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Authors: Taggart, John B., Ellis, J. Marshall, and Sprouse, James D.

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CONSERVATION ISSUES

Prescribed Burning in State Park Properties of North Carolina and Nearby Coastal States

John B. Taggart[1]
Department of Environmental Studies
University of North Carolina
at Wilmington
601 S. College Road
Wilmington, NC 28403, USA

J. Marshall Ellis
North Carolina Division of Parks
and Recreation
West District Office
159 Inland Sea Lane
Troutman, NC 28166, USA

James D. Sprouse
North Carolina Division of Parks
and Recreation
Yorkshire Center
1629 MSC
Raleigh, NC, 27699-1629, USA

[1] Corresponding author:
taggartj@uncw.edu

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ABSTRACT: Prescribed burning has been used by the North Carolina Division of Parks and Recreation (DPR) since 1974 to reduce hazardous fuel loads, to restore/maintain specific habitats, and to preserve rare species populations within state parks, recreation areas, and natural areas. System-wide staff training, development of burn prescriptions, and burning procedures were mandated according to agency guidelines. During 2002-2007, prescribed burns within state park properties were conducted mostly in the coastal plain, but system-wide coverage was far less than adequate to maintain fire-dependent communities. The number of hectares treated per year as a percentage of the number needing treatment decreased yearly. In addition to weather conditions, common obstacles to achieving burning goals included conflicts with other responsibilities, lack of trained staff/dedicated funding, and increasing wildland-urban interfaces. Prescribed burning data and associated information from state parks and natural areas in Virginia, South Carolina, Georgia, and Florida indicated that interagency burning agreements, full-time burning staff, and use of contractors have improved burning results significantly in recent years. Prescribed fire councils have served as advocates for prescribed burning at state-wide levels, while prescribed burning legislation has helped to limit smoke and, in some states, fire damage liability. Suggested enhancements for the DPR prescribed burn program include: use of both internal and external burning organizations, development of cooperative agreements with analogous programs, pursuit of earmarked state funds and outside grants, expansion of staff burn training, active participation in prescribed fire advocacy groups, and site-specific public information/education to address local concerns and to promote benefits of prescribed burning.

Index terms: fire-dependent communities, interagency burn team, prescribed burning, state parks and natural areas, wildland-urban interface

INRODUCTION

The North Carolina Division of Parks and Recreation (DPR), a state agency within the North Carolina Department of Environment and Natural Resources (NCDENR), manages approximately 65,650 ha of land (DPR, unpubl. data) scattered throughout the mountain, piedmont, and coastal plain provinces. Since the establishment of Mount Mitchell as the first North Carolina state park in 1916, the DPR has acquired a system of 55 terrestrial properties, each classified and managed either as a state park, state recreation area, or state natural area according to site-specific management plans required by the State Parks Act of 1987 (State of North Carolina 1997). Twenty-three of these properties have approximately 2685 ha (DPR, unpubl. data) under various burn prescriptions. Natural communities to be maintained or restored within designated fire compartments range from pine *(Pinus* spp.) – oak (*Quercus* spp.)/heath (*Ericaceae*), chestnut oak (*Quercus montana*), and oak – hickory (*Carya* spp.) forests of the mountain/piedmont provinces to pine savannas, pocosins, and bay forests of the lower coastal plain; vegetation types that historically experienced periodic fires (Schafale and Weakley 1990). A summary of DPR properties and hectares under burn prescriptions by physiographic province is given in Table 1.

In this paper, we review published and unpublished information concerning prescribed burning in the North Carolina state park system plus analogous data from state-managed parks and natural areas in Atlantic coastal states with similar habitats: Virginia, South Carolina, Georgia, and Florida. This collective knowledge is used to develop recommendations to enhance prescription burn procedures on DPR lands that will help restore/maintain key examples of North Carolina's natural heritage.

