



Stones River National Battlefield

**Fire Management Plan
2003**

2003 Fire Management Plan
Stones River National Battlefield
Tennessee

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1.0 INTRODUCTION

1.1 Reason for Development of Fire Management Plan

National Park Service (NPS) policy requires that every park unit with burnable vegetation develop a fire management plan (*Director's Order #18: Wildland Fire Management*, Web site <http://www.fire.nps.gov/fire/policy/do18/do18.htm>). The fire management plan serves as a detailed and comprehensive program of action to implement fire management policies and objectives, consistent with the unit's resource management objectives. This plan outlines the fire management program at Stones River National Battlefield (hereinafter referred to as either "the park," or by NPS alpha code "STRI"). The STRI fire management program, guided by federal policy and the park's resource management objectives, will serve to protect life, property, and natural and cultural resources.

1.2 Collaborative Processes

In addition to administering STRI, the National Park Service collaborates with the U.S. Fish and Wildlife Service; the State Historic Preservation Office; the Tennessee Department of Environment and Conservation; Tennessee Department of Agriculture, Division of Forestry the Rutherford County Chamber of Commerce, community and business leaders, and private landowners regarding how to best protect the integrity of the park.

Collaborative opportunities pertaining to fire management at STRI include cooperative agreements with the City of Murfreesboro Fire Department; the Rutherford County Volunteer Fire Department; the Tennessee Department of Agriculture, Division of Forestry; and local law enforcement.

1.3 Implementation of Fire Management Policy

The organizational structure of this fire management plan (FMP) follows the FMP outline furnished in chapter 4 of *Wildland Fire Management Reference Manual-18* (version 3.0, dated 11/05/02), hereinafter referred to as *RM-18* (Web site <http://www.fire.nps.gov/fire/policy/rm18/index.htm>). This FMP will guide the park in implementing federal fire management policy and resource and fire management goals as defined in the *2001 Federal Fire Policy; Managing Impacts of Wildfires on Communities and the Environment, and Protecting People and Sustaining Resources in Fire-Adapted Ecosystems—A Cohesive Strategy*; and *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan*.

1.3.1 2001 Federal Fire Policy

The 1994 fire season with its 34 fatalities triggered a series of reports under the rubric FIRE 21, including the *1995 Federal Wildland Fire Management Policy and Program Review*. This review, the first comprehensive federal fire policy for the Departments of

Agriculture and the Interior, provided direction for fire management programs and activities, including such areas as safety, protection priorities, preparedness, suppression, wildland fire use, prevention, and wildland-urban interface roles and responsibilities. Following the escape of the Cerro Grande Prescribed Fire in May 2000, the *1995 Federal Fire Policy* was evaluated and revised in the *2001 Review and Update of the 1995 Federal Wildland Fire Management Policy (2001 Federal Fire Policy)*. The *2001 Federal Fire Policy* finds no fundamental flaws in the 1995 document. It builds on the *1995 Federal Fire Policy*, and addresses issues not fully covered in 1995, including rehabilitation and restoration of burned lands, the importance of sound science driving fire management activities, and the need for the full range of fire management activities to achieve ecosystem sustainability.

The *2001 Federal Fire Policy* states that “...successful implementation of 2001 Federal Fire Policy depends on the development and implementation of high-quality Fire Management Plans by all land managing agencies.” The policy is founded on the following guiding principles:

1. Firefighter and public safety is the first priority in every fire management activity.
2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
3. Fire management plans, programs, and activities support general and resource management plans and their implementation.
4. Sound risk management is a foundation for all fire management activities.
5. Fire management programs and activities are economically viable, based upon values to be protected, costs, and general and resource management objectives.
6. Fire management plans and activities are based upon the best available science.
7. Fire management plans and activities incorporate public health and environmental quality considerations.
8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
9. Standardization of policies and procedures among Federal agencies is an ongoing objective.

1.3.2 Managing Impacts of Wildfires on Communities and the Environment, and Protecting People and Sustaining Resources in Fire Adapted Ecosystems—A Cohesive Strategy

The *Cohesive Strategy* was developed by the USDA National Forest Service, the US Department of the Interior, and the National Association of State Foresters, in response to the 2000 fire season, during which more than 6.8 million acres of public and private lands burned—more than twice the 10-year national average. The magnitude of these fires was attributed to severe drought, accompanied by a series of storms that produced thousands of lightning strikes followed by windy conditions; and the long-term effects of almost a century of aggressively suppressing all wildfires, resulting in an unnatural buildup of brush and small trees throughout forests and rangelands. The *Cohesive Strategy* provides an overall framework for implementing fire management and forest health programs. It is based upon the following operating principles:

- ❑ **Firefighting Readiness:** Increase firefighting capability and capacity for initial attack, extended attack, and large fire support that will reduce the number of small fires becoming large, to better protect natural resources, to reduce the threat to adjacent communities, and reduce the cost of large fire suppression.
- ❑ **Prevention Through Education:** Assist state and local partners to take actions to reduce fire risk to homes and private property through programs such as FIREWISE.
- ❑ **Rehabilitation:** Focus rehabilitation efforts on restoring watershed function, including the protection of basic soil, water resources, biological communities, and prevention of invasive species.
- ❑ **Hazardous Fuel Reduction:** Assign highest priority for hazardous fuels reduction to communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features, where conditions favor uncharacteristically intense fires.
- ❑ **Restoration:** Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fires on a priority watershed basis. Methods will include removal of excessive vegetation and dead fuels through thinning, prescribed fire, and other treatment methods.
- ❑ **Collaborative Stewardship:** Focus on achieving the desired future condition on the land in collaboration with communities, interest groups, and state and federal agencies. Streamline process, maximize effectiveness, use an ecologically conservative approach, and minimize controversy in accomplishing restoration projects.
- ❑ **Monitoring:** Monitor to evaluate the effectiveness of various treatments to reduce unnaturally intense fires while restoring forest ecosystem health and watershed function.

- ❑ Jobs: Encourage new stewardship industries and collaborate with local people, volunteers, Youth Conservation Corps members, service organizations, and Forest Service work crews, as appropriate.
- ❑ Applied Research and Technology Transfer: Focus research on the long-term effectiveness of different restoration and rehabilitation methods to determine those methods most effective in protecting and restoring watershed function and forest health. Seek new uses and markets for byproducts of restoration.

1.3.3 A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan

In August, 2001, the Secretaries of Agriculture and the Interior joined the Western Governor's Association, National Association of State Foresters, National Association of Counties, and the Intertribal Timber Council to endorse *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy*. This report marked the initial fulfillment of two key Congressional directives that:

- ❑ The Secretaries of the Interior and Agriculture and the Governors jointly develop a long-term national strategy to address the wildland fire and hazardous fuels situation and the needs for habitat restoration and rehabilitation; and
- ❑ The strategy should be developed with "close collaboration among citizens and governments at all levels."

The four goals of the *10-Year Comprehensive Strategy* are:

1. Improve fire prevention and suppression
2. Reduce hazardous fuels
3. Restore Fire-Adapted Ecosystems
4. Promote community assistance

Its three guiding principles are:

1. Priority setting that emphasizes the protection of communities and other high-priority watersheds at risk
2. Collaboration among governments and broadly representative stakeholders
3. Accountability through performance measures and monitoring for results

1.4 Environmental Compliance

In association with this plan, an environmental assessment that meets the requirements of the National Environmental Policy Act, including compliance with Section 106 of the National Historic Preservation Act and with Section 7 of the Endangered Species Act, is included as Appendix 13.4.

1.5 Authorities for Implementing Fire Management Plan

Authority for fire management at the park originates with the Organic Act of 1916. The Organic Act established the National Park Service “to promote and regulate the use of the Federal areas known as national parks,...which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

The 1978 “Redwood amendment” to the General Authorities Act of 1970 expands upon the provisions of the Organic Act, stating that, “...the protection, management, and administration of these [Park Service] areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established...”

As an NPS fire management program by design tiers to the respective park unit’s general and resource management objectives, fire management is an effective way of implementing the above legislation.

2.0 RELATIONSHIP TO LAND MANAGEMENT PLANNING AND FIRE POLICY

2.1 Federal Fire Management Policy

The *2001 Federal Fire Policy*, discussed in section 1.3.1, is the product of a collaborative effort involving the U.S. Department of the Interior, the U.S. Department of Agriculture, the Department of Energy, the Department of Defense, the Department of Commerce, the U.S. Environmental Protection Agency, the Federal Emergency Management Agency, and the National Association of State Foresters. The report recognizes the role that fire plays as a critical natural process, as well as the detrimental effects of its absence in fire-adapted ecosystems. As per the report:

Historically, fire has been a frequent and major ecological factor in North America. In the conterminous United States during the preindustrial period (1500-1800), an average of 145 million acres burned annually. Today only 14 million acres (federal and non-federal) are burned annually by wildland fire from all ignition sources....

This decrease in wildland fire has been a destabilizing influence in many fire-adapted ecosystems such as ponderosa pine, lodgepole pine, pinyon/juniper woodlands, southern pinelands, whitebark pine, oak savanna, pitch pine, aspen, and tallgrass prairie. Fuels increased and understory vegetation became more dense. As a result, those wildland fires that did occur were larger and more severe than historical fires. Eliminating fire also affected individual plant species. For example, Hessl and Spackmen (1995) found that, of the 146 threatened, endangered, and rare plant species found in the conterminous U.S.

for which there is conclusive information on fire effects, 135 species benefit from wildland fire or are found in fire-adapted ecosystems.

The report further states that:

...today's conditions confront us with the likelihood of more rapid, extensive ecological changes beyond any we have experienced in the past. To address these changes and the challenges they present, we must first understand and accept the role of wildland fire, and adopt land management practices that integrate fire as an essential ecosystem process.

The task before us—reintroducing fire—is both urgent and enormous. Conditions on millions of acres of wildlands increase the probability of large, intense fires beyond any scale yet witnessed. These severe fires will in turn increase the risk to humans, to property, and to the land upon which our social and economic well being is so intimately intertwined.

2.2 Establishment of Stones River National Battlefield

The National Park System consists of more than 380 units representing our country's finest natural and cultural assets. Stones River National Military Park (name changed to Stones River National Battlefield in 1960) was established by Congress (44 Stat. 1399) on March 3, 1927, to preserve and interpret a portion of land over which Union and Confederate armies fought the Battle of Stones River. Originally administered by the War Department, the park was transferred to NPS administration in 1933.

The Battle of Stones River occurred over the three-day period from December 31, 1862, to January 2, 1863. It was the first major engagement in a series of actions taken by Union forces in an offensive to split the Confederacy from northwest to southeast through Chattanooga and Atlanta. The battle is nationally significant for several reasons:

- Although there was no clear tactical victor, Confederate forces left Union troops in command of the field, and the Union claimed victory. This had far-reaching effects, including:
 - It provided a much-needed boost to northern morale (Union forces had recently suffered a disastrous defeat at Fredericksburg, VA) and had a profound influence on the North not losing other states, such as Kentucky, to the Confederacy.
 - It influenced Abraham Lincoln's future, as well as the roles of England and France in the war.
 - It resulted in Federal occupation of Murfreesboro and control of the productive agricultural land and supply network of central Tennessee.

- It marked the commencement of the Union army's campaign that resulted in the "March to the Sea," and at the same time marked the end of the Confederate army's attempt to move into Kentucky and the North.
- The site is sacred ground, where 81,000 men fought and more than 23,000 became casualties. For the Union army, the rate of casualties was the highest of any battle in the war. For the Confederate army, the casualty rate was second only to the Battle of Gettysburg.

Following the Battle of Stones River, the Union Army of the Cumberland constructed Fortress Rosecrans, to serve as a supply depot for the Union army's advance to Chattanooga and Atlanta. The largest enclosed earthen fortification built during the Civil War (its 14,600 feet of earthworks enclosed over 200 acres), this fort also controlled access to the Nashville and Chattanooga Railroad and the Nashville Turnpike.

The park's enabling legislation authorized acquiring land by purchase or condemnation to preserve the battlefield, clearly marking park boundaries, and marking battle lines and troop locations with historical tablets. It directed the park to conduct these activities "with a view of preserving and marking such [battle]field for historical and professional military study." In December 1987, Public Law 100-205 directed the Secretary of the Interior, to, among other actions, "preserve the existing remnants of Fortress Rosecrans..."





2.3 General Management Plan Objectives

STRI's 1999 General Management Plan (GMP) states that the park's purpose "is to preserve and interpret the battlefield of Stones River, to mark the significant sites, and to promote understanding and appreciation of the battle and related events." General management objectives include:

- ❑ Preserving a core segment of the Stones River battlefield, representative of major battle action, in a way that allows visitors to visualize and imagine the influence of landscape features on the strategy and outcome of the battle.
- ❑ To the greatest extent practicable, preserving and restoring to a general 1860s appearance the land within the authorized boundary of the national battlefield.
- ❑ Maintaining the open space and marking the sites of Rosecrans's and Bragg's headquarters.

The GMP also addresses park issues and concerns, including exotic plants. As per the GMP:

Nonnative species (i.e., Japanese honeysuckle, privet hedge, kudzu) are detracting from the ability to interpret and preserve battlefield resources, including earthworks, are inducing change in the cultural landscape, and may be adversely affecting the cedar glade habitat and threatened or endangered species such as the Tennessee coneflower (*Echinacea tennesseensis*).

2.4 Resource Management Plan Objectives

Objectives addressed in STRI's 1999 Resource Management Plan that are pertinent to fire management include:

- ❑ Preserving and protecting the historic battlefield landscape.
- ❑ Preserving the cedar glade habitat, which offers ideal habitat for the federally-listed endangered Tennessee coneflower (and which also has cultural significance in that scattered, dense eastern red cedar thickets impeded troop movement, thereby influencing the course of the battle).
- ❑ Controlling exotic plant species. (There are at least 37 known invasive exotic plant species at STRI.)
- ❑ Preserving extant earthworks by removing the exotic plant species, and replacing them with a variety of native grass species to stabilize them.

2.5 How Fire Management Plan Supports General Management Plan and Resource Management Plan Objectives

Principle #3 of the *2001 Federal Fire Policy* states that “fire management plans, programs, and activities [will] support general and resource management plans and their implementation.” This fire management plan serves as a detailed and comprehensive program of action to implement federal fire management policy principles and goals, which in turn support the park’s General and Resource Management plan objectives, as well as its enabling legislation. Specifically:

- ❑ Wildland fire suppression serves to protect human life, property, and natural and cultural resources from the adverse effects of unwanted fire.
- ❑ Prescribed fire and non-fire applications assist in restoring, protecting and maintaining historic vistas. They also serve to reduce hazard fuels accumulations, which creates fuel conditions that support low-intensity fires, thereby reducing the threat of catastrophic wildland fire, and reducing the risk of negative impacts to natural and cultural resources, park infrastructure, and adjacent property in the event of a wildland fire. They additionally improve conditions for firefighter and public safety.
- ❑ Prescribed fire and/or non-fire applications assist in preserving the bunch grass-dominated portions of the cedar glade habitat at STRI. They will help remove competing woody vegetation and exotic plant species, which, in addition to threatening native flora, alter the historic scene the park is mandated to maintain. (As per section 4.4.4.2 of the *National Park Service Management Policies 2001*, high priority will be given to managing—up to and including eradicating—exotic species that have, or potentially could have, a substantial impact on park resources.)
- ❑ Fire and its subsequent effects contribute to healthy ecosystem function as well as bio-diversity preservation. According to ecologist Nat Stephenson (quoted in an article from the May/June 1995 issue of *National Parks*),

Fires thin forests, reducing competition for surviving trees, improving their vigor. Fires result in a rich legacy of snags that are important for cavity nesting birds. They recycle nutrients bound up in dead litter. They can change soil properties, such as its ability to hold water. And they kill soil pathogens.

3.0 WILDLAND FIRE MANAGEMENT STRATEGIES

3.1 General Management Considerations

At STRI, all wildland fire, regardless of ignition source, will be suppressed. Prescribed fire and/or non-fire applications will be used to achieve a variety of resource management objectives. The park’s fire management goals, which follow, incorporate STRI’s overall management objectives as well as previously-discussed federal fire management policy

principles and goals, including firefighter and public safety, collaboration, and accountability.

3.2 Wildland Fire Management Goals

Fire management goals at STRI are:

- ❑ Suppress all wildland fire in a cost-effective manner, consistent with resource objectives, considering firefighter and public safety (always the highest priority), and values to be protected.
- ❑ Use prescribed fire and/or non-fire applications to:
 - Preserve and protect the historic battlefield landscape.
 - Return fire to the cedar glade habitat, simulating natural processes to the fullest extent possible, and thereby restoring and maintaining the integrity of this habitat.
 - Control exotic plant species, which compete with native vegetation and alter the historic landscape.
 - Preserve and protect extant earthworks by removing invasive vegetation, promoting revegetation with native grasses, which serves to stabilize them.
 - Reduce hazard fuels accumulations, which in turn:
 - Reduces the threat of catastrophic wildland fire, and reduces the risk of negative impacts to park resources in the event of a wildland fire.
 - Improves conditions for firefighter and public safety, and reduces suppression costs in the event of a wildland fire.
 - Initiate nutrient recycling for healthy soil conditions.
- ❑ Provide park employees with fire operations training and experience so as to develop fully-qualified personnel commensurate with the normal fire year workload.
- ❑ Manage all wildland fire incidents in accordance with accepted interagency standards, using appropriate management strategies and tactics, and maximizing efficiency via interagency coordination and cooperation.
- ❑ Develop new and maintain existing memoranda of understanding with state and local fire management agencies in order to continue close working relationships and mutual cooperation regarding fire management activities.

- ❑ Develop and conduct a monitoring program with recommended standard monitoring levels commensurate with the scope of the fire management program, and use the information gained to continually evaluate and improve the fire management program.
- ❑ Integrate knowledge gained through natural resource research into future fire management decisions and actions.
- ❑ Maintain the highest standards of professional and technical expertise in planning and safely implementing an effective fire management program.
- ❑ Plan and conduct all fire management activities in accordance with all applicable laws, policies and regulations.
- ❑ Incorporate the minimum impact suppression tactics policy into all suppression activities, to the greatest extent feasible and appropriate.

