FIRE MANAGEMENT GUIDELINES

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1.0 DIRECTOR'S STATEMENT

Historically, fire has played a dominant role in determining the distribution of plants and animals across much of North Carolina. Fire history studies have established that repeated fires operating along a broad scale of intensities and frequencies are a natural component of virtually every vegetated ecosystem. Consequently, ecologists now know that hundreds of plant and animal species that occur in North Carolina, including many that occur in our state parks, are dependent on fire for rejuvenation and reproduction.

Because fire is an inherent aspect of most vegetated ecosystems, it is important to recognize its long term ecological role in the maintenance of intact, normally functioning ecosystems. Since it is part of the Division's mission to perpetuate the presence of high quality natural resources, then where appropriate and feasible in our state parks, prescribed fire will be used in ways that mimic as closely as possible fire's natural role. Ecologically, the use of prescribed fire will allow the Division to accomplish a number of goals, including the removal of hazardous fuel levels; the protection of biological diversity; the protection of rare species and their habitats; and the opportunity to provide the public with timely information on an important environmental education topic.

In addition to providing protocols for the proper planning and implementation of ecologically-based fire management, these Fire Management Guidelines also emphasize safety and effectiveness in the Division's Fire Management Program. Because of constraints such as weather, fuel loads, park neighbors, and smoke management, park fire management programs must be designed with carefully defined objectives so that specific, measurable resource management goals are met and public safety is not compromised. Developing these goals and plans requires a careful analysis of park resources, thorough understanding of responsibilities, and careful coordination among administrative levels and between agencies.

Philip K. McKnelly, Director

2.0 INTRODUCTION

The role of fire throughout North America over the last 10,000 - 12,000 years has been well documented, and numerous fire history studies have shown that fire has operated across a wide range of community types, frequencies, and intensities (Frost 1998). Ecologically, these fires are known to have played an important role in determining the structure of most vegetated upland ecosystems. North Carolina's terrestrial ecosystems are known to support a variety of species that respond vigorously to repeated fire; these species are also known to perform poorly in its absence. Common plant adaptations that allow survival in the face of repeated fire include thick bark; resprouting via underground stems; seeds that survive indefinitely below ground and then germinate following being heated by a fire; thick, waxy leaves; closed, or serotinus, cones; and tall, limb-free trunks with canopies far above all but the most extreme fires (Schafale and Weakley 1990; Elliott et al. 1999, and references therein).

Ecosystems that have been repeatedly burned typically exhibit high plant diversity, and many of these species are now known to be dependent on frequent fires for survival and reproduction. Approximately 65% of the nearly 700 rare plant species that occur in North Carolina are known to be fire dependent, and the repetitive occurrence of fire is particularly important, since the beneficial effects of fire can be short-lived and will disappear if fire is suppressed from these areas. (Wade and Lunsford 1988; Schafale and Weakley 1990; Robbins and Myers 1992; Frost, pers. comm.).

Well planned wildfire control and prescribed burning are critical to the management of our parks' natural resources, but both also present significant risks to resources, facilities, staff, and the public. Errors in fire management can produce unintended effects that can be evident for decades. It is the intention of the Division to avoid risk to persons and property while engaging in fire management activities. The best protection against injury and liability is adherence to these guidelines and to approved fire management plans that include all reasonable safety and hazard reduction measures. These guidelines are intended to improve fire management in the state parks system by:

- Insuring that the use of prescribed burning achieves specific short term and long term resource management objectives;
- Minimizing undesirable secondary effects on park resources;
- Reducing the risk of injury, property damage, and liability;
- Increasing system-wide consistency in fire management actions and expectations;
- Identifying and meeting training, equipment, and other program needs;
- Improving the efficiency and cost-effectiveness of program activities; and
- Developing cooperative agreements with other fire management agencies.

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3.0 POLICY

It will be the policy of the North Carolina state parks system to develop park specific fire management plans addressing wildfire control and, where appropriate, the use of prescribed fire as a long term management technique. Fire management operations must reflect the points addressed in this guideline as well as park-specific ecological and management goals. No park will initiate a prescribed fire management program until an approved plan is in place.

All fires in North Carolina state parks will be classified as wildfires or prescribed fires; structural fires are addressed in a separate guideline. The North Carolina state parks system does not have a "let burn" policy; therefore, all unintended ignitions or escaped prescribed fires will be classified as wildfires and controlled. If necessary, the assistance of appropriate emergency response agencies will be sought. If the on-site personnel deem it appropriate, then a wildfire may be allowed to burn out to previously designated control lines. Regardless of the response level and presence of coordinating agencies, all wildfires will be managed so that secondary impacts arising from suppression are minimized. Where feasible, secondary impacts will be mitigated. Additional details on wildfire control appear in Section 6.

A long term, ecologically-based, prescribed fire plan will be developed for any park with fire dependent natural communities. Staff will be expected to apply prescribed fire appropriately so that those areas continue to function as intact, fire dependent ecosystems. Fire may be excluded for the protection of natural or cultural resources or because its presence may be incompatible with other park resources or management needs. The use, exclusion, or suppression of fire must comply with the goals of the park's fire management plan. Additional details on prescribed fire management appear in Section 6.

All prescribed fire management activities will be dictated by the goals and objectives addressed in each park's fire management plan. As an integral component of natural resource management, prescribed fire may be used to:

- Restore or maintain natural ecosystems.
- Reduce fire hazards by reducing fuel loads.
- Enhance habitat for rare species.
- Control or eradicate exotic species.
- Restore or maintain historic scenes and vistas.
- Create fire breaks near park boundaries or developed areas.

4.0 PROGRAM ADMINISTRATION

4.1 Director

The Director of the Division of Parks and Recreation has overall responsibility for fire management in all areas administered by the Division. The Director sets program policy and standards. The Director' s office will approve all cooperative agreements between the Division and other agencies and organizations.

4.2 Superintendent of State Parks

The Superintendent of State Parks (SUSP) is responsible for the approval of all park fire management plans and the implementation of all fire management activities. The SUSP will also approve all nominations for burn boss certification.

4.3 District Superintendent

District Superintendents (DISU) will review and approve each plan in his/her district and insure compliance with the Division's Fire Management Guidelines. The DISU will oversee the prescribed fire program at the district level and will assist in fire management planning.

4.4 Park Superintendent

Park Superintendents (PASU) are responsible for implementing all fire management activities within their park areas. The PASU will supervise the preparation of a fire management plan for his/her park; this plan will specifically address wildfire suppression and, if it is warranted, a prescribed burning plan. It will be the PASU's responsibility to make sure that adequate staff and equipment are on hand to meet the requirements of the park's fire management plan and that all burn crew staff are adequately trained and equipped. PASU's will supervise the park's fire history records, maps, fire plan updates, and all post-fire evaluations and monitoring programs.

4.5 Public Information Officer

The Division's Public Information Officer (PIO), in coordination with the park superintendent, will prepare and issue press releases informing the public of the status of significant wildfires in the parks, and of the scheduling and purpose of upcoming prescribed burns.

4.6 Burn Boss

A Division-certified burn boss will be on-site to supervise any prescribed fire. It will be the

responsibility of the burn boss to ensure compliance with the Division's Fire Management Guidelines, the park's fire management plan, the burn unit prescription, and all applicable laws and regulations. Where feasible, the burn boss will be on the staff at the park where the fire is occurring. However, the burn boss may come from another park, division or agency.

4.7 District Interpretation and Education Specialist

The District Interpretation and Education Specialists (DIES) will provide assistance as needed with training; preparation of the park's fire plan; development and implementation of monitoring programs; and the development of interpretive programs related to fire management.

4.8 Resource Management Program

The Resource Management Program (RMP) will review each park's fire management plan prior to approval by the DISU and SUSP. RMP staff will be the lead division contact for information and assistance regarding fire ecology and fire management objectives. RMP staff will also consult with other staff and agencies for review and comment on staff training; post-fire monitoring programs; and park fire plan review and updates. The RMP will serve as the clearinghouse for system wide data on total acreage under prescription, acreage burned, and wildfires for each calendar year.

5.0 COOPERATION WITH OTHER AGENCIES AND ORGANIZATIONS

Where appropriate, cooperative agreements with other agencies and organizations will be developed to facilitate fire management, information sharing, training, and annual planning.

5.1 Division of Forest Resources

The N. C. Division of Forest Resources is responsible for wildfire control on all forested lands in North Carolina. DPR and NC DFR have entered into a Cooperative Forest Fire Control Agreement (See Appendix 1).

5.2 Other Agencies and Organizations

Cooperative fire management and training agreements with local, state, and federal agencies and organizations other than DFR should be considered, especially when those agencies own land near or adjacent to a park or if those agencies can provide support for fire management.

