February 28, 2008

Prescribed Burning of Cave Hill, Dennison Hollow, Stoneface, Research Natural Areas, Simpson Township Barrens Ecological Area and Adjacent Oak-Hickory Forest Communities

Fire / Fuels Analysis

Specialist Report

I. Introduction

This report analyzes the potential effects of prescribed burning, tree, and shrub removal at Cave Hill, Dennison Hollow, Stoneface Research Natural Areas, Simpson Township Barrens Ecological Area and Adjacent Oak-Hickory Forest Communities. This report will primarily focus on the environmental effects of the application of fire as a land management tool.

II. Purpose and Need

The purpose of the proposed action is to reduce understory component of shade tolerant tree species (maples, elms, etc.), which will result in an increase of sunlight to the barren and glade plant communities, and potentially undiscovered populations or individual plants of the shade intolerant Mead's Milkweed, a federally listed plant species. The project will also provide for plant and animal community diversity by encouraging regeneration of oak-hickory forest communities and associated herbaceous and shrub species adjacent to the barren communities.

The proposed action will ensure the continued existence of the Natural Area habitat types on the Forest and meet the desired condition identified in the Forest Plan. The Forest Plan describes the desired condition for natural areas:

The areas are biologically or geologically unique and contain a variety of wildlife species and diverse vegetation, predominantly in natural-appearing condition. Because some trees in forested areas may be up to 200 years in age, the areas display some old-growth characteristics, such as multi-layered canopy, large snags, cavities and fallen logs. Existing public use and other human activities range from unnoticeable to very evident. Road networks vary from none to low density.

The objective of the proposed action is the restoration and maintenance of the 4 natural areas' native plant and animal communities, contributing to the maintenance of the biological diversity of the Forest. Many of the species to be managed in these communities are fire-dependent. If these areas are not managed as proposed, the communities and dependent species will be suppressed further and eventually disappear.

III. Enabling Policy and Procedure

A. Shawnee National Forest Land Management Plan: The Land Management Plan states the following as goals in the 2006 Land and Resource Management Plan Executive Summary:

> *Fire-use, the combination of prescribed and wildand fire-use fire, is applied on the landscape to restore and/or maintain desired vegetative communities, ecological processes and fire-adapted ecosystems; and fire regimes, condition classes and desired fuel-loadings.*
>
> *The Forest will utilize various vegetation-management activities, such as landscape-level prescribed burning, timber harvesting and timber-stand improvement to help create and/or maintain the ecological conditions necessary to regenerate and maintain the oak-hickory forest-type.*
>
> *Unique natural environments, such as national natural landmarks and other natural areas, will be managed to preserve and protect their special features.*

B. Protecting People and Sustaining Resources in Fire-Adaptive Ecosystems: A Cohesive Strategy[1]: Addressed in the umbrella of the National Fire Plan.

1. *Improve the resilience and sustainability of forests and grasslands at risk.*
2. *Conserve priority watersheds, species, and biodiversity.*
3. *Reduce wildland fire costs, losses, and damages.*
4. *Better ensure public and firefighter safety.*
5. *Prioritize treatments by 1) wildland urban interface 2) municipal watersheds, and 3) Threatened and Endangered Species habitat protection. Additional priorities include moving from condition class-3 to condition class-1 or condition class-2 vegetation.*

C. A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment – 10 Year Comprehensive Strategy[2] The Comprehensive Strategy has four primary goals. They are listed below. Specific actions under goal 3 "Restore Fire Adapted Ecosystems" applies to this project.

- *Improve Fire Prevention and Suppression Programs*
- *Reduce Hazardous Fuels*
- *Restore Fire Adapted Ecosystems*
- *Promote Community Assistance*

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[1] USDA. 2000. Protecting People and Sustaining Resources in Fire Adapted Ecosystems A Cohesive Strategy. Forest Service. October 2000. 5 pp.
[2] USDA. 2001. A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment – 10 Year Comprehensive Strategy. Forest Service. August 2001. 9 – 11 pp.