HISTORY OF THE DPR BURN PROGRAM

A total fire exclusion policy, similar to that of the United States Forest Service (Williams 2002), was followed on DPR lands until 1974 when it was replaced with one that allowed prescription fire (M. Goodwin, retired DPR superintendent, pers. comm.). The North Carolina Division of Forest Resources conducted the first burn under the new policy that year on Weymouth Woods Sandhills Nature Preserve located near Southern Pines in Moore County. This state natural area was established in

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Table 1. DPR properties with burn prescriptions by use category (hectares under burn prescription[a]) within the three major physiographic provinces of North Carolina.[b]

	Mountain	Piedmont	Coastal Plain
State Parks	1 (13)	10 (710)	9 (1,261)
State Natural Areas	0	0	1 (364)
State Recreation Areas	0	2 (337)	0
Total	**1 (13)**	**12 (1,047)**	**10 (1,625)**

[a] NCDENR, 2004

[b] DPR, unpubl. data

1963 to protect fire-dependent longleaf pine sandhill communities. Fire had been a visitor to this site prior to 1963, but because of the DPR fire exclusion policy, the preserve went unburned for the next decade and the health of its longleaf pine habitats markedly deteriorated. The year following the inaugural burn, DPR staff began conducting burns to restore these fire-dependent communities. In 1979, a management plan was developed for the site that specified fire as the prime management tool to restore and maintain these diverse sandhill ecosystems (M. Goodwin, retired DPR superintendent, pers. comm.; Goodwin and Carter 1979).

Under the auspices of the 1974 policy, restoration of fire-dependent communities was begun on other DPR areas that included Carolina Beach State Park (Carolina Beach, NC) and Goose Creek State Park (near Washington, NC) where fire was used to reduce fuel levels, rejuvenate fire-dependent communities, enhance rare species populations, and reduce local tick populations. Since no formal training was required at that time, appropriate agencies, municipalities, and fire departments were notified and more knowledgeable burners were consulted as DPR staff developed confidence and expertise. In the 1980s, initial criteria were established for burn boss certification and support staff training that made DPR fire management activities safer and more professional (M. Goodwin, retired DPR superintendent, pers. comm.).

Subsequent development of the current division-wide prescribed burn program (Tingley et al. 2003) evolved from three primary factors: (1) existence of analogous fire management programs, (2) documentation of ecological fire importance, and (3) establishment of a DPR resource management policy. The North Carolina Division of Forest Resources, a state agency in the same department, had already trained their staff to control wildfires and to conduct prescribed fires, while The Nature Conservancy in North Carolina had parallel training that emphasized the use of fire for ecosystem management (M. Bucher, assistant director of science and stewardship, The Nature Conservancy in North Carolina, pers. comm.). Use of prescribed burning for stewardship was supported by a strong body of regional scientific and "how-to" literature (e.g., Wade and Lundsford 1988; Schafale and Weakley 1990; Robbins and Myers 1992; Christensen 1993; Frost 1995; Elliot et al. 1999; Christensen 2000; Vandermast et al, 2004) that provided both pre- and post- European colonization references to appropriate fire regimes and techniques to manage plant and animal communities throughout the state, virtually all of which were fire dependent (Shlisky et al. 2007). A 1995 resource management staff directive (McKnelly 1995) provided a nexus to prescribed burning by requiring the DPR to maintain high quality natural resources and by an allowance "to correct or compensate for the disruption of natural processes caused by human activities" (i.e., fire suppression). These factors formed the basis for development of current DPR fire management guidelines (Tingley et al. 2003).

DIVISION OF PARKS AND RECREATION FIRE MANAGEMENT GUIDELINES

Division guidelines specify criteria for fire management administration, cooperation with other agencies, fire management plans, smoke management, training standards, equipment and safety, monitoring and reporting, public relations, and interpretative activities. Fire within DPR lands is considered either a wildfire or prescribed burn: a controlled fire set to remove hazardous fuels, to protect biological diversity, and/or to protect/maintain rare species (e.g., eastern fox squirrels [*Sciurus niger*], bear oak [*Quercus ilicifolia*]), and habitats (e.g., pine-oak/heath, pine savannas). The document includes a memorandum of understanding with the North Carolina Division of Forest Resources that details mutual and division-specific responsibilities, particularly in the event of wildfires and controlled burns that deviate from prescription (Tingley et al. 2003).