3.3 Scope of Wildland Fire Management Elements to be Implemented

STRI will implement a combination of wildland fire suppression, prescribed fire, and non-fire applications.

3.3.1 Wildland Fire Suppression

A wildland fire is defined as any nonstructural fire, other than prescribed fire, that occurs in the wildland. All wildland fires at STRI, regardless of origin, will be suppressed.

3.3.2 Prescribed Fire

STRI will use prescribed fire to accomplish a variety of resource management objectives, as described in section 3.2. Park planning documents will guide the use of prescribed fire.

3.3.3 Non-Fire Applications

STRI will use non-fire applications (mechanical techniques) to accomplish a variety of resource management objectives, as described in section 3.2.

3.4 Park Description

STRI has been divided into two fire management units (FMUs) to facilitate the achievement of fire management objectives. A description of the general physical and biotic characteristics of the park, below, is followed by descriptions of the FMUs. Unless otherwise specified, the overall description of STRI applies to both of the FMUs.

3.4.1 Physical and Biotic Characteristics

3.4.1.1 Real Property

Stones River National Battlefield is located to the immediate northwest of the city of Murfreesboro, in Rutherford County, Tennessee. The authorized boundary of the park includes 712 acres, almost 600 of which are owned by the federal government. The park is divided into six noncontiguous units, including the main battlefield unit, McFadden Farm, remnants of earthen Fortress Rosecrans, the earthwork remains of Redoubt Brannan, Confederate General Bragg's Headquarters site, and Union General Rosecrans's Headquarters site.

3.4.1.2 Soils

Many outcroppings of thick-bedded Ridley limestone exist in the main park and along the two forks of Stones River. These outcroppings, which contain considerable chert, are unique to Rutherford County within the Central Basin. Soils here range in depth from a few inches on the margins of bedrock exposures to more than 20 feet in some of the natural depressions. The soil is less than four feet thick on average in the battlefield area.

The principal soils in and around the park are Cumberland, Bradyville, Rockland, and Barfield. Minor soils include Crider, Pembroke, Arrington, and Bryson (Soil Conservation Service, 1977).

3.4.1.3 Air Quality

STRI is designated a class II air shed under the Clean Air Act. Under class II, modest increases in air pollution are allowed beyond baseline levels for particulate matter, sulfur dioxide, nitrogen and nitrogen dioxide, provided that the national ambient air quality standards, established by the Environmental Protection Agency (EPA), are not exceeded.

Air quality is a concern because the park is located in a growing metropolitan area. Principal sources of air pollutants in the park vicinity include 171 major stationary sources (e.g., Middle Tennessee State University, General Electric Company, and Rutherford County Highway Department), motor vehicles, and various sources in the Nashville-Murfreesboro metropolitan area. Emissions from visitors' vehicles are the major source of air pollution within the park. However, air pollution from vehicles on nearby highways is more significant.

3.4.1.4 Vegetation

The woody vegetation of the main battlefield unit remains almost exclusively as it was in 1862-63—open farmland and scattered forests of mixed hardwood (including oaks, hickories, winged elm, hackberry, blue ash, and sugar maple) and eastern red cedar.

Cedar glades, totaling about 60 acres, are the most distinctive environmental feature on the main battlefield unit. Of the 29 species that are endemic to cedar glades in general, 19 occur only in the southeastern United States (Baskin, J.M. and C.C. Baskin 1999). Of these 19 southeastern species, 12 are present at the park. Numerous exotic plant species have invaded the main battlefield eastern red cedar thickets and glades, altering the historic scene and threatening the glade habitat.

Within the McFadden Farm unit, the Stones River is lined with a mixed hardwood-eastern red cedar forest in which hardwoods dominate. Principle hardwoods are chinquapin, shumard, and post oak; several species of hickory; white and blue ash; elm; honey locust; hackberry; and black walnut. Box elder, sugarberry, American elm, catalpa, sugar and silver maple, black willow, and cottonwood are present near the stream bank. The majority of the unit, however, is open fields.

The Fortress Rosecrans unit and Redoubt Brannan unit are both primarily open, vegetated by perennial grass of varying heights underneath scattered hardwood.

The General Bragg's Headquarters and General Rosecrans's Headquarters sites are vegetated by manicured grass. Although included in fire management unit #1, they lack vegetation capable of sustaining a wildland fire, and technically fall outside the scope of this fire management plan.

3.4.1.5 Wildlife

The hardwood and eastern red cedar forest, cedar glades, and open fields and crops at the park provide food and cover for a variety of animals, including white-tailed deer, great horned owls, eastern cottontails, opossums, raccoons, eastern chipmunks, gray and fox squirrels, meadow voles, eastern moles, groundhogs, short-tailed shrews, skunks, gray and red fox, and several species of bats.

Park species lists are included as Appendix 13.3.

3.4.1.6 Threatened and Endangered Species

Coordination with the U.S. Fish and Wildlife Service revealed that three federally-listed endangered species are known to or may inhabit the park. These species are also listed as state endangered. The Tennessee coneflower and Pyne's ground plum, the two federally-listed plant species, are species endemic to cedar glades of middle Tennessee.

Populations at the park have been planted and are considered to be important to the recovery of these species. Three state-listed threatened species may occur in the park. However, searches for these species have not been conducted. Five plant species are state-listed as species of special concern. Four of these are endemic or near-endemics to the cedar glade community. Two animal species deemed in need of management by the state of Tennessee are also likely to occur on battlefield property. See Table 1 for a list of federally- and state-listed species that occur or are likely to occur at the park and the status of each.

Table 1: Rare, Threatened, or Endangered Species at STRI, or Likely to Occur

Species	Common Name	Federal Status	State Status	Documented from park
<i>Myotis grisescens</i>	gray bat	LE	E	
<i>Astragalus bibullatus</i>	Pyne's ground plum	LE	E	X, planted
<i>Echinacea tennesseensis</i>	Tennessee coneflower	LE	E	X, planted
<i>Carex davisii</i>	Davis' sedge		T	
<i>Fimbristylus puberula</i>	hairy fimbristylus		T	
<i>Gyrinophilus palleucus</i>	Tennessee cave salamander		T	
<i>Amsonia tabernaemontana</i> var. <i>gattingeri</i>	Eastern blue-star		S	X
<i>Astragalus tennesseensis</i>	Tennessee milk-vetch		S	X
<i>Evolvulus nuttallianus</i>	Evolvulus		S	
<i>Leavenworthia exiqua</i> var. <i>exiqua</i>	Tennessee glade cress		S	X
<i>Talinum calcaricum</i>	limestone fame flower		S	X
<i>Neotoma floridana magister</i>	Eastern woodrat		D	
<i>Notropis rupestris</i>	bedrock shiner		D	

* LE=listed federally endangered, E=state endangered, T=state threatened, S=state species of special concern, D=deemed in need of management

Fire effects on the above-listed species, and subsequent recommendations regarding fire management activities are addressed in the environmental assessment included as appendix 13.4.

3.4.1.7 Cultural and Historic Resources

The park in its entirety is listed as an historic district in the National Register of Historic Places (NRHP). Twenty-one park structures are presently included on the List of Classified Structures (LCS); all are also individually listed on the NRHP. Two cultural landscapes and seven component landscapes at the park are listed in the Cultural Landscapes Automated Inventory Management System (CLAIMS). Also scattered about the wildland setting are historic cannon tubes (mounted on reproduction carriages), which are listed as museum objects in the Automated National Catalogue System (ANCS+). There are no known significant archeological sites within park boundaries that would be affected by fire management activities.

Main Battlefield Unit

The main battlefield unit is a cultural landscape of scattered mixed hardwood and eastern red cedar forest interspersed with open fields, cedar glades, and rock outcroppings. It contains the park visitor center/headquarters, most of the park's 3.4-mile self-guided vehicle tour route, a 3.5-mile perimeter hiking trail, numerous artillery pieces, the Hazen Brigade Monument, and Stones River National Cemetery.

- ❑ The Hazen Brigade Monument marks the site of the only Union position to be held throughout the first day of battle. Erected in 1863 by the survivors of Col. William B. Hazen's brigade, it is the nation's oldest intact Civil War memorial in its original location.
- ❑ The 20-acre cemetery, established in 1865, contains the graves of more than 6,000 Union Civil War dead. It is enclosed by a 3,843-foot long limestone wall.

McFadden Farm

This detached unit, located on the banks of Stones River, contains the McFadden farmstead site (no buildings remain), McFadden's Ford across Stones River, a 1906 monument to the fighting that occurred on the last day of battle, and two mounted artillery pieces. The number of artillery pieces will change soon to four or five.

Fortress Rosecrans

This detached unit includes the southwest corner of the original fortification, comprising Lunettes Palmer and Thomas, and Curtain Wall No. 2. These features are all that remain of the fort's exterior earthworks on federally administered land. The unit also includes an interpretive trail with sections of boardwalk and planned wayside exhibits, and the southern trailhead of the Stones River Greenway.

Redoubt Brannan

This detached unit includes the only surviving (of four) rectangular, earthen redoubt that guarded the interior of Fortress Rosecrans, an interpretive trail with wayside exhibits, and pedestrian access to the Stones River Greenway.

General Bragg's Headquarters Site and General Rosecrans's Headquarters Site

These detached units each include an identifying cannonball and granite marker.

3.4.2 Management Considerations

- ❑ Ensure that firefighter and public safety remains the primary consideration in planning and conducting all fire management activities.

- ❑ Ensure that the park's listing in the National Register of Historic Places is considered in planning and conducting all fire management activities.
- ❑ Ensure that smoke management is considered in planning and conducting all fire management activities.
- ❑ Ensure that all applicable laws, policies and regulations are considered in planning and conducting all fire management activities.
- ❑ Ensure that socio-political economic impacts, including wildland urban interface, are considered in planning and conducting all fire management activities.
- ❑ Ensure that appropriate fire prevention and suppression actions are included in the right-of-way plans of development/vegetation management/contingency documents associated with and required for electrical transmission lines located on agency land.
- ❑ Ensure that fire management activities are coordinated as appropriate with all affected parties. This includes any federally recognized Indian tribes that have historical, cultural, economic or other interests in the proposed action or its effects (required, for example, by 36 CFR 800, 40 CFR 1508, and 43 CFR 10).

3.4.3 Past Role of Fire

Ecological and meteorological evidence indicates that lightning-caused fires were a major environmental force shaping the vegetation of North America for millions of years prior to human habitation (Van Lear and Waldrop 1989). Fire-adapted ecosystems developed, as did individual plant species dependent upon or adapted to wildland fire. According to fire ecologist Dr. Cecil Frost (1998), "...fire once played a role in shaping all but the wettest, the most arid, or the most fire-sheltered plant communities of the United States."

While it is difficult to substantiate purposeful landscape burning by American Indians from the archeological record, diaries, letters, reports, and books by eyewitnesses of Indian fire use from the 1600s to the 1900s have yielded considerable evidence that American Indians did use fire to modify ecosystems (Barrett 1980, 1981; McClain and Elzinga 1994; Russell 1983; Whitney 1994), with profound cumulative effects on the landscape. At the time of European contact, many eastern deciduous forests were open and park-like, with little undergrowth (Bonnicksen 2000, Day 1953, Olsen 1996). Says Charles Kay (2000), "...the only way for eastern forests to have displayed the open-stand characteristics that were common at European settlement is if those communities had regularly been burned by native people as part of aboriginal land management activities."

As per chapter 25 (Background Paper: Fire in Southern Forest Landscapes) of the USDA Forest Service General Technical Report entitled *The Southern Forest Resource Assessment Summary Report* (2002):

To appreciate the pervasive role of fire in shaping southern forests requires an understanding of the dynamic response of southern ecosystems to climate change since the retreat of the Laurentide Ice Sheet, which began around 18,000 years ago, and the extent of human influence, which likely began about 14,000 years ago. Humans exert an influence by igniting or suppressing fires. Native Americans used fire extensively for thousands of years. The early European settlers continued and to a degree expanded the use of fire. In the last century, however, human influence over fire in the South changed markedly.

We have divided the long history of fire since humans arrived in the South into five periods:

- ❑ From the earliest appearance of humans in North America around 14,000 years ago (Fagan 2000) until European contact 500 years ago, the first period was one of increasing human population level and more extensive use of fire.
- ❑ For the first 400 years after their arrival, the early European settlers continued to use fire in much the same way as Native Americans, often reoccupying and farming land cleared by Native Americans and expanding burning of woodlands to provide forage for livestock (Williams 1992).
- ❑ At the end of the 19th century and extending into the 20th century, the remaining southern forests were extensively logged to support economic expansion; wildfires were common in the slash left behind. In reaction to these widespread and destructive wildfires, the fourth period of fire suppression started in the early 1900s.
- ❑ The current period is one of fire management, in which the natural role of fire is increasingly recognized and incorporated into forest management.

According to Terri Hogan, STRI ecologist, the cedar glade habitat is a mosaic of plant communities that includes barrens-like areas dominated by species, such as bunch grasses, associated with prairies and longleaf pine savannas. It is likely that these areas benefited from fire historically. Fire is unlikely to occur within the cedar glades themselves due to a lack of continuous ground fuels there. (Drought and erosion appear to be the primary factors maintaining the glades.)

Since 1933, when the park entered NPS administration, any wildland fire within STRI boundaries has been suppressed. The annual occurrence of wildland fires at STRI is very low; since 1980, three known wildland fires have occurred at the park:

- ❑ Spring, 1993 – .5 acre – sparks discharged by railroad equipment
- ❑ Fall/winter, 1995 – .1 acre – escaped debris burn
- ❑ Summer, 2001 – <.1 acre – human caused (fireworks)

3.4.4 Wildland Fire Management Situation

3.4.4.1 Historical Weather Analysis

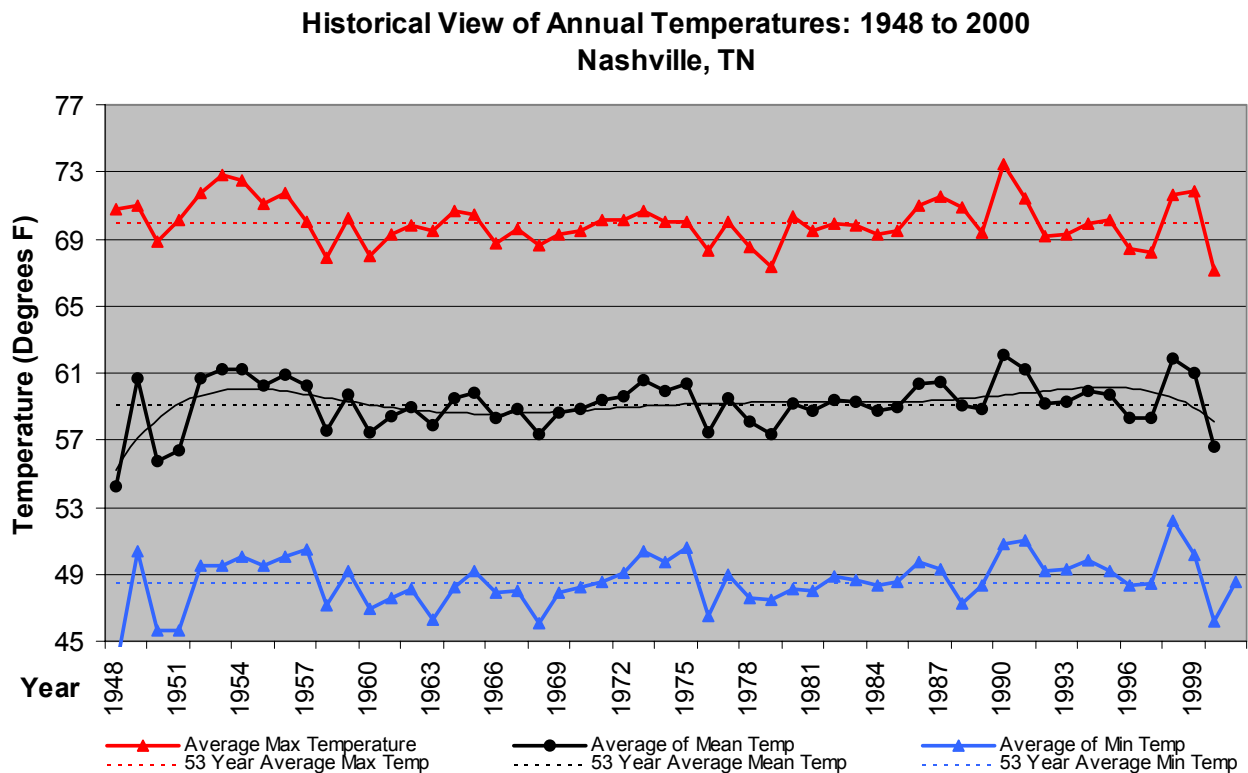
The climate at the park is temperate, characterized by moderate temperatures and rainfall, low wind, relatively high humidity, and frequent weather changes. Extremes of precipitation and temperature are the exception rather than the rule.

Temperatures rarely fall below zero in the winter or exceed 100° F in the summer. The average annual temperature is 60° F. The average daily temperature for the three summer months is around 80° F, with afternoon highs that average about 90° F. July is the warmest month, averaging about 79° F. January is the coldest, averaging about 40° F. Cold spells are usually short and alternate with longer periods of mild weather.

Annual precipitation is about 47.5 inches, fairly well distributed throughout the year. Average monthly rainfall ranges from 2.57 inches in October to 5.45 inches in March. Local showers and thunderstorms are most frequent during the summer months, as are one or more dry spells. A drought occurs every six to seven years. Snowfall averages about 10 inches annually, but heavy snowstorms are infrequent, and snow seldom stays on the ground for more than a few days.