IV. Area Description

The analysis area for fire and fuels management totals 3549 acres and is divided into two separate units. The first unit includes the Cave Hill, Stoneface, and Dennison Hollow Research Natural Areas (3055 acres) and lies within southeast Saline County. The second unit includes Simpson Township Barrens Ecological Area (494 acres) and is found in eastern Johnson County. Both units include forested lands adjacent to and outside of the Research Natural Areas and Ecological Area. Project boundaries were extended outside the Natural Areas to provide better control points during prescribed burn implementation

Saline County, Illinois

- T9S, R7E, Sec 34 and 35
- T10S, R7E, Sec 2, 3, 9, 10, 15, 16, 21 and 22.

Johnson County, Illinois

- T12S, R4E, Sec 10, 11, 14, and 15

The project area is located in rural portions of Southern Illinois on the Hidden Springs Ranger District of the Shawnee National Forest. Numerous roads and trails bisect the project area. The area is primarily used by the public for recreation. The project area is bounded by roads, trails, creeks, private lands, and state owned lands.

V. Existing Conditions

A. Fuel: The project area can be characterized as a dry upland woodland community with associated barrens. The woodlands are primarily an oak-hickory forest with associated species. Shade tolerant maples are common in the understory. The barrens are small openings comprised of patchy grasses and forbs and often have early successional species scattered throughout. Red cedar is common around the barrens, near openings, and along cliff lines. The primary carrier of fire will be leaf litter, dead and downed woody material, grasses, and forbs.

Four Standard Fire Behavior Fuel Models (2006) were selected to represent the fuels within the project area. Table 1 depicts the modeled fuel type and its distribution.

The photo series method was used to determine fuel loadings for the project area. The total fuel loading was light to moderate and is considered normal for Southern Illinois. The average fuel loading was 13.9 tons per acre. Table 2 depicts the distribution of fuels by size class for the project.

Table 1: Fuel Models and distributions[3]

Model Number	Model Name	Percent Present in Project Area
GR2 (102)	Low Load, Dry Climate Grass	6%
TL2 (182)	Low Load, Broadleaf Litter	10%
TL6 (186)	Moderate Load, Broadleaf Litter	76%
TL9 (189)	Very High Load, Broadleaf Litter	8%

Table 2: Fuels by Size Class for Timbered Areas

	Depth (in.)	Loading (Tons/Ac)
Surface Material	1.9	0.54
Duff	1.4	2.39
Total Forest Floor	3.1	2.93

Diameter (inches)	Loading (tons/ac)			Density (Pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
0-0.25	1	0	0	--	--	--
0.26-1.0	1.6	0	1.6	--	--	--
1.1-3.0	1.6	0	1.6	--	--	--
3.1-9.0	6.5	1.9	8.4	117	87	204
9.1-20.0	1.3	0	1.3	10	0	10
>20.0	0	0	0	0	0	0
Total	**12**	**1.9**	**13.9**	**127**	**87**	**214**

B. Fire History: Fire history for Southern Illinois was well documented in the 2006 Shawnee National Forest Land and Resource Management Plan. The following is an excerpt from this plan:

The historic role of fire in the development and maintenance of oak forests has been well established across much of the eastern deciduous biome (Lorimer, 1985; Abrams, 1992; Brose et al., 2001). While pre-settlement fire-history data are limited for southern Illinois, fire as a natural component of the ecosystem is widely accepted (Abrams, 1992; Fralish, 1997; Heikens and Robertson, 1995; Robertson and Heikiens, 1994; Ruffner et al., 2002).

Fire-history studies for the Missouri Ozarks (Guyette and Cutter, 1991) indicate that fire return intervals during periods of Native American settlement (1701-1820) were longer (averaging about 12 years) than those of the Euro-American settlement period (averaging about four years). While these data represent the fire history of only the southern Missouri Ozarks, most forest ecologists would agree with the assumption that similar relationships existed across southern Illinois (Fralish et al., 2002). Similar fire

[3] Scott, Joe H and Burgan, Robert E. 2006. *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model.* Gen. Tech. Report. RMRS-GTR-153. Fort Collins, CO. USDA Forest Service.

occurrences have been noted for the central hardwood forests of southern Indiana as well (Olsen, 1996).

Long-term maintenance of oak across the Shawnee Hills was probably driven by recurring fire with a 15-to-25-year return-interval (Fralish, 1977). Prairie communities of southern Illinois were maintained historically by a combination of drought and recurring fire on a two-to-six-year return-interval. Evaluations of central-hardwood mixed-oak forests suggest that these forests burned with low intensities on a 0-to-35-year return-interval (Ruffner and Carver, Draft, 2004).