An approved fire management plan is required for each DPR property that chooses to implement a prescribed burning program. These plans must include site-specific guidelines for wildfire suppression, prescribed fire procedures, creation of burn units and fire lanes, and state that a written site-specific prescription is prepared for every planned burn. Twenty-three of the 55 terrestrial DPR sites currently have approved plans. Most burns are planned and executed by on-site DPR staff with occasional assistance from outside DPR personnel and/or other organizations (e.g., The Nature Conservancy in North Carolina, North Carolina Division of Forest Resources).

RECENT PRESCRIBED BURNING ACTIVITIES

A summary of DPR hectares burned by province during 2002-07 is presented in Table 2. An average of 166 ha or 6% of the total system-wide area under prescription was burned each year. Coastal plain

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Table 2. Hectares of DPR properties (grouped by physiographic province[a]) burned under prescription during 2002-07.[b]

	Mountain	Piedmont	Coastal Plain
2002	0	36	182
2003	0	4	139
2004	0	26	121
2005	0	45	118
2006	0	84	103
2007	0	94	45
Total	**0**	**289**	**708**
Annual Average	**0**	**48**	**118**

[a] NCDENR, 2004

[b] DPR, unpubl. data

properties encompassed the majority of prescribed burns (118 ha/year) with considerably less at piedmont sites (48 ha/year) and none at the lone mountain park under burn prescription – New River State Park (Ashe Co.).

CURRENT CONSTRAINTS AND PLANNED ENHANCEMENTS

Correspondence with DPR burn bosses and supervisory staff (E. Dousharm, P. Hart, S. Hartley – law enforcement supervisors; A. Rodgers and F. Williams – law enforcement officers; S. Tillotson – retired law enforcement director, DPR, pers. comms.) revealed several reasons why annual system-wide prescribed burn coverage continues to be miniscule and a decreasing percentage of the amount needed to maintain DPR properties in a healthy state. The primary issue involved time conflicts with other management responsibilities (e.g., patrols, law enforcement, maintenance, administration, education, etc.) that received higher priority during potential burn days. Even when dates were allocated for burning, changes in acceptable weather conditions, lack of trained personnel, and/or potential smoke impacts to adjacent properties caused cancellations or early terminations. Wildland-urban interfaces (Radeloff et al. 2005) at several DPR properties were another constraint. Basic fire training (i.e., S-130: firefighter training / S-190: introduction to wildland fire behavior) was limited by availability of local classes at times when personnel could participate, while burn boss training has been restricted by multi-agency competition for slots in upper level courses (i.e., S-290: intermediate wildland fire behavior / S-390: fire behavior calculations). This latter problem has been exacerbated by the fact that a number of staff who attained burn boss certification have retired or moved to administrative levels that make them unavailable for burning. There were also concerns with the consistency and adequacy of burn boss training relative to current practices, priorities, literature, and utilization of fire weather information. Unfortunately, any alternative fire management training is limited by lack of dedicated funding.

Some of these problems are being addressed. A memorandum of understanding between the DPR and The Nature Conservancy in North Carolina was signed in 2006 to allow reciprocal use of staff and equipment for prescribed burns. In 2007, the DPR hired a fire specialist to coordinate system-wide fire management activities and to assist with on-site burns.

PRESCRIBED BURNING IN NEARBY STATE PARK AND NATURAL AREA SYSTEMS

Perhaps the most successful and extensive state park prescribed burn program in the United States is found within the Florida Park Service (FPS). Similar to the North Carolina DPR, most Florida park properties were managed with immediate and complete suppression of all fires until 1970 when the fire exclusion policy was reversed and the use of prescription fire became standard policy (Stevenson 1996). The FPS has responsibility for 198,000+ ha of conservation lands, most of which consist of fire-prone communities. Goals of the burning program include: maintenance of fire-dependent communities, fuel reduction, management of listed species, maintenance of scenic vistas, control of exotic species, preparation for community restoration plantings, and personnel training. Burns performed during the spring-fall lightning season are considered the best means to simulate natural fire conditions; however, the backlog of areas overdue for fire has necessitated year-round ignitions. Approximately 13,360 ha of park property are burned each year by a combination of prescribed burns and wildfires (Mulholland et al. 2003; Florida State Parks 2008).

