United States
Department of
Agriculture

Forest
Service

December 2002

Environmental Assessment Tornado Blowdown Fuels Reduction Project

Jackson and Lawrence Counties, Indiana

Brownstown Ranger District

Hoosier National Forest

December 2002

Abstract: The proposal involves reducing fuel loads on 1,759 forested acres of the Pleasant Run Unit that were damaged by high winds associated with a tornado in 1996. The project is proposed to minimize risks posed to firefighter and public safety by potential wildfires.

Responsible Official:
James E. Denoncour, District Ranger

For more information contact:
Mr. Chris Peterson
Forest Fire Management Officer/Aviation Officer
Hoosier National Forest
248 15th Street
Tell City, IN 47586
812-547-9247
FAX: 812-547-6144

Table of Contents

1.0 INTRODUCTION 1

2.0 PURPOSE OF THE PROPOSED ACTION 1

3.0 NEED FOR THE PROPOSED ACTION 4

3.1 Goals of the Proposed Project 6
- 3.1.1 Reduce Safety Hazards for Firefighters and the Public 6
- 3.1.2 Protect Forests from High-Intensity Fires 6
- 3.1.3 Prevent the Spread of Forest Insects and Diseases 6
- 3.1.4 Promote a Diversity of Vegetation and Habitat Types 6
- 3.1.5 Improve Recreational and Visual Quality 7

4.0 PROPOSED ACTION 7

4.1 Proposed Treatments 8
- 4.1.1 Broadcast Burn 8
- 4.1.2 Pile Burn 10
- 4.1.3 Machine Pile / Burn (Alternative actions include this treatment) 10
- 4.1.4 Treatment by Isolation 10

4.2 Treatment Units 11
- 4.2.1 Starnes Area 11
- 4.2.2 Salt Creek Area 13
- 4.2.3 Pipeline Area 14
- 4.2.4 Hickory Area 15
- 4.2.5 Fork Ridge Area 16

4.3 Mitigations Included in the Proposed Action 17
- 4.3.1 Mitigation Measures for Federally Listed and Regional Forester Sensitive Species 19
- 4.3.2 Mitigation Measures for Heritage Resources 19

4.4 Decision to be Made 20

4.5 Forest Plan Background 20

4.6 Other Related Topics 20

4.7 Other Projects in the Proposed Fuel Treatment Areas 21

5.0 ISSUES RELATED TO THE PROPOSED ACTION 22

5.1 Issue 1: Wildlife Habitat 22

5.2 Issue 2: Soil Effects and Water Quality 22

5.3 Issue 3: Wildfire Threat 23

5.4 Issue 4: Forest Health Effects and Effectiveness of Fire Management 23

5.5 Issue 5: Economic Concerns 23

5.6 Issue 6: Air Quality 23
5.7 Issue 7: Recreational Quality 23
5.8 Issue 8: Visual Quality 23
5.9 Issue 9: Safety 24
5.10 Issue 10: Heritage Resources 24

6.0 ALTERNATIVES 24
6.1 Alternative A (Proposed Action) 24
6.2 Alternative B (Alternative Action) 24
6.3 Alternative C (Alternative Action) 27
6.4 Alternative D (No Action or Existing Condition) 30
6.5 Alternatives Not Considered in Detail 31

7.0 ENVIRONMENTAL EFFECTS 32
7.1 Wildlife and Habitat Effects 32
7.1.1 Affected Environment 32
7.1.2 Direct and Indirect Effects of Alternatives 36
7.1.3 Cumulative Effects of Alternatives on Federally Listed Threatened and Endangered, and Regional Forester Sensitive Species 45
7.2 Soil Effects and Water Quality 49
7.2.1 Affected Environment 49
7.2.2 Direct and Indirect Effects 52
7.2.3 Cumulative Effects 54
7.3 Fisheries Concerns 56
7.3.1 Affected Environment 56
7.3.2 Direct and Indirect Effects 58
7.3.3 Cumulative Effects 61
7.4 Wildfire Threat 61
7.4.1 Affected Environment 61
7.4.2 Direct and Indirect Effects 62
7.4.3 Cumulative Effects 63
7.5 Forest Health Effects and Effectiveness of Fire Management 64
7.5.1 Affected Environment 64
7.4.2 Direct and Indirect Effects 64
7.4.3 Cumulative Effects 66
7.6 Economic Concerns 67
7.6.1 Affected Environment 67
7.6.2 Direct and Indirect Effects 67
7.6.3 Cumulative Effects 70
7.7 Issues Examined in Less Detail 72
7.7.1 Air Quality 72
7.7.2Recreational Quality 74

7.7.3 Visual Quality **76**
7.7.4 Safety **79**
7.7.5 Heritage Resources **82**

DOCUMENT PARTICIPANTS **84**

REFERENCES **85**

APPENDIX A: Public Scoping Comments **1**

APPENDIX B: Mitigation Measures **1**

APPENDIX C: Proposed Action Alternatives **101**

Figure A-1: Alternative A (Proposed Action) Starnes Area Treatment Units
Figure A-2: Alternative A (Proposed Action) Salt Creek Area Treatment Units
Figure A-3: Alternative A (Proposed Action) Pipeline Area Treatment Units
Figure A-4: Alternative A (Propose Action) Hickory Area Treatment Units
Figure A-5: Alternative A (Proposed Action) Fork Ridge Area Treatment Units

Figure B-1: Alternative B Starnes Area Treatment Units
Figure B-2: Alternative B Salt Creek Area Treatment Units
Figure B-3: Alternative B Pipeline Area Treatment Units
Figure B-4: Alternative B Hickory Area Treatment Units
Figure B-5: Alternative B Fork Ridge Area Treatment Units

Figure C-1: Alternative C Starnes Area Treatment Units
Figure C-2: Alternative C Salt Creek Area Treatment Units
Figure C-3: Alternative C Pipeline Area Treatment Units
Figure C-4: Alternative C Hickory Area Treatment Units
Figure C-5: Alternative C Fork Ridge Area Treatment Units

List of Tables

Table 1: Fires on NFS and Private Lands within One Mile of NFS Lands (1973-2001) 5

Table 2: Causes of Fire on NFS Land (1973-2001) 5

Table 3: Proposed Fuels Reduction Treatments 9

Table 4: Proposed Fuels Treatment Summary 9

Table 5: Proposed Fuels Reduction Treatments for Alternative B 26

Table 6: Proposed Fuels Treatment Summary for Alternative B 26

Table 7: Proposed Fuels Treatment for Alternative C 29

Table 8: Proposed Fuels Treatment Summary for Alternative C 29

Table 9: Hoosier National Forest Management Indicators 35

Table 10: Hoosier National Forest Species of Concern 36

Table 11: Summary of Effects on HNF Management Indicators 44

Table 12: Starnes Branch Fish Assemblage, Status, and Historical Collections 57

Table 13: Direct Cost of Project Alternatives 68

Table 14: Treatment Areas with Heritage Resources Requiring Protection 82

List of Figures

Figure 1: Project Vicinity Map 2

Figure 2: Proposed Treatment Units 3

PREFACE

In 1991, the Hoosier National Forest (HNF) completed a comprehensive land management planning effort with the publishing of the Hoosier National Forest Land and Resource Management Plan (*Forest Plan*) that replaced the 1985 *Forest Plan* with a considerable amendment. During this effort, the HNF made a concerted effort to involve the public. With the help of the public, issues and alternative approaches to management of the HNF were identified. An Environmental Impact Statement (EIS) was prepared in conjunction with the *Forest Plan* to document the analysis. The EIS was developed in accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations for NEPA.

The approval of the Record of Decision for the final EIS (USDA FS 1991c) on April 8, 1991, represents the first level of decision-making related to land and resource management planning. This decision determined the desired future condition of the HNF and established the guidance under which future projects will be implemented.

The second, and final, level of decision-making focuses on the analysis and implementation of management practices and projects designed to achieve the goals and objectives of the *Forest Plan*. This involves site-specific analysis to meet the requirements of the NEPA and specific on-site resource needs.

The Environmental Assessment (EA) for the proposed Tornado Blowdown Fuels Reduction Project documents the site-specific analysis for project implementation occurring at the second level of decision-making. This EA was initiated as a result of environmental analysis of the proposed project in accordance with NEPA procedures. These procedures afforded interested and affected publics the opportunity to participate. This report outlines the alternatives for implementing this project, noting any needed mitigation measures and predicting the relevant environmental consequences. The decision maker may now consider the results of this analysis in making an informed decision.

"The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer."

Environmental Assessment
Tornado Blowdown Fuels Reduction Project

1.0 INTRODUCTION

The primary responsibility of the USDA Forest Service is to provide healthy, sustainable ecosystems for Americans, present and future. While doing this, the USDA Forest Service sustains the vitality and diversity of the Hoosier National Forest (HNF) in perpetuity, while providing many benefits.

This proposed fuels reduction project implements the USDA Forest Service natural resource agenda. It addresses watershed health and restoration, along with sustainable forest management. Specifically, the proposed project would develop a series of treatment alternatives to reduce fuel loading, and diminish the possibility of *severe* wildfires that could result in forest destruction and degradation of water quality. Additionally, the project will incorporate environmental, social, and economic concerns into selection of treatment alternatives in order to ensure the long–term health of the HNF.

This Environmental Assessment (EA) displays the direct, indirect, and cumulative effects of the proposed action, one alternative to the proposed action, and a no action alternative. This project proposes to reduce fuel loading in 1,759-forested acres within the Pleasant Run Unit of the Brownstown Ranger District of the HNF, which is located approximately 16 miles southeast of Bloomington, Indiana (Figure 1). The proposed action would address potential threats to firefighter safety and the general public by implementing a variety of burn treatment strategies to reduce the amount of woody forest floor debris.

2.0 PURPOSE OF THE PROPOSED ACTION

The purpose of this proposed action is to reduce the fuel loading in 14 forested areas of the HNF that were damaged by wind associated with a tornado in 1996 (Figure 2). Affected timber stands and proposed prescribed burn treatments to reduce the quantity of woody debris are discussed in Section 4 of this document. This purpose is consistent with moving the present conditions of the affected areas toward the desired future conditions for Management Areas (MA) 2.4, 2.8, and 6.4, as described in the *Forest Plan* (USDA FS 1991a).

General *Forest Plan* standards and guidelines for managing vegetation state “downed logs, limbs, and other scattered ground materials resulting from vegetative management or natural causes are left on the site. Exceptions to this may be made for visual concerns, reducing fire hazards in certain situations, firewood gathering, and recreation area cleanup" (USDA FS 1991a). Thus, the purpose of the proposed project is consistent with Management Area and forest-wide standards and guidelines for the HNF, as stated in the *Forest Plan*.

Most of the proposed fuels reduction project is in MA 2.8 (94 percent). There are also small areas of MA 2.4 (6 percent), and MA 6.4 (less than 0.5 percent) included in the Project Area. MA 2.8, consists of a mosaic of different-aged hardwood forests, each with a high degree of vertical and horizontal vegetative diversity. The *Forest Plan* states that “visual quality and recreation opportunities” should be enhanced in this unit, “interaction among visitors is frequent,” and that “viewing scenery, hunting, fishing, gathering forest products, and hiking are key recreation activities”(USDA FS 1991a). The *Forest Plan* guidelines for MA 2.8 state, "snags will not be left where they might fall on roads, trails or recreation sites or conflict with visual quality objectives" (USDA FS 1991a).

Figure 1: Project Vicinity Map

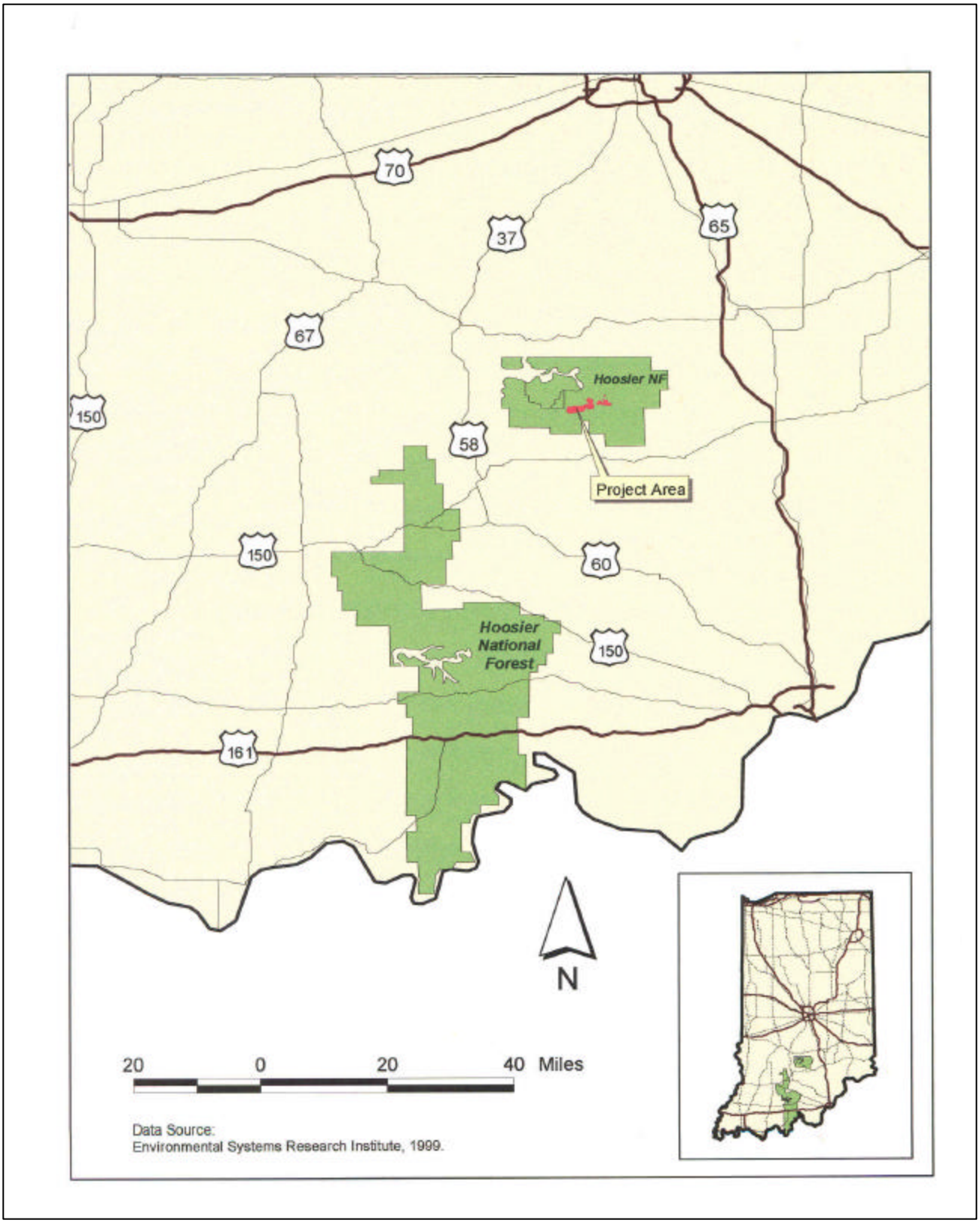
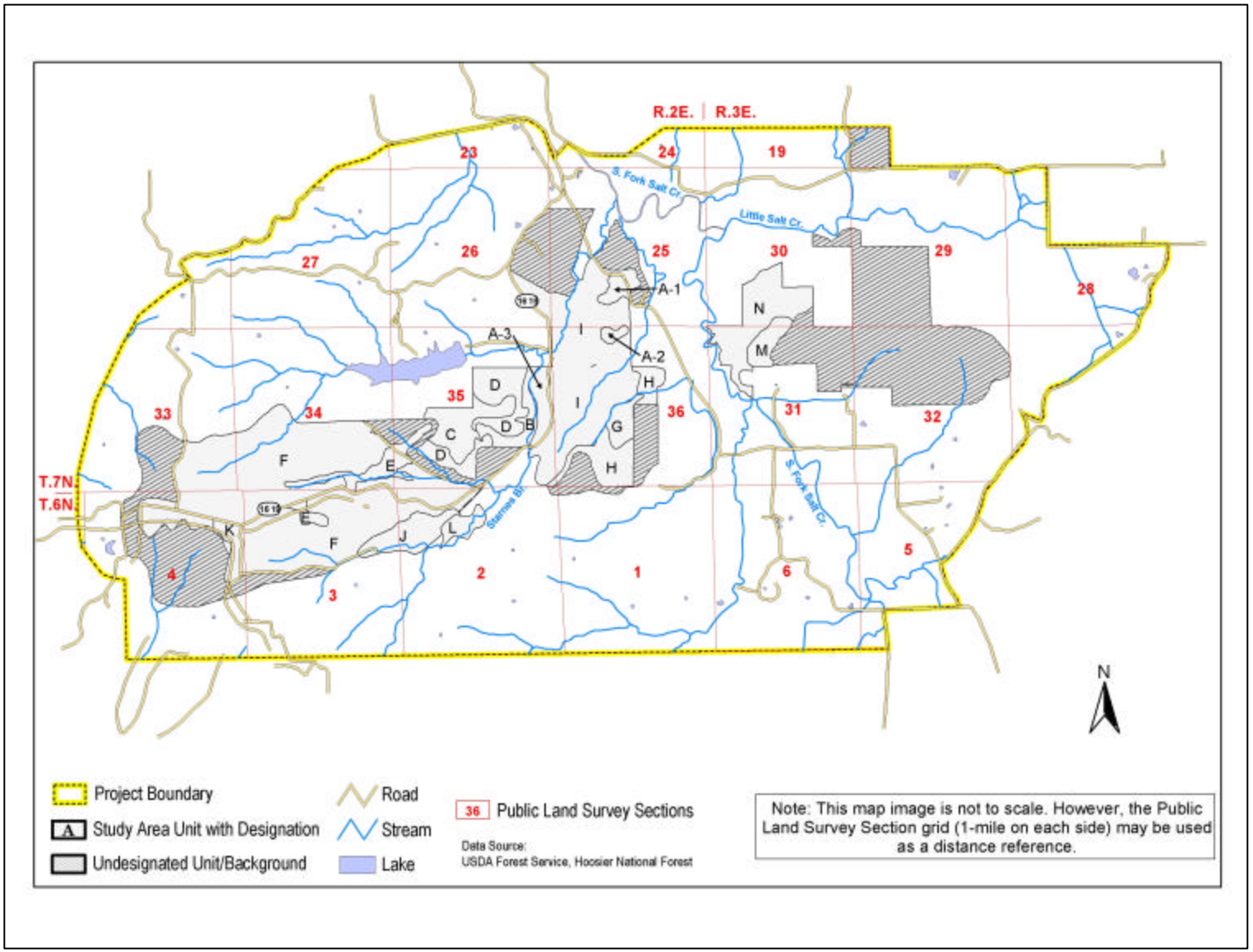


Figure 2: Proposed Treatment Units



Most areas proposed for treatment in MA 2.8 are close to roads and trails that are heavily used by the public. Storm-damaged trees could fall, posing an additional potential safety threat in these areas. Reducing fuel loads would reduce these safety hazards. Reduction of woody debris may improve the visual quality of these damaged areas and enhance recreation opportunities by removing downed logs that make hiking difficult. Reduction of debris will also allow for better natural regeneration in many of the blowdown areas, as it is difficult for trees and shrubs to grow through dense, woody forest floor litter.

Forest Plan guidelines for MA 2.4 state that the desired future condition of this area is "characterized by forested shorelines or corridors…that protect and enhance water-based recreation opportunities, visual quality, and riparian values" (USDA FS 1991a). In order to maintain water quality, visual quality and riparian values of this MA, mitigation measures must be adhered to for burning to take place adjacent to riparian areas. Low intensity prescribed burns proposed in some areas should not change the forested nature of shorelines and riparian corridors. Although there may be some top kill of shrubs and saplings, root systems should remain intact, minimizing soil loss and sedimentation due to erosion in riparian corridors (USDA FS 1989). Reducing fuels in nearby upland forested areas would increase the visual quality for recreationists passing through this portion of the HNF.