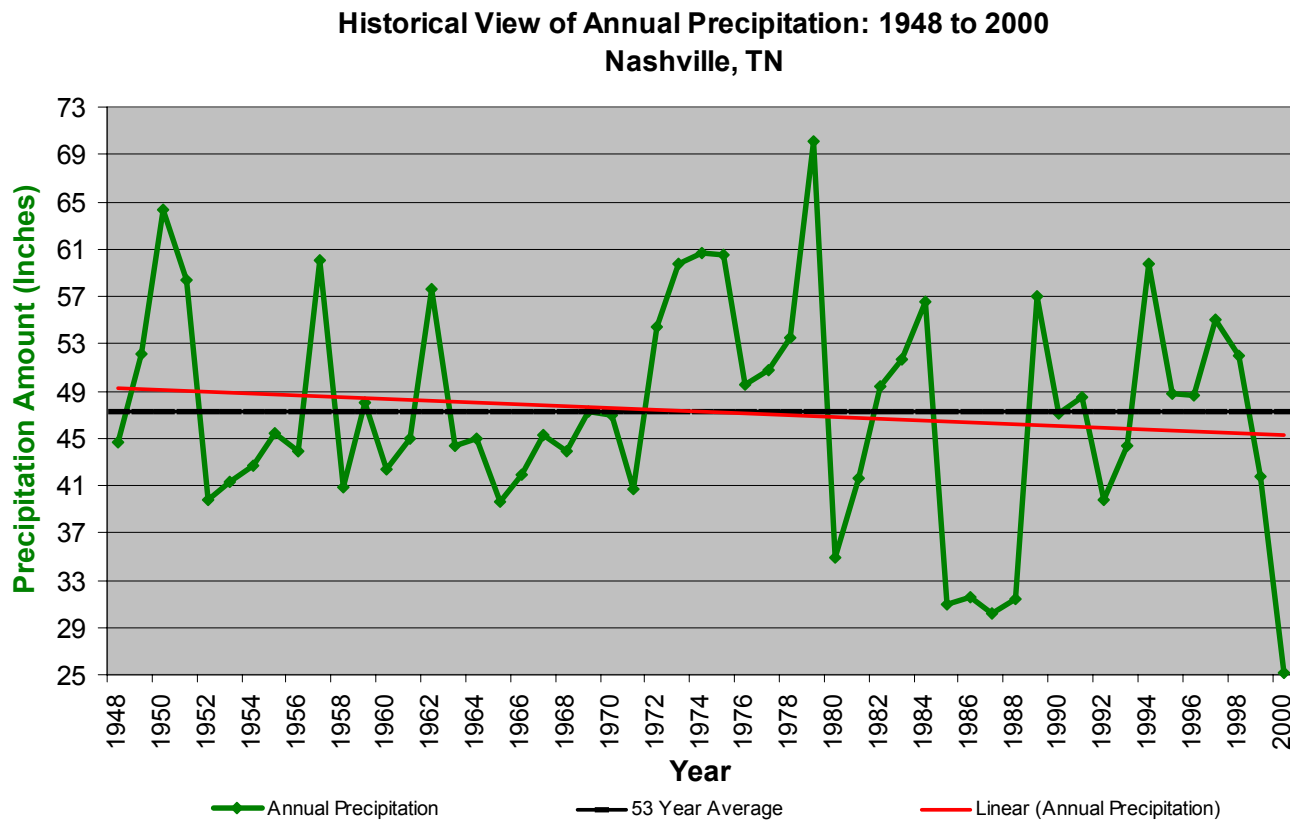
Historic weather data from Nashville, Tennessee, approximately 25 miles to the northwest, serve as a reasonably accurate indication of historic weather patterns of the park area. For the 53-year time period from 1948 to 2000, the average mean temperature, as indicated in Figure 3, was 59° Fahrenheit. The curving black trend line shows mild warming and cooling cycles, which are normal occurrences, according to Kevin Scasny, fire weather meteorologist. The temperature, however, has remained fairly constant, with no discernible overall warming or cooling trend since 1948.

Figure 3:



The average annual mean precipitation from 1948 to 2000, as indicated in Figure 4, was approximately 47.5 inches. The linear red trend line indicates a mild overall precipitation decrease, from 49 inches in 1948 to 45 inches in 2000. However, cautions Scasny, 53 years is such a relatively short time period that little significance should be attributed to this drying trend.

Figure 4:



3.4.4.2 Fire Season

There are two fire seasons in the park area, one in the spring from February 15th to May 1st, and the other in the fall from October 15th to December 15th, determined by historic fire occurrence in the local area. Lower levels of precipitation in the fall and early spring, combined with higher levels of dead or dormant fuels result in the lowest annual fuel moisture rates, and a subsequently higher probability of ignition. Available fuels during these time periods include 1-hour through 1000-hour timelag.

3.4.4.3 Fuel Characteristics and Fire Behavior

The primary fuel types represented at STRI have been classified according to the National Fire Danger Rating System (NFDRS) and the Northern Forest Fire Laboratory Fire Behavior Prediction System (FBPS) (Deeming et al 1978:30, Anderson 1982). Acreages were determined via Geographic Information System.

- ❑ Fuel Model A: This model, and FBPS fuel model 1, most closely match areas of perennial grass which does not exceed one foot in height. Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Surface fires move rapidly through the cured grass and associated material. Very little shrub or timber is present (generally less than one-third of the area). Fuel model A composes approximately 42.5 acres park-wide.
- ❑ Fuel Model C: This model, and FBPS fuel model 2, represent areas of open timber. Perennial grasses and forbs are the primary ground fuel, but there is enough timber litter and branchwood present to contribute significantly to the fuel loading. Some brush and shrubs may be present, but they are of little consequence. Fire spread is primarily through the fine herbaceous fuels, either curing or dead. Fuel model C composes approximately 72.5 acres park-wide.
- ❑ Fuel Model E: This model, and FBPS fuel model 9, most closely match hardwood stands after leaf fall (coinciding with the park's fall fire season). Leaf litter is the primary fuel. High winds will cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves. Concentrations of dead-down woody material can contribute to possible torching out of trees, spotting, and crowning activity. Fires run through the surface litter faster than fuel model R and have higher flame height. In the summer after the trees have leafed out, fuel model E should be replaced by fuel model R. Fuel model E (R after canopy leaf out) composes approximately 316 acres park-wide.
- ❑ Fuel Model L: This model, and FBPS fuel model 1, most closely match areas of perennial grass between one and four feet in height. Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Under windy conditions, the fire may be driven into the upper heights of the grass stand. Very little shrub or timber is present (generally less than one-third of the area). Fuel model L composes approximately 223 acres park-wide.
- ❑ Fuel Model Q: This model, and FBPS fuel model 6, most closely match stands of successional cedar-pine. These areas are dense, with a patchwork of more open savanna with grasses and forbs. In dense areas, the forest floor is covered with moss and lichens, some needle litter, and small branchwood. Surface fires should generally not be very intense, but under windy conditions the fire can carry through the shrub strata. Dead low branches on trees provide ladder fuels for potential crown fire. Fuel model Q composes approximately 26 acres park-wide.

- ❑ Fuel Model R: This model, and FBPS fuel model 8, most closely match hardwood stands after the canopies leaf out in the spring. Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional “jackpot” or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards.

Fields farmed under special use permit are located within park boundaries. At various times these fields are planted in cotton, corn, or soybeans. The crop vegetation is not delineated as a fuel type, as it is not consistent enough to support wildland fire, and the edges of the fields are furthermore treated with herbicide.

Table 2 illustrates historic fire weather parameters at “average” and “extreme” levels for the park fire seasons.

Table 2: Historic Fire Weather Parameters for STRI Fire Seasons (February 15 – May 1; October 15 – December 15) NFDRS Station 221602

Fire Weather/Behavior Parameter	Average Fire Season Weather	97th Percentile Fire Season Weather
20-foot wind speed	3 miles/hour	10 miles/hour
Maximum temperature	68 degrees Fahrenheit	87 degrees Fahrenheit
Minimum relative humidity	46%	20%
1-hour fuel moisture	10%	5%

Assumes maximum fire spread with 0% slope

Table 3 demonstrates anticipated fire behavior at STRI under these average and extreme conditions, as well as critical threshold values influencing fire controllability. The values were calculated using the BEHAVE (Andrews 1986) fire behavior prediction model utilizing weather inputs from the Natchez Trace Parkway manual weather station in Tupelo station (NFDRS station 221602), located approximately 170 miles southwest of STRI. The weather data utilized cover the 10-year period from 1993-2002, and the weather indices were calculated using the Fire Family Plus (Bradshaw 1999) software package. It should be recognized that the table values are based upon models rather than direct observation of fire behavior in these fuel types. As STRI managers have the opportunity to observe and monitor fire behavior, these values may be refined and the model calibrated to better reflect local fuel and weather conditions.

The park uses the Keetch-Byram Drought Index (KBDI) as its primary drought indicator, which, based upon the level, indicates low to extreme drought conditions influencing fire behavior (see section 4.2.2.4.2.2).

Table 3: Potential Fire Behavior Under Average and Extreme Conditions

NFDRS Model	FBPS Model	Fuel Type/Vegetation	Fire Behavior; Average Conditions		Fire Behavior; Extreme Conditions	
			Flame Length (ft)	Rate of Spread	Flame Length (ft)	Rate of Spread
A/L	1	Perennial grass	1	4 chains/hr	4	70 chains/hr
C	2	Perennial grass under open timber	2	3 chains/hr	6	30 chains/hr
E	9	Hardwood leaf litter (after leaf fall)	1	.3 chains/hr	2	4 chains/hr
Q	6	Successional cedar-pine	3	4 chains/hr	6	30 chains/hr
R	8	Hardwood leaf litter (after leaf canopy leaf out)	0.5	9 chains/hr	1	1 chain/hr

Average conditions = 1993-2002 NFDRS station 221602 mean fire season weather conditions

Extreme conditions = 1993-2002 NFDRS station 221602 97% percentile fire season weather conditions

Assumes 0% slope

Table 4 outlines potential critical weather parameters that would result in fire behavior exceeding initial attack capabilities (flame lengths greater than eight feet). These values were calculated using the RX Window Module of the BEHAVE program (Andrews 1986). Such values are useful both for facilitating recognition of potential extreme fire behavior conditions, as well as for assisting in prescription development for the prescribed fire program. It should be noted that generally two or three weather parameters must be aligned in order for extreme conditions to result. It should also be noted that these are modeled values and should serve only as guidelines. As the opportunity arises, fire monitoring data collection on both wildland fires and prescribed fires will facilitate refinement of these values, as well as development of critical values for additional parameters. Last, it should be noted that while the values listed will potentially result in flame lengths greater than eight feet, this does not necessarily indicate a sustained, uncontrollable wildland fire. Rather, they indicate that direct attack is not a safe strategy at the head of the fire. Furthermore, these conditions, particularly wind speed, can vary greatly within a short time period and be fleeting in nature.

Table 4: Critical Weather Parameters Resulting in Need for Indirect Attack

NFDRS Model	FBPS Model	Fuel Type/Vegetation	Moisture of Extinction	Critical Weather Parameters Resulting in Fire Behavior Exceeding Direct Attack Capabilities
A/L	1	Perennial grass	12%	1-hr fuel moisture <5% and eye-level wind speed >10 mph
C	2	Perennial grass under open timber	15%	1-hr fuel moisture <5% and eye-level wind speed >5 mph
E	9	Hardwood leaf litter (after leaf fall)	25%	1-hr fuel moisture <5% and eye-level wind speed >15 mph
Q	6	Successional cedar-pine	25%	1-hr fuel moisture <5% and eye-level wind speed >7 mph
R	8	Hardwood leaf litter (after leaf out)	39%	Flame lengths unlikely to exceed 8 feet even under extreme conditions

Moisture of extinction is defined as the 1-hour fuel moisture upper limit beyond which the fuels described by the given model will not burn. One-hr fuel moisture is a function of temperature, relative humidity, and shading.

3.4.4.4 Fire Regime Alteration

As previously discussed, the primary timber association at the park is mixed hardwood and eastern red cedar, interspersed with open fields and farmland. The following description of the oak-hickory fire regime comes from chapter 25 (Background Paper: Fire in Southern Forest Landscapes) of the USDA Forest Service General Technical Report entitled *The Southern Forest Resource Assessment Summary Report* (2002):

The oak-hickory forest type (Barrett 1994, Braun 1950) occurs primarily on average to dry upland sites, but it also can be found on moist upland sites, depending upon past disturbance history. The oak-hickory type historically had an understory fire regime¹ (Brose and others 2001, Van Lear and Waldrop 1989, Wade and others 2000), but presettlement fire frequencies are not known. Conservative estimates from dendrochronological studies suggest fire return intervals of 2.8 years (Cutter and Guyette 1994) to 14 years (Buell and others 1954, Guyette and Dey 1997). The frequency and extent of Native American burning decreased substantially after European contact. As a result, forest canopies closed over previously open grasslands, savannas, and woodlands (Buckner 1983; Denevan 1992; Dobyns 1983; MacCleery 1993, 1995; Pyne 1997). European settlers of oak-hickory forests increased the frequency and extent of burning and shortened fire-return intervals to 2 to 10 years; they burned many sites annually (Cutter and Guyette 1994, Guyette and Dey 1997, Holmes 1911, Sutherland 1997, Sutherland and others 1995).

Presently, infrequent low-intensity surface fires during the spring and fall characterize the fire regime of oak-hickory forests. These fires are caused almost exclusively by humans and burn small areas (Barden and Woods 1974,

¹ As per this report, fires in the understory fire regime do not kill the dominant vegetation or substantially change its structure. Approximately 80 percent or more of the aboveground dominant vegetation survives fire (Brown 2000).

Pyne and others 1996, Ruffner and Abrams 1998). Fire exclusion created a fuel complex that is probably very difficult to ignite. On drier mountainous sites, fire exclusion allows ericaceous shrubs such as mountain laurel and rhododendron to move from riparian areas into upland forests (Elliott and others 1999). These shrubs are shade tolerant and evergreen, shading the forest floor throughout the year. Although the forest floor rarely dries enough to support surface fire, the ericaceous shrub layer is flammable. When it burns, it typically supports intense crown fires.

At present, this fire regime is in condition class 2², as defined in the USDA Forest Service General Technical Report entitled *Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management* (2002). The proposed treatment (mechanical applications and/or prescribed fire) of approximately 149 acres within this fire regime should begin moving these acres to condition class 1³.

3.4.4.5 Control Problems and Dominant Topographic Features

Fuels, weather and topography are all contributing factors to fire behavior at the park. The greater battlefield terrain is gently rolling, with numerous limestone outcroppings, sinks and caves. Elevations range from 520 to 600 feet above sea level. The west fork of Stones River along the northern and eastern edges of the park is bordered by sharp bluffs that rise in several places to 40 feet in height. See section 3.4.4.3 for a discussion of park fuel characteristics and fire behavior, and Table 3 for potential fire behavior under average and extreme conditions.

3.4.5 Fire Management Units

As previously stated, two fire management units (FMUs) have been identified and established within STRI in order to facilitate the accomplishment of fire management objectives. Associated acreages were determined via Geographic Information System. Values to protect, manage, or at risk pertaining to both FMUs follow descriptions of the FMUs, in section 3.4.6.

² Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.

³ Fire regimes are within an historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and function within an historical range. Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.

3.4.5.1 Fire Management Unit #1: Primarily Fields and Open Areas

FMU #1 contains approximately 305 acres (see Figure 5). The Stones River National Cemetery and primary park development/infrastructure are located within this FMU.

3.4.5.1.1 Specific Fire Management Objectives

Fire management objectives specific to FMU #1 are:

- ❑ Conduct initial attack within 30 minutes of the time a wildland fire report is received.
- ❑ Control 95% or higher of all wildland fires during initial attack.
- ❑ Mechanically treat approximately 69 acres for a variety of resource benefits, including ecosystem sustainability, hazard fuels reduction, exotic vegetation control, and historic landscape preservation.
- ❑ Conduct prescribed burning of approximately 85 acres (69 of which are also undergoing mechanical treatment) for a variety of resource benefits, including ecosystem sustainability, hazard fuels reduction, exotic plant species control, and historic landscape preservation.
- ❑ In the process of mechanically treating and/or prescribed burning 85 acres, begin moving these acres from their current fire regime condition class of 2 to condition class 1.

3.4.5.1.2 Fuel Characteristics/Fire Behavior

Fuel types represented within FMU #1 include fuel models A (approximately 42 acres), C (approximately 22 acres), E or R (approximately three acres), and L (approximately 214 acres). See section 3.4.4.3 for fuel characteristics and Table 3 for potential fire behavior under average and extreme conditions.

3.4.5.2 Fire Management Unit #2: Primarily Mixed Hardwood and Cedar Glades

FMU #2 contains approximately 407 acres (see Figure 5).

3.4.5.2.1 Specific Fire Management Objectives

Fire management objectives specific to FMU #2 include:

- ❑ Conduct initial attack within 30 minutes of the time a wildland fire report is received.
- ❑ Control 95% or higher of all wildland fires during initial attack.

- ❑ Mechanically treat approximately 50 acres for a variety of resource benefits, including ecosystem sustainability, hazard fuels reduction, exotic vegetation control, and historic landscape preservation.
- ❑ Conduct prescribed burning of approximately 63 acres (50 of which are also undergoing mechanical treatment) for a variety of resource benefits, including ecosystem sustainability, hazard fuels reduction, exotic plant species control, and historic landscape preservation.
- ❑ In the process of mechanically treating and/or prescribed burning 63 acres, begin moving these acres from their current fire regime condition class of 2 to condition class 1.

3.4.5.2.2 Fuel Characteristics/Fire Behavior

Fuel types represented within FMU #2 include fuel models A (approximately one-half acre), C (approximately 50.5 acres), E or R (approximately 313 acres), L (approximately nine acres), and Q (approximately 26 acres). See section 3.4.4.3 for fuel characteristics and Table 3 for potential fire behavior under average and extreme conditions.