Native American settlements were distributed across the Ozark Hills and Shawnee Hills and, thus, forests of these provinces were probably influenced by both natives and Euro-American-settler burning (Fralish et al., 2002). Archaeologists believe Woodland Indian cultures cleared forests with fire to create open areas for cultivation. By the time of European contact (1650), the anthropological landscape resembled a mosaic pattern of 1) croplands near settlements, 2) abandoned clearings with early successional taxa and 3) open forest-stands dominated by fire-adapted species such as oak, hickory and walnut (Chapman et al., 1982; Delcourt, 1987; Delcourt et al., 1998; Ruffner and Abrams, 2002).

Regional studies reporting fire histories from the Historic period indicate that fire-ignitions were high during this period due to farmers clearing underbrush from the forest (Miller 1920; Robertson and Heikens, 1994). Reports during the early 1900's noted that farmers annually burned forests to increase the regeneration of grasses and forbs, as well as to reduce the understory to facilitate hunting and travel (Miller, 1920). The forest could not be burned every year due to the lack of sufficient fuels; however, these early accounts record that some portions of the forests were affected by fires each year, but the woods were not completely burned (Robertson and Heikens, 1994).

Fire has played an important role in the development and maintenance of the oak-hickory forests of the area and continued to do so through the early part of the 20th century. Numerous laws and local bans on fire marked the beginning of major efforts to control wildfires. After wildfire controls were enacted, the effects of periodic fire in maintaining healthy forests were removed from the ecosystem. It is during this time that numerous authors suggest a growing shift in species-composition occurred across much of southern Illinois when fire-intolerant species such as sugar maple began to replace fire-adapted oak and hickory species (Fralish et al., 2002).

Similar conclusions have been reached by others researching southern Illinois forests (Ruffner and Carver, Draft, 2004) who, in addition, have documented the beneficial effects of prescribed fire to foster oak regeneration and reduce competing mesophytic species in forestlands. They also note that the protection from disturbance is likely to hasten the transition of species and will likely result in the loss of biological diversity across the region (Parker and Ruffner, 2004).

The effects of fire on other components of southern Illinois ecosystems have been documented by several authors. The effects of fire in maintaining and perpetuating barrens communities where many threatened, endangered and sensitive species occur has been well documented by Anderson (1994), Anderson and Schwegman (1971) and others, as have the detrimental effects of fire-cessation on barrens species (Anderson, Schwegman and Anderson 2000). The use of prescribed fire to maintain unique vegetation and habitat-types in glades and oak savannas has also been noted by Parker and Ruffner (2004). The detrimental effects of the lack of fire on grassland-types and the populations of shortleaf pine have also been documented (Ruffner and Carver, Draft, 2004).

Detailed fire history records for the Shawnee National Forest are available from 1986 to present. Table 3 depicts the known wildland fires that occurred within the project area during this period.

Table 3: Project Area Fire History (1986 – Present)

Fire Name	Size	Year
Weidman	133	2005
Eagle Mountain	55	2004
Eagle Mountain Road	5	2004
Former	1	2002
Sulphur Springs	6	2000
No Name	80	1994
No Name	2	1994
No Name	1	1998
Trigg	1	1995
Upper Simpson	5	1998

Limited fire history records are available from 1961 to 1983. These records divide fires into two groups, greater than 10 acres and less than 10 acres. During this period, there were six fires recorded within the project area. Five fires were greater than 10 acres and one less than 10 acres. The majority of the large fires occurred in the Cave Hill, Stoneface, and Dennison area. The largest acreage fire recorded in the Simpson unit was only five acres. Additionally, it was reported that much of the Cave Hill area burned in two wildfires in the mid 1950s[4].

Prescribed burning has also historically occurred within the project area. During March 2007, 82 acres were prescribe burned at Simpson Township Barrens EA, 119 acres at Cave Hill RNA, 25 acres at Dennison Hollow RNA, and 36 acres at Stoneface RNA, however, these prescribed burn areas are not included in this project area. See Table 1 of the Environmental Assessment for an account of the past prescribe burns to these areas. These burns were typically 200 acres or less.

[4] Verbal communication between Carl Joe Frick and Elizabeth Shimp.