Management Area 6.4 consists of a natural appearing forest that provides much of the backcountry identified on the HNF. This area is managed for its natural physical setting that provides opportunities for solitude, tranquility, and a feeling of closeness to nature. Vegetation is managed to maintain a diversity of ecosystems and provide for a visually pleasing landscape (USDA FS 1991a). Recreational use is low in this area, and long-range HNF goals include closure of all roads in the interior of MA 6.4 to the public for preservation purposes. Reducing fuel loads to acceptable levels in a controlled manner now will minimize the likelihood of loss of canopy trees by a severe fire in the future, while maintaining the natural appearance of the forest. Treating areas with prescribed burns will also reduce hazards posed to backcountry recreational users and provide for a greater diversity of ecosystems that benefit wildlife.

3.0 NEED FOR THE PROPOSED ACTION

A severe windstorm occurred and a tornado touched down in the Pleasant Run unit of the Brownstown Ranger District on April 19, 1996. Several forest stands located in the Starnes Branch, Salt Creek, Pipeline, Hickory Ridge, and Fork Ridge areas of Lawrence and Jackson Counties were affected by the tornado and associated high winds. Damage to timber in the area ranged from minor damage of a few trees to wind throw of entire stands. Downed wood from the tornado blowdown substantially increased the fuel load in that part of the HNF.

Timber salvage operations were conducted in the Pleasant Run Unit from 1997 to 1999, resulting in a reduction of heavy fuel loads in salvaged areas (USDA FS 1996a and 1996b). A recent fuels assessment has determined that fuel loads are still unusually high, and that a wildfire hazard and threats to firefighter and public safety still exist following the previous salvage actions. To address these threats, additional fuel reduction treatments have been recommended for several areas, some of which were salvaged, but continue to have moderate to heavy fuels loads.

In the period from 1973 to 2001, there were a total of 479 fires on Federal property and on private lands within one mile of National Forest System (NFS) lands (USDA FS 2001a; Table 1). These fires were suppressed by USDA Forest Service firefighters, due to a cooperative agreement with the Indiana Department of Natural Resources (IDNR) that allows the USDA Forest Service to take initial action to fight fires on state and private land within one mile of NFS lands (C. Peterson pers. comm. 2002). Of these 479 fires, 178 fires occurred on NFS property. Seventy-four percent of fires in the last 28 years

burned an area of one acre or less. On NFS land, three fires burned over 50 acres and only one fire burned over 100 acres. Two other fires over 50 acres occurred on private property. Approximately 34 percent of fires that burned over an acre of land occurred in 2001 alone, which may be an indication of increasing flammability and fuel loading on the HNF.

Table 1: Fires on NFS and Private Lands within One Mile of NFS Lands (1973-2001)

Acreage Burned	Number of Fires 1973-2000	Number of Fires 2001	Total Number of Fires 1973-2001
> 0 and < 1	321	32	353
> 1 and < 5	5	11	16
> 5 and <10	36	18	54
> 10 and <20	22	9	31
> 20 and <50	16	3	19
> 50 and <100	3	2	5
> 100	1	0	1
Totals	404	75	479

Fires were ignited by a variety of natural and human activities on the HNF and adjoining lands from 1973 to 2001 (USDA FS 2001a; Table 2). The leading causes of fires were arson, debris burning, spread of unattended campfires, and improper disposal of smoking materials. Fires caused by arson burned the most acreage within the HNF and one mile beyond NFS land. Unattended campfires are common within the HNF and burned the second highest acreage of HNF land from 1973 to 2001. The largest fire on HNF land was caused by an unattended campfire, which escaped and burned 140 acres of NFS lands and one acre of private land in 1988. Uncontained burning of debris was the primary cause of fire within the HNF region and burned the second highest total area of land. Forty-five of the 153 fires (30 percent of the fires since 1973) caused by uncontrolled burning of debris occurred in 2001 alone, and 88 (58 percent) of these fires have occurred since the blowdown on April 19, 1996. This may be another indication that fuel load, in combination with environmental conditions, is influencing occurrence of fire in the HNF area. The relatively small area of the HNF burned by fires since 1973 is an indication of the effectiveness of fire suppression efforts by the Forest Service and local fire departments. However, years of fire suppression have contributed to fuel loading in many areas. A naturally occurring or human caused fire in the blowdown area could be too dangerous to control because of existing fuel loads, and could result in high-intensity fires that have the potential to kill canopy trees and threaten private property.

Table 2: Causes of Fire on NFS Land (1973-2001)

Cause of Fire	Total Number of Fires	NFS Acreage Burned	Total Acreage Burned (NFS + Private)
Arson	131	668.2	1464.3
Debris Burning	153	57.5	1252.3
Miscellaneous and Unknown	58	64.3	458.0
Camp Fire	43	239.2	429.3
Smoking	51	95.6	268.9
Railroad	7	8.0	151.1
Equipment Use	25	18.2	76.6
Children Playing	7	6.2	15.1
Lightning	4	0.3	2.2
Totals	**479**	**1157.5**	**4117.8**

3.1 Goals of the Proposed Project

Goals of the proposed fuels reduction project include: reducing hazardous fuels for safety concerns; protecting forests from destructive, stand-replacing fires; preventing the spread of forest pests and diseases; promoting a diversity of vegetation and habitat types; and improving recreational and visual quality of the affected blowdown area. These goals are described in more detail below.

3.1.1 Reduce Safety Hazards for Firefighters and the Public

High intensity fires are currently possible on many of the blowdown areas with moderate to heavy fuel loads. Most of the affected areas abut private lands and recreational areas (i.e. Maumee Boy Scout Reservation), and potential wildfire hazards exist for private landowners and recreational users alike. Reducing fuel levels will ease the potential safety hazard posed by a high intensity fire to nearby populations and firefighters. Safety concerns are especially high in certain areas with rugged, steep topography, where no quick escape routes exist for firefighters or the recreating public.

3.1.2 Protect Forests from High-Intensity Fires

High intensity fires can destroy mature forest characteristics. Historically, occasional fires caused by lightning or set by Native Americans occurred across the Midwest (Olson 1996). While many trees in the area developed adaptations that made them resistant to these occasional fires, most trees cannot withstand high-intensity fires. High levels of woody debris presently create an increased risk of high-intensity wildfire in the proposed Project Area (USDA FS 2001b). If low-intensity, litter-reducing fires are not allowed, stand-replacing, high-intensity fires may eventually result. Treating areas through a variety of prescribed fire techniques helps keep the fuel amounts relatively low, thus reducing the chance that mature forest would be damaged or destroyed by stand-replacing fires. Preventing wildfire would also help protect surrounding stands from potential harm from severe wildfires that could ignite in the damaged area and spread to healthy stands nearby.

3.1.3 Prevent the Spread of Forest Insects and Diseases

The *Forest Plan* states, "the emphasis of insect and disease control programs is on prevention and control through biological means including silvicultural treatments, maintaining species diversity, and introduction of insect predators or parasites" (USDA FS 1991a). Forest stands damaged by storms are more vulnerable to disease and infestation by pests. Treating blowdown areas may reduce this risk of damage, and prevent the potential spread of disease to surrounding stands, if an insect infestation or disease occurs amongst the decaying trees (USDA FS 1989). Treatment of these areas by fire will also aid in maintaining species diversity.

3.1.4 Promote a Diversity of Vegetation and Habitat Types

The *Forest Plan* guidelines for prescribed fire state, "prescribed fire may be used to establish or maintain vegetation on areas where fire was originally part of the forest ecosystem… Prescribed fire is also used to promote a more diverse community of plants and animals and for purposes of managing volumes of accumulated fuels to protect other resource values"(USDA FS 1991a). Treating blowdown areas through prescribed burns and isolation practices will help to assure that a diversity of vegetative types is maintained by allowing less shade-tolerant species, such as oaks, to regenerate with less competition from shade-tolerant species, such as sugar maple. Managing vegetation to promote a diversity of ecosystem types is a general guideline for HNF. A diversity of forest and habitat types (wetlands, barrens, meadows, etc.) benefit many species of wildlife that thrive on the HNF.

3.1.5 Improve Recreational and Visual Quality

Forest Plan guidelines for MA 2.4, 2.8, and 6.4 mandate that recreational opportunities be enhanced. These areas are generally accessible to the public by foot travel and state and county roads. However, at the present time, wind thrown trees block many forested areas and walking through these areas is virtually impossible. Reducing fuel loads in these areas would improve access for hiking, hunting, bird watching, and other recreational pursuits. It would also improve visual quality for recreational users.

4.0 PROPOSED ACTION

The proposed action involves implementing prescribed burn treatment strategies to reduce excess fuel loading on 1,759 acres of the HNF in five treatment areas known locally as Starnes Branch, Salt Creek, Pipeline, Hickory Ridge, and Fork Ridge. These areas consist of forested lands of varying topography and access. Several of these areas were harvested during emergency salvage operations from 1997 through 1999, which resulted in a fuel reduction (USDA FS 1996a, 1996b, 1998a, 1998b). However, a fuels assessment in 2001 indicated that additional treatments are still necessary in areas that were not harvested, as well as some areas that were previously harvested (USDA FS 2001b).

USDA Forest Service personnel conducted a fuels assessment on May 29 and June 1, 2001. Background and current fuel loading of each unit was determined by conducting a standard inventory of downed woody material using the planar intersect technique (Brown 1974). This technique involves counting intersections of woody pieces of debris that come in contact with a vertical sampling plane that is dropped down through woody debris. Sample plane length varies for diameter of debris and quantity of downed material. Lengths of sample planes were based on recommendations given by Brown for areas of continuous heavy slash: three feet for zero to one inch diameters of debris; six feet for one to three inch diameters; and 15 to 25 feet for debris greater than three inches in diameter (Brown 1974).

For most areas where fuel load estimates were desired (Starnes, Salt Creek, Pipeline, Hickory), 15 to 20 sample points were used to locate sampling planes in a variety of affected areas (USDA FS 2001c). The total number of intersections of debris and total length of sampling planes for all sample points were combined to calculate fuel loads. Only ten sampling points were taken in the Fork Ridge area due to its small size. Sample points were generally located five to ten chains (330 to 660 feet) from the beginning of the boundary of the area to be sampled. Subsequent points were located approximately five chains apart. USDA Forest Service personnel located sampling planes to cross the widest part of the blowdown area. If the blowdown area was narrow, the crew randomly placed several transects to provide sampling coverage of the area (USDA FS 2002a).

Volume was estimated from the total numbers of intersections (per size class) of debris with the sampling plane (overall sampling points). Volume was converted to weight by applying estimates of specific gravity of woody material. For fuel load calculations in proposed treatment areas, specific gravities of white oak (0.68) and white pine (0.37) were used to estimate weight of debris from volume data taken in areas of heavy hardwood debris and white pine blowdown, respectively (USDA FS 2000a). Fuel loading was then calculated as weight of fuel or woody debris (in tons) per unit area (acre). Background fuel load calculations for treatment areas (estimations of normal dry weight of debris per acre) were based on data collected in areas of treatment units with similar vegetation that were not damaged by blowdown. If debris accumulation in a unit prevented sampling by USDA Forest Service personnel, background fuel loading was calculated based on adjacent, similarly forested areas.

Fuel load numbers were not taken directly after the blowdown or before timber salvage operations due to inaccessibility of blowdown areas and associated safety concerns. However, white oak, which is the dominant blowdown species, is very resistant to heartwood decay. Eastern white pine, which dominates several areas, is moderately resistant to heartwood decay (USDA FS 2000a). Therefore, it is expected that these fuel loads have not changed considerably due to natural decomposition since the 1996 blowdown. As indicated in Table 3, both hardwood stands (C, D, E, F, G, H, I, M, N) and pine stands (A, B, J, K, L) have a current fuel load ranging from almost two to nine times higher than normal fuel loads.

4.1 Proposed Treatments

Proposed treatments for various units within the five project areas are presented in Table 3. Each treatment area consists of different units that are separated by natural barriers, man-made barriers such as roads or pipelines, or by private property (Figure 2, page 3).

Blowdown damage occurred sporadically in concentrated locations over each of these areas, and only portions of the indicated areas require treatment. For example, pile burn treatments may include burning several to many piles of localized debris within a unit, leaving most of the surrounding area untouched. Treatment by isolation is recommended for several unit areas that experienced heavy blowdown damage, due to their inaccessibility, susceptibility to environmental degradation (i.e. steep slopes and saturated soils), and hazards posed to firefighter safety. These units (C, D, E, J, L and M) account for 323 acres (18 percent) of the total Project Area. Table 4 contains a summary of the number of treatment units, total acreage, and percent of land in the Project Area proposed for each fuels treatment.

The primary criteria in choosing a specific burn treatment were firefighter safety, need for fuels reduction, and site accessibility. Proposed treatments include broadcast burn, pile burn, machine pile burn, and treatment by isolation. All proposed fuels reduction treatments differ in the level of required site preparation and scope of burning activities. Descriptions of the proposed treatments are provided below. Fire break and fuel loading characteristics of all proposed treatment areas are depicted in figures included as Appendix C.

4.1.1 Broadcast Burn

A broadcast burn is a prescribed burn conducted on logs, branches and other forest debris spread over a wide area. Broadcast burns are suitable for areas in which there is an ability to establish control lines with minimal impact, access with wildland fire engines is possible, and firefighter safety is not compromised. Access for wildland fire engines is necessary for all broadcast burning operations as a precaution and line of second defense should a fire not extinguish entirely on its own. Site preparation includes construction of fire lines, typically built by hand. Firefighters clear any burnable leafy or woody material around a 10 to 30 foot perimeter of the treatment area using rakes, leaf blowers, chainsaws, axes and hand tillers. The width of the fire line must be a minimum of 1½ times the height of the fuel load. A limited number of snags may be removed along the fire line to control the spread of fire.

In some areas, fire line is constructed using a rotor tiller pulled by a small tractor. This method is most effective in open areas with slopes less than 30 percent. This type of line would have an average depth of four inches and serve as an excellent seedbed for reestablishment of native vegetation within the cleared areas (Thake et al 2002). Localized conditions, weather, and safety concerns would determine which method of line construction is used (Thake et al 2002).

Table 3: Proposed Fuels Reduction Treatments

Location	Unit	Level of Damage	Harvested?	Background Fuel Loading (tons / acre)	Current Fuel Loading (tons /acre)	Acres Proposed to be Treated	Proposed Treatment	Firebreak (Existing) (feet)	Fire Line (Constructed) (feet)
STARNES	A	Heavy	No	4.4	13.7	53	Broadcast burn	7,221	5,489
	B	Heavy	Yes	4.4	14.1	35	Pile burn	0	0
	C	Heavy	Yes	10.7	27.7	67	Treat by isolation, treat surrounding area	0	0
	D	Moderate	Yes	10.7	23.7	95	Treat by isolation, treat surrounding area	0	0
SALT CREEK	E	Heavy	Yes	9.0	17.0	50	Treat by isolation, treat surrounding area	1,647	13,682
	F	Moderate	Yes	9.0	20.3	763	Broadcast burn	42,331	13,813
PIPELINE	G	Heavy	No	9.0	25.2	26	Broadcast burn	1,096	1,148
	H	Moderate	No	9.0	14.2	80	Broadcast burn	669	9,033
	I	Moderate	Yes	9.0	25.0	340	Broadcast burn	22,888	7,281
HICKORY	J	Heavy	Yes	1.5	14.6	58	Treat by isolation	0	0
	K	Moderate	Yes	1.5	13.4	21	Broadcast burn	5,174	1,381
	L	Moderate	Yes	8.3	11.7	23	Treat by isolation	0	0
FORK RIDGE	M	Heavy	No	2.9	26.6	30	Treat by isolation, treat surrounding area	0	0
	N	Moderate	No	2.9	16.9	118	Broadcast burn	0	16,051

Table 4: Proposed Fuels Treatment Summary

Proposed Treatment	# Units	Total Acreage	Percentage of Total Acreage
Broadcast burn	7	1401	80
Pile burn	1	35	2
Treatment by isolation	6	323	18
All treatments	14	1759	100

Flanking fires would be used on the hillsides of the Project Area. The flanking fire would treat strips of an area with lines of fire set directly into the wind so that the line of fire spreads at right angles to the wind. These fires would be set in strips along the lower flanks and bottomland areas. Head fires would run to the top of the slopes causing high intensity fire, and securing the line of fire from the backfire as it progresses. Backfires, in turn, will limit the spread of flanking fires.

A low intensity backfire with lower flames would be used on the upper slopes in the Project Area. A backfire is usually started along a baseline, such as a road, fire line or other barrier and allowed to back into the wind. Backfires are easier to control and produce minimum scorching of vegetation, provided that wind speed and wind direction are steady, humidity is low, and fuels are continuous (USDA FS 1989). These fires are generally slow and can damage tree feeder-roots if the litter layer is not moist enough.

4.1.2 Pile Burn

A pile burn may be conducted in areas where the fuel load debris is found congregated in a small area or pile. A fire line is not needed to prepare for this treatment, but a path around the pile is cleared of any burnable material to protect surrounding vegetation. The width of the path is similar to that of a fire line constructed for a broadcast burn and depends on the height of the fuel load. Hand tools such as rakes and leaf blowers are used most often to clear small material. Piles are usually burned in winter months or when surrounding fuels will not ignite from burning embers.

Pile burns prolong fire residence time on a restricted area so that larger items have time to be completely consumed. More efficient burning and greater heat output from piles forces air upward, reducing smoke concentrations near the ground.

4.1.3 Treatment by Isolation

Treatment by isolation does not require any burning of areas with heavy fuel load debris. Many of these areas have extreme topography, access limitations, or wet soil conditions that could make them susceptible to environmental degradation during project implementation. Conditions in these areas make them unsafe to burn even in a controlled fashion due to lack of escape routes and access for wildland fire engines. Blowdown areas that would receive different prescribed burn treatments surround many of these areas. Woody debris and fuels that spread fire would be consumed by the proposed burn treatments, thereby isolating inaccessible areas with heavy fuel loads that could potentially burn in a wildfire.

4.1.4 Machine Pile / Burn

Although this treatment is not included in the proposed action, it is described in detail because it is a component of alternatives to the proposed action discussed in Chapter 6 of this document. A machine pile/burn is recommended in areas in which the fuel load is dispersed. This treatment is carried out in a similar fashion to a pile burn with one additional step. Before burning, the logs, branches and leafy material are dragged and pushed into piles using mechanized equipment such as front-end loaders and skidders. The operators would push slash into piles at intervals of approximately 200 feet. With the amount of heavy fuel and the type of work performed, it is anticipated that approximately 50 percent of the area would be ground scarified. Scarification would occur due to the dragging of slash and the machine traffic across the areas. Some soil displacement would occur as machines push the material into piles (Thake et al 2002). Utilizing old skid trails

remaining from previous logging treatments in some units would help minimize additional soil disturbance created for access. Machinery used to concentrate debris in one area may cause soil compaction. Machinery would only be used on dry soils and relatively flat areas to reduce potential for soil disturbance.

Once the pile is constructed, a path around it is cleared of any burnable materials to prevent the spread of fire to surrounding vegetation. Concentrating the debris in a smaller area lengthens the burning time and allows increased consumption of fuels (USDA FS 1989). Trained firefighters would ignite piles with drip torches sometime after the debris has been raked and piled. Mechanized equipment would not be allowed on slopes over 40 percent or in riparian areas. These treatments are generally recommended for areas where skid trails and other land features provide some wildland fire engine access, as well as escape routes and safety zones for firefighters.

Due to measures specified to mitigate potential effects to the Indiana bat, all proposed prescribed burn activities on the HNF would take place between September 15 and April 15. Prescribed burns in the HNF are generally of the type, size, intensity, location, frequency, and technique that leave little, if any, soil exposed after the burn is completed (USDA FS 2000b). The majority of the treatment areas on the HNF have a layer of duff covering the soil after the fire. Rarely are conditions extreme enough to result in complete removal of vegetation. Even then, the amount of bare soil exposed seldom exceeds 20 percent of the prescribed burn unit.

Riparian areas generally contain live herbaceous vegetation that tends to remain green and burn less readily than leaf litter. This buffer area aids in soil retention, and minimizes potential erosion and sedimentation into water bodies. In addition, prescribed burns are primarily a low intensity type of fire that leaves intact root systems and a layer of duff that hold soils in place and prevent erosion.