3.4.6 Values to Protect, Manage, or at Risk

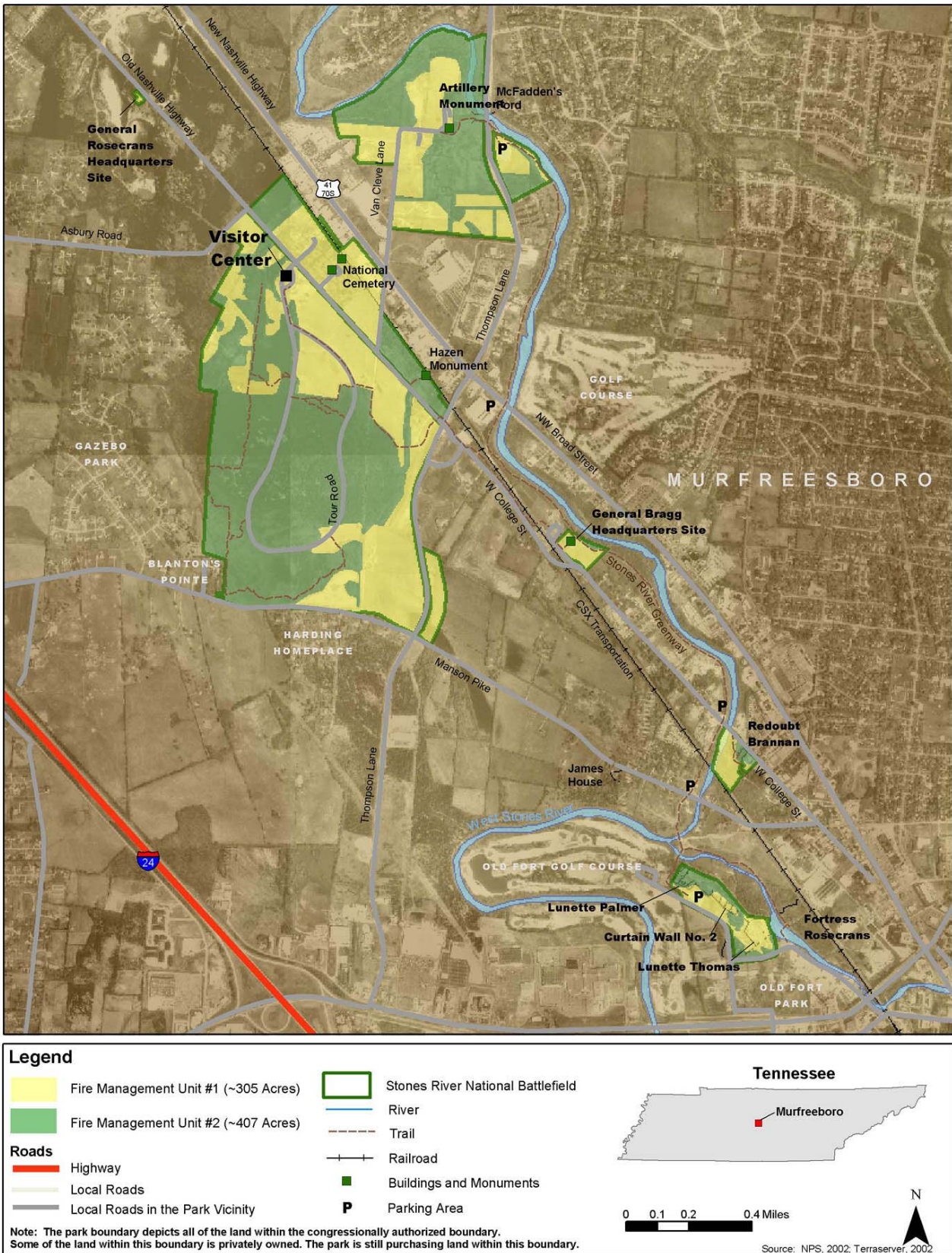
- ❑ Human health and safety: Firefighter and public safety is the highest priority in every fire management activity. In light of this:
 - Only fully qualified (i.e. meeting NPS qualifications and accepted interagency knowledge, skills and abilities for the assigned fire job), red-carded employees will be assigned fire management duties (unless assigned as trainees, in which case they will be closely supervised by an individual fully qualified for the given position).
 - No fire management operation will be initiated until all personnel involved have received a safety briefing describing known hazards and mitigating actions (LCES)⁴, current fire season conditions, and current and predicted fire weather and behavior. Hazards specific to the park include:
 - Snags and dead trees with weak root systems.
 - Loose rock and rocky outcrops that can contribute to poor footing.
 - Steep slopes and steep/sheer cliffs.
 - Stinging/biting insects and poisonous snakes.
 - Poison ivy.
 - Dehydration, heat exhaustion and heat stroke.

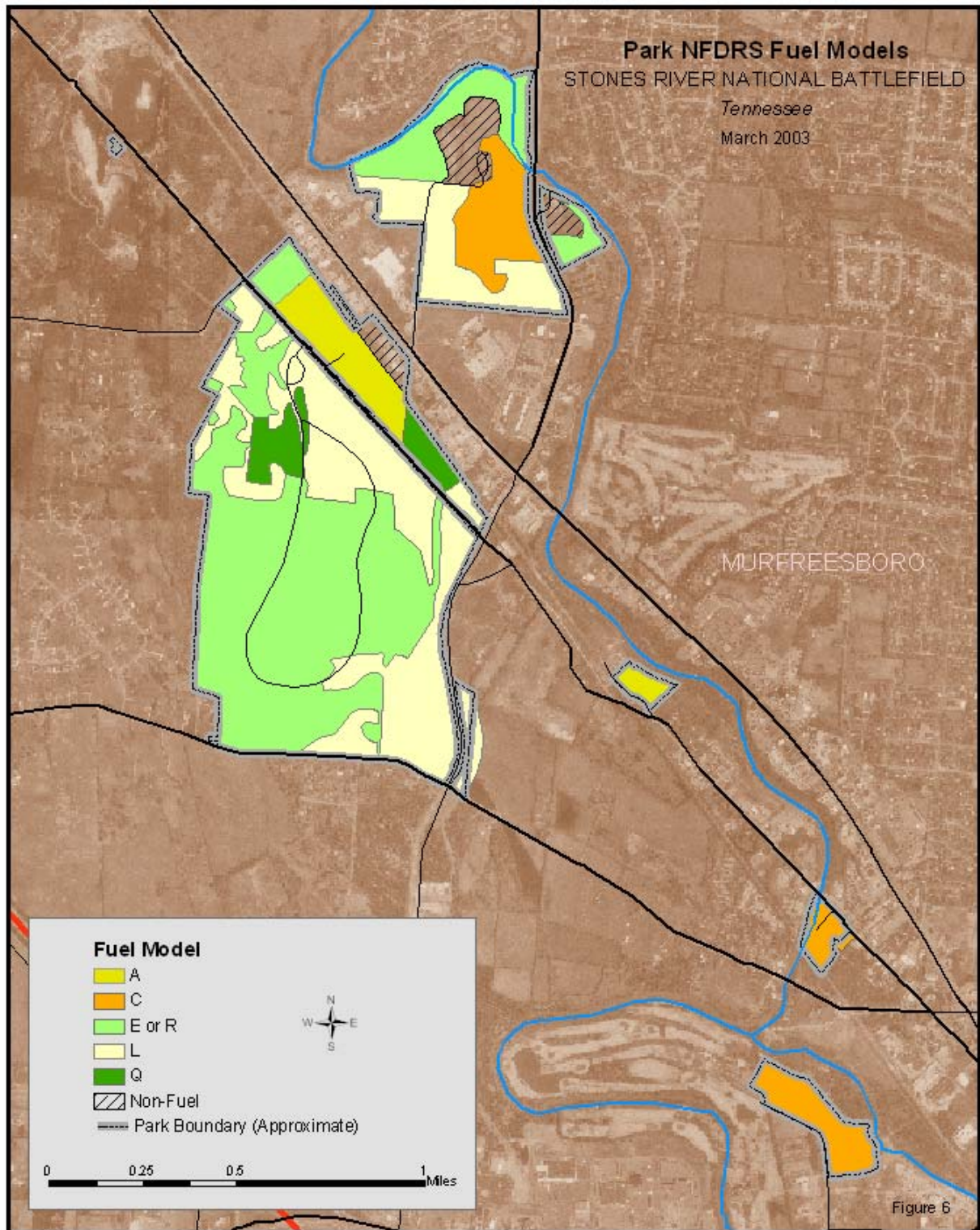
⁴ LCES is an acronym intended to remind firefighters of the four key elements associated with firefighter safety: Lookouts, Communications, Escape Routes, and Safety Zones.

- Possible presence of unexploded ordnance in wooded areas, the visibility of which is obscured by timber understory and leaf litter. Prior to prescribed fire application within a wooded area, it is recommended that the proposed burn unit undergo a grid-style search with a metal detector.
- Wildland fire incident commanders and prescribed fire bosses will minimize firefighter exposure to heavy smoke by incorporating the recommendations outlined in the publication *Health Hazards of Smoke* (Sharkey 1997), available from the Missoula Technology and Development Center.
- Prescribed burning will not be conducted when atmospheric conditions exist that could permit degradation of air quality to a degree that negatively affects public health. Federal and state air quality standards will be the basis for this decision.
- Park neighbors, visitors and local residents will be notified of all planned and unplanned fire management events that have the potential to impact them.
- Smoke on roadways will be monitored and traffic control provisions taken to ensure motorist safety during fire events at the park. The following procedures will be taken to compensate for reduced visibility when a paved road is affected by smoke (the incident commander or prescribed fire boss on a particular event will determine visibility levels):
 - Posting of “Smoke on Road” signs on either side of the affected area.
 - Reducing the posted speed limit when visibility is strongly reduced, and escorting vehicles with a well-marked law enforcement vehicle as necessary.
 - Closing the road to traffic when visibility is severely reduced.
- The STRI superintendent or designee may, as a safety precaution, temporarily close all or part of the park to the visiting public. In the case of prescribed fire, areas needing to be closed for visitor protection will be closed prior to the initiation of prescribed burning.
- Property: To the greatest extent feasible and appropriate, park infrastructure, any other development, and adjacent non-agency land will be protected during all fire management activities.
- Natural and Cultural Resources: Natural and cultural resources will be protected from the adverse effects of unwanted fire as well as the adverse effects of fire management activities (see section 10.0). During all suppression activities, the minimum impact suppression tactics policy will be incorporated to the greatest extent feasible and appropriate, employing methods least damaging to park resources for the given situation (see section 4.2.7).

- Air and water quality: The park will comply with the Clean Air Act, the Clean Water Act, and all other applicable federal, state, and local laws and requirements. Additionally:
 - The suppression response selected to manage a wildland fire will consider air quality standards.
 - Fire weather forecasts will be used to correlate prescribed fire ignitions with periods of optimal combustion and smoke dispersal. Any smoke situation that arises and threatens any smoke-sensitive areas will entail *immediate* suppression action.
 - During fire suppression, water will be used in lieu of fire retardant whenever possible. If retardant must be used, a non-fugitive type will be chosen, and bodies of water avoided.
 - Because prescribed fire will not be applied under extreme conditions, the probability of denuding the soil will be limited, thereby limiting the possibility of extreme erosion. (The primary threat to water quality is sediments and nutrients resulting from uncontrolled erosion.)

Figure 5: Park Fire Management Units





4.0 WILDLAND FIRE MANAGEMENT PROGRAM COMPONENTS

4.1 General Implementation Procedures

As wildland fire will not be used for resource benefits at STRI, suppression is the only appropriate response to a wildland fire. The requirement for a decision checklist as part of the Stage 1: Initial Fire Assessment of the wildland fire implementation plan (WFIP) is considered to be met at the programmatic level in this Fire Management Plan.

4.2 Wildland Fire Suppression

As per NPS policy (*RM-18*, chapter 9),

The objective of wildland fire suppression...is to manage wildland fires safely and efficiently to accomplish protection objectives. It will be integrated into land and resource management plans and activities on a landscape scale...and will be based on best available science.

4.2.1 Range of Potential Fire Behavior

Weather, fuels and topography are the primary influences upon fire behavior at STRI. Depending upon the season and fire weather conditions, fire behavior can range from low-intensity to extreme. During a typical year of normal conditions, most fires should be of low to moderate intensity at the park, and can be suppressed by direct attack strategies.

During years of drought or other abnormal environmental conditions, extreme fire behavior can occur anywhere within the park, involving any of the fuel models. Extreme behavior may entail high fire intensity, rapid spread, long flame lengths, spotting, and (in rare cases) torching and crowning. Brush and vines within the forested portion of the park can act as ladder fuels, facilitating torching, and resulting in undesirable fire behavior such as excessive scorching.

See Table 2 for historic fire weather parameters for STRI fire seasons, Table 3 for potential fire behavior under average and extreme conditions, and Table 4 for critical weather parameters resulting in the need for indirect attack. See section 3.4.4.3 for park fuel characteristics and fire behavior.

4.2.2 Preparedness Actions

NPS policy requires that every unit with a fire management program incorporate preparedness considerations into its fire management plan (*RM-18*, chapter 7, provides guidelines). Preparedness involves planning and implementing activities prior to wildland fire ignitions to keep the unit in a state of fire-readiness. It includes routine actions completed prior to fire season as well as incremental actions conducted during fire season in response to increasing fire danger. The STRI fire management officer

(hereinafter referred to as the “park FMO”) is responsible for coordinating and completing preparedness tasks, and ensuring that the park has access to additional fire resources as needed. STRI preparedness will include⁵:

- ❑ Maintaining a cache of supplies, materials, and equipment sufficient to meet normal fire year requirements. The park FMO will maintain the fire cache to the minimum standard of a six-person cache (nomex, hand tools, personal protective equipment). Fire supplies will be inventoried and restocked as necessary prior to the advent of both fire seasons. Qualified employees will be issued initial attack gear and personal protective equipment from the cache.

All fire equipment (portable water tank, pumps, chainsaws), will be inspected prior to the beginning of both fire seasons, and maintained in a state of readiness throughout the fire seasons.

- ❑ Maintaining fully-qualified personnel commensurate with the normal fire year workload.
- ❑ Preparing a step-up plan based upon staffing classes derived from the National Fire Danger Rating System (see section 4.2.2.5).
- ❑ Maintaining fire records, weather data, maps and other associated information. The park FMO will submit STRI data annually, including daily situation reports during fire events, to the Southeast Regional Office FMO for entry into the Shared Application Computer System (hereinafter referred to as SACS), or the appropriate reporting system. The park FMO will utilize other system options as appropriate to maintain data on employee qualifications, hazard fuels, FIREPRO, etc.
- ❑ Preparing a pre-season risk analysis.
- ❑ Maintaining detection and initial attack capabilities. Fire detection will be accomplished primarily by park field personnel, with additional input from visitors, cooperators and adjacent landowners. During staffing class levels of 4 or 5, the park FMO will assign fire patrols as per the STRI step-up staffing plan.
- ❑ Providing a dispatch system for mobilizing park wildland fire resources to local and out-of-area incidents. In order to facilitate rapid and efficient mobilization:
 - The park FMO will prepare a list of available fire-qualified personnel at the beginning of both fire seasons.

⁵ At the time of this writing, there are no fire operations-qualified park staff; employee development in this respect is a park goal. These preparedness actions will be incorporated commensurate with the increasing level of employee development at STRI.

- All fire-qualified personnel will be provided approved personal protective equipment and assigned park cell phones.
- Response to fire will take priority over routine, scheduled work projects. Meeting park fire suppression needs will take priority over out-of-area assignments.
- At least two people will be available for initial attack throughout both fire seasons. They will keep their initial attack and overnight gear immediately available, and plan daily activities and off-duty hours so as to be ready to respond, fully equipped, within 15 minutes of mobilization. They will notify the park FMO of any planned annual leave and/or changes in their daily work schedules.
- Personnel will receive specific travel, transportation and incident information at the time of mobilization.

Dispatch and mobilization guidelines and procedures are provided in the *National Interagency Mobilization Guide* and the *Southern Interagency Mobilization Guide*.

The park FMO will conduct an annual preseason fire readiness inspection, as outlined in the *Interagency Fire Readiness Review Guide*. The inspection will address detection, communication, dispatch, and response capabilities. It will also serve to determine whether or not STRI's current training levels, equipment, and organizational structure meet the standards described in this fire management plan.

4.2.2.1 Fire Prevention Activities

Prevention activities, designed to minimize the occurrence of human-caused wildland fires at the park, generally fall within one of three broad categories, as follow (*RM-18*, chapter 8, provides guidance):

- ❑ Education – Educating the public regarding the importance of wildland fire prevention can change people's behavior. Park methods include signs, posters, bulletin boards, and face-to-face contacts with visitors, all of which facilitate public awareness, understanding, and support.
- ❑ Engineering – Engineering involves reducing or eliminating fire risks (ignition sources) and hazards (fuels). Park methods include installing spark arresters on vehicles, utilizing fire-safe roofing materials (asphalt shingles or metal) on all buildings, creating and maintaining defensible space of no less than 30 feet around all buildings, and using non-fire applications and/or prescribed fire to reduce hazard fuels accumulations.
- ❑ Enforcement – Enforcement involves activities that ensure compliance with fire regulations and ordinances (including public use and access restrictions during times of high fire danger). It is park policy to aggressively investigate all wildland fires,

both to identify the responsible party, and to gain information that can be applied to future prevention efforts.

A wildland fire prevention plan is included as appendix 13.8. This plan outlines specific activities related to public education, engineering, and enforcement, based upon an analysis of the park's wildland fire risks, hazards and values.

4.2.2.2 Annual Training Needs of Fire Staff

NPS policy requires administrators to ensure that their employees are trained, certified, and made available to participate in the wildland fire program locally, regionally, and nationally as circumstances demand. NPS fire management training meets criteria specified within the training curriculum approved by the National Wildland Coordination Group (NWCG), which is tiered to positions described in the NWCG *Wildland Fire Qualifications*, *Prescribed Fire Job Qualifications*, and *Incident Command System Wildland Fire Job Performance* guides. The park FMO will conduct annual training need analyses, and coordinate training courses as appropriate. Courses identified will be based upon employee needs (as reflected in individual employee development plans), park fire management needs, and regional priorities. Training will be conducted on an interagency basis to the greatest extent possible. All fireline-qualified park staff will receive at least eight hours of annual safety refresher training (see section 8.1).