5.3 Content of Cooperative Agreements

Agreements will include but not be limited to the following points:

- Who is in charge, and when, for various types of fire management and fire suppression actions.
- Minimum training standards.
- A review of any specific park management, training, or suppression issues that are to be addressed during either wildfires or prescribed fires.
- Levels of authority and channels of communication.
- Who communicates with the media concerning what types of incidents.
- Provisions for information sharing and joint training.
- Reimbursable costs for equipment, salaries, and services, if any.

5.4 Approval of Cooperative Agreements

All proposed cooperative agreements at the park or district level will be submitted through the PASU and DISU to the SUSP in written form for approval. The SUSP will forward all division level cooperative agreements to the Director for approval.

6.0 FIRE MANAGEMENT PLANS

Park fire management plans must be based on a thorough understanding of the park's fire ecology and must be integrated with operations and resource management goals. Information should be collected from a variety of sources so that the plan can accurately address goals and objectives. The ecological justification must be soundly documented, the plan's objectives must be clearly stated, and there must be easily measurable parameters by which progress can be monitored. The Division's fire management program will emphasize ecological management at the community level. Single species management is to avoided, even when dealing with threatened or endangered species.

6.1 Review and Approval of the Fire Management Plan

Each park's fire management plan will be developed through the collaboration of park staff, the DISU, the DIES, RMP staff, Natural Heritage Program (NHP), and personnel from other appropriate agencies or organizations.

Following plan review and approval by RMP staff, park fire plans will be submitted to the DISU. The DISU will submit the plan to the SUSP for final approval and implementation. Each fire management plan will be reviewed and updated annually at a meeting between the PASU and the DFR dstrict forester, as required by the current cooperative agreement between the Division and NC DFR. If major changes to a park's fire plan are proposed, the PASU will review those revisions through the normal chain of command and approval. Periodic revisions to specific burn unit prescriptions, fire management goals, etc. may be handled through consultation with appropriate DPR staff, including the RMP, and other qualified personnel as needed. The PASU will collaborate with the RMP in determining if the changes warrant review and approval at the DISU and SUSP level.

6.2 Prescribed Fire Planning and Management

Each park's prescribed fire management plan will include but not be limited to the following:

- Background information on the park's cultural history and natural heritage.
- Ecological background, including brief descriptions of the park's major vegetation types; its fire adapted natural communities; its historical fire regime; fire's known or anticipated ecolgical role; rare species; and exotic species.
- Specific resource management objectives and how the presence or absence of fire can achieve them. These objectives must be clearly stated. Vague objectives, such as "to restore natural conditions," result in weak, poorly defined fire plans.

- Information on burn units, including maps, photos, and prescriptions that provide details on vegetation, management objectives, hazards, smoke management, etc.

- An inventory of smoke sensitive and fire hazard areas, both inside and adjacent to the park, including highways, hospitals, schools, campgrounds, residences, and hazardous or flammable materials.

- An inventory of the fire management training and experience of each staff member.

- An inventory of fire control and suppression equipment in the park and readily available to the park from other sources.

- A directory of names, addresses, and telephone numbers for local DFR personnel, local fire departments, adjacent landowners, and other relevant contacts.

- Copies of all fire-related cooperative agreements with other agencies, organizations, or adjacent landowners.

- A park map, showing roads, firebreaks, access routes, smoke sensitive areas, fire hazard areas, and resource sensitive areas.

The management of any burn unit will typically consist of two phases: The first will be a fuel reduction phase, which is to be followed by an ecosystem management phase. The change from fuel reduction to ecosystem management burns will be an objective one based largely on changes in vegetation, fuels, and natural community structure.

Fuel reduction burns will occur primarily between December and February. Ecosystem management burns will coincide with the period associated with naturally occurring fires, typically March through June. Since burning in high summer can produce unintended ecological impacts, growing season fires will generally not extend beyond June. However, exceptions may be made as necessary in order to address specifically detailed ecological needs. General parameters guiding ecological fire management planning appear in Appendix 2.

6.3 Wildfire Planning and Management

Wildfire suppression measures, including access routes, pre-determined fire lines, and decisions on where and under what conditions wildfires will be allowed to burn out particular blocks, will be planned to the extent possible and will be included in each park's fire management plan. It is vital that park staff meet regularly with local DFR staff to review the park's suppression options and to develop plans under which both parties clearly understand each agency's position. These meetings should also include a review of contingency plans for rehabilitating plowed fire lines and the potential financial charges that could occur from DFR responding to an escaped fire.

All unplanned ignitions or prescribed fires that exceed control will be suppressed. If a fire cannot be controlled by park staff, then DPR staff will contact the appropriate emergency response agencies and request assistance. Under the terms of the MOA between the Division and NC DFR, DFR will assume overall command on wildfires that require their assistance.

Each park will coordinate with the local DFR staff, RMP staff, the DIES, and other appropriate sources to determine the most appropriate management strategies for wildfires or escaped prescribed fires. Fire suppression planning must address the following topics:

- Criteria for imposing burning restrictions or park closures in accordance with the severity of forest fire conditions, in coordination with DFR.
- Procedures for detecting, locating, and reporting wildfires in the park.
- Expected local or regional fire behavior patterns.
- Identification of wildfire suppression strategies that will minimize secondary impacts to park resources.
- Delineation of specific duties for each staff member in case of a wildfire.
- Criteria and procedures for visitor evacuation and other public safety measures.

When conditions are right for wildfires or extreme fire behavior:

- Park staff will increase the frequency of routine patrols.
- All staff will carry filled backpack pumps and other fire equipment in their vehicles.
- The park's pumper unit will be kept full.
- Open fires may be prohibited if the DFR cancels burning permits in the district.
- All unusual smoke will be checked by park staff to determine its origin.

6.4 Wildfire Suppression

For fires that exceed the park staff's ability to control, NC DFR will assume primary responsibility for wildfire suppression. Crew safety will be the primary concern at all times during fire suppression operations. Untrained and improperly equipped personnel are not to be placed on the fireline, and at no time will crew safety be compromised when fighting a wildfire. DPR burn bosses are expected to know when to request assistance from outside agencies, when to pull personnel off the line, and also to adequately brief the crew about all safety issues prior to beginning suppression activities, including escape routes, special terrain or fuel concerns, and emergency contingencies. Regardless of the situation, crews must be diligent in accounting for each member's whereabouts during suppression activities, especially if backfiring or heavy equipment are employed.

Depending on fire severity and on-site conditions, the full range of suppression techniques may be considered, with the level of reponse being the responsibility of DFR's on-site incident commander. However, whenever practical, all appropriate measures should taken to minimize secondary impacts to the park's natural and cultural resources. Although the characteristics of

wildfires are difficult to predict, prior planning and adequate preparation can reduce the adverse impacts of fire suppression activities.

The use of mechanized equipment such as plows and bulldozers will produce ecological and visual impacts that can far outlast those caused by the fire. These impacts include erosion, colonization by non-native plant species, stream siltation, the disruption of animal movement, and the loss of ecotones. Regardless of fire severity, the impacts from many standard fire suppression techniques can be at odds with DPR's preferred control methods and ecological objectives. It is essential that park staff review fire plans annually with DFR staff to ensure that DFR staff are aware of DPR ecological concerns and needs.

Depending on the conditions, exceptions to full suppression may be warranted and ecologically advisable. If appropriate conditions, staff, and equipment are deemed by the senior fire management staff on-site to be present, then unplanned or escaped fires may be managed by allowing them to burn out to established, defensible fire lines, such as roads, trails, streams, or other fire lines. It must be emphasized, especially when considering the use of heavy equipment, that careful consideration be given to establishing lines in the best possible location, not simply in the first available location. To avoid getting trapped by fast moving fire, crews should work in or immediately adjacent to blacked-out areas whenever possible. This will be particularly important when using heavy equipment, conducting pump and roll activities with pumper units, etc.

Direct Attack: Whenever possible, a quick initial attack utilizing hand tools, water, or fire retardant chemicals should be employed. This sort of attack should work effectively on the majority of spot fires. Direct attacks should work from the flanks of the fire and not from the head of the fire. Attacking the head of the fire can expose crew members to intense fire behavior and put them at risk of being surrounded by fire.

Indirect Attack: If conditions prevent the effective use of a direct attack, then whenever possible, control lines will be located at the best and most defensible pre-existing fire line, such as a road, trail, stream, or another fire line. The use of backfires, pump and roll operations, etc., will be at the discretion of the on-site commander. Where feasible, and where weather and fire behavior are deemed by the on-site commander to be acceptable, the fire can be allowed to burn out blocks that are bounded by defensible pre-existing fire lines.

6.5 Burn Units and Fire Lines

All prescribed fires will occur in pre-determined burn units with discrete boundaries. There is no minimum size limit; however, whenever possible, prescribed fire units will encompass as much of a particular habitat type as possible. Also, where feasible, units may be burned in combination with others or subdivided in order to address resource needs, personnel, logistics, etc.