The Florida Park Service has attempted to improve their burning results despite challenges with staffing shortages/training needs, more areas to manage, expanding wildland-urban interfaces, and seasonal burn bans. Purchases of large and specialized equipment have increased fire management capabilities, particularly on larger tracts. Mechanical treatments and herbicides have been used as pretreatments and to supplement (but not replace) fire. A stronger system-wide emphasis has been promoted to reduce the backlog of sites with approved burn prescriptions. Alternative labor sources, such as free training for volunteers and cooperative programs with other agencies, have enhanced staff resources, while overtime allowances have been made for staff burning. The FPS also is an active participant in interagency burn training programs (Mulholland et al. 2003).

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The most successful operational format has been for staff at a given park to write/update the burn plan and to prepare potential burn sites so that when conditions permit, dedicated fire management personnel (either from FPS or an interagency burn team) can assist to increase the likelihood of completing a successful burn. Thus, on-site staffs retained ownership of fire management, but received professional assistance as needed (R. Mulholland, fire coordinator, Florida Park Service, pers. comm.).

Nearby state park systems from Georgia to Virginia also utilized prescribed burning as part of their resource management activities. In contrast to the combination of state parks and natural areas within the North Carolina DPR, these neighboring states divided protected area categories among different management agencies, which have generally facilitated maintenance of an appropriate prescription burn program.

In Georgia, the Division of State Parks and Historic Areas of the Department of Natural Resources created interagency burn teams – personnel from state parks, state forestry commission, wildlife division, and non-governmental organizations (e.g., The Nature Conservancy) – to conduct prescribed burns within a system of 63 sites. Burns during the last three years ranged from 263 to 831 ha and included properties from the mountains to the coast (N. Castleberry, state parks biologist, Georgia Department of Natural Resources, pers. comm.).

Twenty Georgia state natural areas were managed by the Nongame Conservation Section of the Wildlife Resources Division. The interagency team format was used to burn an average of 385 ha per year of these lands during 2003-06 with a high total of 769 ha in 2007. Staff fire training was enhanced through funding made available by federally-funded state wildlife grants (S. Cammack, wildlife biologist II, Georgia Department of Natural Resources, pers. comm.).

Following decades of attempted fire exclusion, the South Carolina Department of Parks, Recreation and Tourism began using burn contractors in 2000 and recently developed cooperative burn agreements with both The Nature Conservancy (for all 47 park properties) and U.S. Fish and Wildlife Service (for two coastal sites) to reintroduce fire. A grant received from the U.S. Fish and Wildlife Foundation will fund development of fire management plans at 15 parks, hire a seasonal burn crew, and provide more staff training (V. Carter, resource management biologist, South Carolina Department of Parks, Recreation and Tourism, pers. comm.).

Heritage Preserves and Wildlife Management Areas in South Carolina are managed by the Wildlife Section of the Department of Natural Resources (SCDNR 2008). Within these properties, approximately 8100 ha are burned per year by agency staff on a regional basis. A 2008 state wildlife grant will be used to expand prescribed burning on these lands (J. Stowe, heritage preserve manager, South Carolina Department of Natural Resources, pers. comm.).

During 2000-07, Virginia State Parks, a branch of the Virginia Department of Conservation and Recreation, burned an average of 53 ha per year with a high of 280 ha in 2006. Of 34 park properties in the system, prescribed burns were conducted at 10 sites located throughout the state by in-house staff for the purposes of grassland management and control of hardwood/shrub species. Assistance for two burns in 2006 was provided by the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and the Virginia Division of Natural Heritage (S. Bailey, environmental program planner, Virginia Department of Conservation and Recreation, pers. comm.).

