping of historical natural vegetation, and developing desired future conditions has helped DOF improve the quality and quantity of prescribed burning on the state forests. With DOF’s multifunctional staff, the movement of personnel to wildfire events and disaster recovery, e.g., following hurricanes, will likely continue to result in impacts to accomplishments in other agency programs such as prescribed burning. Figure 2 shows that both planning and accomplishments have increased during this recent period. The next steps of assessing our initial post-burn evaluation project and of developing stand-specific desired future conditions, objectives, and prescriptions will help to continue this process.

Acquisition of public lands by Florida may continue for some time and state forests may continue to be added. All agencies that manage fire-maintained ecosystems will have to contend with the increase in fire management responsibilities, including both prescribed burning and wildfire control, that comes with additional units and additions to existing units. Stagnating or shrinking land management budgets will likely dictate an increase in the need for wildfire control if unburned fuels are allowed to accumulate.

ACKNOWLEDGMENTS

Many DOF staff, from the Director on down, have participated in stakeholder groups or reviewed results from the prescribed fire history, desired future condition, or natural

community mapping projects. While some of the conclusions in this paper may be shared by some of my colleagues, the conclusions and interpretations are my own.

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