Each unit's fire lines will, whenever possible, utilize pre-existing barriers, such as roads, hiking

trails, streams, and shorelines. Hard lines are to be avoided whenever possible, particularly at ecotonal boundaries between community types; in those instances, temporary fire lines are to be constructed by raking, mowing, or establishing wet or foamed lines. Because non-native species can aggressively colonize disturbed areas, plowed or disced lines are strongly discouraged and are to be used only as a last resort. Plowed lines that are established during wildfire suppression are to be minimized and restoration is to occur as soon as possible.

6.6 Burn Unit Prescriptions

Each burn unit will have an approved prescription prior to ignition (Appendix 3). Prescriptions will be developed through the collaboration of park staff, the DIES, RMP and NHP staff, DFR staff, and other appropriate resources. Unit prescriptions will address all of the ecological, logistical, and meteorological parameters that are required for any given unit. Weather parameters will be expressed as an acceptable range across which ignition may occur and should include parameters for both dormant and growing season burns.

Prescriptions are to be reviewed annually and updated to reflect changes in a unit's management status, vegetation, etc. Particular attention should be paid to a unit's management goals, burn rotation, rare species, smoke management, hazards, and the general ecological parameters addressed in Appendix 2. Unit prescriptions will include but not be limited to:

- A brief description of the fire adapted community type(s) being burned.
- Short and long term management objectives, including preferred season of burn; anticipated short and long term fire rotations; and the unit's burning priority.
- A map and, if available, aerial photos.
- Minimum personnel and equipment requirements.
- Weather parameters and fire hazards, including smoke management issues, and precautions taken.
- Rare or exotic species, ecological or safety hazards, and precautions taken.
- Pre-burn safety checklist and post-burn report.

6.7 Burning Categories and NC DFR Readiness Plan Levels

All prescribed fires conducted by NC DPR staff will occur under NC DFR Burning Category 2, 3, 4, or 5 (See Appendix 4). Under no circumstances will any prescribed fires occur when the Burning Category is classified as 1. Burns ignited under Burning Category 5 have the potential for severe fire behavior; therefore, burns on Category 5 days should be limited to units with light fuel loads and are to be undertaken with extreme caution and only after consultation with NC DFR staff. Regardless of burn category, fires should be planned so that ignitions are completed by one hour before sunset.

Unless otherwise advised by DFR personnel, prescribed fires will be allowed only under NC DFR Readiness Plan levels 1-4 (See Appendix 5). Burning restrictions will be in force in North

Carolina state parks whenever the Readiness Plan reaches Level 5, any time the DFR cancels burning permits, or at the PASU's, DISU's, or SUSP's discretion.

6.8 Pre-Burn Notifications and Checklists

Prior to ignition, all park neighbors will be notified via a press release to be coordinated through the Division PIO. This notice will inform the public of the anticipated date and time of the prescribed fire and will briefly address the management goals. This press release will also alert the public to the potential for smoke in and around the park.

No prescribed fire will be ignited unless the pre-burn checklist in Part F of the burn unit prescription has been completed (See Appendix 3). Prescribed fires will either not occur or will be extinguished if the checklist cannot be completed or if changes in weather, smoke management, or fire behavior exceed prescription parameters. It will be the responsibility of the burn boss to ensure that all personnel and equipment requirements specified in the pre-burn checklist have been met, that all weather parameters are within prescription, and that appropriate warning signs are in place. The completed pre-burn checklist must confirm the following points:

- Park has an approved fire management plan and prescriptions in place.
- Proper burning permit obtained.
- All equipment fully operational.
- Firebreaks inspected and determined to be adequate.
- Emergency protocols covered.
- Updated fire weather in hand.
- Notifications made to: DISU; SUSP; DPR PIO; NC DFR; local fire departments; and adjoining land owners.
- Adequate protection in place for sensitive biological features and park facilities.
- Warning signs, closures, or other public information in place.
- Adequate crew are on-site, and all crew members meet DPR firefighter training and protective equipment requirements.
- All crew members have a radio or a partner with one.
- On-site weather parameters measured and ALL parameters within prescription.
- Smoke dispersal conditions adequate; personnel posted at potential trouble spots.
- Test fire is within prescription and anticipated behavior.

6.9 Post-burn Mop Up and Summary

All flames will be extinguished within 50 feet of the fire line, and burning snags will be dropped if they could fall across a line. Burning or smoldering stumps and logs within 50 feet of the line will be broken open and doused. In areas with concerns about neighboring property, park facilities, high fuel loads, lingering smoke, etc., it is recommended that all flames be extinguished and the fire line cold trailed. Burn units will remain closed to visitors until the PASU and/or burn boss deem conditions to be safe (See Appendix 6).

Mandatory follow-up checks will be made at least once during the evening of the day of the burn and the morning following the burn. Additional checks will be at the discretion of the burn boss or PASU. The post-burn summary in Section G of the prescription will be completed by the burn boss; the original will be kept in the park office files, with copies sent to the RMP. Wildfires will be reported via a PR-63 and a burn summary report.

7.1 Smoke Management Parameters

Fire prescriptions are to be written so that prescribed fires will be ignited under conditions that maximize combustion efficiency and minimize emissions. All fires will be scheduled to enhance convection and dispersion and to ensure that the smoke plume moves away from sensitive areas. NC DFR tracks fire-related smoke management across the state via its Voluntary Smoke Management Program. This program tracks the volume of fuel scheduled for burning and informs cooperators of smoke limits on any given day. Smoke management requirements and limits will differ from county to county, and it will be the responsibility of the burn boss to ensure compliance with all local regulations as well as with NC DFR's Smoke Management Guidelines (See Appendix 7). If night time smoke inversions are an issue, then all fire operations should be completed by one hour before sundown.

Smoke sensitive areas (SSA's) must be identified prior to ignition, and information on all SSA's must be included in the prescription. Any potentially SSA's within 5 miles of the park should be considered when writing the prescription. Critical SSA's will be defined as:

- Areas that already have air quality or visibility problems.
- Any sensitive area within .5 mile of the burn site, including residential areas, urban areas, hospitals, airports, schools, roads, park facilities, campgrounds, etc.

To reduce the hazard of impaired visibility due to smoke on roads near a prescribed burn site, large, easy-to-read signs warning of smoke on the road will be posted at appropriate locations (See Appendix 6). If poor smoke dispersal or decreased visibility become significant on adjacent property or roads, ignition will cease. If conditions do not improve to the satisfaction of the burn boss, then the fire will be extinguished. In either instance, staff will be stationed at appropriate locations to warn approaching vehicles. Traffic control assistance from local law enforcement personnel is to be requested as needed.

To minimize the health and safety hazards of smoke resulting from prescribed burns, burns will be conducted under fuel moisture and meteorological conditions and with firing techniques that will keep the environmental impacts of the smoke within acceptable limits. If the burn prescription meets the following criteria, then smoke management issues should be minimal:

- Is the mixing height 1,700 feet or higher?
- Is transport wind speed at least 9 mph and is it taking smoke away from SSA's?

- o If there are stumps and snags, are you taking steps to keep them from burning and are you providing adequate mop-up?

7.2 Weather Monitoring

Smoke management and fire behavior are largely a function of weather; therefore, all weather parameters are to be closely monitored prior to and during ignition. Up-to-date fire weather forecasts will be obtained prior to ignition, and park staff will record on-site weather conditions prior to and during the fire at 30-45 minute intervals by using a belt weather kit.

It is critical that the burn boss remain fully informed regarding fire weather and that all weather parameters remain within prescription during the burn. The Division could face serious legal consequences and containment costs if a prescribed fire is ignited out of prescription and escapes.

On the day of the fire, burn bosses are to check all available fire weather sources, including the NC DFR fire weather web site; the National Weather Service web site; local fire weather radio; and on-site conditions by using a belt weather kit. If discrepancies arise between weather forecasts, then burn bosses should make the decision to ignite only after reconciling those differences. If discrepancies cannot be reconciled to the satisfaction of the burn boss, then the burn will be canceled.

It is important to note that each prescription's weather parameters will be expressed in ranges; differing combinations of those ranges will accommodate a variety of on-site weather conditions and could result in a variety of fire intensities and behaviors. When considering the interactions between weather, fuel models, and topography, burn bosses are expected to possess the knowledge and skill to reasonably anticipate fire behavior. In all instances, ignition should be based on the most conservative interpretation of the fire weather.

7.3 Test Fire

Every prescribed fire will be preceded by a test fire so that the burn boss and crew can assess ignition patterns, fire behavior, and smoke management. Test fires are to ignited at the location that has been selected as the starting point for the prescribed fire. The test fire will use the same ignition pattern as the main fire, and the main fire is not to be ignited until the test fire is deemed to have demonstrated acceptable fire behavior and smoke management. If the test fire does not behave as anticipated, then it will be extinguished and the fire canceled.