Fire lines for prescribed burns would be laid out along natural firebreaks (such as roads, drainages, and trails) where possible, minimizing the need for construction of new fire lines. Prescribed burns would only be conducted when predicted and actual conditions will promote a low intensity burn and adequate smoke dispersal. Trees and snags that could fall across fire lines will be cut as necessary during the September 15 to April 15 period, which should minimize effects on wildlife active during the remainder of the year. Burn plans will be designed to reduce the density of debris; reduce small diameter fuels in areas affected by timber harvest; favor species adapted to fire and other disturbances by inhibiting growth of their competitors and creating favorable light and moisture conditions; and limit adverse effects of burning on visual quality, especially near trails, roads, and viewpoints.

Each treatment unit proposed for fuels reduction is described in detail below along with the proposed fuels reduction activities based on fuel loading, firefighter safety, and access concerns.

4.2 Treatment Units

Proposed fuels reduction treatment units are shown on Figure 2 (page 3) and described below.

4.2.1 Starnes Area

Unit A

Unit A consists of three portions. Two smaller isolated sections (A-1 and A-2) lie east of Forest Road 1619 and adjacent to another unit (I). One larger, narrow section (A-3) is

located east of Starnes Branch Creek and northwest of a pipeline that traverses the Project Area.

The larger (northern) of the two isolated areas (A-1) is dominated by white pine (*Pinus strobus*). This area experienced heavy blowdown damage but was not commercially harvested. Pockets of dense, heavy softwood fuel remain, especially along a power line that traverses the unit. The softwood fuel has not deteriorated to the extent that most of the hardwood fuel has in the area. Slopes are flat to moderate (approximately 6 percent).

The smaller (southern) isolated area (A-2) is primarily a white pine forest with beech (*Fagus grandifolia*), scarlet oak (*Quercus coccinea*), black oak (*Q. velutina*), and shagbark hickory *(Carya ovata*) that experienced heavy blowdown damage and was not commercially harvested; however, some firewood harvesting occurred following the blowdown in unit A-2. This area has several pockets of heavy hardwood fuel that are deteriorating. Slopes are moderate (average 8 to 10 percent).

The largest portion of unit A (A-3) is just east of Starnes Branch and is dominated by white pine and sycamore (*Plantanus occidentalis)* in the canopy layer. The shrub layer is dominated by Allegheny blackberry *(Rubus allegheniensis)*, while the herb layer is dominated by ebony spleenwort *(Asplenium platyneuron*). There was no harvest of downed logs, although heavy blowdown damage occurred in this pine area as well, especially in the northern portion of unit A-3. Regeneration in unit A-3 is somewhat inhibited due to dense shrub (*Rubus* sp.) and vine growth, and the large quantity of downed timber remaining. However, oak and hickory regeneration is occurring. Slopes in this area are relatively flat (0 to 3 percent).

The USDA Forest Service estimates that background fuel loading for all sections of unit A is 4.4 tons per acre and current fuel loading is 13.7 tons per acre. All 53 acres in unit A are proposed for a broadcast burn treatment. There is good access to all three areas of unit A using HNF roads. Unit A is also a good candidate for broadcast burns because potential firebreaks already exist. Man-made firebreaks totaling 7,221 linear feet (USFS FS 2002a) include a blacktop road, power line/pipeline opening, old-field opening, and a ridge top trail. Established fire lines preclude the need to create additional fire lines in many areas, minimizing soil disturbance and potential for erosion. However, constructed fire line totaling 5,489 linear feet would have to be built to protect surrounding areas from fire (USDA FS 2002b). Fire would also reduce excessive shrub and vine growth in these areas and allow for better regeneration of oaks and hickories.

Unit B

White pine, sycamore and white oak (*Q. alba*) dominate the canopy layer in this narrow section west of Starnes Branch Creek. The shrub layer is dominated by Allegheny blackberry. There was heavy blowdown damage to this unit and a commercial harvest took place. Regeneration is dominated by sapling sycamore. However, dense shrub (*Rubus* sp.) and vine growth, as well as downed trees, are present throughout the area. The USDA Forest Service estimated that background fuel loading is 4.4 tons per acre and current fuel loading is 14.1 tons per acre. A forest road abutting the southern end of the unit provides good access. Thirty-five acres are proposed for a pile burn treatment. Piles of accumulated debris are scattered unevenly throughout the unit and only a small portion of this area would actually be burned. Clearing debris will allow better tree regeneration in these areas and make planting projects easier in the future.

Unit C
Vegetation in unit C is similar to that in unit B with white oak, white pine, and sycamore dominating the canopy layer. There was heavy blowdown damage and a commercial harvest of pines occurred previously, leaving mostly white oak debris. The USDA Forest Service estimated background fuel loading at 10.7 tons per acre and current fuel loading at 27.7 tons per acre. A previously constructed logging road that runs northwest from Forest Road 1619 provides access to this unit. However, the steep topography of this site makes burning problematic, as there is a lack of quick escape routes for firefighters. This unit also borders the privately owned Maumee Boy Scout Reservation on its northern side. To avoid possible adverse effects to the Boy Scout Reservation, a less intense fuel load reduction technique is proposed. Therefore, 67 acres are proposed for treatment by isolation.

Unit D
Unit D is dominated by vegetation similar to that in units A and B. White oak and sycamore are the primary species in the canopy. The shrub layer is dominated by sumac (*Rhus* sp.), whereas the herb layer is dominated by blackberry (*Rubus* sp.), snakeroot (*Eupatorium* sp.) and panic grass (*Panicum* sp.). Damage in this area was moderate and the area was commercially harvested. Some regeneration of oak and beech is occurring. The USDA Forest Service estimated the background fuel loading at 10.7 tons per acre and current fuel loading at 23.7 tons per acre. A previously constructed logging road running northwest from Forest Road 1619 provides access to the site. However, like unit C, topography is rather steep, making firefighter safety a concern. This unit also borders the Maumee Boy Scout Reservation on its northern and western borders. Because of safety concerns and potential impacts to private property, the entire 95 acres of unit D are proposed for treatment by isolation.

4.2.2 Salt Creek Area

Unit E
Dominant tree species identified in this area include white oak, white pine, scarlet oak, and black oak. Unit E experienced heavy blowdown damage and was commercially harvested. The majority of the fuel remaining is white oak and is concentrated along the northern boundary of the unit. Previously harvested areas have some piles of scattered slash remaining. Regeneration is dominated by beech and maple (*Acer*) species. The USDA Forest Service estimated background fuel loading at 9 tons per acre and current fuel loading at 17 tons per acre. Logging roads from an earlier harvest provide access to the site; however, topography is generally very steep, ranging from 25 to 75 percent in some areas. Given the steepness of the site and lack of escape routes, firefighter safety is a concern in this unit. This area is also part of a floodplain forest adjacent to a tributary of Starnes Branch Creek, which makes degradation of water quality from burning activities a concern as well. Therefore, these fifty acres are proposed for treatment by isolation. To protect this area from adjacent broadcast burn treatments, 13,682 feet of fire lines would be constructed. Existing features that total 1,647 linear feet would also be utilized as fire breaks (USDA FS 2002b).

Unit F
White oak, tulip tree (*Liriodendron tulipifera*), white pine and shagbark hickory dominate the canopy in this large area. The topography and slope aspect vary throughout unit F. White, black and chestnut (*Q. prinus*) oaks are generally found on south-facing slopes. White oak, beech and sugar maple (*A. saccharum*) are primarily found on north and east-

facing slopes. Moderate blowdown damage occurred and the area was commercially harvested. The majority of the remaining fuel is white oak and harvested areas have some piles of slash remaining scattered throughout. Tulip tree and maple dominate regeneration species, especially in the pine blowdown area. In hardwood areas, regeneration is dominated by beech and maple species. The USDA Forest Service estimated background fuel loading at 9 tons per acre and current fuel loading at about 20.3 tons per acre. Access is fair to good, with roads passing through the center of the area. The northern and southern portions of this unit would be difficult to access due to steep terrain and lack of roads or paths leading into the areas. Seven hundred sixty-three acres are proposed for broadcast burn treatment in this area. To prevent the spread of fire into adjacent units and private property, 13,813 feet of fire line would be constructed, while existing features would provide 42,331 feet of the fire line (USDA FS 2002b). Burning in unit F will reduce the fuel load and encourage more woody plant diversity by allowing oaks and hickories to regenerate in openings created by fire.

4.2.3 Pipeline Area

Unit G

Vegetation in this unit is dominated by oak species typical of the region. As in unit F, topography and slope orientation vary throughout unit G. White, black and chestnut oaks typically inhabit the south-facing slopes, and white oak, beech and sugar maple are found on the north-and east-facing slopes. Heavy damage was inflicted on this area by the blowdown event, but it was not harvested. There are pockets of heavy hardwood fuel loading, but the majority of the fuel is deteriorating, has sloughing bark, and is in contact with the forest floor. Advanced regeneration is occurring in the most disturbed areas. The USDA Forest Service estimated background fuel loading at 9 tons per acre and current fuel loading at approximately 25.2 tons per acre. Twenty-six acres are proposed for treatment with a broadcast burn, which would be effective in removing the fine fuels. HNF personnel with prescribed burn experience have observed that, due to close contact with the forest floor, the heavy fuels would likely be reduced by approximately 10 percent (Thake et al 2002). A ridge top trail provides access to the area, as does a blacktop road to the east. Roads, streams and the pipeline corridor would provide a total of 1,096 feet of fire line. In addition, 1,148 feet of fire line would have to be constructed in preparation for the burn treatment (USDA FS 2002b).

Unit H

Vegetation in this unit is dominated by oak species. As in units F and G, dominant species vary with slope aspect. White, black and chestnut oaks are found on south-facing slopes, and white oak, beech and sugar maple dominate north and east-facing slopes. Moderate damage in this area occurred during the 1996 blowdown, but a harvest was not conducted here. Scattered, light blowdown debris remains with some small pockets of moderate disturbance. Except for small gaps, tree canopy is continuous. Heavy hardwood fuel load is deteriorating. Much of it is lying flat on the forest floor and has sloughing bark. However, regeneration is sparse due to lack of light in many areas for tree seedlings. Slopes range from moderate in some areas to steep in others. The USDA Forest Service estimated background fuel loading at 9 tons per acre and current fuel loading at approximately 14.2 tons per acre. A gravel road and ridge top trails along the western edge of the area provide good access, escape routes, and approximately 669 feet of potential firebreaks (USDA FS 2002b). Unit H includes a total of 80 acres proposed for treatment with a broadcast burn. In addition to existing firebreaks, 9,033 feet of fire line would be created to prepare the area for a broadcast burn (USDA FS 2002b). Burning will allow for

more light penetration to the forest floor, encouraging regeneration. A broadcast burn will also encourage growth of a native herbaceous understory, and make this area less susceptible to a stand-replacing, high intensity fire that could destroy its closed nature and reduce its diversity.

Unit I

In this unit, vegetation is dominated by oak species and the tree canopy is mostly continuous. Unit I differs throughout its area in topography and slope aspect. Dominant tree species found on south facing slopes are white, black and chestnut oaks. On north and east-facing slopes, white oak, beech and sugar maple are the dominant species. Unit I was commercially harvested. It is composed of a large region that shows scattered light to moderate blowdown debris with some heavy pockets of greater disturbance. The heavy hardwood fuel load is deteriorating, has sloughing bark, and much of it is in contact with the forest floor. Dense, advanced regeneration of trees and shrubs is occurring where disturbance was the greatest. The USDA Forest Service estimated background fuel loading at 9 tons per acre and current fuel loading at approximately 25 tons per acre. There is good access to Unit I and 22,888 feet of existing firebreaks provided by gravel roads, ridge-top trails, a pipeline, a blacktop road, and a stream in the northern portion of the unit. Three hundred forty acres are proposed for treatment with a broadcast burn. This method of treatment would minimize the length of constructed fire line to 7,281 feet (USDA FS 2002b), which would limit the landscape disturbance, but still effectively treat steeper portions of the unit and the variable fuel loads remaining (Thake et al 2002).

4.2.4 Hickory Area

Unit J

Dominant tree species identified in this unit include white pine, tulip tree, sycamore, maple and scarlet oak. The area experienced heavy blowdown damage and was commercially harvested. There is still considerable white pine fuel remaining that is concentrated along a ravine in the southern one-quarter of the site. Most of the damaged trees are lying on the ground, but a number of others were broken-off approximately 20 to 30 feet above the ground and remain as snags. The blowdown area is now dominated by Allegheny blackberry and round-leaved greenbrier (*Smilax rotundifolia*), but regeneration of pine and red cedar (*Juniperus virginiana*) is also occurring. Topography in this area is somewhat steep on the northern one-third and very steep on the southern one-quarter. The USDA Forest Service estimated background fuel loading at 1.5 tons per acre and current fuel loading at 14.6 tons per acre. Access is provided by a pipeline clearing to the east of the area and Forest Road 1619, which lies within several hundred feet of the unit. However, the steep topography within this unit makes access difficult and presents safety concerns for firefighters. In addition, the heavy fuel loading of this unit is concentrated in a very steep ravine area in the southern portion, and burning debris here could cause increased erosion of the ravine. For these reasons, all 58 acres of this unit are proposed for treatment by isolation.

Unit K

Dominant tree species identified in this unit include white pine, scarlet oak and sugar maple. This area experienced moderate blowdown damage and was commercially harvested, although it appears that only hardwoods were removed. The majority of the remaining fuel is white pine and is concentrated at the northern end of the area. HNF personnel with prescribed burn experience state that, when the fuel load is predominantly pine, an estimated 60 to 70 percent of the fine fuels and 20 percent of the large fuels would

be consumed (Thake et al 2002). Most of the damaged trees are on the ground, but some have fallen on other trees and are suspended as much as twenty feet above the ground causing safety concerns. Areas that were previously harvested still have piles of remaining slash scattered throughout. Regeneration, especially in the pine blowdown area, is moderate and dominated by tulip tree and sugar maple. Regeneration in the hardwood areas is also moderate and dominated by beech, sugar maple and oak species.

Although this unit is on a ridge, the topography is primarily flat. The USDA Forest Service estimated background fuel loading at 1.5 tons per acre and current fuel loading at approximately 13.4 tons per acre. Access is good, with roads along the eastern and northern borders and a multi-purpose trail bisecting the area from north to south. The roads and path could also serve as potential firebreaks. Twenty-one acres are proposed for treatment with a broadcast burn. Unit K is ideally suited for a broadcast burn due to its good access, presence of firebreaks, uneven accumulation of debris, and flat topography that creates decreased erosion potential. Existing features provide 5,174 linear feet of fire line. An additional 1,381 feet of firebreaks would have to be constructed along the western portion of the stand prior to implementation of the prescribed burn (USDA FS 2002b). Crews would be able to quickly burn small pockets of fuel dispersed throughout the unit due to the scattered nature of the blowdown damage (Thake et al 2002). Reduction of fuels in this unit would ensure the safety of recreational users who utilize the multi-purpose trail that crosses the area.

Unit L

Dominant tree species identified in this unit include white pine, tulip tree, sycamore, maple, and scarlet oak. This area experienced moderate blowdown damage and was commercially harvested. Regeneration, especially in the pine blowdown area, is dominated by maples and three to four-inch diameter tulip trees. Regeneration in the hardwood areas is dominated by beech and maple species. Topography is moderate in this unit, but somewhat steep along the eastern edge. The USDA Forest Service estimated background fuel loading at 8.3 tons per acre and current fuel loading at approximately 11.7 tons per acre. Access is good, with a pipeline clearing and a multi-purpose trail running from the southwest to the northeast boundary of the area. The pipeline clearing and multi-purpose trail could act as firebreaks.

Twenty-three acres in this unit are proposed for treatment by isolation. This treatment would avoid the danger of conducting a prescribed burn near power lines that traverse the area. It would also eliminate the soil disturbance and environmental damage caused by fire line construction and the use of machinery to concentrate fuels. Due to the mesic conditions in this unit and the well-established regeneration, isolation is a viable treatment option for this unit. The fuels are lying close to the ground and will decompose quickly with the high moisture content of the soils (Thake et al 2002). The higher relative humidity also limits the danger of a natural fire and reduces the safety hazards to recreationists that utilize the multi-purpose trail.

4.2.5 Fork Ridge Area

Unit M

White, black, and scarlet oaks dominate woody vegetation in unit M. Although heavy damage was inflicted on this unit by the 1996 storm event, it was not commercially

harvested. There is scattered, moderate blowdown debris throughout much of the site. Advanced regeneration is occurring in pockets where wind damage was the greatest. Much of the affected area is on a steep slope (25 to 55 percent). The USDA Forest Service estimated background fuel loading at 2.9 tons per acre and current fuel loading at approximately 26.6 tons per acre. Since no roads or trails are in close proximity to the unit, and surrounding ownership is private, access is poor. For this reason, 30 acres are proposed for treatment by isolation. Treatment will include burning of forest residue in unit N, which borders unit M on the northwest side. A broadcast burn is proposed for treating unit N. The area southeast of this unit had heavy to moderate fuel loads and was harvested. Fuels reduction in that area will minimize the likelihood of a forest fire traveling from HNF to surrounding private land.

Unit N

As with abutting unit M, white, black, and scarlet oak trees are also the dominant woody vegetation in unit N. This unit experienced moderate damage during the blowdown, but was not commercially harvested. The heaviest damage is located in the north-central portion of the unit, although a continuous tree canopy still remains over the entire unit. The hardwood fuel is deteriorating and most logs are in contact with the forest floor and have sloughing bark. Dense, advanced regeneration of tree and shrub species is present in areas of greatest damage. Slopes are moderate, but access is poor as this unit is surrounded by private property and has no roads or trails nearby. The USDA Forest Service estimated background fuel loading at 2.9 tons per acre, while current fuel loading was estimated at 16.9 tons per acre. One hundred-eighteen acres are proposed for treatment with a broadcast burn. To prevent encroachment of fire into riparian habitat, construction of a firebreak would be needed on the western edge of unit N. Firebreaks would also be needed on the remainder of the perimeter of the unit to ensure that the fire does not spread into other areas of the HNF or cross the wildland-private property interface. A total of 16,051 linear feet of fire line would be constructed before implementation of the prescribed burn (USDA FS 2002b).

4.3 Mitigations Included in the Proposed Action

Under this proposal, standard mitigation measures for streamside management zones (SMZ) will be applied to protect riparian zones, riparian filter strips, and special consideration zones (USDA FS 1991a). SMZs often encompass areas larger than the riparian area, riparian filter strip, and special consideration zone, depending on the combination of soil and/or topographic characteristics of the watershed. Riparian filter strips include an area 100 feet from the edge of a riparian ecosystem or from the edge of the water. Special consideration zones extend from the riparian filter strip a distance equal to 3 feet for every percent slope, as measured from the water of a perennial stream or to the crest of a hill, whichever comes first. Special consideration guidelines for protection of intermittent and ephemeral streams also exist, but are less stringent (USDA FS 1991a).

Prescribed burning is proposed in areas that include riparian zones, riparian filter strips, or special consideration zones on the HNF. It is possible that some burning or fire line creation will occur within the boundaries of a SMZ. *Forest Plan* guidelines for management of vegetation in these areas state, "vegetation management may occur in the portion of the SMZs not included in the riparian area, riparian filter strip, and special consideration zone, on a site-specific basis, considering ecological and biological values of individual sites" (USDA FS 1991a). Should a fire encroach upon an SMZ, the guidelines state "emergency construction, such as for fire lines, will be permitted within filter strips; however, these disturbed areas will be stabilized as soon as possible" (USDA FS 1991a).

The potential for erosion to occur may increase temporarily following prescribed burning; however, the nutrient release generated through burning also stimulates growth of vegetation that, once established, stabilizes bare soils. Because erosion may occur following prescribed burning practices, the *Forest Plan* also indicates that any soil disturbance within riparian areas, filter strips, or special consideration zones requires immediate protection with hay or straw mulch, immediate stabilization, and seeding as soon as growing conditions permit. All mitigation measures for soil disturbance within an SMZ will be applied under this proposal. In addition, HNF guidelines for seeding of disturbed areas will also be followed if seeding becomes necessary (USDA FS 1991a). More specific mitigation measures are included in the environmental effects discussion and in Appendix B of this document.