The park FMO will submit all pertinent employee data to the Southeast Regional Office FMO for entry into SACS (or the appropriate reporting system), and ensure the accuracy and approval of annual red cards.

4.2.2.3 Annual Equipment and Supply Readiness Procedures

STRI maintains a cache of supplies and equipment sufficient to meet normal fire year requirements. Table 5 lists activities that will be performed to ensure the fire readiness of park personnel, supplies and equipment, as well as the month(s) that each should be accomplished⁶.

⁶ These readiness activities will be incorporated commensurate with the increasing level of employee development at STRI.

Table 5: Annual Fire Readiness Activities

	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Maintain state of fire readiness as per step-up plan.	X	X	X	X	X	X	X	X	X	X	X	X
Access weather data through WIMS daily.	X	X	X	X	X	X	X	X	X	X	X	X
Post staffing class level if at 4 or 5.	X	X	X	X	X	X	X	X	X	X	X	X
Update park firefighter qualifications.	X											
Complete park training analysis.	X											
Fitness test park staff.	X											
Coordinate fire training.	X											
Equip fire-qualified staff with PPE as needed.	X								X			
Inventory fire cache; restock as necessary.	X								X			
Inspect mechanical equipment.	X								X			
Issue updated red cards.		X										
Provide annual refresher training.				X								
Submit FIREPRO funding requests.					X							
Submit fuels management funding requests.							X					
Complete project accomplishment reports.									X			
Update interagency agreements.												X
Review fire management plan and program.												X

4.2.2.4 Fire Weather and Fire Danger

4.2.2.4.1 Weather Station

The park FMO will access weather data through WIMS (Weather Information Management System) from the automated Meriwether Lewis weather station (ID number 406401), located approximately 60 miles to the southwest of STRI. This station measures pertinent fire danger parameters, facilitating accurate fire predictions and safety for fire personnel.

4.2.2.4.2 National Fire Danger Rating System

The National Fire Danger Rating System (NFDRS) enables a land management unit to determine fire danger based upon an evaluation of the upper limit of predicted fire behavior. Calculations of fire behavior are based on fuels, topography and weather. NFDRS outputs give relative ratings of potential wildland fire growth and behavior, thereby allowing a unit to systematically correlate its readiness level to the predicted fire problems of the day. STRI uses the burning index (the NPS standard) as its primary day-to-day indicator of the potential amount of effort needed to suppress a single fire in a particular fuel type within a given area, and the Keetch-Byram Drought Index as its primary drought indicator. Both of these indices influence decisions regarding prevention activities, initial attack, extended attack, and prescribed fire activities.

4.2.2.4.2.1 Burning Index

The burning index (BI) is a number on an open-ended scale (although typically between 0 and 100), expressing the potential amount of effort needed to suppress a single fire in a particular fuel type within a given area. BI is based upon fuel model, fuel moisture, and current and forecasted weather parameters. As the BI increases, expected fire intensity increases. The higher the expected fire intensity, the more effort that will be necessary for fire suppression. Thus, BI directly influences the staffing class levels that are part of the park step-up staffing plan (see section 4.2.2.5).

4.2.2.4.2.2 Keetch-Byram Drought Index

The KBDI is a mathematically-calculated drought indicator relating to the amount of moisture in the top seven inches of soil or duff. It ranges from 0-800, with 0 being saturated and 800 indicating maximum drought. Drought directly influences the flammability of all fuel/vegetation complexes (as drought progresses the upper soil layers dry, increasing the amount of dead and cured live fuels available for consumption), which in turn influences fire behavior and control efforts. For a description of fire behavior and effects that can be expected at increasing levels of drought in the southeast, see Web site <http://www.tncfire.org/resource/keetch.htm>.

4.2.2.5 Step-Up Staffing Plan

As previously stated, STRI uses the burning index (BI) to indicate the potential amount of effort needed to suppress a single fire in a particular fuel type within a given area. This, in turn, determines the staffing class. Staffing classes levels range from 1 to 5 (lowest to highest). As BI increases, the staffing class increases, with corresponding actions intended to mitigate the predicted difficulty of containing a wildland fire.

Table 6, below, illustrates the correlation between BI and step-up staffing class levels and actions. Break points were established via a Fire Family analysis, with weather inputs from the automated Meriwether Lewis Station (ID number 406401) in Lewis County, Tennessee, located approximately 60 miles to the southwest of the park. Staffing classes 4 and 5 were calculated at the 90th and the 97th percentiles, respectively. (Conditions exceeding the staffing class 4 parameters should occur only 10% of the time, and conditions exceeding the staffing class 5 parameters should occur only 3% of the time.) NFDRS fuel models 1988 E (hardwood litter after leaf fall) and 1988 R (hardwood litter after canopy leaf out) were utilized for step-up staffing purposes.

This BI/staffing class correlation should be validated based upon day-to-day observation and experience. As park managers have the opportunity to track indices influencing fire occurrence and size, the step-up staffing plan can be refined to better reflect large fire probability in the future.

Table 6: Burning Index, Staffing Class Levels and Step-Up Actions⁷

Fuel Model	Burning Index	Staffing Class	Step-Up Actions
E R	0-6 0-4	1	Vehicles equipped with hand tools and maintained; portable water tank available. Fire-qualified park staff fire-ready, with all PPE and fire packs prepared and close-at-hand should suppression action become necessary.
E R	7-13 5-8	2	All staffing class 1 actions continue.
E R	14-28 9-18	3	All staffing class 1 and 2 actions continue. Park FMO apprises park staff daily of staffing class level. Interpretive rangers/volunteers stress fire prevention in all visitor contacts. Notification of high fire danger posted on all park bulletin boards.
E R	29-32 19-20	4	All staffing class 1, 2 and 3 actions continue. Park FMO informs TN Interagency Coordination Center of conditions as appropriate. Campfires prohibited within park boundaries. Fire-qualified park staff advised of potential for extended tour-of-duty.
E R	33+ 21+	5	All staffing class 1, 2, 3 and 4 actions continue. Park superintendent may cancel leave, may authorize overtime for fire-qualified staff. Fire-qualified park staff on call 24 hours/day for suppression duty. Comprehensive prevention effort undertaken, stressing visitor contact and notification of conditions, and appropriate signing. Park superintendent may, as safety precaution, close part or all of park.

*Park FMO has authority to raise the staffing class one level to account for increased risk of starts/increased suppression difficulty due to human activity, drought, additions to the fuel load, etc.

ONPS and FIREPRO fund routine preparedness actions conducted in staffing classes 1 through 3. Emergency preparedness funds are available from the Southeast Regional Office (SERO) to accomplish approved step-up activities for staffing classes 4 and 5. If severity funding is necessary, the park FMO will submit a written assessment of the current and potential situation, including a description of mitigating actions and costs to the SERO.

4.2.3 Pre-Attack Plan

RM-18, chapter 7, provides a pre-attack planning checklist that will serve as a reminder of various elements to be considered at the park (as applicable) upon reaching staffing class levels 4 and 5.

4.2.4 Initial Attack

Initial attack forces comprise the first suppression personnel to arrive at a fire, as well as any reinforcements that arrive during the first burning period. At present, as there are no qualified firefighters at the park, the City of Murfreesboro Fire Department; the Rutherford County Volunteer Fire Department; or the Tennessee Department of Agriculture, Division of Forestry will most likely respond to any wildland fire at the park. In coordination with the park FMO, the responding agency will develop an appropriate

⁷ Step-up actions will be incorporated commensurate with increasing employee development in the realm of fireline operations at STRI.

initial attack response to the incident, organize and direct the fire resources on hand toward safe, efficient implementation of that response, monitor the effectiveness of the suppression tactics, and adjust strategy and tactics accordingly. The responding agency will be responsible for the fire until it is out or until relieved of that duty via a formal command change.

4.2.4.1 Information Used to Set Initial Attack Priorities

The goal in all initial attack actions is to suppress the fire in a cost-effective manner, consistent with resource management objectives. Initial attack priorities at STRI are tiered to firefighter and public safety (the highest priority in every fire management activity), and the threat that the wildland fire poses to park values. Factors considered in assessing the degree of threat that the fire poses include the fire location, fuels, current and forecasted weather, and current and predicted fire behavior. When multiple fires are reported, fires occurring in the wildland-urban interface will take priority over fires occurring in natural areas.

4.2.4.2 Criteria for Appropriate Initial Attack Response

The appropriate initial attack response will be determined from an analysis of the given situation, and must be consistent with the park's general and resource management objectives. Factors dictating the appropriate response include firefighter and public safety, fire location, current and predicted fire weather/fire behavior, park values at risk, cost-effectiveness, and potential adverse effects of both the fire and suppression efforts.

The appropriate initial attack response will vary from fire to fire, and sometimes even along the perimeter of the same fire. Options range from monitoring with minimal on-the-ground disturbance to aggressive suppression actions along the entire fire perimeter.

4.2.4.3 Confinement as an Initial Attack Suppression Strategy

A confinement strategy may be implemented as the initial attack action as long as it is not used to meet resource objectives. Confinement is selected in lieu of wildland fire use to maximize firefighter safety, minimize suppression costs, minimize cost + loss in low-valued and commodity resource areas, and to maximize availability of critical suppression and management resources during periods of high fire danger associated with fire in highly-valued resource areas.

Confinement may also be a strategic selection through the wildland fire situation analysis (WFSa) process when a fire is expected to exceed initial attack capability or planned management capability. When confinement is selected as the initial action, the same management process applies as for wildland fire use decisions. A long-term implementation plan is needed to guide the implementation of the confinement strategy. The wildland fire implementation plan (WFIP), prepared in stages, meets this requirement.

4.2.4.4 Typical Fire Response Time

Regardless of the time of year or resource type, the response time to a fire anywhere within the park should take no more than 30 minutes from the time the fire report is received.

4.2.4.5 Restrictions and Special Concerns

Chainsaws, hand tools and drip torches may be used at any time for fire management purposes. Fire engines or slip-on units may be used as water sources, provided that they stay on existing roads. Water will be used instead of fire retardant whenever possible. (If retardant must be used, a non-fugitive type will be chosen, and bodies of water avoided.) Heavy equipment such as bulldozers or plows will not be used to construct fireline except in extreme situations when high value resources are at risk (and then only with the authorization of the park superintendent or designee), nor will fireline explosives be used.

4.2.4.6 Work/Rest Guidelines, Rest and Recuperation

The *Interagency Incident Business Management Handbook* (chapter 10, section 12.6) provides comprehensive direction on work/rest guidelines and rest and recuperation (R&R). It also provides guidance on the application of management-directed days off for employees at their home units. Management of work schedules, directed days off and R&R will be incorporated as appropriate into STRI fire management activities to give personnel proper rest so they remain productive, mentally alert, and physically capable of performing their jobs safely.

4.2.5 Extended Attack and Large Fire Suppression

4.2.5.1 Determination of Extended Attack Needs

Extended attack occurs when a wildland fire has not been controlled by initial attack forces, and additional firefighting resources are arriving, en route, or being ordered by the initial attack incident commander. It requires a wildland fire situation analysis (WFSA) to guide a re-evaluation of suppression strategies. The WFSA process determines current fire complexity and facilitates selection of a new management response, which in turn determines the number and type of resources needed for extended attack. Extended attack continues until the fire has been suppressed, or until transition to a higher-level incident management team is completed.

4.2.5.2 Implementation Plan Requirements—WFSA Development

A WFSA, required when extended attack occurs, serves as the decision record for selection of the appropriate management response. Whenever reasonable doubt exists regarding the successful outcome of an initial attack response, the incident commander will immediately begin a WFSA.

4.2.5.3 Complexity Decision Process from Initial to Extended Attack

One of the WFSA components is a fire complexity analysis guide. This guide contains specific yes/no questions regarding fire elements, including current and predicted fire behavior, resources committed, resources threatened, safety, ownership/jurisdiction, external influences, change in strategy, and existing overhead. The total number of positive responses to the questions determines the complexity/management level of the fire, i.e. type I, type II, or type III. The incident commander will submit the WFSA to the park superintendent for approval. If fire complexity dictates, the park FMO will request an interagency incident management team (type I or II) through the Tennessee Interagency Coordination Center.

4.2.5.4 Incident Commander Delegation of Authority

When an incident management (IM) team is mobilized to a STRI fire event, the park FMO will coordinate the transition of authority for suppression actions, and serve as agency advisor to the team during their time on the incident. The park superintendent will execute a written limited delegation of authority to the incoming incident commander, which will be included in the briefing package provided to the incoming IM team. The park superintendent will also conduct the eventual close-out and evaluation of the team. Appendix 13.5 includes a copy of the STRI limited delegation of authority for an incoming incident commander.

4.2.6 Exceeding Existing WFIP, Selecting New Strategy

The existing wildland fire implementation plan (WFIP) is exceeded when a wildland fire escapes initial attack or when the appropriate management response has not been successful, or when a prescribed fire can no longer be implemented in accordance with the approved plan. The incident commander will initiate a wildland fire situation analysis (WFSA), from which the most appropriate management strategy will be determined.

4.2.7 Minimum Impact Suppression Tactics

NPS policy requires fire managers and firefighters to select management tactics commensurate with a fire's existing or potential behavior, but which cause as little impact to natural and cultural resources as possible. All suppression activities at STRI will therefore incorporate the minimum impact suppression tactics policy, to the greatest extent feasible and appropriate for the given situation. Examples of minimum impact suppression tactics that will be implemented include:

- ❑ Keeping fire engines or slip-on units on existing roads.
- ❑ Restricting the use of heavy equipment such as bulldozers or plows for constructing fireline. A tractor with box blade or disc will be used for fireline construction only in extreme situations when high value resources are at risk, and then only with the authorization of the superintendent or designee.
- ❑ Not using fireline explosives.

- ❑ Using existing natural fuel breaks and human-made barriers, wet line, or cold trailing the fire edge in lieu of handline construction whenever possible.
- ❑ Keeping fireline width as narrow as possible when it must be constructed.
- ❑ Avoiding ground disturbance within known natural (e.g. cedar glade habitat, T&E species) and archeological/cultural/historic resource locations. When fireline construction is necessary in proximity to these resource locations it will involve as little ground disturbance as possible and be located as far outside of resource boundaries as possible. ***Under no circumstances will fireline be constructed within cedar glade boundaries.***
- ❑ Using water instead of fire retardant. If retardant must be used, using a non-fugitive type, and avoiding bodies of water.
- ❑ Using soaker hose, sprinklers or foggers in mop-up; avoiding boring and hydraulic action.
- ❑ Minimizing cutting of trees.
- ❑ Scattering or removing debris as prescribed by the incident commander.
- ❑ Protecting air and water quality by complying with the Clean Air Act, the Clean Water Act, and all other applicable federal, state, and local laws and requirements.

RM-18, chapter 9, provides minimum impact suppression tactics guidelines. The STRI resource management specialist will provide input in the selection and implementation of minimum impact suppression tactics for any wildland fires that go into extended attack.

4.2.8 Rehabilitation Guidelines and Procedures

Fire rehabilitation involves short-term actions (generally 0-6 months) to stabilize a burned area and mitigate the effects of fire suppression activities. Immediate rehabilitation actions to prevent further land degradation or resource loss, or to ensure safety, may be undertaken as part of the incident. The incident commander is responsible for immediate rehabilitation action, which typically includes removing trash and debris from all incident locations and along the fireline, and seeding all firelines and burned areas with native grasses so as to reestablish ground cover.

Rehabilitation actions may be funded through emergency fire operations accounts. The park resource management specialist will plan major rehabilitation efforts, which cannot be undertaken during or immediately after an incident, for implementation as soon as feasible.

4.2.9 Reporting and Documentation

When STRI reaches staffing class levels 4 or 5, or upon confirmation of a wildland fire on park land, the park FMO will notify the Southeast Regional Office FMO of such at the earliest possible time. During a fire event, the park FMO will submit a daily situation report to the Southeast Regional Office FMO for entry into SACS (or the appropriate reporting system). The park FMO will also complete a final record for each wildland fire, to be kept on file at STRI, which will include:

- ❑ Individual fire report DI-1202
- ❑ Narrative
- ❑ Wildland fire implementation plan
- ❑ Daily weather forecasts and spot weather forecasts
- ❑ Cumulative fire map showing acreage increase by day
- ❑ Total cost summary
- ❑ Monitoring data

GPS/GIS data should be the norm for recording location information whenever practical.

4.3 Prescribed Fire

Prescribed fire at STRI will promote ecosystem sustainability, exotic plant species control, hazard fuels reduction, and historic landscape preservation.

4.3.1 Planning and Documentation

The prescribed fire program at STRI will be tiered to resource management objectives. Permissible prescribed fire intensity will be based upon the desired fire effects specified in the burn prescription.

Prior to all STRI prescribed fires, the park FMO will obtain a burning permit from the Tennessee Department of Agriculture, Division of Forestry. Nearby landowners and other interested parties, such as local law enforcement and fire departments, will be notified prior to and on the day of the planned ignition.

Go/no-go documents, one for STRI superintendent approval and the other for the prescribed fire burn boss, will be completed and signed prior to executing a prescribed fire. The superintendent's go/no-go approval is the final management approval prior to ignition of the prescribed fire. It is valid for up to 30 days after the approved date; if ignition does not occur prior to expiration of the superintendent's approval, a new go/no-go approval document will be completed.

The prescribed fire operations go/no-go checklist is the final operational confirmation that all requirements of the prescribed fire plan have been met, and conditions are appropriate for initiation of the prescribed fire (i.e. do we commence with firing or not?). This checklist will be used as a daily validation until ignition is completed, and there are no existing or eminent threats to the fireline/project boundary.