State natural areas or nature preserves in Virginia (managed by the Division of Natural Heritage within the same department as state parks) have approximately 607 ha under burn prescription at 11 sites – mostly located in the southeastern or coastal portion of the state. Areas treated with fire by agency staff since 2000 have averaged 136 ha per year including 2006/07 burns that averaged over 278 ha per year (R. Myers, stewardship program manager, Virginia Department of Conservation and Recreation – Division of Natural Heritage, pers. comm.).

PRESCRIBED BURNING LEGISLATION

The North Carolina Prescribed Burning Act (State of North Carolina 1999) includes the benefits of prescribed burning, pertinent definitions (e.g., certified prescribed burner, prescribed burning, and prescription), limitations of liability, and protocols for proper prescribed burning. Of particular interest to prescribed burners is the liability issue relative to potential claims against damage caused by smoke, although fire damage is not included. A prescribed burn conducted according to the protocols listed in the legislation is exempt from smoke damage liability; however, this exemption does not apply when a nuisance or damage results from negligently or improperly conducted prescribed burns.

Original prescribed burning legislation in Florida and Georgia included both smoke and fire damage liability at the simple negligence level. However, both states have amended their laws such that a certified burner can no longer be held civilly liable for simple negligence: a court now must prove gross negligence (Brenner and Wade 2000; Wade et al. 2006; State of Georgia 2008). The South Carolina Prescribed Fire Act (SCL 2008) covers both smoke and fire damage for simple negligence (Sun 2005), although changing the statute to gross negligence is under consideration (J. Stowe, heritage preserve manager, South Carolina Department of Natural Resources, pers. comm.). Neither North Carolina nor Virginia, states that specify only smoke liability protection at the simple negligence level, has proposed any amendment to their respective acts (State of North Carolina 1999; NCSL 2003).

ADVOCACY

Prescribed fire councils have been active for a number of years in the aforementioned states and exist or are being formed in at least 30 states and our two adjoining nations (National Coalition 2008). The

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DPR is a participant on the newly formed North Carolina Prescribed Fire Council that brings together representatives from various governmental agencies, non-profit organizations, and private entities to: "promote public education about the benefits of prescribed fire; advocate for the ability to use prescribed fire as a land management tool now and in the future; increase expertise in prescribed fire by sharing technical and biological information; promote safety, training, and research in the art and science of prescribed fire; preview prescribed fire practices, regulations, and policies and suggest improvements; and promote best management practices that minimize smoke and air quality impacts from prescribed fires" (NCPFC 2008). Three regional prescribed fire councils in Florida have promoted prescribed burning by numerous activities such as: (1) promoting county "right-to-burn" ordinances; (2) developing leaflets and explaining the need for fire in fire-prone communities; (3) successfully convincing the Governor to proclaim a prescribed Fire Week and to participate in the Prescribed Fire Day at the state capital during that week; and (4) through the free interchange of information/burning techniques at biannual conferences (Stevenson 1996; PFCFL 2008). Similar councils have been formed in Georgia (GPFC 2008) and South Carolina (SCPFC 2008) which have successfully undertaken similar tasks. In addition, a national umbrella coalition of prescribed fire councils has been established (National Coalition 2008; M. Melvin, coordinator, National Coalition of Prescribed Fire Councils, pers. comm.).

DISCUSSION

The DPR has begun to establish the framework necessary to implement a successful prescribed burning program, albeit major shortcomings involving adequate funding earmarked for fire management have yet to be solved. The small number of hectares treated each year indicates a clear need for stronger leadership and commitment to prescription fire at the highest agency levels and for more pro-active efforts throughout the chain of command. The number of hectares treated per year as a percentage of the number needing treatment is actually decreasing yearly. Major changes will be necessary to reverse this unacceptable trend and substantially decrease the backlog of sites not being managed with an appropriate fire regime, as well as to accommodate anticipated additions to DPR managed lands.