C. Fire Regime and Condition Class: Fire Regimes are used to classify geographic areas based upon historical fire frequency and severity (See exhibit 1). Condition Class describes a geographic area's departure from its historic Fire Regime (See Exhibit 2). The project area is classified as a Fire Regime class 1 according to analysis done by the USDA Forest Service's Rocky Mountain Research Station[4].

Exhibit 1: Forest Fire Regimes[5]

I = 0-35 year frequency, low severity
II = 0-35 year frequency, stand replacement severity
III = 35-100+ year frequency, mixed severity
IV = 35-100+ year frequency, stand replacement severity
V = 200+ year frequency, stand replacement severity

Utilizing the fire history and fire regimes for the project area, it was determined that the timbered units have missed between 2 and 4 fire return intervals, making them a condition class 3 (See Exhibit 2 for definitions of each condition class). USDA Forest Service's Rocky Mountain Research Station[4] analysis shows most of the Shawnee National Forest to be a condition class 3 with only small portions of the Mississippi Bluffs Ranger District at condition class 1 or 2.

Exhibit 2[6]

Condition class	Attributes	Example management options
Condition Class 1	• Fire regimes are within or near an historical range. • The risk of losing key ecosystem components is low. • Fire frequencies have departed from historical frequencies by no more than one return interval. • Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	• Fire regimes have been moderately altered from their historical range. • The risk of losing key ecosystem components has increased to moderate. • Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or 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.
Condition Class 3	• Fire regimes have been significantly altered from their historical range. • The risk of losing key ecosystem components is high. • Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. • Vegetation attributes have been significantly altered from their historical range.	Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

[5] Schmidt, Kristen M.; Menakis James P.; Hardy, Collin C.; Hann, Wendall J.; Bunnell, David l. 2002. Development of Coarse Scale Spatial Data for Wildland Fire and Fuel Management. Gen. Tech. Report. RMRS-GTR-87. Fort Collins, CO. USDA Forest Service. 41 pp.
[6] Condition Class Definitions. www.fs.fed.us/fire/fuelman/curcond2000/def. 1 - 2 pp.

D. Fire Behavior: Fire behavior predictions, as discussed in the effects section, were modeled using the BEHAVE Plus program. The inputs required for the models are in the categories of Fuels, Weather, and Topography. The fuels inputs include downed dead woody debris moisture content. The topography input required is slope. Slopes were averaged 15 % and ranged from 0 – 40% for the project area.

Weather inputs were derived using the districts existing burn plan prescription parameters. Modeling was done at both the "hot" and "cool" end of the prescription in order to determine the full range of expected fire behavior. See table 4 for prescription variables that were used.

Table 4

Environmental Prescription	
Relative Humidity %	>20
Wind Speed (20 foot)	5 - 25
Wind Direction	Any
Temperature (Dry Bulb %)	32 - 87
Live Herbaceous Fuel Moisture %	>50
Live Woody Fuel Moisture %	>90
Dead Fuel Moisture % 1hr. T/L	5 – 15
10hr. T/L	6 – 16
100hr. T/L	7 – 17
1000 Hr. T/L	N/A
Probability of Ignition	<70%
Season/time of year:	October - April

Predicted fire behavior was averaged for the project area with a weighting factor used for different fuel types. The following table represents the range of expected fire behavior for the environmental prescription listed in Table 4.

Rate of Spread (chains/hour)	Flame Length (feet)	Scorch Height (feet)	Probable Tree Mortality (Sugar Maple) (%)
1 – 6.8	1 – 2.7	1.9 – 11.8	21.9 – 27.2

E. Resistance to Control: Burn plans are developed to ensure enough resources are assigned to the burn to ensure control of any spot fire or escape even at the hottest end of the prescription. The containment objectives for any spot fire or escape are to confine, contain, and control them as soon as possible. The safest and most efficient method of suppression is through direct attack tactics. Direct attack methods for handcrews and engines suggest that flame lengths be less than 4 feet and fireline intensity should be less than 100 BTU/ft/second. The conditions within this project area meet the requirements for direct attack and are similar to other burns recently conducted on the forest.

The Shawnee National Forest has an active suppression and prescribed fire program and has adequate resources to staff most prescribed fire operations. Table 5 depicts the fire assets available to Shawnee National Forest.