4.3.1.1 Annual Activities for Preparation and Implementation of Prescribed Fire Program

Table 7: Annual Prescribed Fire Program Activities⁸

	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Access weather data through WIMS daily.	X	X	X	X	X	X	X	X	X	X	X	X
Update park firefighter qualifications.	X											
Complete park training analysis.	X											
Fitness test park staff.	X											
Coordinate fire training.	X											
Equip fire-qualified staff with PPE as needed.	X								X			
Inventory fire cache; restock as necessary.	X								X			
Inspect mechanical equipment.	X								X			
Construct/refurbish prescribed fire lines.	X	X	X							X	X	
Issue updated red cards.		X										
Conduct prescribed burning.	X	X	X	X						X	X	X
Provide annual refresher training.				X								
Submit FIREPRO funding requests.					X							
Submit fuels management funding requests.							X					
Complete project accomplishment reports.									X			
Review fire management plan and program.												X

4.3.1.2 Long-Term Prescribed Fire Strategy

See Appendix 13.7 for STRI's five-year fuels treatment plan.

4.3.1.3 Personnel Requirements for Program Implementation

A certified prescribed fire burn boss is required to implement every prescribed fire at the park. The burn boss type (RXB1, RXB2) will be determined via the prescribed fire complexity rating process (see *RM-18*, chapter 10). The burn boss may be from another agency as long as s/he is qualified to burn in the fuel type of the proposed prescribed fire. The burn boss will use the complexity rating process to determine the minimum type, number and response time of holding resources. Prescribed fire crewmembers will each be minimally qualified at the type II firefighter level. Burn bosses and all other positions assigned to prescribed fires at the park will meet all national requirements for training and experience.

In the absence of qualified STRI personnel, the park FMO will coordinate with cooperators to obtain qualified personnel. The park FMO will obtain any necessary regional and national clearance for use of such personnel.

⁸ These activities will be incorporated commensurate with the increasing level of employee development at STRI.

4.3.1.4 Prescribed Fire Monitoring

See section 6.3 for a discussion of monitoring.

4.3.1.5 Prescribed Fire Project Critiques

See section 11.1 for a discussion of wildland fire and prescribed fire critiques.

4.3.1.6 Reporting and Documentation Requirements for Accomplishments and Escaped Fires

The burn boss on a prescribed fire will document the fire with the following information, stored individually in STRI files:

- ❑ Original signed prescribed fire plan
- ❑ Checklist of pre-burn prescribed fire activities
- ❑ All reviewer comments
- ❑ All maps
- ❑ Notification checklist
- ❑ Permits (e.g. burn, smoke, etc.)
- ❑ Monitoring data
- ❑ Weather forecasts
- ❑ Agency administrator go/no-go pre-ignition approval
- ❑ Operational go/no-go checklist
- ❑ Incident action plan(s)
- ❑ Unit logs, daily validation, or other unit leader documentation
- ❑ Press releases, public comments, complaints
- ❑ Smoke dispersal information
- ❑ Post-fire critique
- ❑ Individual fire report Fire DI-1202, completed by the burn boss and submitted to the Southeast Regional Office FMO for entry into SACS (or the appropriate reporting system) within 10 working days after the fire has been declared out

4.3.1.7 Prescribed Fire Plan

An individual plan is required for every prescribed fire application. While prescribed fire plans will vary in their degree of detail depending upon the scale of the application, each of the following elements will be fully considered (see *RM-18*, chapter 10 for element details):

- ❑ Technical review
- ❑ Seasonal severity
- ❑ Collaborative planning and review
- ❑ Prescribed fire project plan, which will include, at a minimum:
 - Signature page
 - Executive summary
 - Description of the prescribed fire area
 - Goals and objectives
 - Risk management
 - Project complexity
 - Organization
 - Cost
 - Scheduling
 - Pre-burn considerations
 - Prescription
 - Ignition and holding actions (including test fire, firing and ignition, holding actions, critical holding areas, project area division, and mop-up operations)
 - Wildland fire transition (contingency) plan
 - Protection of sensitive features (include compliance with all applicable NEPA and NHPA requirements)
 - Public and firefighter safety
 - Smoke management
 - Interagency coordination and public information (including media releases, public notice postings, notifications)
 - Monitoring (including fire behavior and fire effects)
 - Post-fire rehabilitation
 - Post-fire reports
 - Appendices (including reviewer comments, technical reviewer checklist and comments, maps, prescribed fire complexity rating worksheet, fire modeling outputs, adequate holding resources worksheet, agency administrator go/no-go pre-ignition approval, and prescribed fire operations go/no-go checklist)

All burn plans used at STRI will follow the above format.

4.3.2 Exceeding Existing Prescribed Fire Plan

If a prescribed fire can no longer be implemented in accordance with the approved plan, the entire prescribed fire area will be declared a wildland fire, and suppression action

taken. All subsequent action (i.e. initial incident commander, operational needs, notifications, strategies, resource orders, etc.) will be defined under the wildland fire transition plan, included in the prescribed fire plan. The contingency plan should be tiered to the worst-case scenario, utilizing current fire behavior processing systems for the fuel types and conditions outside the burn block and adjacent to the project area. In the event that the contingency plan is unsuccessful, the incident commander will develop a WFSA (see section 4.2.5.2).

4.3.3 Air Quality and Smoke Management

As a chemical air pollutant, smoke is subject to scrutiny under federal legislation established by the Environmental Protection Agency. In addition to posing health risks, smoke can reduce visibility many miles away from its source, affecting the safe operation of automobiles and aircraft and diminishing the quality of scenic views.

As previously stated, STRI is designated a class II air shed under the Clean Air Act. Under class II, modest increases in air pollution are allowed beyond baseline levels for particulate matter, sulfur dioxide, nitrogen and nitrogen dioxide, provided that the national ambient air quality standards, established by the Environmental Protection Agency (EPA), are not exceeded. The fire management program at STRI will manage smoke in compliance with the Clean Air Act and Tennessee State requirements, so as to minimize its effects on park visitors, firefighters, adjoining lands and neighbors, natural and cultural resources, and roads and highways. Smoke management will be incorporated into all STRI fire management planning and operations. Each prescribed fire plan will include smoke trajectory maps and identify smoke-sensitive areas. Fire weather forecasts will be used to correlate ignitions with periods of optimal combustion and smoke dispersal. Mitigation measures will be defined in the plan and arrangements made prior to ignition to ensure that designated resources are available if needed to implement the mitigation measures. Prescribed fire will not be implemented when atmospheric conditions exist that could permit degradation of air quality to a degree that negatively affects public health. (Federal and state air quality standards will be the basis for this decision.) Any smoke situation that arises and threatens any smoke-sensitive areas will entail *immediate* suppression action.

Smoke on roadways will be monitored and traffic control provisions taken to ensure motorist safety during fire events at the park. The following procedures will be taken to compensate for reduced visibility when a paved road is affected by smoke (the incident commander or prescribed fire boss on a particular event will determine visibility levels):

- ❑ Posting of “Smoke on Road” signs on either side of the affected area.
- ❑ Reducing the posted speed limit when visibility is strongly reduced, and escorting vehicles with a well-marked law enforcement vehicle as necessary.
- ❑ Closing the road to traffic when visibility is severely reduced.

4.4 Non-Fire Fuel Treatment Applications

Non-fire fuels management at the park includes mechanical techniques to maintain designated open areas and historic vistas, promote ecosystem sustainability, promote exotic vegetation species control, reduce hazard fuels accumulations, and create and/or maintain defensible space of at least 30 feet around all park buildings. All non-fire applications will be conducted in compliance with NEPA, NHPA, and other legal requirements.

Mechanical thinning will involve limited, selective thinning (e.g. chainsaws) of hardwoods and cedars encroaching upon xeric limestone prairies, meadows, open fields, and earthworks, as well as any hazard trees. While a few large-diameter trees may be cut, thinning efforts will focus primarily on small-diameter woody shrubs and trees. Mechanical thinning efforts will also include cutting hay and mowing (e.g. brush hog). Thinning activities at the park will involve 119 acres (69 acres in FMU #1, and 50 acres in FMU #2).

4.4.1 Annual Activities for Preparation and Implementation of Program

Table 8: Annual Non-Fire Applications Program Activities

	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Inspect/maintain equipment.	X	X	X	X	X	X	X	X	X	X	X	X
Mechanically create/maintain defensible space.	X	X	X	X	X	X	X	X	X	X	X	X
Mechanically thin select areas.	x	x	x	x	x	x	x	x	x	x	x	x
Mow designated open areas/historic vistas.			X	X	X	X	X	X	X	X	X	
Review non-fire applications program.												X

4.4.2 Equipment and Seasonal Use Restrictions

Section 4.2.4.5 discusses equipment restrictions pertaining to fire management activities at the park.

4.4.3 Effects Monitoring

The park will coordinate effects monitoring with Southeast Regional Office fire staff.

4.4.4 Project Critiques

Southeast Regional Office fire staff will review and critique ongoing projects at the park, ensuring that the non-fire applications program is meeting its objectives, and that projects are as cost-effective as possible for the given objectives and circumstances.

4.4.5 Cost Accounting

Creation/maintenance of defensible space, and maintenance of designated open areas and historic vistas are ONPS-funded activities. Hazard fuels reduction funding is available through Wildland Urban Interface, Hazard Fuels (both distributed by the National Interagency Fire Center in Boise), and PMIS. The park FMO will ensure that expenditures are tracked in the appropriate accounting system.

4.4.6 Reporting and Documentation

The park FMO will document all non-fire applications at the park, and report accomplishments to the Southeast Regional Office FMO for entry into SACS (or the appropriate reporting system).

4.4.7 Annual Planned Project List

See Appendix 13.7 for STRI's five-year fuels treatment plan.

4.5 Emergency Rehabilitation and Restoration

Burned area emergency stabilization and rehabilitation actions are intended to protect public safety, stabilize and minimize unacceptable change to biotic communities, improve ecosystem structure and function according to approved field unit management plans, and repair or replace minor facilities damaged or destroyed by a wildland fire. Burned area rehabilitation (BAR) subactivity funds can only be used for treatments on agency lands within the perimeter of the fire or impact area downstream from the burned area. The use of BAR funding is further limited based on treatment effectiveness and to improve economic efficiencies. The Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook provides treatment guidance and standards.

5.0 ORGANIZATIONAL AND BUDGETARY PARAMETERS

5.1 Fire Management Team Member Responsibilities⁹

SUPERINTENDENT

❑ Approves:

- Park fire management plan.
- Delegation of authority and briefing statement for any incoming incident management teams.
- Prescribed fire plans.
- Wildland fire situation analysis.

⁹ One individual may act in more than one of these roles.

- ❑ Ensures that:
 - All aspects of the park fire management program are effectively planned and implemented.
 - The park fire management plan is reviewed and revised as necessary.
 - An adequate number of trained and qualified personnel is available (onsite or via intra- and interagency cooperation) to meet park fire management needs.
- ❑ Conducts a post-fire critique of every wildland and prescribed fire at the park.
- ❑ Establishes and maintains cooperative relationships with the public, media, other agencies, and park neighbors regarding STRI's fire management program.
- ❑ May, as a safety precaution, temporarily close all or part of the park to the visiting public in the case of a wildland fire or as necessary during prescribed fire operations.

PARK FMO

- ❑ Plans, coordinates and implements all aspects of the park fire management program, including:
 - Conducting an annual preseason fire readiness inspection.
 - Coordinating and completing preparedness tasks.
 - Maintaining park fire cache and fire equipment.
 - Conducting annual fire-related training need analyses; organizing or arranging for training courses as appropriate.
 - Maintaining a current roster of fire-qualified resources.
 - Conducting FIREPRO budgeting process, requesting and tracking emergency preparedness and suppression expenditures, and fuels management accounts.
 - Maintaining fire-related computer files and submitting data to the Southeast Regional Office FMO for entry into SACS (or the appropriate reporting system).
 - Obtaining weather information through WIMS.
 - Apprising park staff of staffing class levels, and any fire management activities.
 - Providing fire-related input to park superintendent, including research proposals, and recommending restrictions/area closures, as appropriate, when fire danger reaches critical levels.
 - Preparing delegation of authority for park superintendent's signature, and representing superintendent with incoming incident management teams.
 - Coordinating patrols of the park during times of critical fire danger.
 - Providing or coordinating the required physical fitness testing for park personnel.
 - Ensuring that only NWCG-qualified personnel are assigned to fire management activities at STRI.
 - Requesting additional fire resources as necessary through the TN Interagency Coordination Center, and serving as the primary mobilization coordinator for any park fire resources requested for out-of-area assignments.
 - Planning and coordinating the park prescribed fire program.

- Obtaining burning permits as appropriate from the TN Department of Agriculture, Division of Forestry.
- Collaborates with park superintendent to ensure that fire-related MOUs and cooperative agreements are updated/revised as appropriate.

LAW ENFORCEMENT OFFICER

- ❑ Investigates all wildland fire ignitions at the park.
- ❑ Conducts evacuations, controls/escorts traffic, and performs other public safety duties as needed during wildland fire and prescribed fire events.
- ❑ Assists park FMO in all fire-related duties; serves as alternate FMO as necessary.

RESOURCE MANAGEMENT SPECIALIST

- ❑ Coordinates with the U.S. Fish and Wildlife Service to ensure that STRI has the most current data regarding identified sensitive, proposed, and listed species, as well as any proposed or designated critical habitat areas within its boundaries. Provides recommendations on how to mitigate adverse effects to these resources during fire management activities.
- ❑ Coordinates with the Southeast Archeological Center to ensure that STRI has the most current data regarding archeological resources within its boundaries. Provides recommendations on how to mitigate adverse effects to these resources during fire management activities.
- ❑ Provides input regarding minimum impact suppression tactics.
- ❑ Assists park FMO with prescribed fire program implementation by helping to determine prescribed fire units and objectives.
- ❑ Provides input regarding the fire monitoring program to ensure that prescribed fire at STRI effectively meets overall objectives.
- ❑ Coordinates any necessary compliance with Section 106 of the National Historic Preservation Act and Section 7 of the Endangered Species Act.

CHIEF RANGER

- ❑ Assists in fire management-related public education activities.
- ❑ Assists park FMO as needed.
- ❑ Enforces any temporary park closures.

ADMINISTRATION

- ❑ Notifies FMO and LEO of smoke/fire reports.
- ❑ Follows established mobilization guidelines.
- ❑ Acts as communication center during ongoing fire management activities.

5.2 FIREPRO Funding

FIREPRO funds are separate from the ONPS appropriation, and must be utilized for fire-dedicated functions. Base funding needs are calculated each year through the FIREPRO funding analysis. All positions base-funded by FIREPRO will remain dedicated to wildland fire management, with at least 80% of their normal tour-of-duty spent on wildland fire activities. FIREPRO provides funding for fire planning and oversight functions, budgeted activities necessary to prepare for the normal fire year, and for the development and implementation of the wildland fire suppression, emergency rehabilitation, and hazard fuels reduction programs. FIREPRO-funded fire management program elements include (see chapter 18 of *RM-18* for element details):

- ❑ Preparedness
- ❑ Prescribed fire management
- ❑ Wildland fire management
- ❑ National resource crews
- ❑ Step-up plans
- ❑ Severity
- ❑ Emergency rehabilitation

5.3 Organizational Structure of Fire Management Program

Appendix 13.5 includes an organizational chart depicting the STRI fire management program and its relationship to the park's overall organizational structure.

5.4 Interagency Coordination

STRI coordinates with the Tennessee Department of Agriculture, Division of Forestry; the Tennessee Interagency Coordination Center; the City of Murfreesboro Fire Department; the Rutherford County Volunteer Fire Department; and local law enforcement (see chapter 5 of *RM-18* for authority and guidelines regarding interagency coordination).

5.5 Interagency Contacts

City of Murfreesboro Fire Department, (615) 893-1422
Rutherford County Sheriff's Department, (615) 898-7770

Rutherford County Volunteer Fire Department, (615) 898-7770
Tennessee Department of Agriculture, Division of Forestry, Rutherford County,
(615) 898-8016
Tennessee Interagency Coordination Center, (423) 476-9775

5.6 Fire-Related Agreements

STRI maintains a memorandum of understanding (MOU) with the City of Murfreesboro Fire Department (CMFD). The STRI superintendent and FMO will review this MOU annually and update it as necessary. A statewide reciprocal fire protection MOU exists between the National Park Service and the Tennessee Department of Agriculture, Division of Forestry. The park is currently developing an MOU with the Rutherford County Volunteer Fire Department (RCVFD). Appendix 13.5 includes copies of fire-related MOUs.

STRI has no structural firefighting capability. All structural fire events at the park will be referred to the CMFD or the RCVFD. The STRI Emergency Response Plan is filed onsite.

6.0 MONITORING

6.1 NPS Fire Monitoring Handbook

NPS policy requires managers to monitor the effects of all wildland and prescribed fires. Monitoring directives, summarized here from *Director's Order #18* are:

- ❑ Fire effects monitoring must be done to evaluate the degree to which objectives are accomplished.
- ❑ Long-term monitoring is required to document that overall programmatic objectives are being met and undesired effects are not occurring.
- ❑ Evaluation of fire effects data is the joint responsibility of fire management and natural resource management personnel.

STRI will conduct its fire monitoring program in accordance with the *NPS Fire Monitoring Handbook 2001 (FMH 2001)*, which outlines standardized methods to be used for monitoring both wildland and prescribed fires. Monitoring protocols will be reviewed and approved at the Southeast Regional Office level before receiving funding.

6.2 Recommended Standard Monitoring Levels

FMH 2001 provides recommended standards, divided into four monitoring levels, which constitute the lowest level of fire monitoring to be conducted by NPS units. Table 9 illustrates how these monitoring levels correspond to the given park management strategy.

Table 9: Management Strategies and Recommended Standard (RS) Monitoring Levels

Management Strategy	RS Level
Suppression: All management actions are intended to extinguish or limit the growth of the fire.	1. Environmental 2. Fire observation - Reconnaissance - Fire conditions
Prescribed fire: Management uses intentionally set fires as a management tool to meet management objectives.	1. Environmental 2. Fire observation - Reconnaissance - Fire conditions 3. Short-term change 4. Long-term change

*Bold face print in RS level column indicates mandatory monitoring for the given management strategy.