Prescribed burns may increase the potential for soil movement and run-off from treatment areas, and thus lead to an increase in nutrient loading and sedimentation of nearby waterways. Topography, fire intensity, soil type and frequency of burning all help determine the severity of effects to soil and water resources (USDA FS 1989; Wells et al 1979; Tiedman et al 1979). Every attempt will be made to minimize erosion potential. Fire lines will be constructed by hand, when possible, using leaf rakes and leaf blowers to remove vegetation and leaf litter down to the soil. This will minimize soil disturbance in comparison to that which could be caused by mechanical tilling equipment. Trails, roads, forest clearings, and pipeline/utility clearings will all be used as firebreaks to keep hand fire line construction to a minimum and reduce the amount of soil disturbance. All areas proposed for broadcast burning (80 percent), except unit N, include the use of some existing firebreaks (see Appendix C).

Prescribed burns will be planned in terms of size, intensity and location so that there is little, if any, exposed soil after the burn. Usually, a layer of duff covers the soil after burning activities are completed, and only rarely are conditions extreme enough to result in areas of bare soil (USDA FS 2000b).

Roughly 18 percent of the fuel load reduction treatments are isolation treatments. An additional two percent of the proposed treatment area includes pile burn treatments. These treatments require debris to be consolidated before burning. Burning debris in large piles causes an increased fire residence time on a restricted area so larger debris might be consumed. A minimal amount of soil would be exposed to create firebreaks for these treatments. Additional measures to mitigate soil disturbance are discussed in Appendix B.

Burns will only be conducted when predicted and actual conditions allow for adequate smoke dispersal. Due to the large quantity of material burned in piles, these treatments have potential to cause smoke problems. However, keeping piles relatively small and minimizing the amount of soil in them allows surface water to pass through and keeps the piles dry. This, in turn, allows for quick consumption of debris during the burn treatment and reduces smoke problems. Burns would also be designed to minimize adverse effects on aesthetics, especially near trails, roads, and viewpoints utilized by the public (USDA FS 1989). The final decision of whether or not to burn will be made in the morning of the proposed treatment day based on fulfillment of the criteria listed below.

On the morning of planned burn activities, the burn boss will review the following list of criteria in order to determine if the burn treatments should be performed (USDA FS 2002a):

1. Are all fire prescription specifications met?
2. Is the weather forecast favorable?
3. Are all necessary control lines constructed and checked?
4. Are all personnel required in the site-specific fire plan present?
5. Have all personnel been briefed on the prescribed burn plan?
6. Have all personnel been briefed on safety hazards, escape routes, and safety zones?

7. Do all personnel have the required PPE with them?
8. Is all required equipment in place and in working order?
9. Do you have direct communication to your unit dispatcher?
10. Have you notified your back-up forces that you are beginning?
11. Were all publics identified in the site-specific burn plan contacted?
12. In your opinion, can the burn be carried out according to plan and will it meet the planned objectives?
13. Have you notified the SO, RO, and CO-OPS?

An answer of "no" to any of these questions could temporarily or permanently delay prescribed burn activities. If a prescribed burn is implemented, all burn areas will be patrolled daily until it is declared that the fire is indeed extinguished. Patrols will also allow fire staff to identify and eliminate any public safety hazards generated by the burn.

The public would be notified of all prescribed burn activities on a site-specific basis. A summary and map of prescribed burn activities would be prepared for distribution, and a series of meetings would be held with local residents, businesses, and organizations in advance of burns to present information and answer questions. Additionally, advisories would be posted on the HNF website, in campgrounds and entry points one week before the proposed burn dates. Approximately two days before a planned burn, USDA Forest Service Fire Management Staff would begin to sweep the treatment areas for visitors. Entry points to treatment areas and key interior locations along trails would be staffed to assure that visitors remain out of the areas. After the burns, the Fire Staff will determine when it is safe for the public to return to the area. Additional mitigation measures to be implemented for all prescribed burn activities are discussed in Appendix B.

4.3.1 Mitigation Measures for Federally Listed and Regional Forester Sensitive Species

A Biological Evaluation (BE) was prepared to discuss potential effects of proposed fuel reduction activities on Federally listed threatened and endangered species (T&E) and Regional Forester sensitive species (RFSS) that may reside in or find suitable habitat within the Project Area (TN&A 2002). All prescribed fire treatments and related cutting of trees will occur between September 15 and April 15 to minimize the possibility of taking an Indiana bat (*Myotis sodalis*), roosting in a tree. Additional protection measures include the maintenance of canopy cover and protection of roost trees preferred by the Indiana bat. All mitigation measures to be employed to minimize effects to the Indiana bat are further described in Appendix B.

Populations of endangered gray bats (*Myotis grisescens*) and eastern fanshell pearly mussels (*Cyprogenia stegaria*) are not known to occur in the Project Area and, as such, would not be affected by proposed fuel reduction activities. Although some burning would take place near streams or in associated floodplains, appropriate mitigation measures for SMZs would be implemented, so effects to aquatic life and water quality should be minimal.

Areas around the large lakes and rivers on the HNF are used by the Federally threatened bald eagle (*Haliaeetus leucocephalus*). However, these areas are not within the Project Area, so fuels reduction activities should not have an effect on bald eagles. Potential effects to these T&E and other sensitive species, and mitigation measures to minimize threats are discussed in more detail in the BE, and in the environmental effects discussion (Section 7.0) of this document.

4.3.2 Mitigation Measures for Heritage Resources

The Project Area has been surveyed for heritage resources (see Section 7.10). Cultural and heritage resources in the Project Area would be flagged by a USDA Forest Service Archaeologist and protected by avoidance during fuel treatment activities (Krieger 2002). If necessary to remove any downed or

hazardous trees from the area, techniques that minimize soil disturbance would be used. No heavy equipment would be used on sites with cultural and heritage resources. Other specific measures to be utilized are included in the environmental effects discussion (Section 7.0) of this document and in Appendix B.

4.4 Decision to be Made

The decision to be made is whether to carry out some or all of the proposed fuel reduction treatments on the timber stands affected by the 1996 blowdown, as shown in Table 3 (page 9).

4.5 Forest Plan Background

This proposal is consistent with the *Forest Plan.* The proposal moves the area toward the desired future condition, as described by the goals, objectives, and guidance for Management Areas 2.4, 2.8, and 6.4 in the *Forest Plan* (USDA FS 1991a). The desired condition for each of these MA's is discussed in detail in Section 2.0 of this EA. Fuel reduction activities in 2.4, 2.8, and 6.4 will reduce fire hazards in the area and improve visual quality, wildlife habitat, and access for recreation. The option of prescribed burning as a means of reducing fire hazards and managing vegetation to provide diverse ecosystems is consistent with *Forest Plan* guidance. The *Forest Plan* was adopted to meet the requirements of the National Forest Management Act (NFMA) of 1976. Fuel reduction activities are authorized by NFMA to achieve multiple use objectives and goals of forest plans. This analysis is tiered to the Draft (USDA FS 1990) and Final Environmental Impact Statements (USDA FS 1991b), the *Forest Plan* (USDA FS 1991a), and the Record of Decision (USDS FS 1991c).

4.6 Other Related Topics

HNF has implemented several pine and hardwood salvage projects in response to the same 1996 tornado blowdown. These projects took place largely in the same areas as the proposed project to reduce fuel loads and to salvage timber for economic and social benefits.

The Pleasant Run Emergency Pine Salvage Project was conducted to remove dead, downed, severely damaged, or weakened trees on 162 acres of a pine plantation affected by the April 19, 1996 tornado (USDA FS 1996b). An EA was conducted to determine the impacts of the proposed action and no action alternative. A decision on this project was signed on September 20, 1996, and authorized the salvage of 2.075 million board feet of softwood timber. This project began in spring, 1997, and continued through fall, 1998.

The Pleasant Run Emergency Hardwood Salvage Project was proposed to remove dead, downed, severely damaged, or weakened trees from 752 acres in 55 hardwood stands following the 1996, tornado blowdown (USDA FS 1996a). An EA was conducted to determine the impacts of the proposed action and no action alternative. A decision on this project was signed on October 18, 1996 and authorized the salvage of 3.138 million board feet of hardwood timber. This project began in spring, 1997, and continued through fall, 1998.

The Maumee – Poke Patch Salvage Project (I &II) was conducted to remove dead, downed, severely damaged, or weakened trees on 214 acres in nine hardwood stands following the 1996 tornado blowdown (USDA FS 1998a and 1998b). An EA was conducted to determine the impacts of the proposed action and no action alternative, emphasizing the effects of the proposed action on Indiana bats. A decision on this project was signed on July 16, 1998 and authorized the salvage of 1.080 million

board feet of hardwood timber; however, on October 26, 1998, the Regional Forester reversed this decision and the project was not carried out.

A February 10, 1993 decision to conduct a prescribed burn on approximately 250 acres in the Fork Ridge Area was carried out, and is documented in the fiscal year 1995 monitoring report (USDA FS 1996d). There have also been numerous other small pine and hardwood timber sales in relation to damage caused by the 1996 blowdown. All salvage timber sales in the Project Area have been completed. Some small areas of downed trees near roads have also been cut, piled, and burned to reduce wildfire potential. However, there have been no previous fuels reduction projects involving prescribed burn treatments on the HNF that have required an Environmental Assessment.

4.7 Other Projects in the Proposed Fuel Treatment Areas

Other projects in the proposed fuel treatment areas include: maintenance of existing trails, forest openings, and recreation areas; house log and firewood sales; and collection of miscellaneous forest products. No additional fuel reduction treatments or salvage operations are anticipated. However, several mowing and prescribed burning projects were conducted to create forest openings in the Starnes area on the HNF. The projects were implemented in March 2000 on a total of 31 acres under the Forest Openings Maintenance decision (USDA FS 2000d).

5.0 ISSUES RELATED TO THE PROPOSED ACTION

Issues and management concerns related to the proposed action were identified by reviewing *Forest Plan* direction for the area, and by contacting interested and affected publics and USDA Forest Service employees.

On August 21, 2001, scoping letters were sent to approximately 467 individuals and organizations requesting their comments about the proposed action.

On August 24, 2001, a news release was sent, notifying the public of the proposal and requesting their comments. Several articles appeared in local and regional newspapers as a result.

Public scoping comments were accepted from August 22 through September 28, 2001. Specific comments, issues, and concerns were identified from these sources. Responses were received as written letters, telephone calls, and personal contacts. A list of groups and individuals that responded is provided in Appendix A. The interdisciplinary team evaluated each comment to determine how it should be addressed. The results of the evaluation are displayed in Appendix A.

Some issues raised were programmatic in nature, and are addressed in the *Forest Plan*. Other issues were raised regarding HNF compliance with NEPA requirements and lack of scientific documentation, which are addressed by this EA. Some issues regarding timber management were out of the scope of this EA, and other comments regarding air pollution are addressed in the environmental effects section of this document.

Five key issues (Issues 1 through 5) were identified from public comments and served as a basis for evaluating the alternatives, including the proposed action. These issues were also used to assess environmental consequences of alternatives. Five additional issues were identified and examined in less detail. These issues (Issues 6 through 10) related to potential indirect environmental consequences of the proposed project alternatives.

5.1 Issue 1: Wildlife Habitat

Some public scoping respondents raised concerns that prescribed burn treatments would change vegetation growth and composition, and alter or destroy wildlife habitat. Some respondents also expressed concern that wildlife utilizing the area might be directly harmed by fire activities, especially the Federal endangered Indiana bat that utilizes snags and other trees with cavities and exfoliating bark for nesting and roosting.

5.2 Issue 2: Soil Effects and Water Quality

Some respondents raised concerns that elimination of vegetative cover by fire and preparation activities for burn treatments would increase potential for soil erosion and compaction. Eroding soil could result in sedimentation of local water bodies and degradation of water quality.

5.3 Issue 3: Wildfire Threat

Some public scoping respondents commented that the moist, deciduous forest of the Project Area is not prone to lightning-ignited fires, and that there is a very low probability that a large wildfire would occur on the HNF. Other commenters doubted the current level of risk to firefighting personnel and private property owners posed by potential wildfires in blowdown debris. Some respondents commented that small brush fires in the past twenty years have always been controlled quickly due to the abundance of local firefighters in the area, and that fuel reduction treatments are not necessary.

5.4 Issue 4: Forest Health Effects and Effectiveness of Fire Management

Some respondents questioned the use and effectiveness of fire for managing the health of forests. Other comments supported the use of prescribed fire treatments in promoting early successional forest habitat, clearing damaged areas, removing flammable forest understory, and reducing potential threats to other forest resources and wildlife. Some comments questioned whether local vegetation is fire-dependent, and whether the proposed action may further degrade remaining vegetation. Some respondents believe that most of the downed timber from the blowdown has begun deteriorating and replenishing the forest soil and no longer poses a fire risk. Other people are concerned about the effect of fire on the tree and shrub regeneration in areas that have experienced considerable recovery in the six years since the blowdown.

5.5 Issue 5: Economic Concerns

Some respondents are concerned that the proposed fuel reduction project is not the best use of HNF funds. There were also comments that forests with low fire risks, such as the HNF, were not the intended targets of Federal money allocated for fire control, and that the current proposal is entirely due to availability of funds, rather than a careful analysis of wildfire threat.

5.6 Issue 6: Air Quality

One respondent was concerned about the potential release of smoke and particulate matter caused by prescribed burns. However, the *Forest Plan* mandates that the effect of air pollution emissions should be considered in analysis of all potential projects (USDA FS 1991a).

5.7 Issue 7: Recreational Quality

Recreational quality of the Project Area must be maintained, and remain consistent with Recreation Opportunity Spectrum (ROS) standards and guidelines that provide direction for affected Management Areas.

5.8 Issue 8: Visual Quality

Visual Quality Objectives (VQO) for the Project Area must be maintained and remain consistent with *Forest Plan* direction for affected Management Areas.

5.9 Issue 9: Safety

Effects of proposed action alternatives, and the no-action alternative, on public and firefighter safety hazards from the dead, down, and severely damaged trees remaining from the April 19, 1996 severe storm and tornado that swept across the Project Area must be addressed.

5.10 Issue 10: Heritage Resources

The Project Area has been surveyed for cultural and heritage resources. Environmental effects of project alternatives on heritage resources, and site-specific mitigation measures would be considered prior to selection of any alternative.

6.0 ALTERNATIVES

Following public input activities, the interdisciplinary (ID) team met and discussed issues and alternatives. Once a set of key issues was identified, the team developed four alternatives that respond to concerns. The proposed or preferred action is called Alternative A. Two additional action alternatives, Alternative B and Alternative C, were developed. These alternatives vary the type of prescribed burn treatments in several units, and decrease the total acreage burned. The no action alternative is called Alternative D.

6.1 Alternative A (Proposed Action)

The proposed action (Alternative A) includes broadcast burn treatments over 1401 acres, pile burn treatments for 35 acres, and treatment by isolation of 323 acres. Compared to the other action alternatives, the proposed action would result in the most fuel reduction; requiring treatments that include burn activities across 82 percent of the Project Area, with 18 percent of the area treated by isolation. Alternative A is explained in detail and summarized in the purpose and need section of this EA and depicted on figures provided in Appendix C, as are all proposed action alternatives.

6.2 Alternative B (Alternative Action)

Alternative B proposes different prescribed burn treatments for several units described in Alternative A, resulting in a 22 percent decrease in broadcast burn treatment area, and a 23 percent increase in machine pile burn treatment area. As in Alternative A, burn treatments are emphasized with 58 percent of the Project Area proposed for broadcast burns, two percent for pile burns, and 23 percent for machine pile burns. The area treated by isolation would decrease by only one percent. Both Alternative A and Alternative B treat approximately the same percentage of the Project Area with prescribed burns (82 and 83 percent, respectively). However, the actual surface area burned would be less for Alternative B because some fuels would be concentrated into piles by hand or with machines before burning.

Selection of prescribed burn treatments is based on data from the same fuels analysis performed by USDA Forest Service personnel and described for Alternative A. Selection of treatments is based on firefighter and public safety, access issues, utility concerns, and environmental concerns. Tables 5 and 6 describe proposed fuels reduction treatments under Alternative B. Bold text in the “proposed treatment” column of Table 5 (page 26) indicates that these treatments are different than those proposed for Alternative A.

Alternative B proposes different treatments than Alternative A for several units. Reasons for consideration of these alternative treatments for affected units (G, I, K, and L) are explained below.

Unit G: With a broadcast burn treatment, it is estimated that most of the fuels consumed would be fine fuels. In order to increase the consumption of heavy fuels and decrease the area affected by burning, a machine pile burn is suggested for this area. Fifty to 70 percent of the heavy fuel would be consumed with a machine pile burn treatment, compared to 10 percent consumption of heavy fuels with a broadcast burn (Thake et al 2002). When fuels are concentrated before burning, the effect is to increase the intensity and duration of the burn, while limiting the area, which allows greater consumption of large fuels and greater reduction in risk of wildfire.

A machine pile burn would eliminate the need for 1,148 feet of constructed fire line, limiting disturbance due to rotor tilling or hand clearing vegetation (USDA FS 2002a). However, additional scarification would occur due to use of heavy equipment used to pile the debris before burning. Scarification would result from the machines dragging slash as well as from the movement of tracks or tires covering the area. It is estimated that up to 50 percent (13 acres) of the area treated would be scarified during a machine pile burn treatment, depending on the season, soil conditions, and technique used by equipment operators (Thake et al 2002). The amount of soil displacement would be kept to a minimum by working with the operators to lift their blades during the process of consolidating fuels. The USDA Forest Service anticipated that soil displacement could be limited to between 10 and 15 percent by timing machine piling from early spring to mid summer when vegetation is actively growing and would re-vegetate disturbed areas (Thake et al 2002). However, one of the mitigation measures for the Indiana bat is that treatments should not take place after April 15 or before October 15 and all work would have to be completed within these time constraints. The use of machines would also increase the cost of treatments.

Unit I: A machine pile burn is also suggested as an alternative to a broadcast burn for unit I. A machine pile burn would eliminate the need for 7,281 feet of constructed fire line. However, additional scarification would occur due to the movement and action of the machines consolidating the slash and other debris. It is estimated that up to 50 percent (170 acres) of the area treated would be scarified during a machine pile burn treatment, depending on the season, soil conditions, and technique used by equipment operators (Thake et al 2002).

Unit K: A machine pile burn is suggested as an alternative to a broadcast burn for unit K. A machine pile burn would eliminate the need for 1,381 feet of constructed fire line. Under the machine pile burn alternative, approximately 14 acres could be effectively treated. The blowdown pattern in this unit was such that some pockets exist where no trees were blown over and would not need treatment. Of the area that could be treated, 50 percent is expected to require ground scarification for a total of seven acres (Thake et al 2002). Since the remaining fuel in this unit is predominantly white pine, consumption of heavy fuels would be somewhat higher, estimated at up to 60 to 70 percent (Thake et al 2002).

Unit L: Treatment by isolation is proposed under Alternative B for this unit and would depend on natural processes to decompose the predominantly white pine fuels remaining from the blowdown. Until decomposition occurs, the risk of wildfire would remain elevated due to higher than background fuel levels. Recent estimates indicated a difference of 3.4 tons per acre between background and current fuel load. Only three to four acres of the unit would require treatment with a machine pile burn due to the wet, mesic conditions that exist in the greater part of the unit (Thake et al 2002). With approximately 50 percent of the area affected by the machinery used to pile debris, the result would be two acres of ground scarification (Thake et al 2002). Fire line construction would not be necessary, but as in all machine pile burns, burnable material would be cleared from an area around the perimeter of the piles.

Table 5: Proposed Fuels Reduction Treatments for Alternative B

Location	Unit	Level of Damage	Harvested?	Background Fuel Loading (tons / acre)	Current Fuel Loading (tons /acre)	Acres Proposed to be Treated	Proposed Treatment	Existing Firebreak (feet)	Constructed Fire line (feet)
STARNES	A	Heavy	No	4.4	13.7	53	Broadcast burn	7,221	5,489
	B	Heavy	Yes	4.4	14.1	35	Pile burn	0	0
	C	Heavy	Yes	10.7	27.7	67	Treat by isolation, treat surrounding area	0	0
	D	Moderate	Yes	10.7	23.7	95	Treat by isolation, treat surrounding area	0	0
SALT CREEK	E	Heavy	Yes	9.0	17.0	50	Treat by isolation, treat surrounding area	1,647	13,682*
	F	Moderate	Yes	9.0	20.3	763	Broadcast burn	42,331	13,813
PIPELINE	G	Heavy	No	9.0	25.2	26	**Machine pile/burn**	1,096**	0
	H	Moderate	No	9.0	14.2	80	Broadcast burn	669	15,306
	I	Moderate	Yes	9.0	25.0	340	**Machine pile/burn**	4,019**	0
HICKORY	J	Heavy	Yes	1.5	14.6	58	Treat by isolation, treat surrounding area	0	0
	K	Moderate	Yes	1.5	13.4	21	**Machine pile/burn**	0	0
	L	Moderate	Yes	8.3	11.7	23	**Machine pile/burn**	0	0
FORK RIDGE	M	Heavy	No	2.9	26.6	30	Treat by isolation, treat surrounding area	0	0
	N	Moderate	No	2.9	16.9	118	Broadcast burn	0	16,051

* Firebreak to isolate this unit from surrounding unit F proposed for a broadcast burn.
**Existing firebreak for machine pile /burn is used as a precaution against accidental escape of prescribed burn.