Table 5: Shawnee National Forest Fire Resources

Resource	ICS Type	Resource Designator	Production Rates ch/hr
2 Prescribed Fire Burn Bosses	RXB2	Division 84, Chief 8	N/A
2 Prescribed Fire Managers	RXM2	Division 84, Chief 8	N/A
4 Law Enforcement Officer	N/A	FS 1-4	N/A
3 Type 6 Engines	Type 6	Engine 40	25-40
	Type 6	Engine 41	25-40
	Type 6	Engine 21	25-40
1 Type 7 Engine	Type 7	Engine 22	25-40
2 Type 3 Dozers	Type 3	Dozer 2	35-60
	Type 3	Dozer 4	35-60
1 Squad FFT (4 Personnel)	Type 2	Squad 21	32
1 Tracked Crawler w/ 150 gallon slip-on	Type 7 Engine	Crawler	8
4 Polaris Rangers w/ 50 gallon slip-on	N/A	N/A	8 each

The line production rate[7] for all forest resources combined is between 242 and 352 chains per hour if all equipment is staffed. Although most prescribed burns do not utilize all forest equipment and resources, it is available if needed. The variety of equipment allows burn bosses the flexibility to assign the appropriate number and type of equipment to burns based upon expected fire behavior, topography, and access.

VII. Alternative 1 (No Action Alternative)

Under the No Action alternative there would be no prescribed fire activities and no tree removal activities. Natural process of succession, and disturbances such as insect and disease infestations and mixed severity wildfires would continue to occur over time.

A. Direct Effects

There are no known direct effects to fuels or change to surface loading in the short term by taking no action.

B. Indirect and Cumulative Effects

Over time, in the absence of prescribed fire or any treatment that would reduce surface fuels, ladder fuels, and crown bulk density, the fuel loading may continue to increase. Debris is added to the forest floor annually. At some point, the amount of

[7] Incident Operations Standards Working Team. 1998. Fireline Handbook. PMS 410-1, NFES 0065. Boise, ID. National Wildfire Coordinating Group. A-20 – A-22 pp.

debris added may equal the amount that decays yearly, but this scenario is impossible to predict. If fuels continue to increase, the area may experience a high severity wildfire.

Smoke production related to a high severity wildland fire may exceed the Ambient Air Quality Standards for PM 2.5, PM 10, and Carbon Monoxide. This smoke production could likely effect population centers such as Harrisburg.

The timbered portions of the project area that were in a condition class two will be replaced with condition class three. Condition Class three is described as having a high risk of losing key ecosystem characteristics due to wildland fire.

VIII. Alternative 2 (Proposed Action)

Under this alternative the Forest would manage the 4 natural areas with prescribed fire, tree and shrub removal where necessary. As in the past, each of the 4 natural areas would be managed based on a site-specific assessment of vegetative conditions and management needs. Management will be applied as necessary to enhance, maintain or restore an area and, in accordance with the Shawnee National Forest Land and Resource Management Plan Appendix D. Management would occur over a multi-year period, with prescribed burns repeated on appropriate cycles. The burns would be implemented when weather and site conditions are conducive to meet site-specific management objectives. Burns would be planned and implemented during the most optimal periods, depending on the natural community. Roads, trails, streams and ravines will be used as natural fire-control lines whenever possible. Other fire-control lines—areas cleared of vegetation by leaf blowers, raking, mowing or other mechanical means—would be prepared before burning, as necessary.

Prescribed fire would be introduced at one to five-year intervals for up to five burns within the next ten years. The prescribed burning would include associated firelines to contain the fire. Control lines would be constructed manually or mechanically and would generally follow past fire-control lines along the perimeter of the project area. In accordance with Forest Plan standards and guidelines to protect the Indiana Bat, no burning would be conducted between May 1 and September 1.

A. Direct Effects:

Trees and shrubs will be cut around new populations of Meads Milkweed. Cut material may be removed, left on-site in piles and burned, or scattered. If left on-site, this will increase fuel loadings by 3 – 8 ton per acre in these areas. Burning will reduce this material back to an acceptable level, however, there will be a time-lag between the cutting and burning in which increased fuel loadings will be present. If the material is scattered, it may require multiple burns to reduce fuel loadings back to the desired level of 10 ton per acre or less.