6.3 Wildland and Prescribed Fire Monitoring

As indicated, wildland fire suppression requires level 1 and the first stage of level 2 monitoring. Level 1 monitoring, coordinated by the park FMO, involves environmental or planning data that provide the basic background information needed for decision-making when a wildland fire occurs. The reconnaissance stage of level 2 monitoring, coordinated by the incident commander, provides a basic overview of a fire event. Monitoring the effect of suppressed wildland fire on vegetation or other area-specific variables can identify specific threats to park resources, facilitate adjustments to suppression actions, and identify the need for a rehabilitation response.

Prescribed fire requires all four monitoring levels to determine changes/trends in fuel loading and vegetative composition over time. These changes, sometimes subtle, can be critical indicators of whether the prescribed fire program is meeting specific objectives. Levels 3 and 4 monitoring objectives are tiered to resource and fire management objectives. STRI fire and resource managers will collaborate to ensure that prescribed fire effectively meets overall objectives.

Level 3 (short-term change) monitoring provides information on vegetative change within a specific vegetation and fuel complex. These data allow for a quantitative evaluation of whether or not a stated objective was achieved. Data are collected primarily through sampling of permanent monitoring transects or plots. Level 4 (long-term change) monitoring typically involves a continuation of level 3 monitoring at the same permanent transects or plots, and serves to identify trends that can guide management decisions.

The park FMO will coordinate with the Southeast Regional Office Fire Ecologist to establish monitoring plots at select locations within the park. The Natchez Trace Fire Effects Team will conduct the levels 3 and 4 monitoring of these plots and complete associated documentation. The information gathered will be used as feedback to make any necessary refinements or changes to the prescribed fire objectives and prescriptions in place at the park. The monitoring program will continue to be refined as more

intelligence is gathered through research regarding the role of fire in the various park vegetation communities.

7.0 FIRE RESEARCH

The park's Resource Management Plan suggests no specific fire research necessary to implement or refine the fire management program. However, monitoring of fire effects at STRI, previously discussed, may indicate fire research that would serve to improve the program.

8.0 FIREFIGHTER AND PUBLIC SAFETY

8.1 Firefighter Safety and Related Training, Qualifications, and Fitness Standards

Firefighter and public safety is the first priority in every fire management activity. Agency administrators at all levels must stress that firefighter and public safety *always* takes precedence over property and resource loss. This policy will be emphasized throughout all fire management operations at the park.

NPS wildland fire training, qualification, and certification system meets or exceeds all National Wildfire Coordinating Group (NWCG) standards. Only fully qualified (i.e. meeting NPS qualifications and accepted interagency knowledge, skills and abilities for the assigned fire job), red-carded employees will be assigned fire management duties (unless assigned as trainees, in which case they will be closely supervised by an individual fully qualified for the given position). All personnel (including emergency hire firefighters) engaged in fireline operations must have completed a minimum of 32 hours of basic wildland fire training, including the modules on basic firefighting, basic fire behavior, and standards for survival¹⁰. The park FMO will coordinate at least eight hours of mandatory annual safety refresher training for all STRI staff likely to be on the fireline.

Refresher training will concentrate on local conditions and factors, the 10 Standard Fire Orders, 18 Watch Out Situations, LCES (Lookouts, Communication, Escape Routes, Safety Zones), and common denominators of tragedies and near-miss situations. NWCG courses such as Standards for Survival, Lessons Learned, and Look Up, Look Down, Look Around, meet the firefighter safety refresher training requirement. Hands-on fire shelter inspection and deployment practice *will* be included as part of the annual refresher. Efforts should be made to vary the training from one year to the next. It can be presented in an eight-hour block or in increments. The park FMO will document completed training for each firefighter and submit this information to the Southeast Regional Office FMO for entry into SACS (or the appropriate reporting system).

¹⁰ Exceptions to this are members of the City of Murfreesboro Fire Department and the Rutherford County Volunteer Fire Department, who adhere to state-determined standards during the first operational period of a wildland fire (beyond that, they must adhere to NWCG standards).

All park fire management personnel will be equipped with approved personal protection equipment (PPE), and trained in its proper use. Operational personnel on wildland and prescribed fires are required to use the PPE. Mandatory PPE includes:

- ❑ 8” high, laced, leather boots with lug soles
- ❑ Fire shelter
- ❑ Hard hat with chin strap
- ❑ Goggles/safety glass
- ❑ Ear plugs
- ❑ Nomex shirt and trousers
- ❑ Leather gloves

The NPS *Wildland Fire Qualification System Guide* contains a supplemental list of PPE. Special PPE and hazard analysis is required for operations involving fuel gelling agents, fireline explosives, aircraft (particularly helicopters), and chainsaw operations.

Prior to and throughout all fire management field operations at the park, fireline supervisors will cover safety factors with incident personnel, via operational briefings beforehand, and safety briefings that occur during the incident. At least one person, operationally qualified at a level corresponding to the complexity of the given incident, should be assigned responsibility for safety oversight. Fireline supervisors will designate lookouts, and all operational personnel will maintain open lines of communication, and know where escape routes and safety zones are located at all times. No NPS employee, contractor or cooperator will ever be intentionally exposed to life-threatening conditions (see *RM-18*, chapter 3, for further safety-related planning and operational guidelines).

NPS policy requires that all personnel (including emergency firefighters) engaged in suppression and prescribed fire duties meet the physical fitness standards set by the NWCG. Physical fitness/work capacity levels for wildland firefighters and other fire-qualified employees will be determined by the “pack test” series of tests. Descriptions of the three work capacity levels (light, moderate and arduous), as well as medical and physical fitness requirements and procedures are outlined in the NWCG *Wildland Fire Qualifications Subsystem Guide*. The park FMO will annually administer (or coordinate the administration of) the pack test to STRI fire management personnel, and maintain up-to-date records of employee qualifications.

8.2 Public Safety Issues/Concerns, and Mitigation Procedures

Under no circumstances will an individual be permitted near a wildland fire at STRI without the appropriate training and required personal protective equipment (PPE). Members of the press will be allowed in the vicinity of a fire only if they are determined to meet the standards established for the light fitness rating, wear the required PPE, and are accompanied by a trained, qualified firefighter who can assist them.

In the case of a large wildland fire or prescribed fire operations, or during times of extraordinary fire danger, the STRI superintendent or designee may, as a safety

precaution, temporarily close all or part of the park to the visiting public. The chief ranger is responsible for actually enforcing the closure. Every effort will be made to inform the general public of the situation and evacuate the area, if necessary. If a fire threatens to escape park boundaries, adjacent authorities and landowners will be given as much advance warning as possible so that they may take appropriate action.

Every prescribed fire plan will outline safety measures. Actions will be taken as needed to ensure public safety, including contacting STRI neighbors with as much advance notice as possible for them to properly prepare for the event, posting signs at the park alerting visitors of the planned event, ensuring that areas to be ignited are cleared of all visitors prior to ignition, closing portions of the park as appropriate, and posting “smoke on road” signs and controlling/escorting traffic as needed.

9.0 PUBLIC INFORMATION AND EDUCATION

9.1 Public Information Capabilities and Needs

The STRI wildland fire prevention plan, included as appendix 13.8, outlines public information/education activities related to the park fire management program.

9.2 Step-Up Public Information Activities and Capabilities

Table 6 includes step-up public information activities corresponding with escalating fire danger.

10.0 PROTECTION OF SENSITIVE RESOURCES

10.1 Archeological/Cultural/Historic Resources

The park in its entirety was administratively listed as an historic district in the National Register of Historic Places, with the passage of the National Historic Preservation Act of 1966. A formal nomination was completed and approved in 1978, and an updated nomination is presently undergoing completion. The Fortress Rosecrans unit was formally nominated and approved for listing as an historic district on the NRHP in 1974. Twenty-one park structures are presently included on the List of Classified Structures (LCS); all are also individually listed on the NRHP. Two cultural landscapes and seven component landscapes¹¹ at the park are listed in the Cultural Landscapes Automated Inventory Management System (CLAIMS). Also scattered about the wildland setting are historic cannon tubes (mounted on reproduction carriages), which are listed as museum objects in the Automated National Catalogue System (ANCS+). There are no known significant archeological sites within park boundaries that would be affected by fire

¹¹ Stones River National Battlefield and Stones River National Cemetery are cultural landscapes. The main battlefield; Lunettes Palmer, Thomas and Curtain Wall No. 2; Redoubt Brannan; the Artillery Memorial; the Hazen Memorial; Bragg’s Headquarters site; and Rosecrans’ Headquarters site are component landscapes.

management activities. A listing of classified structures and other significant cultural resources is on file at the park.

The park will incorporate archeological/cultural/historic resources protection into fire management in a variety of ways. For example:

- ❑ The park resource management specialist will coordinate with the Southeast Archeological Center to ensure that STRI has the most current data regarding archeological resources within its boundaries. S/he will provide recommendations on how to mitigate adverse effects to these resources during fire management activities, and will coordinate compliance with Section 106 of the National Historic Preservation Act, as appropriate
- ❑ Historic structures and cannons will be protected from wildland fire via defensible space around each (a minimum of 30 feet around buildings), which may consist of nonflammable material (asphalt, concrete), or a lack of fuel resulting from non-fire applications or prescribed fire.
- ❑ During all suppression activities, the minimum impact suppression tactics policy (see section 4.2.7) will be incorporated to the greatest extent feasible and appropriate for the given situation. Tactics directly or indirectly facilitating the protection of archeological/cultural/historic resources include:
 - Keeping fire engines or slip-on units on existing roads.
 - Restricting the use of heavy equipment such as bulldozers or plows for constructing fireline. A tractor with box blade or disc will be used for fireline construction only in extreme situations when high value resources are at risk, and then only with the authorization of the superintendent or designee.
 - Not using fireline explosives.
 - Using existing natural fuel breaks and human-made barriers, wet line, or cold trailing the fire edge in lieu of fireline construction whenever possible.
 - Keeping fireline width as narrow as possible when it must be constructed.
 - Avoiding ground disturbance within known archeological/cultural/historic resource locations. When fireline construction is necessary in proximity to these resource locations it will involve as little ground disturbance as possible and be located as far outside of resource boundaries as possible.
 - Using soaker hose, sprinklers or foggers in mop-up; avoiding boring and hydraulic action.

10.2 Natural Resources

The park will incorporate natural resources (including cedar glade habitat, threatened and endangered species, and air and water quality) protection into fire management in a variety of ways, including minimum impact suppression tactics. The tactics listed in 10.1 as directly or indirectly facilitating the protection of archeological/cultural/historic

resources also directly or indirectly facilitate the protection of natural resources. Additional tactics include:

- ❑ Avoiding ground disturbance within known natural (e.g. the cedar glade habitat, T&E species) resource locations. When fireline construction is necessary in proximity to these resource locations it will involve as little ground disturbance as possible and be located as far outside of resource boundaries as possible. ***Under no circumstances will fireline be constructed within cedar glade boundaries.***
- ❑ Using water instead of fire retardant. If retardant must be used, using a non-fugitive type, and avoiding bodies of water.
- ❑ Minimizing cutting of trees.
- ❑ Protecting air and water quality by complying with the Clean Air Act, the Clean Water Act, and all other applicable federal, state, and local laws and requirements.

The park resource management specialist will coordinate with the U.S. Fish and Wildlife Service to ensure that STRI has the most current data regarding identified sensitive, proposed, and listed species, as well as any proposed or designated critical habitat areas within monument boundaries. S/he will provide recommendations on how to mitigate adverse effects to these resources during fire management activities, and will coordinate compliance with Section 7 of the Endangered Species Act, as appropriate.

10.3 Development/Infrastructure

Park development/infrastructure includes the park headquarters/visitor center, interpretive vehicle and pedestrian tour routes with wayside exhibits, and replica wooden fencing. (Intended to help accomplish the general management plan objective of “preserving and restoring to a general 1860s appearance the land within the authorized boundary of the national battlefield,” this fencing is located where historic records indicate its presence at the time of the battle, primarily along the edges of fields and open areas.) These structures will be protected from wildland fire via defensible space around each (a minimum of 30 feet around buildings), which may consist of nonflammable material (asphalt, concrete), or a lack of fuel resulting from non-fire applications.

11.0 FIRE CRITIQUES AND ANNUAL PLAN REVIEW

11.1 Critiques

As per NPS policy, the park superintendent or designee will conduct a post-fire critique of every wildland and prescribed fire at STRI, involving as many personnel who participated in the incident as possible. The critique will follow *RM-18* (chapter 13) guidelines, and will cover all aspects of the incident, including safety, tactics, difficulties encountered, areas needing improvement, and whether or not specified objectives were met. The information gathered from these critiques will be used to continually improve the effectiveness and efficiency of the fire management program. The critique will be attached to the associated DI-1202 fire report as a permanent record, and stored in park fire files.

As previously stated, firefighter and public safety is the first priority in every fire management activity. Any incident which results in human entrapment, serious injury, fatalities, or near-misses, will be investigated and reviewed, with appropriate administrative action taken based upon investigation results. Additionally, the park superintendent may request a regional-level review of any incident in which:

- ❑ The fire crosses park boundaries into another jurisdiction without the approval of the adjacent landowner or agency.
- ❑ The park receives adverse media attention.
- ❑ Significant property damage occurs.
- ❑ Controversy involving another agency occurs.

The Southeast Regional Office FMO will conduct an in-depth review of any wildland fires involving a type I or type II team.

11.2 Annual Plan Review

The park FMO will review the fire management plan annually and identify any changes that should be made to improve the effectiveness of the plan. The STRI superintendent will approve significant changes to the body of the plan (excluding grammatical corrections, minor procedural changes, deletions, corrections, and additions to the appendices). The park FMO will promptly forward copies of all changes to the Southeast Regional Office FMO for review and comment. Changes requiring approval will be submitted with a new cover sheet for signatures and dates, which will replace the original cover sheet.

A formal plan review will be conducted every five years, and the plan revised to incorporate any policy changes that have occurred in that five-year period.

12.0 CONSULTATION AND COORDINATION

The following individuals provided information, assistance, and guidance in the preparation of this plan:

Gib Backlund, Fire Management Officer, Stones River National Battlefield
Clint Cross, Wildland Urban Interface Coordinator, Southeast Regional Office
Randy Dzialo, Intelligence Coordinator, Southern Area Coordination Center
Dean Gettinger, Fire GIS Specialist, Southeast Regional Office
Terri Hogan, Ecologist, Stones River National Battlefield
Caroline Noble, Fire Ecologist, Southeast Regional Office
Kevin Scasny, Fire Weather Meteorologist, Southern Area Coordination Center
Kevin Walsh, Prescribed Fire Specialist, Southeastern Regional Office

Appendix 13.1

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Appendix 13.2

Definitions of Terms, as They Pertain to Fire Management

Burning index (BI): A relative number related to the contribution that fire behavior makes to the amount of effort needed to contain a fire in a specified fuel type. Doubling the burning index indicates that twice the effort will be required to contain a fire in that fuel type as was previously required, providing all other parameters are held constant.

Confinement: The restriction of a wildland fire within specific boundaries identified prior to or during the fire event. The boundaries, which are natural or human-made barriers, serve to confine the fire. Direct and/or indirect attack methods can be taken to hold the fire at the barriers, including backfiring, cold trailing, use of hose lays, and patrolling or mopping up the fire perimeter.

Cultural resource: Any physical evidence of past human activity used to reconstruct human history and prehistory.

Direct attack: Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel.

Extended attack: Occurs when a wildland fire cannot be controlled through initial attack and requires more than two operational periods to be controlled, and/or when the appropriate management response has not been successful. Extended attack implies that the complexity level of the incident will increase beyond the capabilities of initial attack incident command.

Fire management plan (FMP): A strategic document that defines a long-term program to manage wildland and prescribed fires within an NPS unit, in support of the unit's general and resource management plans.

Fire management unit (FMU): Any land management area definable by objectives, topographic features, access, values to be protected, political boundaries, fuel types, major fire regimes, etc. that set it apart from management characteristics of an adjacent unit.

Fire regime: The pattern of fire in an area as determined by its systematic interaction with the biotic and physical environment. It includes the timing, number, spatial distribution, size, duration, behavior, return interval, and effects of natural fires.

Fire weather: Weather conditions that affect fire ignition, behavior, and suppression.

Fuel: All combustible material, including grasses, dead branches and pine needles on the ground, standing live and dead trees, flammable minerals near the surface (e.g. coal) and human-built structures. Fuels are generally divided into four size classes based on their ability to ignite:

- ❑ 1 - hour time lag - <1/4" diameter (grass, litter, duff)
- ❑ 10 - hour time lag - 1/4" to 1" diameter (twigs, small stems)
- ❑ 100 - hour time lag - 1" to 3" diameter (branches)

□ 1000 - hour time lag - >3" diameter (large branches and stems)

Fuel model: A simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

Hazard fuels: Large or abnormal fuel concentrations that form a special threat of ignition and resistance to control.

Hazards: The fuels and topography on which a wildland fire will spread.

Holding actions: Planned actions required to achieve wildland and prescribed fire management objectives. For prescribed fires, these actions are developed to restrict the fire inside the planned burn unit. For suppression actions, holding actions may be implemented to prohibit the fire from crossing containment boundaries. These actions may be implemented as firelines are established to limit the spread of fire.

Incident commander (IC): Person responsible for incident activities including the development and implementation of strategic decisions, and for approving, ordering and releasing resources.

Indirect attack: A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuel breaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions.

Initial attack: The actions taken by the first resources to arrive at a wildland fire to protect lives and property, and prevent further extension of the fire.

National Fire Danger Rating System (NFDRS): A set of computer programs and algorithms that allow a unit to estimate fire danger, based on an evaluation of the upper limit of predicted fire behavior.

Preparedness: Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination.

Prescribed Fire: A management-ignited wildland fire that burns under specified conditions of weather, fuel moisture, soil moisture, etc., that allow confinement of the fire to a predetermined area, and at the same time produce the fire behavior and fire characteristics required to accomplish planned management objectives.

Risk: Any heat source or human activity that can result in wildland fire ignition.

Suppression: All actions intended to extinguish or limit the growth of a fire, regardless of the strategies or tactics chosen.

Values: Areas where losses from wildland fire are unacceptable, such as archeological sites, developments, endangered species, adjacent land, etc.