Table 6: Proposed Fuels Treatment Summary for Alternative B

Proposed Treatment	# Units	Total Acreage	Percent of Acreage
Broadcast burn	4	1014	58
Pile burn	1	35	2
Treatment by isolation	5	300	17
Machine pile/burn	4	410	23
All treatments	14	1,759	100

6.3 Alternative C (Alternative Action)

Alternative C proposes different prescribed burn treatments for several units described in Alternative A, resulting in a 47 percent decrease in total acreage burned in the Project Area. However, machine pile burn treatments are increased by 24 percent as compared to Alternative A. The prescribed burn treatments themselves would be performed in the same fashion as described in the proposed treatment section (Section 4.1). Selection of prescribed burn treatments is based on data from the same fuels analysis performed by USDA Forest Service personnel and described for Alternative A. Selection of treatments is based on firefighter and public safety, access issues, utility concerns, and environmental concerns. Tables 7 and 8 describe proposed fuels reduction treatments under Alternative B. Bold text in the "proposed treatment" column of Table 7 (page 29) indicates that these treatments are different than those proposed under for Alternative A.

Although both alternatives would occur over the same Project Area acreage, Alternative C differs from Alternatives A and B in that treatment by isolation is emphasized (65 percent in Alternative C versus 18 and 17 percent in Alternatives A and B, respectively) and broadcast burn treatments are minimized (2 percent in Alternative C versus 80 and 58 percent in Alternatives A and B, respectively). Pile burn treatments in Alternative C are increased by 7 percent over the other alternatives, while machine pile burn treatments are approximately the same (24 percent) as Alternative B, and 24 percent more acreage than Alternative A.

Alternative C proposes different treatments than Alternative A and B for units A, F, H, and N. Treatments in units G, I, K, and L are different for Alternative C than Alternative A. Reasons for consideration of these alternative treatments are explained below:

Unit A: Portion A-1 of unit A has a power line passing through it, areas of heavy debris, and is relatively small. Changing the treatment from broadcast burn to machine pile burn in this area may more efficiently consume fuels, while allowing fires to be located away from power lines.

Unit F: Areas of heavy slash exist in this large unit, which is located mostly in steep terrain. Changing the treatment from broadcast burn to isolation may be safer for firefighters. Treatment by isolation would also eliminate the need for 13,813 feet of fire line construction.

Unit G: With a broadcast burn treatment, it is estimated that most of the fuels consumed would be fine fuels. In order to increase the consumption of heavy fuels and decrease the area affected by burning, a machine pile burn is suggested for this area. An estimated 50 to 70 percent of the heavy fuel would be consumed with a machine pile burn treatment, compared to 10 percent consumption of heavy fuels with a broadcast burn (Thake et al 2002). When fuels are concentrated before burning, the effect is to increase the intensity and duration of the burn, while limiting the area, which allows greater consumption of large fuels and reduction in risk of wildfire.

Under Alternative C, a machine pile burn would eliminate the need for 1,148 feet of constructed fire line in the proposed action, limiting disturbance due to rotor tilling or hand clearing vegetation (USDA FS 2002a). However, additional scarification would occur due to activities associated with the equipment used to pile the debris before burning. Scarification would result from the machines dragging slash as well as from the movement of tracks or tires covering the area. It is estimated that up to 50 percent (13 acres) of the area treated would be scarified during a machine pile burn treatment, depending on the season, soil conditions, and technique used by equipment operators (Thake et al 2002). The amount of soil displacement would be kept to a minimum by working with the operators to lift their blades during the process of consolidating fuels. The USDA Forest Service anticipated that soil displacement could be limited to between 10 and 15 percent by timing machine piling from early spring to mid summer when

vegetation is actively growing and would re-vegetate disturbed areas. However, one of the mitigation measures for the Indiana bat is that treatments should not take place after April 15 or before October 15, so most of the work for this alternative would have to occur outside of that time frame. The use of machines would also increase the cost of treatments.

Unit H: Terrain of this unit is steep and fuel load is relatively low. Access is difficult and extensive perimeter fire lines would have to be created for the broadcast burn proposed in Alternatives A and B. This alternative would eliminate the need for 9,033 feet of fire line construction. An isolation treatment is proposed under this alternative, due largely to safety concerns for firefighters. Units G and I would still be treated with machine pile/burn treatments, which would reduce fuels in these areas and contain / isolate any potential fire started in unit H.

Units I and K: For the same reasons stated previously for unit G, a machine pile burn is suggested as an alternative to a broadcast burn for units I and K. A machine pile burn would eliminate the need for 7,281 and 1,381 feet of constructed fire line for units I and K, respectively. However, additional scarification would occur due to the movement and action of the machines consolidating the slash and other debris. It is estimated that up to 50 percent (170 acres) of the area treated would be scarified during a machine pile burn treatment, depending on the season, soil conditions, and technique used by equipment operators (Thake et al 2002).

Unit L: The proposed treatment by isolation would depend on natural processes to decompose the predominantly white pine fuels remaining from the blowdown. However, until decomposition occurs, the risk of wildfire would remain elevated due to higher than background fuel levels. The most recent estimate indicated a difference of 3.4 tons per acre between background and current fuel load. Under the machine pile burn alternative, due to the wet, mesic conditions that exist in the greater part of the unit, only three to four acres would be require treatment (Thake et al 2002). With approximately 50 percent of the area affected by the machinery used to pile debris, the result would be two acres of ground scarification. Fire line construction would not be necessary, but as in all machine pile burns, burnable material would be cleared from an area around the perimeter of the piles.

Unit N: Most of the blowdown in this area is concentrated on one ridge in the north-central part of the unit. Alternative C proposes that a pile burn treatment be implemented in this portion of the unit, which would result in a considerably smaller area of soil disturbance than would occur with the broadcast burn treatment proposed in Alternative A and B. Due to access concerns in this area and the close proximity to private property, pile burns may offer better control of burns and better safety for firefighters. In Addition, areas of heavy regeneration in this unit could be negatively affected by broadcast burn treatments.

Alternative C was recommended primarily as a means to achieve a higher level of short-term firefighter safety. However, because fuel loads would remain unnaturally high in areas treated by isolation and with difficult access, the threat of high intensity wildfire would remain. These areas have steep slopes and are adjacent to power lines and residential structures. In the event that a wildfire did occur in one of these areas, the fire intensity may be so high as to compromise safety, destroy existing forest canopy, and damage or obliterate structures. For this reason, the proposed project alternative (Alternative A) is preferred. Tables 7 and 8 describe proposed fuels reduction treatments under Alternative C. Bold text in the "proposed treatment" column of Table 7, below, indicates that these treatments are different than those proposed for Alternative A.

Table 7: Proposed Fuels Reduction Treatments for Alternative C

Location	Unit	Level of Damage	Harvested?	Background Fuel Loading (Tons / Acre)	Current Fuel Loading (Tons /Acre)	Acres Proposed to be Treated	Proposed Treatment	Existing Firebreak (feet)	Constructed Fire Line (feet)
STARNES	A	Heavy	No	4.4	13.7	53	**Machine pile burn in A1 (15 acres)**; broadcast burn in A2 & A3 (38 acres)	7,221	3,153
	B	Heavy	Yes	4.4	14.1	35	Pile burn	0	0
	C	Heavy	Yes	10.7	27.7	67	Treat by isolation, treat surrounding area	0	0
	D	Moderate	Yes	10.7	23.7	95	Treat by isolation, treat surrounding area	0	0
SALT CREEK	E	Heavy	Yes	9	17.0	50	Treat by isolation	0	0
	F	Moderate	Yes	9	20.3	763	**Treat by isolation**	0	0
PIPELINE	G	Heavy	No	9	25.2	26	**Machine pile/burn**	1,096*	0
	H	Moderate	No	9	14.2	80	**Treat by isolation**	0	0
	I	Moderate	Yes	9	25.0	340	**Machine pile/burn**	4,019*	0
HICKORY	J	Heavy	Yes	1.5	14.6	58	Treat by isolation, treat surrounding area	0	0
	K	Moderate	Yes	1.5	13.4	21	**Machine pile/burn**	0	0
	L	Moderate	Yes	8.3	11.7	23	**Machine pile/burn**	0	0
FORK RIDGE	M	Heavy	No	2.9	26.6	30	Treat by isolation, treat surrounding area	0	0
	N	Moderate	No	2.9	16.9	118	**Pile burn**	0	0

* Existing firebreak for machine pile/burn is only a precaution against accidental escape of prescribed burn.

Table 8: Proposed Fuels Treatment Summary for Alternative C

Proposed Treatment	# Units	Total Acreage	Percent of Acreage
Broadcast burn	0.72	38	2
Pile burn	2.00	153	9
Treatment by isolation	7.00	1,143	65
Machine pile/burn	4.28	425	24
All treatments	14	1,759	100

6.4 Alternative D (No Action or Existing Condition)

This alternative does not implement the fuels reduction proposal. It maintains the areas damaged by the 1996 storm in their existing condition and depends on natural processes to regenerate and restore the forest community. This alternative maintains wildlife habitat in its current state and protects wildlife from being directly harmed by prescribed fire. However, a high-intensity wildfire started in the blowdown area could potentially harm or kill large numbers of wildlife directly. Under this alternative, soil would not be disturbed by prescribed fire or by preparation activities for burn treatments. However, consequences of deferral of fuel load reduction treatments could lead to high intensity, uncharacteristically damaging wildland fires that can cause complete destruction and loss of critical habitat for fish, wildlife, and plant species at risk. Such high intensity fires can also cause complete consumption of understory and herbaceous vegetation.

This no action alternative does not address potential wildfire threats to natural resources, firefighter safety, public safety hazards, and potential losses of private property. However, it does address several public comments regarding the low probability of wildfire in the proposed treatment areas. This alternative indirectly affects forested areas by allowing continued deterioration of downed timber, and continued regeneration of both shade tolerant and intolerant vegetation at their current rates. However, the no action alternative may lead to increased costs, losses, and damages in the future should a high-intensity, uncontrollable fire ignite in an area with heavy fuel loading. This alternative concedes to public doubt of effectiveness of fire for managing the health of forests, but does not address positive aspects of fire management in promoting diverse habitat types, clearing damaged understory, reducing competing understory to allow for regeneration of shade-intolerant species, and reducing potential threats to other forest resources.

The no action alternative addresses potential air pollution concerns, as no smoke or particulate matter would be released as a result of prescribed fires. However, constraining the use of fire to ensure public health now may inadvertently increase risks to public safety and health in the future caused by large wildfires. Low-intensity prescribed burns, and proper construction of burn piles minimize the amount of smoke that remains at ground level. Smoke levels produced by spontaneous, unplanned, high-intensity wildfires could be much greater. Another important consideration is that prescribed burns on the HNF are performed in the fall or winter, which is preferable to naturally-caused wildfires that normally occur in summer when stagnant atmospheric conditions inhibit smoke dispersal. These summer wildfires lead to a prolonged exposure of local communities to unhealthy smoke levels (USDA FS 2000c).

The no action alternative is also consistent with some of the guidelines for MA 2.4, 2.8, and 6.4 in the *Forest Plan.* Approximately 111 acres in the Project Area are in MA 2.4 and 6.4 and are designated as semi-primitive in the Recreational Opportunity Spectrum (ROS). *Forest Plan* guidelines recognize natural succession as the primary influence on the vegetation in these areas (USDA FS 1991a). MA 2.8 is designated as a roaded natural area ROS in which selective timber harvesting is allowed, and the primary method of regeneration is through natural means (USDA FS 1991a). Choosing this alternative would agree with natural regeneration objectives for these MAs.

Both roaded natural ROS areas (MA 2.8) and semi-primitive ROS areas (MAs 2.4 and 6.4) describe the desired condition of these areas as "natural-appearing environments." Some fuel reduction treatments might be inconsistent with this preferred condition immediately following burn activities, so this alternative is consistent with *Forest Plan* guidelines. However, natural measures might not be sufficient to ensure that a diversity of vegetative types is maintained on the HNF (USDA FS 1991a), given that invasion of non-native species and forest conversion to shade-tolerant species is promoted by fire suppression. Additionally, high-intensity, stand-replacing fires that could result from deferral of fuel

load treatments could completely destroy both shade-tolerant and shade-intolerant canopy trees. Thus, the no action alternative could also result in the loss of "natural-appearing environments" in the future.

The *Forest Plan* recognizes the natural values of downed trees, branches and other debris left after a storm: "downed logs, limbs, and other scattered ground materials resulting from vegetative management or natural causes…. help to maintain viable populations of indigenous species, such as reptiles and amphibians, nesting cover for bird and other wildlife, nutrient recycling, and long-term sustainability" (USDA FS 1991a). Reducing the debris in the proposed treatment areas would eliminate some of the values provided by downed timber such as replenishing the soil nutrients, and providing shelter and nest sites for ground dwelling species. However, this same section of the *Forest Plan* states that exception to leaving debris on site may be made "for visual concerns, reducing fire hazard in certain situations, firewood gathering, and recreation area clean-up," all of which apply to the proposed Project Area.

Leaving the blowdown area in its current condition with natural openings that are undergoing varying degrees of succession caused by storm damage currently agrees with the *Forest Plan* goal of providing natural openings as habitat for certain species of flora and fauna. Storm damage also leaves "snags" or standing dead trees, and piles of debris that serve multiple functions for birds and mammals (USDA FS 1991a).

6.5 Alternatives Not Considered in Detail

One alternative considered was to broadcast burn the entire Project Area. This alternative was not pursued because some of the areas pose serious safety concerns to firefighters due to steep topography and lack of escape routes. There are also several areas that cannot be accessed by wildland fire engines, which are necessary to ensure firefighter safety and that burns are limited to a defined area.

Another alternative considered was to allow the public to remove downed timber and debris as firewood. This option is unlikely to substantially reduce the fuel loading in areas with heavy to moderate accumulations of debris, and thus would not decrease the risk of wildfire. There are also several areas in which fuel wood removal is impractical because these areas lack good public access, have steep terrain and are not accessible from Forest roads.

Chipping downed woody debris was also considered as an alternative, but discarded due to the prohibitive expense of removing the wood from blowdown areas.

7.0 ENVIRONMENTAL EFFECTS

This section presents the environmental effects of implementing each alternative. The effects are presented in response to the issues and concerns identified earlier. Knowing the expected environmental consequences of proposed activities gives the decision maker a basis for selecting which actions to implement. The need for an Environmental Impact Statement (EIS) is based on what environmental effects are expected from the proposed actions; however, comparisons of effects and impacts between action alternatives is somewhat difficult to accurately determine because the exact area that will be affected by project implementation in each case is not known. For instance, locations and size of fire breaks, locations of wood piles, and firefighter egress routes will be determined in the field during project implementation. As such, it is possible only to discuss potential effects of each prescribed burn technique and compare the quantity for each of the prescribed burn treatments proposed under each alternative.

The following effects are discussed because they are related to the major issues: wildlife and habitat effects; soils effects and water quality; wildfire threat, forest health and effectiveness of fire management; and economic concerns. Effects on air quality, recreational quality, visual quality, safety and heritage resources are also considered in less detail. Effects on threatened and endangered species are shown to document compliance with the Endangered Species Act. Effects on Regional Forester sensitive species, forest species of concern (FSOC), and management indicator species (MIS) are shown to document compliance with the *Forest Plan*. The effects on heritage resources are shown to document compliance with the National Historic Preservation Act (NHPA) and other acts that protect heritage resources.

7.1 Wildlife and Habitat Effects

There is concern that prescribed burn treatments will change vegetation growth and composition in the treatment areas, and these changes in vegetation will alter the existing plant and wildlife habitat. Another issue raised was that wildlife utilizing the area could be directly harmed by fire, in addition to indirect effects brought on by changes in habitat. There is also concern that burning activities will negatively impact the Federally endangered Indiana bat, which utilizes snags, tree cavities, and trees with exfoliating bark for nesting and roosting within the Project Area.

7.1.1 Affected Environment

There are 14 forested areas that were disturbed by the 1996 tornado blowdown and which are proposed for fuels reduction treatments. Wind damage from the tornado caused varying degrees of disturbance, ranging from blowdown of entire areas of trees, to topping of trees and minor vegetation damage. The woody debris in these areas has been deteriorating at various rates for six years. Several of the proposed fuels reduction areas were also salvage-logged from 1997-1999, resulting in additional localized areas of disturbance. Despite natural processes and previous salvage logging efforts, the USDA Forest Service determined in their 2001 fuels analysis that moderate to heavy accumulations of debris still exist in the Project Area (USDA FS 2001b, 2002).

Blowdown damage occurred sporadically in concentrated locations over each of the proposed treatment units, altering habitat for sensitive plants and animals in many areas. Many areas proposed for burning are adjacent to roads, heavily used trails, and private property. These areas contain a considerable amount of “edge” habitat that is not suitable for many sensitive and forest-interior species. More remote forest units in the Project Area generally have difficult access, are not located adjacent to roads, or have severe topography that limits access and escape routes for firefighters. Thus, many of the areas that

provide higher quality habitat for plant and animal species due to their remoteness from human disturbance are generally the areas being treated by isolation. Descriptions of specific vegetation in each proposed treatment unit are given in the "Proposed Action" section of this EA. The Project Area consists of several dominant plant community types, which are described below. Dominant plant species for each community type are also provided.

7.1.1.1 Affected Plant Communities

Dry Forest
Dry forest makes up a large portion of the plant community in the Project Area. This forest type is generally found on ridges, especially on south and west facing slopes in the area. Dominant trees include white oak (*Quercus alba*), black oak (*Q. velutina*), chestnut oak (*Q. prinus*), scarlet oak (*Q. coccinea*), and shagbark hickory (*Carya ovata*). Witch hazel (*Hammamelis virginiana*), American hornbeam (*Carpinus caroliniana*), and ironwood (*Ostrya virginiana*) make up the sub-canopy. Dominant species in the shrub layer include American hazelnut (*Corylus americana*), common greenbriar (*Smilax rotundifolia*), maple-leaved viburnum (*Viburnum acerifolium*), and raspberry (*Rubus)* species. Dominant species in the herb layer include white snakeroot (*Eupatorium rugosum*), goldenrod (*Solidago* sp.), panic grass (*Panicum* sp.), calico aster (*Aster lateriflorus*), and slender bush clover (*Lespedeza virginica*). Plantations of white pine (*Pinus strobus*) also exist in the Project Area within dry forest types.

Dry-Mesic Forest
Dry-mesic forest makes up the majority of the plant community in the Project Area. This forest is similar to the dry forest but is usually found on ridges and north to northeast facing slopes. Dominant trees include red oak (*Q. rubra*), white oak, black oak, chestnut oak, shagbark hickory, pignut hickory (*C. glabra*), and red maple (*Acer rubrum*). Shrub and herbaceous vegetation is similar to that in the dry forest with the addition of more mesic vegetation such as Christmas ferns (*Polystichum acrosticoides*). Plantations of white pine also occur within certain areas of dry-mesic forest.

Mesic Forest and Wet-Mesic Forest
These community types are found primarily on low, north-facing slopes and on flat, riparian areas in the Project Area. Trees are dominated by American beech (*Fagus grandifolia*), sugar maple (*A. saccharum*), northern red oak, white ash (*Fraxinus americana*), and American basswood (*Tilia americana*). On flatter, bottomland areas, some scattered sycamore (*Platanus occidentalis*) and eastern cottonwood (*Populus deltoides*) trees can be found. Dominant shrubs include maple-leaved viburnum, common greenbriar, and Allegheny blackberry *(Rubus allegheniensis*). These forests also have a rich flora of spring ephemerals and ferns.