8.0 TRAINING STANDARDS

Anyone participating in prescribed fires on DPR-managed lands will be required to obtain training ensuring that they have the skill to safely conduct prescribed burns, control minor wildfires, and to provide assistance to DFR on major wildfires.

8.1 Basic Fire Crew Certification

All Division field staff participating in any aspect of fire management are required to have basic fire crew certification. This certification is open to any division employee and requires:

- National Wildfire Coordinating Group (NWCG) S-130, Firefighter Training; and S-190, Introduction to Wildland Fire Behavior (See Appendix 8).
- Demonstrated proficiency with the DPR radio system.
- Demonstrated proficiency with the park's pumper unit.

8.2 Maintenance of Basic Firefighter Certification

Basic firefighter status can be maintained by participating in one prescribed burn in a two year period and by maintaining proficiency with radio/pumper systems.

8.3 Burn Boss Certification

The Division's goal is to have a certified burn boss at every park that utilizes prescribed fire. Following basic fire crew certification, any Division employee may qualify for certification as a burn boss by completing the following:

- NWCG courses S-290/390 (See Appendix 8).
- DFR, DPR, or The Nature Conservancy prescribed burning workshop.
- DFR, DPR, or The Nature Conservancy ecological burning workshop.
- Participation in a minimum of four prescribed burns.
- Plan and direct a minimum of two prescribed burns as an apprentice burn boss under the supervision of a division- certified burn boss.

The participation in four prescribed burns can be accomplished at any time during the certification process. However, because of the advanced skills that are addressed in the workshops, the S-290/390 series must be completed prior to attending, or as part of the curriculum of, those workshops. The apprentice burns are to be conducted only after all other burn boss requirements have been met.

On completing the apprentice burns, the supervising burn boss will submit a recommendation to the DISU, who will forward the recommendation to the SUSP for final approval. Copies of the SUSP letter of approval will go to the individual, the DISU, and the RMP.

8.4 Maintenance of Burn Boss Certification

To maintain certification, a burn boss must participate in at least one prescribed burn every two years, and plan and direct at least one prescribed burn in a three year period.

8.5 Participation by Non-DPR Staff

The participation of properly trained and equipped non-DPR staff in fire management operations and the development of cooperative agreements with outside agencies are strongly encouraged. Cooperative management programs will be accompanied by a simple written document in which agency responsibilities and training, experience, and equipment standards are clearly established. See Section 5.4 for review and approval criteria of such agreements. Questions concerning the training qualifications of non-DPR personnel are to be resolved prior to their participation.

Because of overriding liability exposure and safety issues, non-DPR staff who do not meet the criteria for basic fire crew certification or who do not have the proper personal protective equipment (see Section 9.3) will not be allowed on the fire line and can not be allowed access to an area when a prescirbed fire is in progress. At the discretion of the PASU and burn boss, the participation of untrained volunteers and visitors such as school groups, researchers, private citizens, environmental education seminars, etc., will be limited to participating in pre- and post fire monitoring and reporting.

8.6 NC DFR Certified Prescribed Burner Act

This program provides training to the public, encourages private landowners to use fire appropriately, and limits the liability arising from smoke management from burns conducted on private property in North Carolina (See Appendix 9). Certification requires the landowner to write a burn plan, take a prescribed fire course, and conduct a burn under supervision.

Although the participation of DPR staff under this program is not a requirement for qualification as a DPR burn boss, certification is recommended for state parks staff. Parks with prescribed burning programs are to contact the DFR county forester to review the park's plan and to coordinate certification.

9.0 EQUIPMENT AND SAFETY

Under no circumstances will fires be ignited without the minimum equipment and personnel specified in the prescription. All safety procedures will be vigorously enforced, safety equipment will be used properly at all times, and every precaution will be taken to minimize risks and avoid injuries.

All Division safety guidelines apply to activities involving any fire management equipment, including chainsaws, weed eaters, tractors, pumper units, bush axes, or similar tools. All fire crews must be instructed in the safe and proper use of all equipment. This should be accomplished by using fire control safety as a documented topic at park safety meetings. For prescribed burns, equipment instructions will be included in the pre-burn team briefing.

9.1 Equipment Inventory

The equipment needs for prescribed burns will be specified in the unit prescription and will depend on management goals, burning conditions, and the size of the burn unit. An inventory of fire control equipment, including type, quantity, condition and location will be documented in each park's fire management plan. Appendix 10 shows a typical fire equipment inventory.

9.2 Physical Fitness

All participants in fire management activities must possess physical strength sufficient to work at heavy manual tasks for considerable periods of time under trying conditions. The burn boss or PASU should not allow any person to participate in a burn if a physical condition exists that would cause that person to be a hazard to himself/herself or to others, or that would prevent efficient performance of the duties required for wildfire control or prescribed burning.

9.3 Personal Protective Equipment

All fire crew personnel will wear the mandatory clothing and personal safety equipment listed below. Nomex fire retardant clothing is the universal standard in fire retardant clothing and is required when on the fire line. Because of overriding liability issues, under no conditions will personnel without flame retardant clothing be allowed on the fire line or in an area where fire management activities are occurring.

Mandatory Clothing

- Body covering: Nomex fire shirt and Nomex fire pants; or 1-piece Nomex jumpsuit.
- Gloves: Leather or leather and cotton. No all cotton gloves.
- Boots: Leather lace-up, high-top.
- Hard Hat: OSHA-approved hard hat.

Optional Clothing

- Kerchief or respirator.
- Portable fire shelter.
- Nomex face and neck flap.
- Goggles.

9.4 Communications

Every crew member must have a radio or be paired with someone who does. All participants must be familiar with DPR radio guidelines and procedures. In cases where personnel from different parks or agencies are involved, the burn boss may improve communications efficiency by temporarily assigning special call signals for personnel and equipment.

9.5 First Aid

Fully stocked first-aid kits and an ample supply of drinking water must be located within easy access of all participants in prescribed burns or wildfire control. All burn bosses and field staff participating in prescribed burns must have completed a First Responder course. Ignition will cease and, if necessary, suppression will be initiated in the event of an injury requiring the evacuation of any crew member.

9.6 Pre-burn Briefing

A team briefing and site inspection will be conducted before each burn. The following points are to be covered in the pre-burn briefing and at any team meeting during wildfire suppression:

- Walking or driving tour of the unit and review of fire lines and escape routes.
- Fuel models, vegetation types, ignition patterns, and anticipated fire behavior.
- Heat exhaustion prevention and treatment.
- Emergency procedures and phone numbers.
- Location of first aid.
- Radio check.
- Team assignments, equipment locations, and any special circumstances.
- Confirmation that all crew members meet minimum equipment standards.

9.7 Public Safety

Access by anyone other than DPR personnel will be allowed only under conditions that have been agreed to in advance by the burn boss and PASU. Under no circumstances will the public be granted access to any burn unit during a prescribed fire. Roads leading to the burn unit will be blockaded on the morning of the burn. All trails leading to the burn unit will be signed as closed, and a pre-burn inspection will be conducted to confirm that no park visitors are in the area.

10.0 MONITORING AND REPORTING

10.1 General Information

The total acreage burned and the environmental effects of wildfires and prescribed burns will be recorded and monitored to determine if the park's fire management objectives are being met. It is vital that staff keep accurate burn records and develop a long term monitoring plan, since fire effects will dictate revisions to the park's fire plan. A reporting and monitoring program will be included in each park's fire management plan, and a record of all wildfires and prescribed fires will be maintained by the park, with copies of all information provided to the RMP.

The park PASU should obtain assistance as needed from other Division personnel or volunteers in developing and implementing a monitoring program. Monitoring techniques must be consistent, simple, repeatable and reliable. The procedures used should be standardized methods tailored to individual sites, situations, and needs.

Fire effects monitoring will provide park staff with opportunities to develop long term cooperative research projects with a variety of agencies, including university level scientists. Park staff are strongly encouraged to identify and enlist the participation of appropriately skilled and knowledgeable researchers and volunteers in documenting pre- and post-burn fire effects.

10.2 Wildfires

For wildfires or escaped prescribed fires, the park superintendent will document the fire's effects by completing the applicable sections of the Burn Summary Report (See Appendix 3) and attaching it to a PR-63. Additional monitoring activities will be conducted as deemed appropriate. Where feasible, wildfire areas will be maintained as burn units and incorporated into the prescribed fire plan. Additional review of wildfire or escaped fire situations will be at the discretion of the DISU and SUSP.

10.3 Prescribed Burns

A Burn Summary Report will be recorded for every prescribed fire, with copies to be retained by the park and the RMP. The type and extent of prescribed burn monitoring will depend upon the circumstances of each burn unit. Considerations in developing an appropriate monitoring program are: the burn management objectives; the significance of species and communities; the amount of information available to help predict fire effects; the experimental design; and the logistical constraints.