Wildland fire: Any non-structural fire, other than prescribed fire, that occurs in the wildland.

Wildland fire implementation plan (WFIP): A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire. A full WFIP consists of three stages. Different levels of completion may occur for differing management strategies (i.e., fires managed for resource benefits will have two-three stages of the WFIP completed, while some fires that receive a suppression response may only have a portion of stage I completed.)

Wildland fire situation analysis (WFSA): A systematic decision-making process that evaluates alternative management strategies to determine the most appropriate management strategy for a particular situation. Reasonable management alternatives are identified, analyzed and evaluated, consistent with the expected probability of success/consequences of failure. Evaluation criteria include firefighter and public safety, anticipated costs, resource impacts, and environmental, social and political considerations. From the management alternatives, a preferred alternative is selected, and the decision documented. The evaluation must clearly identify the point at which failure of the alternative is imminent. This becomes the triggering mechanism for re-evaluation of the WFSA, at which point the WFSA is amended or a new WFSA is completed to develop new alternatives.

Wildland fire use: The permitting of a naturally-ignited fire to burn under specific, predetermined environmental conditions, in pre-designated areas, in order to achieve defined resource management objectives.

Weather Information and Management System (WIMS): An interactive computer system designed to accommodate the weather information needs of all federal and state natural resource management agencies. Provides timely access to weather forecasts, current and historical weather data, the National Fire Danger Rating System (NFDRS), and the National Interagency Fire Management Integrated Database (NIFMID).

Appendix 13.3

Species Lists

Appendix 13.4

NEPA Compliance

Appendix 13.5

Supplemental Information

13.5.1 Fire Call-Up List

13.5.2 Preparedness Inventory

13.5.3 Memoranda of Understanding

13.5.4 Limited Delegation of Authority

13.5.5 Fire Management Program Organizational Chart

Appendix 13.5.1

Stones River National Battlefield Fire Call-Up List

During business hours, 0700 to 1700, contact should be made with the battlefield directly by calling:
(615) 893-9501

After business hours the order in which contact should be made if there is a fire event at Stones River National Battlefield is as follows*:

1. Jim Lewis** - Safety Officer, Park Ranger (615) 849-7945 (home)
2. Gib Backlund** - Chief of Operations (615) 895-8293 (home)
3. Terri Hogan** - Resource Manager (615) 896-4645 (home)
4. Stuart Johnson - Superintendent (615) 893-0985 (home)
5. Teresa Watson - Administrative Officer (615) 848-5285 (home)
6. Laura Stresemann - Maintenance Work Leader (615) 904-0898 (home)
7. Emergency Services 911
8. Rutherford County Fire Department Inc (615) 895-3473
9. Tennessee Division of Forestry, Dixon County (800) 337-3157

*** Firefighter Qualified*

Additional Fire Qualified staff at Stones River National Battlefield:

Laurel Temmen	- Biological Technician	(615) 849-3630 (home)
Nathan Singer	- Biological Technician	(615) 426-2977 (cell)

*** NOTE: If there is an immediate threat to structures or neighboring properties after hours, contact Emergency Services at 911 and then proceed from the beginning of the list.**

Appendix 13.5.2

Preparedness Inventory

Appendix 13.5.3

Memoranda of Understanding

Appendix 13.5.4

Limited Delegation of Authority

Memorandum

To: _____, Incident Commander

From: Superintendent, Stones River National Battlefield

Subject: Limited Delegation of Authority

Effective as of ____/____/____ (mm/dd/yyyy), at _____ hours, I have delegated you limited authority to manage the _____ fire, number _____, in the Stones River National Battlefield.

As Superintendent I maintain ultimate responsibility for the protection of the Battlefield's resources and the lives of visitors and employees. You have full authority and responsibility for managing the incident activities within the confines of the law, National Park Service Policy, the direction given in the Incident Briefing and this Delegation.

Specific direction for this Incident and my considerations for management are:

1. Provide for firefighter, visitor, employee and neighbor SAFETY FIRST.
2. My preferred suppression strategy for this fire is one of: (*check one*) ☐ **Confine** ☐ **Contain** ☐ **Control**. This strategy should be implemented with as little resource damage as possible. Attached are the NPS definitions of CONFINE, CONTAIN, and CONTROL strategies (Exhibit 1) and Minimum Impact Suppression Guidelines (Exhibit 2.)
3. Dozers or tractor plows may not be used within Battlefield boundaries without my prior approval. The only exception would be in case of the immediate need for the protection of human life, and such use must be documented.
4. Tracked or wheeled vehicles may be used inside the Battlefield where roads exist, and that are identified for public or administrative use. Helicopters, power saws, portable pumps, and leaf blowers may be used as required within the Battlefield.
5. Cultural features requiring priority protection are:

6. Key resource considerations are:

7. Constructed firelines must be rehabilitated as per NPS policy.

8. Disruption of visitor access and use should be kept to a minimum if consistent with public safety.
9. Training opportunities for Battlefield personnel shall be provided when possible to strengthen our organizational capabilities.
10. A close-out fire analysis and evaluation will be conducted by me or my representative prior to team departure. I request at least 24 hour advance notice for this meeting.
11. My Agency Advisor is:

Signed:

Superintendent
Stones River National Battlefield

Incident Commander

Name (*printed*)

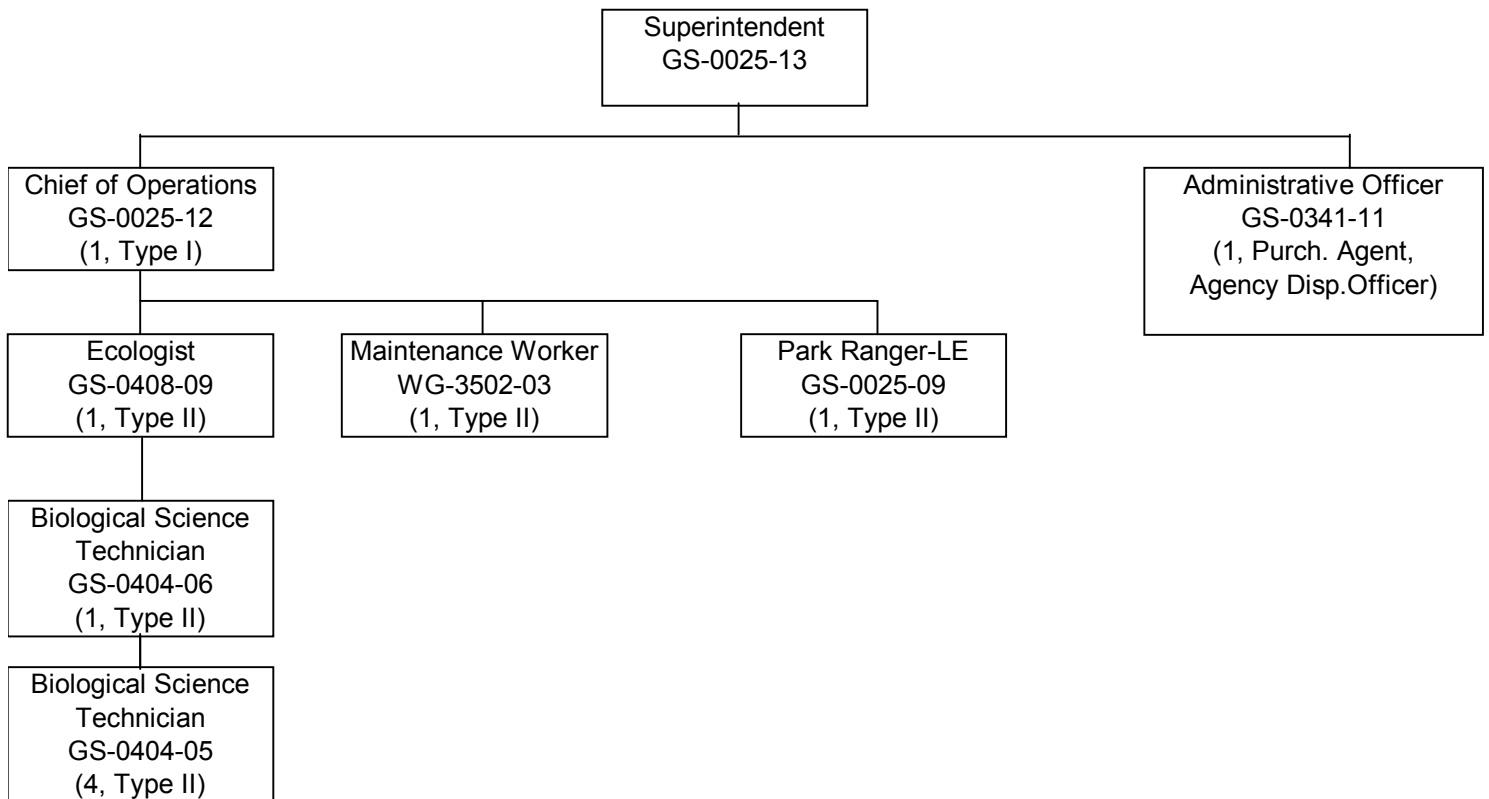
Name (*printed*)

Date: _____

Date: _____

Appendix 13.5.5

Stones River National Battlefield Fire Management Program Organizational Chart FY2003



Appendix 13.6

Wildland and Prescribed Fire Monitoring Plan

Appendix 13.7

Five-Year Fuels Treatment Plan

13.7.1 Multi-Year Prescribed Fire Schedule

As per the following schedule, sixteen units will be prescribed burned at the park, totaling approximately 148 acres, for hazard fuels reduction, historic landscape preservation, and to promote ecosystem sustainability and exotic plant species control. See the following map for the burn unit locations. Initial fire return intervals would be between 2-5 years. Those prescribed fire units on a 2-year cycle would need more frequent prescribed fires to combat exotics and reduce competition. Once the park reaches fire management goals and objectives for a particular prescribed fire unit, it will implement a maintenance program for the unit that would involve a prescribed fire return interval of 5 years.

The five-year prescribed fire program for the park is as follows (acres to be burned is considered to be “desirable acreage,” and may or may not be feasible depending on environmental conditions during any given year):

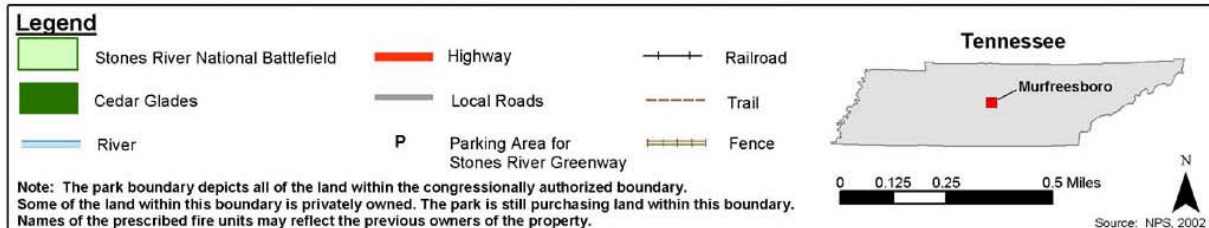
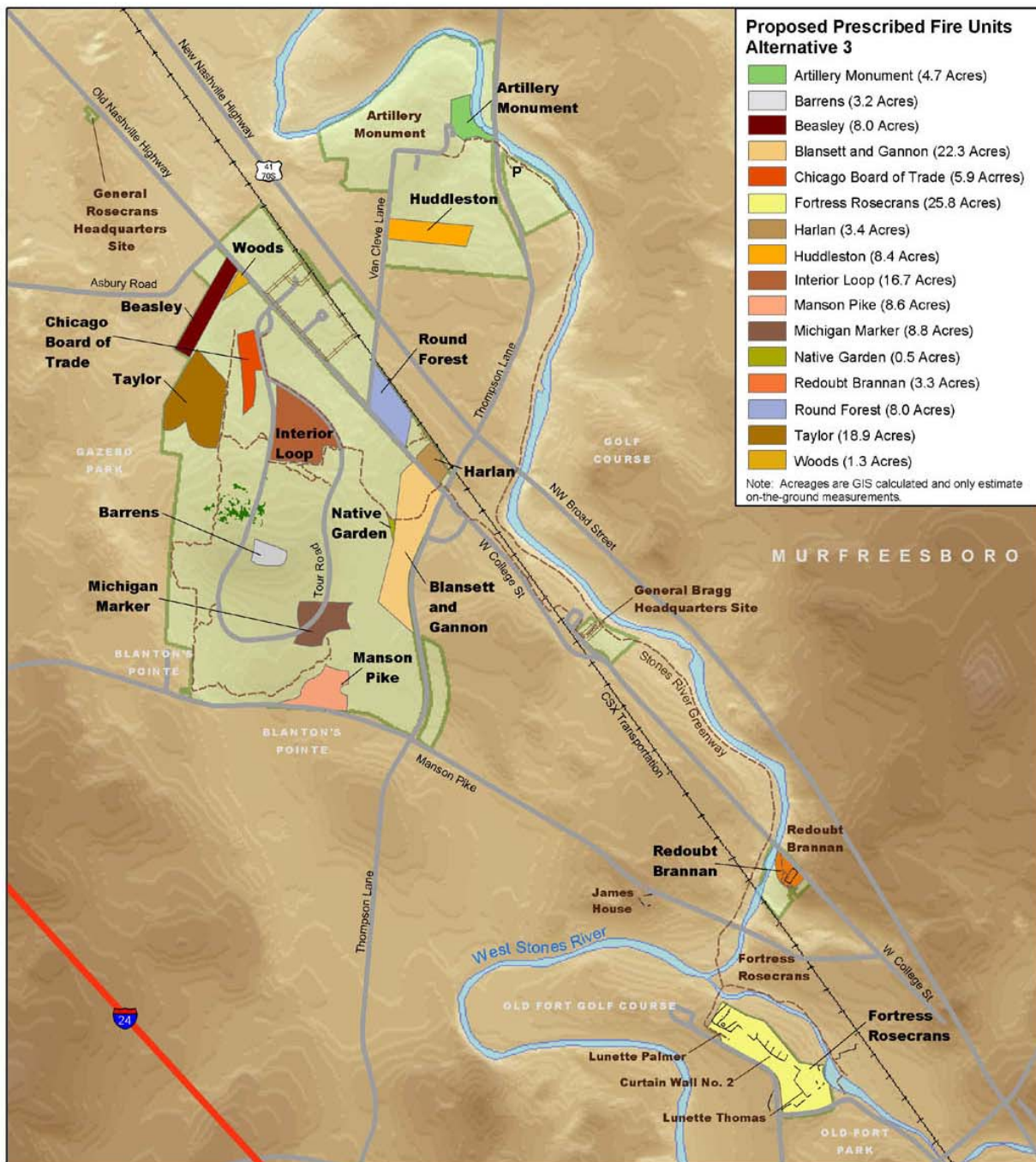
- ❑ 2004 – 42 acres
- ❑ 2005 – 45 acres
- ❑ 2006 – 44 acres
- ❑ 2007 – 37 acres
- ❑ 2008 – 64 acres

13.7.2 Multi-Year Mechanical Hazard Fuels Reduction Schedule

Mechanical thinning at the park will involve limited, selective thinning (e.g. chainsaws) of hardwoods and cedars encroaching upon xeric limestone prairies, meadows, open fields, and earthworks, as well as any hazard trees. While a few large-diameter trees may be cut, thinning efforts will focus primarily on small-diameter woody shrubs and trees. Mechanical thinning efforts will also include cutting hay and mowing (e.g. brush hog). Thinning activities at the park will involve 119 acres, and could occur during any time of the year. See the following map for mechanical unit locations.

Stones River National Battlefield Treatment Units

Prescribed Fire Unit Name (Acreage)	Timing of Prescribed Fire	Treatment	Unit Description (General Fuel Types)
Fortress Rosecrans (25.8 acres)	Nov-Apr 2004	Manual and mechanical thinning (tree removal, brush cutting, and mowing)	Grasses; mature open hardwood; savanna
Redoubt Brannan (3.3 acres)	Nov-Apr 2004	Manual and mechanical thinning (tree removal, brush cutting, and mowing)	Grasses; mature open hardwood; savanna
Barrens (3.2 acres)	Nov-Apr 2004	Mechanical thinning (tree thinning)	Grasses
Michigan Marker (8.8 acres)	Nov-Apr 2004	Manual and mechanical thinning (brush removal, cutting hay, mowing)	Agricultural use; native grasses
Manson Pike (8.6 acres)	Nov-Apr 2005	Mechanical thinning (cutting hay, mowing)	Grasses
Blansett and Gannon (22.3 acres)	Nov-Apr 2005	Mechanical thinning (cutting hay, mowing)	Grasses
Chicago Board of Trade (6.0 acres)	Nov-Apr 2005	Mechanical thinning (mowing)	Agricultural use
Native Garden (0.5 acres)	Nov-Apr 2005	Mechanical thinning (cutting hay, mowing)	Grasses
Beasley (8.0 acres)	Nov-Apr 2005	Manual and mechanical thinning (tree removal, cutting hay, mowing)	Grasses
Harlan (3.4 acres)	Nov-Apr 2006	Manual and mechanical thinning (tree removal, cutting hay, mowing)	Grasses
Round Forest (8.0 acres)	Nov-Apr 2006	Manual and mechanical thinning (tree removal, mowing)	Grasses; mature open cedar; savanna
Taylor (18.9 acres)	Nov-Apr 2006	Manual and mechanical thinning (tree removal, cutting hay, mowing)	Grasses
Woods (1.3 acres)	Nov-Apr 2006	Mechanical thinning (cutting hay, mowing)	Grasses
Interior Loop (16.7 acres)	Nov-Apr 2008	Mechanical thinning (mowing)	Agricultural use
Huddleston (8.4 acres)	Nov-Apr 2008	Manual and mechanical thinning (tree removal, cutting hay, mowing)	Grasses; some trees in fence lines
Artillery Monument (4.7 acres)	Nov-Apr 2008	Manual and mechanical thinning (tree removal, mowing)	Grasses; mature open hardwood; savanna



Appendix 14.8

Wildland Fire Prevention Plan