Floodplain Forest
There are only a few acres of floodplain forest in the Project Area. Small portions of Units A (Unit A-3) and B border the Starnes Branch of South Fork Salt Creek. Portions of Units E and F also contain tributaries of the Starnes Branch. A small tributary of the South Fork Salt Creek passes along the northern border of Unit G and through a portion of Unit H. The southwest perimeter of Unit I borders the Starnes Branch and another tributary of the South Fork Salt Creek passes through its center. Units J and L contain segments of the Starnes Branch, and the southwest portion of Unit N borders the South Fork Salt Creek. It is possible that small portions of floodplain forest within the treatment areas may be affected by construction of fire lines and burn treatments.

Exotic Species
There are many exotic species in the Project Area, as well as old pine plantations. Exotic species

that are a cause for concern include multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), and autumn-olive (*Elaeagnus umbellata*). These exotics take advantage of high light levels in canopy openings and ground disturbance to invade new areas. These species are becoming established in the open, disturbed soil conditions created by the tornado blowdown. Once established, these species can outcompete native vegetation, affecting plant distribution and wildlife habitat.

7.1.1.2 Threatened, Endangered and Regional Forester Sensitive Species

Flora

There are no known Federally listed protected endangered, threatened or proposed plant species in the Project Area. There are also no known Regional Forester sensitive plant species of concern within the Project Area. However, there is habitat within the Project Area for several Regional Forester sensitive flora species including large yellow lady's slipper (*Cypripedium pubescens*), trailing arbutus (*Epigaea repens*), butternut (*Juglans cinerea*), Illinois wood sorrel (*Oxalis illinoensis*), American ginseng (*Panax quinquefolia*), and Clingmans's hedge-nettle (*Stachys clingmanii*) (TN&A 2002).

Fauna

There is one Federally listed endangered species, the Indiana bat, known to occur within the Project Area. There is no critical habitat for the Indiana bat on the HNF. However, two small bat hibernacula were discovered on the HNF, approximately 30 miles southwest of the Project Area. Both sites have Priority Three status (Olson 2002). The closest Priority One hibernacula are in Greene and Harrison Counties in Indiana, approximately 25 miles to the west of the Project Area and within 10 miles of the forest proclamation boundary. These hibernacula consist of eight caves and are designated as critical habitat for the Indiana bat. Since there are a number of Indiana bat hibernacula near and on the HNF, it is possible that male Indiana bats use portions of the Forest for roosting and foraging in the spring and fall.

In 1996, the Indiana bat was documented near treatment units A, B, and D along the Starnes Branch, in the northeast quarter of section 35, Township 7 north, Range 2 east (IDNR 2002). In the summer of 1998, four male bats were captured during mist netting on the HNF in the Tell City Ranger District, 50 miles south of the proposed Project Area. Several male Indiana bats have been observed on NFS land in previous mist nettings and surveys during spring through fall. No maternity colonies have been documented as occurring on the forest. Given this information, it is possible that Indiana bats may be present on the project site from spring staging through fall swarming. The BE (TN&A 2002) contains more detailed information regarding the Indiana bat and other sensitive and listed species known to occur on the HNF.

There are 12 Regional Forester sensitive fauna species that have been sited or could potentially find suitable habitat in or adjacent to the Project Area (TN&A 2002). They include the cerulean warbler (*Dendroica cerulea*), migrant loggerhead shrike (*Lanius ludovicianus migrans*), bobcat (*Lynx rufus*), evening bat (*Nycticeius humeralis*), and timber rattlesnake (*Crotalus horridus*). In addition, some of the RFSS are aquatic and could be affected by erosion and sedimentation into riparian areas if mitigation measures are not followed. Aquatic species include the lake sturgeon (*Acipenser fulvescens*), eastern sand darter (*Ammocrypta pellucida*), rock pocketbook mussel (*Arcidens confragosus*), snuffbox mussel (*Epioblasma triquetra*), Ohio pigtoe mussel (*Pleurobema cordatum*), pyramid pigtoe mussel (*Pleurobema rubrum*), rabbitsfoot mussel (*Quadrula cylindrica cylindrica*), salamander mussel (*Simpsonaias ambigua*), and purple lilliput mussel (*Toxolasma lividus*).

7.1.1.3 Management Indicators

According to the *Forest Plan* (USDA FS 1991a), management indicators are selected to serve as a basis for evaluation. The USDA Forest Service Manual (FSM) defines MIS as "plant and animal species, communities, or special habitats selected for emphasis in planning in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent" (FSM 2620.5). The effects of implementing the *Forest Plan* on forest ecosystems are assessed using information provided by monitoring this select group of species and communities as shown in Table 9, below.

Table 9: Hoosier National Forest Management Indicators

Scientific Name	Common Name	Species or Habitat in Project Area
Birds		
Aix sponsa	wood duck	X
Bonasa umbellus	ruffed grouse	X
Buteo platypterus	broad-winged hawk	X
Dendroica discolor	prairie warbler	X
Dendroica pinus	pine warbler	X
Dryocopus pileatus	pileated woodpecker	X
Empidonax virescens	Acadian flycatcher	X
Helmitheros vermivorus	worm-eating warbler	X
Hylocichla mustelina	wood thrush	X
Icteria virens	yellow-breasted chat	X
Meleagris gallopavo	wild turkey	X
Mniotilta varia	black-and-white warbler	X
Scolopax minor	American woodcock	X
Piranga olivacea	scarlet tanager	X
Seiurus noveboracensis	Louisiana waterthrush	X
Mammals		
Lynx rufus	bobcat	X
Procyon lotor	raccoon	X
Sciurus carolinensis	gray squirrel	X
Fish		
Ambloplites rupestris	rock bass	X
Esox americanus	grass pickerel	X
Lepomis macrochirus	bluegill	X
Micropterus dolomieui	smallmouth bass	X
Micropterus salmoides	largemouth bass	X
Notropis emiliae	pugnose minnow	X
Notropis umbratilus	redfin shiner	X
Phoxinus erythrogaster	southern redbelly dace	X
Communities types or other groups		
	wetlands	X
	cliff plant associates	
	barrens/glades	
	stream invertebrates	X
	cave invertebrates	

Source: USDA FS 1991a

7.1.1.4 Forest Species of Concern

In cooperation with Indiana Department of Natural Resources, Division of Nature Preserves, and Division of Fish and Wildlife, the HNF has determined that the following are forest species of concern (FSOC) (USDA FS 1991a):

Table 10: Hoosier National Forest Species of Concern

Scientific Name	Common Name	Species or Habitat in Project Area
Chimaphila maculata	spotted or striped wintergreen	X
Rubus centralis	Illinois dewberry or blackberry	X
Spiranthes ochroleuca	nodding ladies' tresses	X

Potential effects to three other FSOC, the large yellow lady's slipper (*Cypripedium pubescens*), butternut (*Juglans cinera*) and American ginseng (*Panax quinquefolia*), are addressed and discussed in detail in Section 7.1.2.3.1 of this document and in the Biological Evaluation for this proposed project (TN&A 2002).

7.1.2 Direct and Indirect Effects of Alternatives

7.1.2.1 Effects on Plant Communities/Habitat

Prescribed burning under the Action Alternatives (A, B, and C) should not result in any decrease in habitat for forest interior-dependent species for two reasons. First, many of the proposed treatment areas occur near roads, heavily used trails, or near the wildland-urban interface. Although roads and trails may occur under full canopy, in many instances, edge effects would preclude the presence of interior-dependent species. Second, many habitat changes in these hardwood stands, such as loss of canopy, fragmentation, structural differences, and altered light conditions have already occurred as a result of the tornado blowdown and subsequent salvage logging activities. A large portion of the proposed Project Area is presently occupied primarily by disturbance-adapted plant and animal species. Prescribed burning will temporarily set back succession in some of these areas, but it is likely that regeneration will occur within one to two years after burn treatments are implemented. These treatment areas should be recolonized by many of the same disturbance-adapted plant and animal species that currently occupy the Project Area. After several years, woody species should begin canopy formation and shade out early-successional, herbaceous shrub and tree species.

Alternative A: Broadcast burning activities are emphasized under the Proposed Action, Alternative A. Prescribed burn activities are conducted in the spring, prior to establishment of new growth of herbaceous species. As a result, broadcast burns are not likely to impact herbaceous species, but may benefit plant communities by releasing nutrients stored in dead plant material. Although plant community responses differ between open and closed canopy conditions, broadcast burns may change plant community structure by resulting in conditions that favor some species over others. It is unlikely that any sensitive or Federally listed species would be affected by broadcast burning. Changes in plant community composition may affect habitat for certain types of ground nesting birds and small mammals. Under Action Alternative A, 80 percent of the Project Area would be broadcast burned.

Eighteen percent (323 acres) of the Project Area would be treated by isolation under Action Alternative A. Isolation treatments should have minimal to no effect on existing plant communities and wildlife habitat, as the majority of the area with heavy fuel loading would be left to naturally decompose.

Pile burns would be implemented on two percent of the area under Alternative A. Plant and wildlife

habitat should be minimally affected by pile burn treatments. These burns would be conducted on piles of heavy debris within 35 acres of the proposed treatment area and only a small portion of these units would be actually affected by burning activities. Debris would be cleared from larger areas by machines or workers concentrating materials into piles. Piles would be burned in winter months when surrounding fuels are not likely to ignite from burning embers. When constructed correctly, piles burn very quickly and cleanly, minimizing smoke at ground level.

Machine pile burns are not performed under Alternative A.

Alternative B:
Broadcast burn treatments are emphasized to a lesser extent under Alternative B than the Proposed Action. This alternative calls for broadcast burn treatments across 58 percent of the Project Area. Therefore, any effects due to broadcast burn treatments, whether positive or negative, would be proportionally less under Alternative B than the Proposed Action.

Machine pile burns would occur on 23 percent of the Project Area under Alternative B. Machine pile burns are only proposed for areas with existing roads and skidding trails from past timber operations, so new soil disturbance should be negligible. However, consolidating the fuels into piles before burning creates considerably more heat in a concentrated area than broadcast burns. The result of high heat and fuel quantities may include destruction of underlying vegetation and root masses, along with deposition of excessive nutrients at the pile location. As a result, pile burns would be located away from streams and ignited in winter when soils are more stable. Performing these operations in winter should minimize potential soil erosion and sedimentation that could be harmful to aquatic wildlife, and reduce soil compaction that could deter plant growth.

Isolation treatments would be implemented on 17 percent (300 acres) of the Project Area under Alternative B. Isolation treatments should have minimal to no effect on existing plant communities and wildlife habitat, as the majority of the area with heavy fuel loading would be left to naturally decompose.

Pile burn treatments are the same under Alternative B (two percent) as they are under the Proposed Action. Therefore, effects on plant and animal habitat would be the same.

Alternative C: Effects of Alternative C on plant and animal habitat should be generally similar to effects of Alternative A and B. However, since the total acreage to be burned is decreased by approximately 47 percent under Alternative C, potential negative effects to habitat caused by prescribed burning operations would be proportionally less than Alternatives A and B. Several areas proposed for broadcast burning in Alternative A and B were changed to isolation or pile burn treatments in Alternative C, largely due to potential safety concerns. However, this would result in larger areas of untreated fuel that could potentially ignite in the future and cause uncharacteristically intense fires that could damage habitat and change forest microclimates. Many areas proposed to be treated by isolation that currently maintain high fuel loads are surrounded by other fuels reduction treatments. These adjacent treatments should reduce the potential for spread of future fires and minimize stand and habitat destruction.

Alternative D: The no action alternative may result in more rapid hardwood succession in the Project Area, but the existing heavy accumulations of woody debris could result in a high-intensity, stand destroying fire that could eliminate the forest canopy and inhibit natural regeneration in the future. Under this no action alternative, shade-tolerant trees and shrubs will continue to dominate many of the blowdown areas, and may change habitat and food availability for many wildlife species

and altering microclimate for many flora species. There would also be a higher probability that insects and disease from rotting debris would spread to healthy forest trees if no treatment activities are implemented, potentially affecting plant and wildlife habitat in the future.

7.1.2.2 Effects on Exotic Species

The damage to the forest canopy caused by the 1996 tornado blowdown has resulted in increased sunlight penetration and has encouraged growth of exotic plant species that thrive in disturbance areas. Some of the species that pose the greatest threat of invasion include garlic mustard, crown vetch, and bush and Japanese honeysuckle species (Hedge 2002). Since exotic species tend to utilize disturbance corridors such as roads, trails and stream corridors, it is likely that exotic species growing along existing USDA Forest Service roads and trails will further invade the proposed treatment areas in the future (Hedge 2002). Some of these plants may be shaded out over the next several decades as new hardwood stands become established, while other exotic plants may persist. Meanwhile, shade cast by exotics will continue to deter natural regeneration of shade-intolerant trees, shrubs, and herbaceous plants in blowdown-affected areas.

In fire-adapted ecosystems such as the HNF in which fuels have accumulated over many years due to fire suppression, fires could burn with such intensity that habitats are burned beyond their adaptive limits. Damage to these forests would not only degrade ecosystems and desirable habitat for many species, but could drastically change site conditions (light, temperature, moisture etc.) and the ability of native species to regenerate. This may result in increased spread of already existing exotic species (USDA FS 2000c).

Prescribed burning activities under Action Alternatives A, B and C could decrease the spread of invasive and non-native plants in the future by minimizing the likelihood of large wildland fires.

Alternative A: Prescribed burning activities under the Proposed Action Alternative, particularly broadcast burning, should have a positive effect on reducing the encroachment of exotics into blowdown openings. Most existing exotic plant species within the Project Area are less than three inches diameter breast height (d.b.h.) and may be top-killed by fire, but their root systems are likely to survive. As a result, combinations of treatments may be necessary for long-term control (USDA FS 1989). Removing non-native plants should improve the habitat quality for many native wildlife species, as well as allowing native, shade-intolerant plants to prosper under increased light conditions.

Alternative B: Since less broadcast burning will be employed under this alternative relative to Alternative A, less exotic species control would be provided. However, burn treatments would be used on approximately the same area (83 percent). Reduction of forest floor debris through limited broadcast and pile burn treatments should result in improved habitat for native wildlife species and allow native, shade-intolerant plants to prosper under higher light conditions. Tree, shrub, and plant regeneration should also improve under this alternative with the reduction in woody slash. However, exposed soils under burned piles may provide sites for non-native invasive species to become established because these species are able to adapt to disturbance conditions and would experience reduced competition from other vegetation.

Alternative C: Since Alternative C calls for the greatest reduction in broadcast burn treatments (78 percent), it would offer the least exotic species control of the three action alternatives. An additional 33 percent of the Project Area would be treated with either machine pile or pile burn treatments.

Alternative D: Under the no action alternative, exotic and edge species will persist in the proposed Project Area until larger trees and shrubs shade them out. Many exotics such as multiflora rose are

also fairly shade tolerant and may persist much longer without the presence of natural controls. Encroachment by exotic species displaces native plant populations; changes microclimates of forests making conditions unacceptable for many native plants; causes increased shade that inhibits regeneration of shade-intolerant tree, shrub, and herbaceous plants; and results in loss of food and nesting sites for many species of native birds (USDA FS 2000c). Failure to control these species will result in decreased habitat and habitat value for native species of plants and animals.

7.1.2.3 Effects on Federal Threatened, Endangered and Regional Forester Sensitive Species (RFSS)

The BE for this proposed project (TN&A 2002) addressed potential effects on Federally threatened and endangered (T&E) and Regional Forester sensitive species (RFSS) of plants in the Project Area. Although no known T&E or RFS species were found in the Project Area, there is suitable habitat for several RFS plant species, and it is possible that these plants occur within the Project Area.

Alternatives A, B and C: Prescribed burn and site preparation activities, such as creation of fire lines, could have effects on individual plants and small plant populations. The primary differences between project alternatives are in how much habitat is impacted during project implementation and what the expected habitat response will be over the long-term, depending on the treatment implemented. Alternative A emphasizes broadcast and pile burns over 82 percent of the Project Area. Alternative B emphasizes broadcast, pile and machine pile burns performed over 83 percent of the Project Area and Alternative C emphasizes treatment by isolation on 65 percent of the Project Area. Short-term disturbance to forest species and their habitats would be experienced to a greater extent with Alternatives A and B than with Alternatives C and D (no action alternative). The primary difference between Alternatives A and B is that 3,537 more feet of fire line would be required for Alternative A. However, Alternative B would probably result in approximately 192 acres of ground scarification due to the action of machines to consolidate fuels prior to burning. These potential effects are discussed below along with recommended mitigation measures to be employed.

7.1.2.3.1 Flora

Large yellow lady's slipper– This species is not likely to be found in the Project Area, because of past disturbance, which has created unsuitable habitat conditions. Fuels reduction would favor establishment of this species by opening up more suitable habitat and reducing competition from early successional and non-native species. Disturbance for broadcast burn and pile burn treatments (creation of firebreaks, soil disturbance caused by fire fighting equipment) should be minimized to protect this plant. Machinery should be restricted to logging trails, roadways, and trails that have been previously constructed. Machine pile burns, which are not included in the Proposed Alternative, are similar under Alternatives B and C, and may adversely impact the large yellow lady's slipper. However, it is unlikely that this plant is present within the proposed treatment areas because of the past level of disturbance. Thus, no impacts should occur to this species due to implementation of the proposed action alternatives.

Butternut - The habitat of this tree is found within floodplain and stream terrace forests. However, no individuals were identified during field surveys. Prescribed burns and associated preparation activities may be performed within riparian areas, including possible emergency fire line construction. These activities may impact individual butternut not yet identified in those areas. However, due to the microclimate conditions near wetlands and the presence of green vegetation that is fire resistant, it is unlikely butternut trees will be damaged. If a prescribed burn did spread into floodplain, its low intensity would likely leave tree roots intact to resprout (USDA FS 1989). Therefore, implementation of the proposed action alternatives may impact individual butternut trees, but is not likely to cause a trend to Federal listing of the species or loss of viability.

American ginseng - This species prefers moist forest and usually occurs on north-facing slopes associated with maple species. It is likely that ginseng occurs in the Project Area. Fuels reduction treatments should also favor establishment of ginseng by opening up more suitable habitat and reducing competition from early succession and non-native species. When mesic forests are burned and the density of understory growth is reduced, prairie and woodland forb growth is usually stimulated (Olson 1996). Therefore, beneficial impacts should occur to this species due to implementation of the proposed action alternatives.

Illinois wood sorrel– This perennial herb is found in moist forest and has been found on the Pleasant Run unit in ravine bottom areas (Olson et al 1991). Although work under the action alternatives may occur within ravine bottoms, floodplains, stream terraces or areas that would provide suitable habitat for Illinois wood sorrel, burns would not be conducted when the plants are actively growing. Therefore, the action alternatives are not likely to negatively impact herbaceous species (USDA FS 1989) such as Illinois wood sorrel, and may actually stimulate herbaceous vegetation growth due to the release of nutrients into the soil from prescribed burns. Therefore, implementation of the action alternatives may impact individual plants, but is not likely to cause a trend to Federal listing or loss of viability for this species.

Trailing arbutus – This creeping evergreen shrub is generally found on ridges dominated by chestnut oaks on the HNF. It is very intolerant of habitat disturbance, and thus unlikely to be growing in areas affected by the 1996 tornado blowdown. Burning could favor establishment of forest conditions that could subsequently provide habitat for this plant. As a result, action alternatives may have beneficial impacts on this species over the long term.

Clingman's Hedge-nettle – This herb grows in seasonally wet soil and has been observed at one site in the Pleasant Run unit that may be the only recent record statewide (IDNR 1993). Although work may be performed within wetlands or floodplains for this project, these areas are not likely to burn effectively due to microclimate conditions and because of the low intensity type of fire that is generally produced during prescribed burns (USDA FS 2000b). In addition, a burn often stimulates herbaceous vegetative growth. To limit the length of constructed fire line and keep ground disturbance to a minimum, natural firebreaks would be utilized as much as possible. Therefore, no impacts should occur to this species due to implementation of the proposed action alternatives.

Alternative D: Under the no action alternative, there should be no immediate impacts to existing populations of sensitive plants that may exist in the Project Area. However, if forest floor debris is not reduced and exotic species are not controlled, habitat quality may decline.