Prescribed burning will reduce surface fuel loads to 10 tons per acre or less in units both units. Some snags may be removed along control lines to reduce the probability of spot fires outside the project area. Snag removal will adhere to Indian Bat protocols. The project area will be returned and/or maintained at a condition class one.

Smoke emissions from prescribed burning would be managed to meet the Clean Air Acts Ambient Air Quality Standards for PM 2.5, PM 10, and Carbon Monoxide. A smoke management plan will be completed for this burn. A smoke permit will be obtained from the Illinois EPA and burning will only be conducted with concurrence from the State. The nearest smoke sensitive areas are the communities of Harrisburg, Equality, Herod, and Simpson. Burning will be conducted under conditions that prevent negative impacts to smoke sensitive areas.

B. Indirect Effects:

Cut material from the tree and shrub removal, if left on-site and piled, will burn at very high intensities. This may cause small areas of soil sterilization. Piles should not be placed within riparian filter strips or increased run-off could occur.

Cut material from the tree and shrub removal, if left on-site and scattered, will burn at higher intensities when fuel moistures are low. This would likely not sterilize the soil, but it may remove ground cover provided by the duff layer and expose mineral soil. Material should be scattered widely and should not be placed in the riparian Streamside Management Zone to ensure a filter strip remains and run-off does not occur.

Reducing fuel loadings to 10 tons per acre or less will change the Fire Behavior Fuel Model for the timbered units to a TL2 (low load, broad leaf litter). In the event a wildfire should occur within the project area, fire behavior would be reduced and effects from the fire would be less severe. The following table depicts expected fire behavior and effects for TL2, TL6, and TL9 at the hot end of the prescribed burn prescription.

Table 6: Comparison of Fire Behavior in Timber Fuel Models

	TL2	TL6	TL9
Rate of Spread (chains/hour)	1.2	5.2	8.1
Fireline Intensity (BTU/Feet/Sec)	3	44	162
Flame Length (Feet)	0.8	2.6	4.7
Mid Flame Wind Speed (mph)	3.9	3.9	3.9
Scorch Height (feet)	1	10	30
Probability of Mortality (Sugar Maple) (%)	22	22	61

Introducing fire into the barrens habitat will likely reduce the encroachment of early successional species and encourage more grasses and forbs. As this occurs, the

barrens will convert form Fire Behavior Fuel Model GR2 (low load, dry climate grass) to GR4 (moderate load, dry climate grass) or GR7 (high load, dry climate grass). This change will be due to a more continuous fuel bed and increased fuel loading. This change will increase potential fire behavior. This increase is actually seen as beneficial in meeting the resource objectives. It will aid in reducing the encroachment of pioneer species into the barrens, and may help increase the size of the barrens by killing adjacent over-story trees. Increased fire behavior is not a fire management concern because the barrens are relatively small and surrounded by timbered units where wildfires can easily be contained. Table 7 shows a comparison of fire behavior for the three grass fuel models at the hot end of the prescribed burn prescription.

Table 7: Comparison of Fire Behavior in Grass Fuel Models

	GR2	GR4	GR7
Rate of Spread (chains/hour)	34.2	68.9	102.1
Fireline Intensity (BTU/Feet/Sec)	157	614	3177
Flame Length (Feet)	4.6	8.6	18.4
Mid Flame Wind Speed (mph)	3.9	3.9	3.9
Scorch Height (feet)	29	82	254
Probability of Mortality(Sugar Maple)(%)	56	98	98

C. Cumulative Effects:

Past Projects: Prescribed burning has historically occurred within the project area. During March 2007, 82 acres were prescribe burned at Simpson Township Barrens EA, 119 acres at Cave Hill RNA, 25 acres at Dennison Hollow RNA, and 36 acres at Stoneface RNA, however, these prescribed burn areas are not included in this project area. Prescribed burns occurring within the project area are depicted in Table 1 of the Environmental Assessment.

The Eagle Mountain prescribed burn is adjacent to the project area on the south side of Dennison Hollow Natural Area. This project, 542 acres, was burned in the fall of 2006. It is likely that it will be burned again in the next two to four years.

Future Projects: The Shawnee National Forest plans to burn 5162 acres in fiscal year 2008. Approximately 3100 acres are planned on the Hidden Springs Ranger District. There are no burns planned in close proximity to the project area (all are greater than 5 miles away).