10.4 Pre-burn Inventories

Prior to any unit being burned, park staff will record a basic biological inventory. At a minimum, this inventory will document the natural community type and will include a vegetation

species list. Rare and exotic species, or species or areas of particular ecological concern will be noted and mapped.

10.5 Photo Transects

As a minimum level of monitoring, photo reference points will be established on all units. The locations of these transects are to be permanently recorded so that photo orientation will remain consistent. Photos are to be taken with the same orientation and should include some type of reference tool indicating height. Slides or digital images are preferred.

Photos will be taken during the growing season so that the unit's vegetation composition and structure can be documented. When combined with the pre-burn inventory data, these photos will document a visual baseline for future comparisons. After a unit is burned, a set of follow-up photos will be taken as closely as possible to the same date as the baseline set for that unit. In addition, a set of before and after photos should be taken for every prescribed burn.

10.6 Rare Species and Communities

The presence of rare species and communities of special concern warrants detailed planning and monitoring data collection. Rare and endangered species and communities should be monitored to determine if the biological objectives stated in the park's fire management plan and burn unit prescription are being met. For these special elements, permanent research plots should be established and sampled to evaluate the effects of prescribed burning, and to determine if changes in the burning program are needed. Protection protocols will be addressed in the burn unit prescription for all rare or sensitive species and community types.

10.7 Additional Monitoring

Additional monitoring activities may include collecting specific information on fire behavior or documenting overall site and biological effects. Examples of burn monitoring tasks are:

- Observing fire behavior and weather during burning to compare predicted and observed fire characteristics.
- Documenting the fire event, fire containment, and logistical problems to provide a permanent record and to improve future performance.
- Recording effects on fuels to determine if fuel modification goals were achieved.
- Measuring ecological parameters to assess achievement of biological objectives.

11.0 PUBLIC RELATIONS

The public and media outlets will be informed about the status and results of significant wildfires, the scheduling of individual prescribed burns, and the objectives of the overall prescribed burning program.

11.1 Wildfires

As soon as is reasonable, the PASU will notify the Director' s office and the Division PIO through the DISU and the SUSP of any wildfire or escaped prescribed fire that is on or threatening park property. If the fire continues for more than one day, the PASU will give the PIO a daily status report. All media information releases concerning wildfire will be coordinated through the Division PIO.

News releases concerning park burning restrictions or closures due to fire hazards will be coordinated through the Division PIO in compliance with Staff Directive 87-2, and upon recommendation of the DFR staff.

11.2 Prescribed Burns

The PASU will coordinate with the Division PIO in developing a press release for local media outlets. Adjacent landowners will be notified of the anticipated burn date by telephone, letter, visit, or press release.

The PASU will have a clear understanding of the history of fire in the park, and will be expected to explain clearly the purposes and objectives of the burn to the press or public. The PASU will respond appropriately to any complaints or requests for information as soon as possible, and will document all public participation and comments.

11.3 Access to Burn Sites by Media Personnel

Unless approved in advance by the DISU and the Division Director or appointed designee, all fires, regardless of their status, size, or purpose, will be closed to the media. Any fire that is approved for media coverage will be subject to the points covered in Section 8.5.

12.0 INTERPRETATION

Educational programs on fire ecology will be incorporated into the park's Interpretation and Education program, visitor center exhibits, and other public programs.

12.1 Interpretive Activities

Each park participating in prescribed burns will develop information as part of any program on fire, or as a handout when responding to public inquiries. Where appropriate, fire ecology should become an Interpretation and Education theme. Preparation of video footage and slides during a burn is encouraged for future uses in programming and training. For parks that conduct prescribed burning, technical assistance will be provided by the DIES, RMP staff, and other sources as appropriate.

12.2 Restrictions

Under no circumstances will a prescribed burn be advertised or used as an interpretive program. Visitor access will be subject to the conditions of Section 8.5. Otherwise, access to any burn site will not be allowed until the burn boss or PASU determines that conditions warrant reopening the site.

Literature Cited

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APPENDIX 1: Memorandum of Agreement With NC DFR

COOPERATIVE FOREST FIRE CONTROL AGREEMENT
BETWEEN N.C. DIVISION OF FOREST RESOURCES
AND
N.C. DIVISION OF PARKS AND RECREATION

The purpose of this Agreement is to define and set forth the relative responsibilities of N.C. Division of Forest Resources and the N.C. Division of Parks and Recreation for preventing and controlling wildfires on Parks and Recreation land. The N.C. Division of Forest Resources is charged, under General Statutes, with the responsibility of protecting state and private forest lands from forest fires and is also charged with enforcing laws relating to forest fires. The Division of Parks and Recreation is charged with the responsibility of enforcing the laws and regulations on State Park lands. Both the Division of Forest Resources and Division of Parks and Recreation contribute to the protection of State Park land and agree to the following guidelines in carrying out these responsibilities.

The Division of Forest Resources Agrees:

- That the District Foresters will keep the Park Superintendents informed, as needed, concerning forest fire danger during periods of normal forest fire conditions.
- That the District Foresters will alert the Park Superintendents when unusually severe forest fire conditions are eminent and provide them with advice on the use of fire in State Parks.
- That the District Forester or County Forester/Ranger will notify the Park Superintendent immediately of any fires on or threatening a State Park.
- To assume direction for the control of any wildfire either on or threatening State Parks as quickly as possible after discovery.
- That the District Forester will inform the Park Superintendent of any burning restrictions affecting State Park lands.

The Division of Parks and Recreation Agrees:

- That the Park Superintendents will consult with the District Foresters when the danger of forest fires increases in State Parks and restrict the use of fire when fire conditions warrant such action.
- That the Director, Division of Parks and Recreation, will direct the closure of any of the State Parks to public use when fire conditions warrant such action and he is notified of such conditions by the Director, Division of Forest Resources.
- That the Park Superintendent will report any fire detected, either on or off State Park Land, to the District Forester or County Forester/Ranger.
- To take immediate action on any fire on, or threatening State Park land.
- To turn over direction for control of any wildfire to the first North Carolina County Forester/Ranger to arrive and male Park personnel, equipment, and facilities available for use in suppressing the fire.

APPENDIX 1 (continued): Memorandum of Agreement With NC DFR

- That the Parks and Recreation Public Information Officer will consult with the Forest Resources Public Information Officer prior to issuing news releases relating to the restrictions of burning in State Parks.

Both Agencies Agree:

- To be responsible foe training their own employees and to participate in joint training meetings for the purpose of developing closer working relationships.
- To render mutual assistance in law enforcement activities, the gathering of evidence, and in actual court prosecutions.
- The normal fire control expenditures will be paid by the Division of Forest Resources and claims for unusual expenditures will be forwarded through regular channels to the Director of Forest Resources for handling at that level.
- To hold an "Annual Plan Meeting" prior to July 1 of each year, for each Park area at the Park Superintendent-District Forester level, to develop an "Annual Action Plan" for use during the coming year. This plan will include appropriate maps, communication procedures, directories. Equipment, operational procedures, and other appropriate items.

NORTH CAROLINA
Department of Natural Resources
and Community Development
Division of Forest Resources

_____ _____

(Date) Director

NORTH CAROLINA
Department of Natural Resources
and Community Development
Division of Parks and Recreation

_____ _____

(Date) Director

*Signed copy on file at DFR and in park.

APPENDIX 2: General Fire Management Planning

Conducting Ecologically Appropriate Prescribed Fires in North Carolina State Parks

Basic Ecological Information

The goal is to replicate the park's historical fire regime, so burning at the right time, and with the appropriate fire return intervals and intensities, will be key. Burning when you can is **not** the same as burning when you should. Burning at inappropriate times conditions might actually fail to control competing vegetation or to perpetuate fire adapted species. Points to consider:

1. Know what fire adapted natural communities are in your park, and know their condition. Key indicators include soils, species composition, and fire history. For help in determining community types, consult the *Classification of Natural Communities of North Carolina*, 3rd Approximation, by Mike Schafale and Alan Weakley. This publication is available from the Natural Heritage Program.

2. Pay particular attention to season of burn, fire severity, and fire frequency. Growing season burns are the most ecologically appropriate, but remember that season is only one of several factors to be considered. Fire severity is often linked to a species' or community's growing characteristics. Fire frequency may be the single most important factor to consider.

3. Develop your burn schedules so that they cover 10 years at a minimum. Restoration and maintenance become more difficult with long fire-free periods, so priority should go to units with the shortest fire-return intervals. **Keep complete records of all burns.**

4. Remember the Rule of 2/3: Aim to conduct 2/3 of your burns during the growing season. Ecologically, it's generally best to burn early in the growing season (March, April, May). It's also historically accurate, and it gives your communities time to deal with fire-induced stress. Mid and late summer burns should be considered with care.

5. It is acceptable, even desirable, to see mortality among canopy species. This is bound to happen, especially if you experiment in various community types. Ideally, the mortality resulting from any single fire should not exceed 15% of the total stand density.