7.1.2.3.2 Fauna

The BE (TN&A 2002) addressed potential effects to T&E and RFS animal species in the Project Area. This evaluation found that one Federally listed endangered species, the Indiana bat, and several RFS animal species, could be potentially impacted by the proposed action alternatives. Potential impacts of the Action Alternatives on these species and mitigation is discussed below:

Indiana Bat

Alternatives A, B and C: As previously discussed, because the closest known Indiana bat hibernacula are 25 miles away and there are no caves in the Project Area, the proposed Action Alternatives A, B, and C should have no effect on bat hibernacula or fall swarming. Since no known maternity colonies are known to occur within the Project Area, and mitigation measures require all burning to be conducted between September 15 and April 15, it is unlikely that the proposed

activities will affect individual Indiana bats. However, proposed burning activities under all Action Alternatives A, B, and C could affect potential summer habitat and Indiana bat roosting and foraging activities.

Alternative A and B emphasize broadcast, machine/pile, and pile burns over a wide area (1,436 and 1,459 acres, respectively), whereas Alternative C includes application of these methods over only 616 acres and proposes treatment by isolation for the remaining 1,143 acres. Although timber removal is not a part of any proposed action alternative, it may be necessary to remove certain trees if they pose safety hazards to firefighters or the general public. Removing trees during roosting season could potentially cause harm to bats utilizing them. For this reason, tree cutting and burns would not be conducted between April 15 and September 15, the period of time when bats have emerged from hibernacula and would likely be occupying roost trees. Burning of standing trees could reduce roosting habitat, although this is unlikely since the prescribed burns would be controlled to prevent the loss of standing timber or destruction of snags.

The quality of most of the foraging habitat in the proposed treatment areas is not optimal (TN&A 2002). Additionally, the proposed Project Area represents only a very small portion of the available foraging habitat for Indiana bat on NFS lands. Changes in plant community structure and composition following broadcast burn treatments would generally include stimulation of warm season grasses and native plant species, and top-kill of shrubs and some saplings. For pile and machine/pile burns, disturbance would occur where machinery is used to construct firebreaks and create piles. In addition, some permanent destruction of vegetation may occur at the pile burn locations due to damage caused by intense heat. The changes in vegetation may shift the type of nocturnal flying insects in the area, but these changes are not likely to cause a substantial decrease in overall numbers of prey insects. Therefore, the proposed action alternatives should have a minimal effect on foraging habitat for the Indiana bat.

Indiana Bat Mitigations

To avoid potential effects to Indiana bats caused by the prescribed burning treatments in the action alternatives, mitigation measures shall be followed. These measures are described in detail in Appendix B of this EA. If these mitigation measures are followed, implementation of Action Alternatives is not likely to adversely affect the Indiana bat or its habitat. Under the no-action alternative, there would be no effects on the Indiana bat or its habitat.

Effects on Other Sensitive Fauna Species

Alternatives A, B and C: Effects of action alternatives on Regional Forester sensitive fauna species should be minimal and are discussed below:

Cerulean Warbler - Cerulean warblers prefer large tracts of mesic forest for breeding and feeding along major streams. The Indiana Natural Heritage Database has documented cerulean warblers at specific sites within the proposed Project Area (IDNR 1993; Dunning and Rea 2001). Also, the North American Breeding Bird Survey (BBS 2001) indicated that the cerulean warbler was observed along the BBS route 35-900 that uses roads in the Project Area. The 1996 storm caused substantial break-up of the forest canopy, resulting in loss of habitat for canopy dwelling species, such as the cerulean warbler. Prescribed burn treatments under the Action Alternatives would not result in removal of additional canopy or mature, live trees. Burning of downed and/or damaged trees will not impact this species' habitat. Therefore, there should be no impact on cerulean warblers.

Evening Bat - There are no known populations of evening bat within the Project Area and thus no alternative is likely to impact this species. However, if an unknown population does exist in the

area, it would benefit from protection provided by mitigation measures previously discussed for the Indiana bat.

Timber Rattlesnake – This species inhabits dry, usually rocky forests with graminoids dominating the ground flora. It is most frequent in the Brown County Hills, but may be found at locations throughout the Shawnee Hills as well. Most recorded sightings of this species are during mid-summer. Timber rattlesnake is rare and local on the Hoosier, and it continues to be persecuted, leading to declining populations. It is unlikely that this species exists in the Project Area. The nearest sightings of the timber rattlesnake have been in the Nebo Ridge area, approximately three to five miles northeast of the proposed Project Area. In addition, even if the snake were present, it would not likely be impacted because no burning activities will occur on steep slopes due to firefighter safety concerns. Due to lack of known occurrences of this species in the Project Area, it is not likely to be impacted by the action alternatives.

Migrant Loggerhead Shrike – This bird is common to open country dominated by dense concentrations of thorny trees and shrubs. Although the Project Area contains suitable habitat for this species, there are no known occurrences of the shrike in the proposed treatment areas. Suitable habitat for the shrike that will not be disturbed will remain through the region. Burning should not kill stands of dense shrubbery, and should be conducted outside of the nesting season for this bird, which generally takes place from late March through late June (Mumford and Keller 1984). This species is not likely to be impacted by the action alternatives.

Sensitive Mussel Species – Although work may be performed within rivers, streams, or floodplains under the proposed project alternatives, it is not likely to adversely affect sensitive mussel species. Although there are no records of sensitive mussel species occurring in the Project Area, prescribed burns are generally of the type, size, intensity, location, frequency, and technique that there is little, if any, soil exposed after a burn is completed (USDA FS 2000b). In addition, moist conditions near streams are likely to stop the spread of prescribed fire treatments, leaving an unburned strip of vegetation as a buffer that would help to deter erosion and sedimentation into sensitive aquatic environments (USDA FS 2000b). Activities such as hand-construction of fire lines also reduce potential erosion and sedimentation into water bodies. In addition, standard mitigation measures for HNF SMZs will be followed. Therefore, activities proposed under the action alternatives are not likely to adversely impact sensitive mussel species or their habitat. Mitigation measures are described in detail in Appendix B.

Bobcat – This wide-ranging predator needs a diversity of habitat, secluded areas, and dense brush or rocky outcrops for cover. The size of the disturbance area would be minimal relative to the available habitat within the region. In addition, disturbances caused by fuel load reduction activities will be temporary. Therefore, this species is unlikely to be impacted by any of the action alternatives.

Alternative D: Under the no action alternative there should be no short-term adverse impacts to Regional Forester sensitive fauna species. However, over the long term, some fauna species could be negatively affected by encroachment of exotics into blowdown areas and conversion of shade-intolerant oak and hickory species to shade-tolerant maple and beech trees.

The consequences of deferring any prescribed burn activities under the no-action alternative may actually increase the potential for erosion, sedimentation, and negative effects to aquatic and terrestrial wildlife by allowing fuel loads to increase to hazardous levels. A high intensity fire, which could ignite elevated fuels created by decades of fire suppression, could burn at such intensity as to kill smaller trees and brush, as well as larger, normally fire-tolerant trees. Root masses that stabilize soils and prevent erosion would not be destroyed by low-intensity fires. As such, low

intensity fires pose little risk to biodiversity and water quality. High-intensity fires are difficult to suppress, and may damage root systems that stabilize soil, trunks that provide habitat, and leaves that provide shade and moderate water temperatures for aquatic wildlife. In addition, high-intensity fires burn off the entire organic layer, volatizing nutrients, and create conditions in which water will run unimpeded over the surface. Under these circumstances, soil becomes more susceptible to erosion and its capacity to absorb water is often lost. Changes in soil structure, nutrient levels and moisture amounts may substantially change vegetation composition and habitat characteristics.

7.1.2.4 Effects on Management Indicator Species (MIS)

Alternatives A, B, and C:
Management indicator species are monitored on National Forest System lands to determine population trends and to evaluate the effects of implementation of *Forest Plan* activities on selected species (USDA FS 1999). Long-term trends for MIS are discussed in the *Environmental Assessment for Forest Openings Maintenance* (USDA FS 1999). This document is a detailed analysis of the effects of maintaining forest opening habitats on management indicator species and its findings apply to the proposed project action alternatives because the maintenance activities analyzed included burning or mowing to maintain early seral vegetation. Probable effects to all MIS, as described in detail in the Forest Openings EA, are listed in Table 11 (page 44).

The action alternatives would reduce fuel loading in areas of the HNF affected by the tornado blowdown. Prescribed fire treatments and associated changes in habitat may benefit many Management Indicator plant and animal species in the long term. Reducing the quantity of down, dead debris would also indirectly affect the Project Area and adjacent forest habitat by lowering the risk of tree mortality from insects and disease.

Cliff, barrens/glades and cave communities are not present in the Project Area. Therefore, the project alternatives will not affect the species associated with those communities. In addition, although prescribed burns may take place in riparian corridors, mitigation measures will be taken to protect streams and other wetlands from activities associated with burn treatments. As a result, management indicator fish species and stream invertebrates will not be affected by the project alternatives.

Table 11: Summary of Effects on HNF Management Indicators

Scientific Name	Common Name	Proposed Action (Alternative A)	Alternative B	Alternative C	Alternative D
Birds					
Aix sponsa	wood duck	No effect	No effect	No effect	No effect
Bonasa umbellus	ruffed grouse	Positive	Positive	Positive	Negative
Buteo platypterus	broad-winged hawk	Neutral to slightly positive	Neutral to slightly positive	Neutral to slightly positive	No effect
Dendroica discolor	prairie warbler	Positive	Positive	Positive	Negative
Dendroica pinus	pine warbler	Negative	Negative	Negative	Negative
Dryocopus pileatus	pileated woodpecker	Neutral to slightly negative	Neutral to slightly negative	Neutral to slightly negative	Positive
Empidonax virescens	Acadian flycatcher	Negative	Negative	Negative	Positive
Helmitheros vermivorus	worm-eating warbler	Negative	Negative	Negative	Positive
Hylocichla mustelina	wood thrush	No effect	No effect	No effect	No effect
Icteria virens	yellow-breasted chat	Positive	Positive	Positive	Negative
Meleagris gallopavo	wild turkey	Positive	Positive	Positive	Negative
Mniotilta varia	black-and-white warbler	Negative	Negative	Negative	Positive
Scolopax minor	American woodcock	Positive	Positive	Positive	Negative
Piranga olivacea	scarlet tanager	Positive	Positive	Positive	Positive
Seiurus noveboracensis	Louisiana waterthrush	No effect	No effect	No effect	No effect
Mammals					
Lynx rufus	bobcat	Positive	Positive	Positive	Negative
Procyon lotor	raccoon	No effect	No effect	No effect	No effect
Sciurus carolinensis	gray squirrel	No effect	No effect	No effect	No effect
Fish					
Ambloplites rupestris	rock bass	No effect	No effect	No effect	No effect
Esox americanus	grass pickerel	No effect	No effect	No effect	No effect
Lepomis macrochirus	bluegill	No effect	No effect	No effect	No effect
Micropterus dolomieui	smallmouth bass	No effect	No effect	No effect	No effect
Micropterus salmoides	largemouth bass	No effect	No effect	No effect	No effect
Notropis emiliae	pugnose minnow	No effect	No effect	No effect	No effect
Notropis umbratilus	redfin shiner	No effect	No effect	No effect	No effect
Phoxinus erythrogaster	southern redbelly dace	No effect	No effect	No effect	No effect

Table 11: (Continued)

Community types or other groups		Proposed Action (Alternative A)	Alternative B	Alternative C	Alternative D
	wetlands	No effect	No effect	No effect	No effect
	cliff plant associates	No effect	No effect	No effect	No effect
	barrens/glades	No effect	No effect	No effect	No effect
	stream invertebrates	No effect	No effect	No effect	No effect
	cave invertebrates	No effect	No effect	No effect	No effect

Alternative D: There would be no effects on the current distribution of management indicator species (MIS) with implementation of the no action alternative. However, the storms have already caused considerable modifications to habitat in the Project Area as compared to previous conditions, making much of the Project Area unsuitable for many MIS, such as the American woodcock, wild turkey, ruffed grouse, prairie warbler, pine warbler, yellow-breasted chat and bobcat. MIS plant and wildlife species should return to the Project Area over time as natural succession and regeneration processes proceed.

7.1.2.5 Effects on Forest Species of Concern (FSOC)

Alternatives A, B and C: Action Alternatives are not expected to negatively impact the viability of forest species of concern. However, habitat for several species may be impacted during project implementation. Short-term impacts to FSOC habitat may include soil compaction, which may make soils unsuitable for growth, and loss of individuals through crushing, trampling or burning. Prescribed burning may provide long-term benefits to FSOC following implementation of the proposed project alternatives by reducing competition from exotic vegetation, reintroducing soil nutrients and simulating the growth of native species

Alternative D: There would be no effect on forest species of concern (FSOC) under the no-action alternative. However, changes in habitat due to storms and previous salvage timber operations have already occurred, affecting distribution of FSOC in the Project Area. Under this alternative, habitat for these species would be improved over time due to natural processes.

7.1.3 Cumulative Effects of Alternatives on Federally Listed Threatened and Endangered, and Regional Forester Sensitive Species

The predicted direct and indirect effects on plant and wildlife habitat are limited to the effects of proposed project activities on plant and wildlife populations and their habitat within the Project Area. Cumulative effects for Federal threatened, endangered, and Regional Forester sensitive species are considered during project implementation and in terms of the potential effects on the overall population viability. The cumulative effects analysis extends to the larger landscape level of the Project Area including private lands and to past, present and future effects of collective management activities by HNF and others.

Historically, Native Americans used fire in the Midwest, contributing to fire adapted community conditions (Olson 1996). But before the 19th century, curtailment of deliberate burning and suppression of all fire by Europeans began to alter the composition, structure, and functioning of fire-adapted

ecosystems (USDA FS 2001d). As a result of fire suppression in areas like HNF, fire-intolerant species such as beech and maple trees have replaced fire-tolerant species such as oaks in many areas of the country. Forest stands that previously contained 50 large, fire-tolerant trees per acre became crowded with more than 600 smaller, fire-intolerant trees per acre (USDA FS 2001d). High levels of fuel loading from this type of ecosystem, in combination with fuels from natural processes, have created very high levels of flammable materials in many areas, posing serious safety concerns. During the past century of fire suppression, many agricultural areas that were acquired by the Federal government in the 1930's as part of the HNF were planted to non-native pines to stabilize and restore soil productivity. Many exotic plant species were also introduced during this time. These introductions have also contributed to changes in local fire regimes.

Activities on HNF land in the recent past include construction of multiple use trails, house log sales, collection of forest products, firewood collection, forest opening maintenance, and extensive salvage of storm-damaged pine and hardwood trees from 1996-1998 (USDA FS 1996a, 1996b, 1998a, 1998b). The above uses on NFS lands will continue into the future. In addition, private land activities include habitat destruction, agricultural use, cattle grazing, timber harvest, small feedlot operation, and residential construction. These activities are also likely to continue in the future. In particular, increasing residential construction near the HNF is likely to change USDA Forest Service fire management activities in many areas in the future.

Recent activities on adjacent lands have included timber salvage at the Maumee Boy Scout Camp following the 1996 storms, along with timber harvest on other private lands located in the region. Harvesting operations on private lands are not subject to the same strict oversight as those performed on NFS lands and it is likely that these operations will continue into the foreseeable future. As a result, loss of species populations and degradation of habitat for Federally listed species, RFSS, and FSOC will likely continue to occur on adjacent properties.

The HNF is also likely to continue to harvest pine (500 to 1000 acres) in the next decade, which will eventually be replaced by hardwood forest through natural succession. Given no action, a large percent of oak-hickory forest is also expected to decline substantially through forest succession in the next several decades through a slow conversion to a beech and sugar maple forest in the absence of fire (USDA FS 1991a). This conversion may affect growing conditions for shade-intolerant plants and habitat value for species of wildlife that rely on oak mast to survive. Succession to fire-intolerant forest types also increases the possibility that habitat for plants and animals could be destroyed in the future by high-intensity wildfires.

Given combined past, present, and reasonably foreseeable future actions, the cumulative effects on plant and animal habitat caused by the proposed action alternatives are minimal. The proposed action alternatives will reduce threats to habitat posed by hazardous fuel loading and exotic species and planted pines. These alternatives will also maintain habitat for shade-intolerant oaks and hickories and slow succession to shade-tolerant forests that will be less resistant to future wild and arson-caused fires. Activities associated with the proposed project may occur in aquatic or riparian habitats and, as such, these habitats could be impacted by project implementation. However, mitigation measures will be taken to protect streams and other wetlands prior to and during project implementation. All potential effects to uplands are largely beneficial to native species of plants and wildlife because high intensity fires would not threaten habitat in the future.

7.1.3.1 Cumulative Effects on Indiana Bats

Past activities on private land which have probably affected Indiana bat in the lower Midwest include conversion of riparian foraging and roosting areas to agricultural or residential uses, timber harvest of

foraging and roosting areas, and disturbance of hibernacula through flooding, ceiling collapse, or by human activity (USFWS 1983). Past activities on NFS land that may have affected Indiana bats include timber harvest in both riparian and upland foraging and roosting habitat.

Present or reasonably foreseeable future activities on NFS land include the conversion of non-native pines to native hardwoods, either naturally or through vegetation management, such as timber harvest. However, riparian resources will be maintained and timber harvest will be limited. The *Forest Plan* states "Vegetation management in riparian areas will emphasize enhancement and/or maintenance of riparian dependent resources."

Present or reasonably foreseeable future activities on private land which may affect this species include construction or use of roads; continued agricultural use of riparian areas; timber harvest; prescribed burning practices; arson resulting in wildfire; and activities associated with nearby residences. Private lands near the proposed Project Area will continue to be a mix of forest, open pasture, crop fields and residences.

Hibernation - Since all but two of the known hibernacula in Indiana are located on ownerships that are beyond the control of the HNF, land use decisions made by other owners affect Indiana bat populations more than activities carried out on HNF. There is an unknown amount of activity on private land that may affect caves on or off the Forest because of their subterranean connections. This project will have no cumulative effects on hibernation, because it will not affect caves.

Summer Habitat – HNF is attempting to manage for forest conditions where there are large areas of mature, large-diameter trees. Dead trees, trees with obvious den holes, and known live roost trees are retained as wildlife reserve trees. Over one-half of HNF is being managed to produce mature or old growth forest communities. Species that are preferred by Indiana bat as roost trees are being preferentially left in the Project Area.

In an area of about 640,000 acres (encompassing all lands within the Forest proclamation boundary), about 460,000 acres are within 0.6 miles of permanent streams. HNF manages over 196,000 acres intermixed with lands owned by many others. About 20 small communities are within the HNF boundary. There are many isolated homes, and many of the flat ridge tops and creek bottoms in the region are farmed. IDNR Division of Fish and Wildlife manages lands around Monroe and Patoka lakes for a variety of wildlife species. State forests are also managed for wildlife. Private landowners may manage some or all of their land for wildlife. These actions also affect Indiana bats.

Since NFS lands account for only about 30 percent of the acreage in the area, a large majority of what could be considered potential Indiana bat maternity habitat is not on HNF. Loss of bottomland forest to human development in the surrounding parts of Indiana would further decrease available forested habitat. These streamside forest communities, with their fertile soil and desirable location, have been converted to agriculture and developments. While the continued loss of floodplain forest to urban or agricultural development occurs on other ownerships, there are no activities associated with implementing the *Forest Plan* or this proposed project that would convert riparian forests to non-forest. On-going restoration of wetlands and bottomland forests would increase suitable habitat.

Tree harvest on other ownerships may have a greater potential for directly or indirectly affecting Indiana bats than prescribed burning on NFS land. Other ownerships may not protect standing snags and potential roost trees to the extent HNF does. They also may not limit burns to a specific time period when bats are unlikely to occupy roost trees, as the HNF does.

Few activities implemented by the USDA Forest Service adversely affect summer habitat of Indiana bat. When taken together, USDA Forest Service activities are small in relation to the species population as a whole. USDA Forest Service land management practices are not likely to jeopardize the continued existence of the Indiana bat (USFWS 2001).

7.1.3.2 Cumulative Effects on RFSS, MIS and FSOC

Past activities on private land that have affected the RFSS, FSOC, and MIS in the lower Midwest include conversion of riparian and forest habitat areas to agricultural or residential uses, timber harvest, and other disturbances through flooding or other human activities. Past activities on NFS land that may have affected these species include timber harvest in both riparian and upland habitats.