The 2007 hiring of a fire specialist was a good first step. This person can devote full-time efforts to the prescribed burn program and serve as the focus for training development and coordination of burn activities among DPR personnel/other agencies, plus provide on-site burn assistance. However, without operational base funding, implementation and maintenance of appropriate fire regimes will remain wishful thinking. Part of this effort should involve regular discussions with operations staffs to monitor, promote, and further integrate prescribed burning into responsibilities at each park with a burn prescription as well as to be pro-active in development of burn prescriptions for many of the 32 other terrestrial DPR sites. Another important task for this position will be the hiring and coordination of contractors when funding is available (e.g., a 2008 Wildlife Habitat Incentive Program grant was received by DPR).

A recently signed cooperative agreement with The Nature Conservancy in North Carolina has been used to perform burns at coastal plain sites (Chris Helms, law enforcement supervisor, DPR, pers. comm.). Agreements with other agencies that have burning expertise (e.g., North Carolina Division of Forest Resources, North Carolina Wildlife Resources Commission, United States Fish and Wildlife Service, United States Forest Service) are feasible and should be considered. These resources could be pooled to develop an interagency burn team to provide burning assistance on days with acceptable conditions, in a fashion similar to the Florida operational format.

Staff training should be substantially increased to develop the capacity to manage DPR fire-dependent communities with appropriate fire regimes. While basic training (S-130/190) will be facilitated or performed by the new burn specialist, the advanced S-290/390 courses must become more available for burn boss candidates. An obvious solution is to increase the number of training sessions or allow staff to attend training in other states. The possibility of hosting training sessions at a DPR facility and being given a higher number of training slots should also be explored.

Seeking outside funding (e.g., Fish and Wildlife Foundation, state wildlife grants) for basic and advanced fire training should be a priority judging from the success of that approach mentioned above for South Carolina and Georgia. In Florida one can take a correspondence course developed specifically for burn certification rather than attend a week-long training session, although all other conditions still have to be met including that individual's presence at a central location to take the final exam (Wade, 1995).

DPR should strongly consider the template used by the Florida Park Service whereby staff at a given park write/update the burn prescriptions and prepare the sites so that when conditions permit, dedicated fire management personnel from DPR or elsewhere can assist to increase the likelihood of completing a successful burn. Thus, on-site staffs retain ownership of fire management, but receive assistance as needed.

The above suggestions are not just wishful thinking. Many DPR fire-dependent communities are already outside the historical variation in their fire return intervals and may require considerably more effort, including careful use of herbicides and heavy equipment as pretreatments before fire can be reintroduced. Many fire-starved communities on other locations and ownerships have experienced the same scenario over the past four decades, so even though DPR is late in addressing this problem, a large body of helpful literature is available (e.g., Glitzenstein et al. 2003; Myers 2006).

Public information/education concerning prescribed burning is always needed, but particularly in the vicinities of park properties with wildland-urban interfaces where local attitudes toward burning may be problematic. Drawing on experience and

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techniques from other agencies, especially cooperative agreement participants, will not only increase the likelihood for successful relationships with land owners adjacent to a given park property, but convert them to advocates of prescribed fire. Continued DPR participation on the North Carolina Prescribed Fire Council will help to promote the benefits of prescribed burning on a state-wide basis. In the end, it is the public that will determine the future of prescribed fire so we had better educate them (Brenner and Wade 1996; Brenner and Wade 1999).

Finally, the North Carolina Prescribed Fire Council can play an important role in increasing the area under appropriate fire management programs in North Carolina. They can take the lead in a number of suggestions given above and provide cross-agency representation to benefit endeavors such as organization of interagency burn teams to help specific agencies plan and execute burns.

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John B. Taggart is an Assistant Professor of Environmental Studies at the University of North Carolina at Wilmington. His research and professional interests involve natural resource management of protected areas.

J. Marshall Ellis is the Western Regional Biologist for the North Carolina Division of Parks and Recreation. His research and professional interests include natural resource management and environmental education.

James D. Sprouse is the Fire Specialist for the North Carolina Division of Parks and Recreation. His research and professional interests include natural resource management and fire ecology.

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