Interpretation and Education in Burned Areas

1. Avoid using emotional terms like "devastation," "destruction," etc., when interpreting fire. Such terms reinforce the notion that the ecosystem has somehow been unnaturally damaged, or even worse, lost. Use terms that accurately discusses fire intensity and ecology.

2. Stress that fire is a natural ecological force that works to rejuvenate communities. The more we do to advance this notion, the less we'll have to explain that fires are not ecological disasters.

3. Remind visitors that repeated fire has occurred for thousands of years in your park; this helps them understand that these communities are altered, but not "destroyed" by fire. The analogy of resetting a clock is also useful.

APPENDIX 2 (continued): Fire Management Planning

Restorations of Fire Adapted/Dependent Communities

1. Establish a long term vision, 10 years minimum, of how you want the area to look.

2. Make your best guess at how the communities will respond to repeated fire. Experiment, with small units, and wait long enough to see the ecological results before trying again. Be patient!

3. Develop objectives that are specific and measurable. This may require some experimentation.

4. Monitor, re-evaluate, and adapt your management as needed.

Managing at the Landscape Level

1. Manage on the landscape level by burning so that you maintain a patchwork of various community types and successional stages across your burn units.

2. If fire won't carry, **don't** force it. Natural fires typically burn unevenly; prescribed fires should do the same. Let the fuel moisture and relative humidity set the limits.

3. Learn to identify and understand both the small and large scale effects of fire. Also, learn to understand time frames when anticipating and interpreting a burn's effects.

4. Establish photo plots on each burn unit and monitor all burn units on an annual basis and immediately after burning. The importance of this cannot be overstated!

5. Remember these rules of thumb for protecting biological diversity:

- If the habitat is not common outside or inside the park, then assume it to be unusual.
- If you have an unusual or interesting community, assume that it supports interesting species.
- If the unusual habitat is fire dependent, assume that burning all of it at one time will result in the loss of its unusual or interesting species.
- If you burn only part of it, assume that you will provide a refuge for recolonization to occur.
- Don't ever burn all of a particular habitat type at one time.

Appendix 2 (continued): Fire Management Planning

Key Weather Parameters

Temperature: Fuel or Hazard Reduction (Winter): Air temperature below 60° F.

Ecological Restoration/Maintenance (Growing Season): Air temperature greater than 60° F but less than 95° F.

Relative Humidity: All burns greater than 30% but less than 60%.

Fine Fuel Moisture: Greater than 10% but less than 20%.

Wind:	20 Foot	Eye Level
Hazard Reduction or Maintenance:	6-20 mph	1-12 mph
Preferred in-stand wind	1-3 mph	

Smoke Dispersion:

Mixing Height	1,700 to 6,500 feet above ground
Transport Wind speed	9-20 mph
Atmospheric Stability	Neutral or slightly unstable
Burning Category	2-4
Nighttime Dispersion	Very poor to good

Keetch/Byram Drought Index: Variable, depending on season and burn objectives. Generally speaking, 0-200 for dormant season burns; 200-400 for growing season burns.

APPENDIX 3: Prescription NC DIVISION OF PARKS AND RECREATION
Revised 12/99 **Burn Unit Prescription**

Park _____ Date of Last Burn: _____ Acreage: _____
M gement Unit _____ Percent That Burned: _____ Rotation: _____

Part A: Unit Description (Attach Map)

Natural Community Type(s): _____

Brief Description of Dominant Vegetation and Fuels: _____

Fuel Model(s): _____ Fuel Arrangement: _____

Soil Type and Series: _____ Topography/Aspect: _____

Part B: Fire Management Objectives

Short Term: _____

Long Term: _____

Part C: Pre-Burn Preparation

Crew and Equipment Required: _____

Firebreaks/Locations: _____

Hazard Areas, Precautions Taken: _____

Species/Communities of Ecological Concern and Precautions Taken: _____

Part D: Smoke Management Information (Attach map if necessary)

Smoke Sensitive Areas: _____

Distance to Nearest SSA: _____ Estimated Tons/Acre: _____ Total Tons: _____

Forestry Map Information: Block _____ Square _____ Point: _____

Part E: Acceptable Weather Parameters			Dormant Season	Growing Season
Burning Category	_____	Surface Wind Speed/Direction	_____	_____
DFR Readiness Plan	_____	Transport Wind Speed/Direction	_____	_____
Mixing Height	_____	Temperature Range	_____	_____
1hr Fuel Moisture	_____	Relative Humidity Range	_____	_____
		KBDI Range	_____	_____

Special Instructions/Unacceptable Parameters/Constraints, etc: _____

This Prescription Developed By: _____ Date: _____

APPENDIX 3 (continued): Prescription

N.C. DIVISION OF PARKS AND RECREATION

Burn Unit Prescription

Park _____ Forest Service District _____

Management Unit _____ County _____

F. Decision Checklist to be Completed in the Field by Burn Boss Prior to Ignition

___ Approved burn prescription for the unit(s)

___ Proper burning permit obtained

___ All equipment fully operational

___ Firebreaks inspected and determined to be adequate

___ Updated fire weather forecast obtained within last 6 hours

___ Adequate personnel on hand, with backup plan/personnel available if needed

___ Notifications made: District Supt.; Supt. Of State Parks; DPR Pubic Info. Officer; NC DFR; local fire departments; adjoining land owners.

___ Adequate protection in place for sensitive biological features and park facilities

___ Signs or other public information in place

___ All crew members briefed and emergency procedures covered

___ All crew members have a radio or a partner with one

___ On-site weather parameters measured and ALL parameters are within prescription

___ Smoke dispersal conditions adequate; personnel posted at potential trouble spots

___ Test fire behavior is within prescription

Burn bosses are expected to ignite only when within prescription. If any of these conditions are not met prior to ignition, then the burn boss must obtain verbal approval from the DISU or his/her representative prior to igniting. A written justification, to be provided below, must be included as part of the post-burn report. Attach additional pages if necessary. **The responsibility and consequences of burning out of prescription rest with the burn boss.**

_____

_____

_____

_____

_____

N.C. DIVISION OF PARKS AND RECREATION

Burn Unit Prescription

G. Post Burn Summary: To Be Completed by Burn Boss

Park _____ Burn Unit _____ Burn Boss _____

Prescribed Fire _____ Wildfire _____ Wildfire Source/Location _____

Crew and Duty Stations _____

_____

_____

Date of Ignition _____ Time of Ignition _____ Burn Completed _____

Test Fire Location _____ Ignition Pattern _____

On-Site Weather Taken Before and During the Burn

	Before	During		Before	During
Burn Category	_____	_____	Mixing Height	_____	_____
Wind Direction (surface)	_____	_____	Wind Direction (Transport)	_____	_____
Wind Speed (mph)	_____	_____	Night Smoke Dispersion	_____	_____
Temperature (F)	_____	_____	Fine Fuel Moisture (%)	_____	_____
Relative Humidity	_____	_____	Readiness Plan	_____	_____

Source and Times of On-Site Weather: _____

Post-Fire Evaluation (Attach additional pages, maps, etc. if needed)

Unit #	Unit Acreage	Acreage Burned	Fuel Type (Model #)	% of Surface Fuels Consumed	% of Duff Consumed
____	_____	_____	_____	_____	_____
____	_____	_____	_____	_____	_____
____	_____	_____	_____	_____	_____
____	_____	_____	_____	_____	_____
Totals	_____	_____		_____	_____

Comments on fire behavior, severity, anticipated effects on hazard reduction, ecological restoration/maintenance:

_____

_____

Comments on firebreaks, equipment, personnel, mop-up, etc: _____

_____

Recommendations for future fires, including next rotation: _____

_____

Dates/times of post-burn follow-ups: _____

_____

APPENDIX 4: Burning Category Designations

NC DFR bases its burn category designations on fire parameters and weather data supplied by the National Weather Service. Adjustments in the parameters and calculations that are used to determine ventilation rates and burn categories can occur without notice; therefore, burn bosses should contact the nearest NC Division of Forest Resources district office for updates on smoke management compliance, refinements to burn category determinations, and allowable tonnages.

BURNING CATEGORY

Ventilation Rate*	Category	Explanation of Category
0 - 33,499	1	Low level inversion and stagnant air the entire day. **NO BURNING**
33,500 - 44,999	2	Inversion until early afternoon and very light transport winds. **MID-AFTERNOON BURNING ONLY.**
45,000 - 59,999	3	Inversion until late morning. Light transport winds. **DAYTIME BURNING**
60,000 - 111,999	4	Little or no inversion. Moderate transport winds. **BURN ANYTIME**
>112,000	5	No inversion. Strong and gusty transport winds. **BURN WITH CAUTION. GOOD SMOKE DISPERSAL, BUT POTENTIAL FOR SEVERE FIRE BEHAVIOR.**

* Ventilation Rate = Mixing height x transport wind speed.