The Shawnee National Forest Land and Resource Management Plan allows up to 12000 acres per year of prescribed burning forest wide. Current planning and implementation capabilities do not have the capacity to meet this element of the Forest Plan. In the near future, it is expected that the forest will burn an average of 5000 – 7000 acres per year.

Smoke Emissions: All burn projects must comply with the elements of the Clean Air Act (CAA) as amended, 1990, and State Implementation Plans (SIP), which are state-derived implementation documents of the elements of the CAA. The State of Illinois has not yet finalized their SIP, so only compliance with the CAA is dealt with here.

The CAA prescribes National Ambient Air Quality Standards (NAAQS) for criteria pollutants (Particulate Matter < 10 microns in diameter (PM_{10}), Particulate Matter < 2.5 microns in diameter ($PM_{2.5}$), Total Suspended Particulate Matter (TSP), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ozone, Carbon Monoxide (CO), and Lead (Pb)) to limit the negative health or welfare effects from air pollution. Areas not meeting these standards are considered "non-attainment areas," and states must develop plans to improve air quality there. In general, southern Illinois has good air quality and meets the NAAQS. In fact, the area around Carbondale had the lowest annual average in the state for PM_{10} at 19µg/m^3 in 2005 (the year of most recent data). The only non-attainment areas in Illinois are in the Chicago Metro Area and Madison, Monroe, and St. Clair Counties in the East. St. Louis Metro Area, which were non-attainment for 8-hour ozone concentrations only. These counties are over 90 miles northwest of the project area and are outside of the range that expected smoke emissions will reach.

The Clean Air Act also proscribes measures called Prevention of Significant Deterioration (PSD) to prevent limit the impacts to visibility in certain areas. The entire Shawnee NF and surrounding counties are in a Class II area, which allows for some incremental increase in pollution, but not to the limit of the NAAQS. Class I areas are those with high air quality that allow only minor additional pollution. The nearest Class I areas are at the Mingo Wilderness Area in southeast Missouri (approximately 95 miles to the southwest) and Mammoth Cave National Park (approximately 180 miles east-southeast in central Kentucky). These areas will not be affected by this project.

Burning is expected on 5000 - 7000 acres per year over the next 10 years on the Shawnee National Forest. This is an increase from historical levels which began in 2007 when the forest burned 4700 acres. Previous to 2007, the forest burned less than 1500 acres per year annually. Burn Bosses will coordinate with the Illinois State EPA to ensure emissions are within Air Quality standards and smoke does not negatively impact the public. Burns will be conducted under conditions that provide good lift and transport of smoke away from population concentrations. Size of units burned may be limited to reduce the volume of smoke generated at one time. Public notices will be provided to the local media, fire departments, and residents neighboring the projects. Visibility on roadways could be impacted, so burn bosses will ensure affected roads are signed throughout the burning periods to mitigate this hazard.

/s/Jon Teutrine February 28, 2008
District Fire Management Officer
Hidden Springs Ranger District

E-mail note:

Jon W Teutrine/R9/USDAFS

03/13/2008 03:26 PM

Beth,

Since my time on the Shawnee National Forest I have had many opportunities to observe firelines throughout their many stages (construction, utilization, restoration). I have not seen any negative effects from lines constructed with leaf blowers. These lines are only 2 - 4 feet in diameter, do not remove the organic duff layer, and often leave decaying woody debris across the line. As conditions become more dry in the late spring, leaves are more easily blown around by the wind and these lines will usually have 25 - 50% ground cover on them by spring green-up. By fall leaf off, these lines are completely covered over and can't be seen. I have not seen any rutting, channeling, or other evidence of an erosion problem associated with leaf blown lines.

Firelines constructed with the dozer in timbered stands do remove the organic duff layer and are approximately 5 - 6 feet in diameter. We follow the State Best Management Practices when constructing dozer line, so these lines will have water control structures when built on a slope. Additionally, berms on the downhill side of the line are knocked down in order to prevent water channeling. Like leaf blown lines, these lines will become partially leaf covered from wind blown material beginning in late spring. By fall leaf-off, these lines are also completely covered. I have not seen any evidence of erosion on these lines either.

Attached is the Fire and Fuels report for the Natural Areas Prescribed Burning

NA Specialist Report.doc

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