APPENDIX 5: NC DFR District Readiness Plan Determinations

The District Readiness Plan level is an indication of how effectively the district is expected to be also to respond to any fire event. North Carolina state parks generally burn under readiness plans 2,3, and 4. Prescribed fires may occur at level 5, but only with extreme caution.

Readiness Plan Level	Explanation
Readiness Plan 1	No appreciable fire activity. There is little or no chance of fire occurring.
Readiness Plan 2	Occasional fire activity. Fire suppression is within the county's capability.
Readiness Plan 3	Moderate fire activity. Fire suppression is usually within the county's capability, but district-level support is available if needed. The district Operations Room is manned.
Readiness Plan 4	Normal fire activity. Fire suppression is within the county's capability, but the need for district-level support is probable. Air support is available at the discretion of the Regional forester. The regional Operations Room is manned.
Readiness Plan 5	Severe fire conditions. Fire suppression is within the district's capability. Full regional air support is available. C.O. Operations Room is manned.
Readiness Plan 6	Critical fire conditions. The need for regional fire support is probable. Effective control of all fire is within regional capability. Project Fire Team is on alert. Emergency Management (EOC) is notified.
Readiness Plan 7	Extreme fire conditions. It is probable that assistance from outside the region may be needed to effectively control fires. One or more Project Fire Teams are alerted.

APPENDIX 6: Prescribed Fire Public Information Signs

This area has been burned as part of the park's fire management program. This fire will benefit the park's wildlife and plants and will also reduce the danger of wildfire.

For Information:

Please contact park staff.

APPENDIX 6 (continued): Prescribed Fire Public Information Signs

This Area Closed Until Further Notice

Prescribed Fire

In Progress.

For Information: Please contact park staff.

APPENDIX 6 (continued): Prescribed Fire Public Information Signs

WARNING
Prescribed Fire in Progress.

Dense Smoke May Appear.

For Information: Please contact park staff.

APPENDIX 7: NC DFR Smoke Management Guidelines

Smoke Management Guidelines for Forestry Burning Operations

Objective

To minimize particulate matter and smoke in smoke-sensitive areas resulting from prescribed burning activities by defining those days and volumes of vegetative debris that may be burned.

Control

The State Forester is responsible for the development of the Smoke Management Guidelines. He or she will consult with the National Weather Service and the Div. of Env. Management and will be responsible for the coordination of prescribed burning on state and private forest lands.

Administration

The burn plan should include the location of all potential smoke-sensitive areas from the site of the prescribed burn and should manage all burning activities so as to maintain a satisfactory atmospheric environment in smoke-sensitive areas. The person in charge should evaluate downwind conditions prior to beginning operations; if he or she determines that visibility in a smoke-sensitive area is already seriously reduced or would likely become so with additional burning, or upon notice from DFR staff that the area would likely become so, he or she should not begin prescribed burning or, if burning, should terminate burning as soon as practical. Upon termination, residual burning should be mopped up as soon as practical, and no additional burning should be attempted until approval has been received from the State Forester.

Smoke Dispersal Categories for Prescribed Burning

Ventilation Rate*	Category	Explanation of Category
0 - 33,499	1	Low level inversion and stagnant air the entire day. **NO BURNING**
33,500 - 44,999	2	Inversion until early afternoon and very light transport winds. **MID-AFTERNOON BURNING ONLY.**
45,000 - 59,999	3	Inversion until late morning. Light transport winds. **DAYTIME BURNING**
60,000 - 111,999	4	Little or no inversion. Moderate transport winds. **BURN ANYTIME**
>112,000	5	No inversion. Strong and gusty transport winds. **BURN WITH CAUTION. GOOD SMOKE DISPERSAL, BUT POTENTIAL FOR SEVERE FIRE BEHAVIOR.**

APPENDIX 7 (continued): NC DFR Smoke Management Guidelines

Smoke Management Guidelines

Refer to the following Smoke Management Guidelines for permissable tonnages to be burned per 16,000-acre block (25-square miles) as designated on NC DFR maps.

I. **Smoke Drift Away From Potential Smoke-Sensitive Areas:**

A. No specific tonnage limitation will be placed on prescribed burning. Burning should be done to best accomplish maximum plume height and minimize nuisance effects.

II **Smoke Drift Toward Potential Smoke-Sensitive Areas:**

A. Category I: No new prescribed fires will be ignited.

B. Category 2: Daytime burning only. Burning to start after inversion burnoff temperature is reached and will cease by sunset. Burning will cease 2 hours before sunset if forecasted nighttime dispersion is forecasted to be poor or very poor.

Downwind Distance in Miles to Smoke Sensitive Areas	Total Available Tons of Fuel/25 sq. miles	
0 - <.5	0	0*
.5 - <5	360	720*
5 - <10	720	1440*
10 - <20	1080	2160*
20 - <30	1200	2400*
30+	1440	2880*

*Daytime understory burning IF: 1) Backing fire is used, OR 2) Headfire used in 3-year-old or less rough, OR 3) Mass ignition with burning accomplished by sunset.

C. Category 3: Daytime burning only. Burning to start after inversion burnoff temperature is reached and will cease by sunset. Burning will cease 2 hours before sunset if forecasted nighttime dispersion is forecasted to be poor or very poor.

Downwind Distance in Miles to Smoke Sensitive Areas	Total Available Tons of Fuel/25 sq. miles	
0 - <.5	0	0*
.5 - <5	450	900*
5 - <10	900	1800*
10 - <20	1350	2700 *
20 - <30	1600	3200 *
30+	1800	3600 *

*Daytime understory burning IF: 1) Backing fire is used, OR 2) Headfire used in 3-year-old or

less rough, OR 3) Mass ignition with burning accomplished by sunset.

D. Category 4: Daytime and nighttime burning except during nighttime when poor to very poor smoke dispersal is forecasted.

Downwind Distance in Miles to Smoke Sensitive Areas	Total Available Tons of Fuel/25 sq. miles		
	1	2	3*
0 - <.5	0	0	1030
.5 - <5	720	1440	2160
5 - <10	1440	2880	4320
10 - <20	2160	4320	6480
20 - <30	2500	5000	7500
30+	2880	5760	8640

1: Allowable tonnage when nighttime dispersion is poor or very poor, with burning accomplished by sunset.

2. Allowable tonnage when nighttime dispersion is fair or good.

3. *Daytime and nighttime understory burning when nighttime dispersion is fair or good IF: 1) Backing fire is used, OR 2) Head fire is used in 3-year old or less rough, OR 3) Mass ignition.

NOTE: If nighttime dispersion is poor or very poor, use column 2 for dayitme understory burning. Nighttime understory burning is not permissable.

E. Category 5: Daytime and nighttime burning except during nighttime when poor to very poor smoke dispersal is forecasted.

Downwind Distance in Miles to Smoke Sensitive Areas	Total Available Tons of Fuel/25 sq. miles		
	1	2	3*
0 - <.5	0	0	1350
.5 - <5	900	1800	2700
5 - <10	1800	3600	5400
10 - <20	2700	5400	8100
20 - <30	3000	6000	9000
30+	3600	7200	10,800

1: Allowable tonnage when nighttime dispersion is poor or very poor, with burning accomplished by sunset.

2. Allowable tonnage when nighttime dispersion is fair or good.

3. *Daytime and nighttime understory burning when nighttime dispersion is fair or good IF: 1) Backing fire is used, OR 2) Head fire is used in 3-year old or less rough, OR 3) Mass ignition.

NOTE: If nighttime dispersion is poor or very poor, use column 2 for dayitme understory burning. Nighttime understory burning is not permissable.

Organic Material - Residual Burning

When organic material is ignited during prescribed burning, and the material continues to burn, a daily evaluation will be made to estimate: 1) The acres continuing to burn within a given 16,000 acre block, and 2) The daily tonnage that will be consumed.

The standard daily burning rate of undisturbed organic material is 16 tons/acre/day. This assumes that one solid acre burns at the rate of approximately one inch per day. Adjustments to the daily burning rate of organic materials and to the actual number of acres on fire are necessary to actually assess the impact of residual burning within each 16,000 acre block. The tonnage derived from residual burning will be subtracted from the available total tonnage each day to determine the adjusted tonnage that can be burned within the 16,000 acre block.

Forest Fuel Types - Description and Fuel Concentrations in Tons/Acre

LITTER

Litter Type	Light Fuel Conc.	Moderate Fuel Conc.	Heavy Fuel Conc.
Pine	3	6	12
Hardwood	3	5	7
Mixed	4	6	8

SLASH

Light: Partial cuts or thinning operations in hardwood and pines. Typical stands can include untreated light clear cuts that are normally burned and planted.

Moderate: The fuels are normally drum-chopped prior to burning. The fuel is evenly distributed and the majority of the fuel will normally be consumed during burning.

Heavy: These fuels are large trees of heavy brush that cannot be drum-chopped and is dropped using a KG or V-blade prior to burning. Fire intensity and loading are dependent on length of drying time prior to ignition.

APPENDIX 7 (continued): NC DFR Smoke Management Guidelines

Slash Type	Light Fuel Conc.	Moderate Fuel Conc.	Heavy Fuel Conc.
Light	5	10	20
Moderate	10	20	40
Heavy	30	40	60

BRUSH

Light: Brush up to 2 feet tall. Typical brush occurs on 1-3 year-old cutovers and small brush on untended fields.

Moderate: Brush 2-4 feet tall. Examples are species of bays, gallberry, and wax myrtle. Low pocosins are also represented in this fuel type.

Heavy: Brush over 4 feet tall. Fuel types include the high pocosin, laurel slicks, and species found in Carolina Bays.

Brush Type	Light Fuel Conc.	Moderate Fuel Conc.	Heavy Fuel Conc.
Light	4	7	10
Moderate	6	8	15
Heavy	10	20	30

GRASS

Short: Dominated by wiregrass and commonly associated with longleaf pine and scrub oak overstory. The amount of wiregrass typically increases as crown closure decreases.

Tall: Sawgrass, marshgrass, and broomsedge are typical grass types that occupy the majority of the site. Grasses up to 3 feet are included. Light brush may be present, but grass is the primary carrier.

Grass Type	Low Fuel Conc.	Moderate Fuel Conc.	Heavy Fuel Conc.
Short	2	5	7
Tall	3	6	8

APPENDIX 7 (continued): NC DFR Smoke Management Guidelines

Screening System for Prescribed Fire Smoke Management

This screening system is straightforward and easy to use. However, it should not be used without some knowledge about fire behavior and smoke management. It should be used only as a starting place and with judgement by personnel experienced and qualified in the use of prescribed burning. There are many variables that affect the amount of smoke that is produced, for how long, and how it will be dispersed. This system only utilizes a few of the major parameters and is based on slightly unstable atmospheric conditions and the average size and fuel conditions of most burns in the south. Also, some steps are based on very limited research. As you gain experience in its use, you can modify to more closely suit your types of burns, fuels, and unit sizes. This system is an updated version of the one found on pages 24-25 in "A Guide for Prescribed Fire in Southern Forests."

Step 1: Deterrmine the area affected by the smoke plume.

A. Utilizing accurate maps, plot the folowing wind direction and distances based on your fuel types:

Grass fuels: 5 miles
Backing fires: 5 miles*
Head fires or burns approaching 1,000 acres: 10 miles*
Logging debris: 30 miles

B. Draw lines from each end of the fire at an angle of 30 degrees from the wind direction and draw arcs at the distances indicated above. This is your probable smoke impact area. If your winds are variable, use 45 degrees.

C. Go down drainage for one-half the distance of the distance estimated in "B," but do not spread out except to cover valleys and bottoms. This is your probable impact area at night.

*: Double these distances if in palmetto-gallberry fuels.

Step 2: Identify Smoke-Sensitive Areas

A. Identify and mark any smoke-sensitive areas located with both probable impact areas.

B. If no smoke-sensitive areas occur, burn as planned. If smoke-sensitive areas are found, continue the screening system.

Step 3: Identify Critical Smoke-Sensitive Areas

A. Critical Smoke-sensitive areas are:

1. Areas that already have air pollution or visibility problems.
2. Areas within the probable smoke impact areas as follows:

If distance criteria detemined in Step 1 was:

a . 5 miles: Any smoke-sensitive area within one-half mile is critical, both down and upwind.

b. 10 miles: Any smoke-sensitive area within one mile.

c. 30 miles: Any smoke-sensitive area within three miles.

B. If any critical smoke-sensitive areas are located, DO NOT BURN under present prescription. Make one of the following changes:

1. Prescribe a new wind direction that will miss the critical area.

2. If the smoke-sensitive area is in the last half of the distance criteria, reduce the burn area by one-half and complete the burn by 3:00 pm.

3. Use some alternative other than burning.

C. If no critical smoke-sensitive areas are found, or if criteria in "B" above are met, continue the screening system.

Step 4: Adjusting for Fuel Types

The amount of smoke will vary greatly by amount, type, and condition of fuel. From the list below, determine which of the broad categories of fuel types most fit your fuel.

A. Fuel Types

- Grass (with pine overstory)
- Light Brush
- Pine Needle Litter
- Palmetto-Gallberry
- Logging Debris

B. If fuel type matches or is comparable, then continue with the screening system. If your fuel type differs, then pick the fuel type that most closely matches. USE EXTREME CAUTION when burning; it is recommended that you experiment with several test burns to guage fire and smoke behavior.

C. If your fuel type is piled logging debris, DO NOT BURN unless you:

- Prescribe a new wind direction.
- Use a better procedure.

APPENDIX 7 (continued): NC DFR Smoke Management Guidelines

D. If the fuel type is scattered logging debris or small, round, dry piles, the following conditions should be met:

1. Size of area to burn is less than 100 acres.
2. No interstates or major highways within 5 miles down drainage.

No research is completed on logging debris. However, windrows are known to be the most polluting of all Southern fuels. Dirt in piles or windrows will increase the amount of smoke by as much as four-fold.

E. If any of the other types, the total fuel loading should be less than 10 tons/acre. Generally, the total fuel loading will be less than 10 tons/acre for the following ages:

Grass: Any age
Light Brush: 7 years
Pine Needle Litter: 7 years
Pine Needle Slash: 5 years
Palmetto-Gallberry: 3 years

Step 5: Minimizing Risk

If your prescribed fire meets all of the criteria so far and you can answer yes to the following questions, you may burn as prescribed. Otherwise, change your prescription.

1. Is the mixing height 1,700 feet or higher?

2. Is the transport windspeed 9 mph or greater?

3. Is background visibility 5 miles or greater?

4. If fuels are older than two years, is a backing fire prescribed or can the prescribed burn be completed by 3:00 pm?

5. If a smoke-sensitive area is in the trajectory of two plumes, is it at least one mile from either source (two miles for logging debris)?

6. For night burns, are winds over 4 mph, relative humidity under 80%, and is backing fire prescribed?

7. Are you taking steps to keep stumps and snags from smoldering after the fire?

If your prescribed fire complies with all of the conditions in these steps, you can safely burn without causing a smoke problem. If you have any marginal answers, areas that are extra sensitive to smoke, heavy fuel loads, or wet fuel loads, the burn boss must make the final call.

APPENDIX 8: National Wildfire Coordinating Group Training Courses

S-130 Firefighter Training

This is an entry level course that takes between 20 and 30 hours to complete and can also be used as a refresher course as needed. It includes an overview of common firefighting concepts and techniques used throughout the United States and provides hands-on instruction in the following topics: firefighter preparedness; use of tools and equipment; firing devices; fire suppression; securing the fireside; scouting; patrolling; communication; and safety review. Optional topics include use of water; use of maps; wildland fire investigation; and first aid.

S-190 Introduction to Fire Behavior

This course is frequently taken with S-130 and requires 15-20 hours to complete. It covers the principle environmental factors that affect the initiation and spread of wildfire, how basic suppression methods apply to breaking the fire triangle, and situations that are potentially threatening to life and property.

S-290 Intermediate Fire Behavior

This is a 32-hour course that is designed to meet the training requirements required for personnel involved in the operations section of the Incident Command System. This is a skills oriented course for fireside supervisors and emphasizes wildland fire behavior.

Topics covered include basic wildland environmental factors affecting fire behavior; the causes of extreme fire behavior; assessing fireside data and determining fire behavior and suppression limitations; and the conditions and influences that must be monitored continuously when managing a fire. There is a final examination that requires a minimum score of 80%.

S-290 Introduction to Wildland Fire Behavior Calculations

This is a 16-hour course that is usually taken in combination with S-290. The course consists of three formal classroom units and a final examination. Topics covered include determining what inputs are needed for developing surface fire behavior nomograms; performing fire behavior calculations for rate of spread, fireside intensity; flame length, and area/perimeter growth; factors determining safe control tactics; and applications of fire behavior predictions and how those predictions may be different from the observed. There is a final examination that requires a minimum score of 80%.

APPENDIX 10: Park Fire Fighting Equipment

Quantity	Condition	Equipment
		Axes
		Backpack Pumps
		Drip Torch
		Fie Rakes
		First Aid Backpacks
		Round-point Shovels
		Flat Shovels
		Tractor
		Nomex Clothing
		Radios, Portable
		4 Wheel or pick up with slip-on pumper
		Chainsaws
		Gas cans 2 ½ gallons
		Hard Hats
		Chain Saw Chaps
		6 Ton Dump Truck
		Pulaski
		Bush Axes
		Nomex
		5 gallon gas can
		Leather gloves
		Water cooler 3 gallon
		Signs/prescribed burn in progress
		Signs/Dense Smoke ahead
		Signs/This Area burned