Present or reasonably foreseeable future activities on private land that may have an impact on these species include construction or use of roads, herbicide use associated with roadways and agricultural areas, continued agricultural use of riparian areas, timber harvest, and activities associated with nearby residences. Private lands near the proposed Project Area will continue to be a mix of forest, open pasture, and crop fields that will benefit some species and exclude others.

Continued loss of bottomland forest to human development in the surrounding parts of Indiana would further decrease available habitat for aquatic or wetland-dependent species. Many streamside forest communities, with their fertile soil and desirable location, have been converted to agricultural use and developments. While the continued loss of floodplain forest to urban or agricultural development occurs on other ownerships, there are no activities implementing the *Forest Plan* or this proposed project that would convert riparian forests to non-forest.

There are no appreciable cumulative impacts of the proposed project alternatives when added to other impacts from past, present, and reasonably foreseeable activities.

7.2 Soil Effects and Water Quality

Many people believe that prescribed burning activities will result in elimination of vegetative cover and increase the potential for soil loss due to erosion, especially on steeper slopes. There is also concern that preparation activities for burn treatments (fire line construction, pile creation by machine etc.) may also contribute to an increased potential for soil erosion and compaction.

7.2.1 Affected Environment

The proposed treatment areas are located within the Interior Low Plateau, Highland Rim Section (McNab and Avers 1994) and the Brown County Hills Subsection (Homoya 1995) of Indiana. The Brown County Hills is one subdivision of the Norman Upland, which has a rock base made up of a series of shales and siltstones that are variably resistant to erosion and landscapes that are characterized by relatively smooth and steep slopes (USDA FS 2001e). The Norman Upland area is known for its dissection by streams, and rocks of uniform structure and lithology (USDA FS 2001e). Within this area, prescribed burns will occur on ecological landtypes (ELTs) of Bottomlands, Mesic Ridges, Mesic Slopes, Dry Ridges, and Dry Slopes (Van Kley et al 1994). The upland ELTs consist of soils that formed in loess over residuum of interbedded siltstone, fine-grained sandstone, shale, and soils that formed in loess and underlying lacustrine sediments (USDA FS 1998b). The soil surface layer of this parent layer is predominantly composed of silt loams. Bare, exposed, and disturbed or cultivated silt loam soils with no vegetative cover or root mats are most susceptible to erosion (USDA FS 2001e), which tends to increase as slope increases.

ELTs, soil conditions, and watershed areas of each fuels reduction treatment unit are discussed below. Many units consist of multiple ELTs, soils, and topography. The Jackson County Soil Survey Report (USDA Soil Conservation Service 1990) and Lawrence County Soil Survey Report (USDA Soil Conservation Service 1985) describe characteristics of soils in the Project Area, including soil limitations, erosion hazards, and equipment limitation.

Soils limitations are described as slight, moderate, and severe. Soil limitations provide an indicator of the degree to which soil could be impacted by burning and site preparation activities. Erosion hazards indicate the probability that damage to soil will occur as a result of possible soil exposure after burning activities and burn preparation activities (construction of fire lines, machinery activity etc.). A rating of slight indicates that soil erosion prevention measures are not needed; a rating of moderate indicates that erosion control measures should be implemented if considerable soil disturbance has occurred; and a rating of severe indicates that special precautions would be needed prior to any burning or site preparation activities and/or that soil moving activities should be restricted. Equipment limitation, along with erosion hazard, reflects the characteristics and conditions of the soil that should limit the use and mobility of heavy equipment that may be needed for pile burn treatments and wildland fire engines. However, it is important to note that all soil types in the area have severe rutting hazards, so equipment should only be used when soil is dry or frozen during winter conditions. These criteria complement *Forest Plan* guidelines that require standard mitigations to prevent soil erosion (USDA FS 1991a).

Soil Characteristics of Treatment Units

Starnes Area

Unit A - These treatment units are in the South Fork Salt Creek-Negro Creek Watershed. Unit A-1 is relatively flat, with small areas of moderate to steep slope, and consists of a mainly Mesic Ridge ELT with some Dry Slope, Dry Ridge, and Mesic Slope ELTs. The Starnes Branch of South Fork Salt Creek is located along the western border of Unit A-3. Soils consist of Spickert silt loam (2 to 6% slopes), Gilwood-Wrays silt loam (10 to 25% slopes), and Brownstown channery silt loam (25 to 75% slopes). Unit A-2 consists of ELTs of Dry Ridge, Dry Slope, and Mesic Slope, and the same soils as unit A-1. Unit A-3 consists of Bottomland ELT with Spickert silt loam (2 to 12% slope), occasionally flooded Beanblossom silt loam (1 to 3% slope), Haubstadt silt loam (2 to 6%), Gilwood-Wrays silt loam (10 to 25%), and occasionally flooded Haymond silt loam (0 to 2% slope).

Spickert soils have a slight erosion hazard (due to off-trail use) and a slight equipment limitation, although severe rutting can occur. Gilwood-Wrays soils have a moderate erosion hazard and moderate equipment limitation due to 10 to 25% slope. Brownstown channery silt loams have a moderate to severe erosion hazard and severe equipment limitation due to 25 to 75% slope. Beanblossom, Haubstadt and Haymond soils have slight erosion potential and equipment limitations due to relative flatness of their soils. However, occasional flooding may limit activities on these soils.

Unit B - The Starnes Branch of South Fork Salt Creek flows along the eastern border of this unit. The unit consists of mainly Bottomland ELT, with some Mesic Slope and Dry Slope ELTs. Soils consist of occasionally flooded Beanblossom silt loam (1 to 3% slopes), Spickert silt loam (6 to 12%), Brownstown channery silt loam (25 to 75% slope), and Gilwood-Wrays silt loam (10 to 25% slopes).

Beanblossom soils have slight erosion potential and equipment limitation due to flatness of sites. However, seasonal wetness may preclude machinery operation on these soils. Beanblossom and Spickert soils have a slight erosion hazard and slight equipment limitation. Brownstown channery soils have a moderate to severe erosion potential and severe equipment limitations. Gilwood-Wrays soils have a moderate erosion hazard and equipment limitation.

Units C and D– These treatment areas consist of Bottomland, Dry Ridge, Dry Slope, Mesic Ridge, and Mesic Slope ELTs; and Spickert silt loams (2 to 12% slopes), Gilwood-Wrays silt loams (10 to 25% slopes), and Brownstown channery silt loams (25 to 75% slopes). Erosion potential and equipment limitation is slight on flatter soils and moderate to severe on sloped Gilwood-Wrays and Brownstown channery soils. Unit D has a very small area of Cincinnati silt loam (6 to 12%) and Beanblossom silt loam (1 to 3%), which both have slight erosion potential and equipment limitations.

Salt Creek Area

Units E and F – These treatment units are also located within the South Fork Salt Creek – Negro Creek Watershed. ELTs in this diverse topographic area include Bottomland, Dry Ridge, Dry Slope, Mesic Ridge, and Mesic Slope. Both units contain Gilwood-Wrays silt loam on 10 to 25% slopes, Brownstown channery silt loams on 25 to 75% slopes, and Beanblossom silt loams on occasionally flooded areas with 1 to 3% slopes. These units also contain segments of a Starnes Branch tributary. Unit E contains Spickert silt loams in some areas with flatter slopes (2 to 6%). Unit F contains smaller areas of Brownstown Gilwood silt loams on slopes of 25 to 75% slope, Spickert silt loams on 2 to 12% slopes, Cincinnati silt loams on 2 to 12% slopes, Hosmer silt loams on 2 to 6% slopes, and also includes some pond and lacustrine areas. Erosion potential and equipment limitations in these units range from slight to severe, depending on slope. Equipment limitations occur in flooded, pond, and lacustrine areas.

Pipeline Area

Units G and H – Tributaries to the South Fork Salt Creek pass along the northern borders of these units. These units are located within the South Fork Salt Creek – Tipton Creek Watershed and consist primarily of Dry Ridge, Dry Slope, Mesic Slope, and Bottomland ELTs with some Mesic Ridge ELT in unit H. Soils on 10 to 25% slopes consist of Gilwood-Wrays silt loams and soils on 25 to 75% slopes contain Brownstown channery silt loams. Erosion potential and equipment limitation of Gilwood-Wrays is moderate. Erosion potential of Brownstown channery soils is moderate to severe and equipment limitation is severe due to slope. Unit H also contains small areas of Spickert and Beanblossom silt loams on flatter areas, which have slight erosion potential and equipment limitations.

Unit I – Unit I is located west of units G and H. As part of the South Fork Salt Creek – Negro Creek Watershed, it contains a tributary to the South Fork Salt Creek. Unit I consists of Dry Ridge, Dry Slope, Bottomland, Mesic Ridge, and Mesic Slope ELTs; and Spickert silt loam (2 to 12% slopes), Gilwood-Wrays silt loam (10 to 25% slopes), and Brownstown channery silt loam (25 to 75% slopes) soils.

Spickert soils have slight erosion and equipment limitations in this unit, Gilwood-Wrays soils have moderate erosion potential and equipment limitations, and Brownstown channery soils have moderate to severe erosion potentials and severe equipment limitations due to steeper slopes. Unit I also contains smaller areas of Haymond silt loams (0 to 2% slopes), Beanblossom silt loams (1 to 3% slopes), Otwell silt loams (6 to 12% slopes), and Steff silt loams (0 to 2% slopes).

Hickory Ridge Area

Unit J – This unit is part of the South Fork Salt Creek – Negro Creek Watershed and consists of mostly Bottomland ELT, with some Mesic Ridge and Mesic Slope ELTs. This unit contains a segment of the Starnes Branch Creek and consists of Beanblossom silt loams on 1 to 3% slopes that are occasionally flooded. The unit also contains Cincinnati silt loams (2 to 12% slopes), Spickert silt loams (6 to 12% slopes), Gilwood-Wrays silt loams (10 to 25% slopes), and Brownstown channery silt loams (25 to 75% slopes). Ponds and lacustrine areas exist within this unit. Beanblossom, Cincinnati, and Spickert soils have slight potential for erosion and slight machinery limitations. Gilwood-Wrays soils have moderate to severe potential for erosion and moderate machinery limitations. Brownstown channery silt loams have moderate to severe erosion potential and severe machinery limitations due to steep slopes in certain areas.

Unit K – This unit consists of mostly Mesic Ridge ELT (with some Dry Ridge and Dry Slopes) that straddles the South Fork Salt Creek – Negro Creek and Henderson Creek Watersheds. Soils consist of Gilwood-Wrays silt loams on 10 to 25% slopes with Brownstown-Gilwood and Brownstown channery silt loams on 25 to 75% slopes. Erosion potential and equipment limitation range from moderate to severe in this unit.

Unit L – This area is located entirely within the South Fork Salt Creek – Negro Creek Watershed and contains Bottomland ELT. This unit contains a stretch of Starnes Branch Creek and consists of occasionally flooded Beanblossom silt loam soils on 1 to 3% slopes and frequently flooded Haymond silt loams on 0 to 2% slopes. The unit also contains Cincinnati silt loams on 6 to 12% slopes. Slight erosion potential and equipment limitations exist in this flat area, but seasonal high moisture may limit certain activities.

Fork Ridge Area

Unit M – This unit is part of the South Fork Salt Creek – Tipton Creek Watershed and consists of Bottomland, Mesic Slope, Dry Slope, and Dry Ridge ELTs. Soils consist of Cincinnati silt loam (2 to 12% slopes), Gilwood-Wrays silt loam (10 to 25% slopes), Gnawbone silt loam (22 to 55% slopes),

Brownstown channery silt loams (25 to 75% slopes), and very small areas of Haubstadt and Beanblossom silt loams on flatter areas. Cincinnati, Haubstadt and Beanblossom silt loams have slight erosion potential and equipment limitations; Gilwood-Wrays soils have moderate to severe erosion potential and equipment limitations; Gnawbone silt loams have severe erosion potential and equipment limitations; and Brownstown channery silt loams have moderate to severe erosion hazards and severe equipment limitations.

Unit N – This unit is located in the South Fork Salt Creek – Tipton Creek Watershed. The southwestern border of this unit is fairly close to the Callahan Branch of the South Fork Salt Creek. The unit consists of roughly one-half Bottomland ELT with additional ELTs of Dry Ridges, Dry Slopes, Mesic Ridges, and Mesic Slopes. Soils are extremely varied and include frequently flooded Haymond silt loams and Steff silt loams 0 to 2% slopes; Haubstadt silt loams on 2 to 6% slopes; Gilwood-Wrays silt loams on 10 to 25% slope; Gnawbone silt loams on 22 to 55% slope; and Brownstown channery silt loams on 25 to 75% slopes. Haymond, Steff, and Haubstadt silt loams have slight potential for erosion and equipment limitations. Gilwood-Wrays soils have moderate to severe potential for erosion and equipment limitations, and Gnawbone and Brownstown channery silt loams have moderate to severe erosion potential and severe equipment limitations.

7.2.2 Direct and Indirect Effects

The Project Area for this proposed fuels reduction project is almost entirely contained within the South Fork Salt Creek Watershed. One recent study of this watershed found that roughly 75 percent of the watershed is forested and 13 percent consists of roads (Ewing and Merchant 2000). Forest land generally has low soil erosion rates because the presence of vegetation allows for increased infiltration and reduced runoff from precipitation. However, combustion of organic fuels on watersheds by fire results in mineralization and release of chemical nutrients, principally Ca, Mg, and K. These elements can increase soil pH by occupying cation exchange sites. Rapid growth on a burned site shortly after fire is primarily due to increased nitrogen availability. Fire also can convert bound organic nitrogen and phosphorus to soluble forms (Zwokinski 2000). Roughly 42 percent of the land in this watershed is under NFS jurisdiction (USDA FS 2001e). Thus, the actions of the USDA Forest Service can have a considerable impact on watershed health (USDA FS 2001e). Therefore, mitigation measures must be employed to ensure that nutrient-laden sediment does not erode into water bodies or other sensitive areas (see Appendix B).

Alternative A: Under Alternative A, units A, F, G, H, I, K and N would be broadcast burned. Most burn activities on the forest allow for retention of a duff layer covering the soils after the fire, and only rarely are conditions extreme enough to result in areas of bare soil (USDA FS 2000b). As a result, potential for erosion is low. However, Units F, G, H, I, and N contain large amounts of Brownstown channery silt loam soils, which are found on steeper slopes (25 to 75%) that have moderate to severe erosion potential and severe machinery limitations. Therefore, mitigation measures must be implemented and construction of new fire lines limited to minimize soil erosion in these treatment units. There will be approximately 79,379 linear feet of existing fire line used and approximately 54,196 linear feet of fire line constructed in these broadcast burn units. All disturbed areas will be revegetated, which would further limit soil erosion and subsequent sedimentation into nearby water bodies.

Several of these units, notably units A, B, E, F, I, J, L and N also have significant areas of occasionally flooded soils. Tributaries flow throughout these units, thus it is important that mitigation measures be implemented to protect the riparian areas where necessary. Some riparian areas would be protected by fire line construction, which would be primarily performed by hand and erosion should be negligible. Riparian areas and streams in some of these areas will also be used as natural fire breaks to minimize soil disturbance caused by fire line creation. Effects on soil and water quality in proposed broadcast burn

areas adjacent to streams should be minimal. Riparian areas contain live herbaceous vegetation that tends to stay green and burn less readily than leaf litter, leaving an unburned strip of vegetation or buffer between the fire unit and any streams/water features. Water may also be withdrawn from area streams to wet the burn perimeters and minimize potential for fire escape from broadcast burn units, and thus minimize negative effects to riparian vegetation, soils, and water quality. Standard mitigation measures for soil and water and mitigation measures for SMZs will be followed to minimize effects of broadcast burn treatments on soil and water quality (USDA FS 1991a).

Isolation treatments and pile burn treatments should have minimal to no effects on soil erosion and water quality. Most of the isolation units (units C, D, E, J, L and M) are separated from other treatment units by existing fire breaks such as roads, old logging trails, hiking trails, and pipeline clearings. These barriers should minimize the potential for spread of fire from surrounding burn units into the isolation units. Unit E will require construction of approximately 13,682 linear feet of fire line and use of 1,647 linear feet of existing fire line to isolate this area of heavy fuel load from adjacent treatment units and private property. Pile treatments (Unit B) will require minimal clearing away of debris in a perimeter around the piles and it is possible that some piles will burn down to the soil level. Burning down to mineral soil could damage herbaceous vegetation growing within and near piles of woody debris and result in loss of root mass due to creation of intense heat. Loss of root systems may result in erosion if mitigation measures are not employed to reestablish vegetative cover. However, it is likely that erosion would be minimal due to pile burn treatments, as most piles would be burned in areas with flat topography.

Alternative B: Although no roads or trails will be constructed under any of the action alternatives, Alternative B requires the operation of heavy equipment in units G, K, L, and I for machine pile/burn treatments. Units G, K, and I contain areas of moderate to severe slope (Brownstown channery silt loams of 25-75% slope) and soils with moderate to severe potential for erosion, which would limit the use of equipment. Machinery would be confined to areas with less than 40 percent slope within these units. Thus potential for erosion would be reduced in these areas. However, soil compaction and soil rutting can occur wherever heavy equipment is used. On wet or moist soils, compaction reduces water-holding capacity and infiltration rates, decreases soil permeability, increases runoff rates and sedimentation, and impedes penetration of roots, which inhibits regeneration of vegetation. Environmental impacts can be minimized by limiting machinery use to dry soils, and to periods when soils are most resistant to compaction and rutting. Project activities would include *Forest Plan* standard mitigation measures for soil and water (USDA FS 1991a). Any disturbed areas would be seeded and mulched following project completion to prevent erosion until vegetation is reestablished (see Appendix B).

Under Alternative B, units A, F, H, and N would be broadcast burned. Most burn activities on the forest allow retention of a duff layer covering the soils after the fire, and only rarely are conditions extreme enough to result in areas of bare soil (USDA FS 2000b). As a result, potential for erosion is low. Units F, H, and N contain some steep slopes, with moderate to severe potential for erosion. Several of these units, notably units A, F and N, have large areas of occasionally flooded soils. Tributaries flow throughout all these units. Therefore, thus it is important that mitigation measures be followed to protect these riparian areas. Fire line construction will occur in small portions of Units A and F, but will occur along the entire perimeter of Unit N and most of the perimeter of Unit H. A total of 50,659 linear feet of fire line will be constructed in broadcast burn units. Fire lines will be constructed mostly by hand and erosion should be negligible. Portions of Units A and F adjacent to streams will also be used as natural fire breaks. Effects to riparian areas from broadcast burns should be minimal because vegetation near streams that tends to stay green and burn less readily than leaf litter, thus leaving an unburned strip of vegetation or buffer between the fire unit and streams or other wet areas. Water may also be withdrawn from area streams to wet the burn perimeters and minimize potential for fire escape from broadcast burn units. Standard mitigation measures for soil and water and mitigation measures for SMZs will also be followed to minimize effects on soil and water quality from broadcast burn treatments (USDA FS 1991a).

Isolation treatment in Unit E will involve construction of fire lines (approximately 13,682 linear feet) to isolate areas of heavy fuel loading from surrounding Unit F and nearby areas of private property. However, most of the isolation units (units C, D, E, J and M) are near existing fire breaks such as roads, old logging trails, hiking trails, and pipeline clearings, which should minimize construction of fire lines and soil disturbance. Pile treatments will require minimal clearing of debris in a perimeter surrounding the piles and it is possible that piles will burn down to mineral soil. Erosion of this mineral soil is unlikely given that piles would be constructed in flat areas rather than on slopes.

Alternative C: Direct and indirect effects on soil from burn treatments under this alternative would be similar to effects of Alternative B. However, Alternative C requires a reduction in broadcast burn treatments from 58 percent of the Project Area acreage in Alternative B to only two percent of total acreage. Thus, potential negative effects to soil and plants that aid in soil retention would be greatly reduced under this alternative. Only 3,153 linear feet of fire line would be constructed under Alternative C, as opposed to construction of 64,341 linear feet of fire line under Alternative B. Pile burn treatments affect seven percent more area under this alternative and machine pile burns are increased by one percent over Alternative B. Isolation treatments would be increased to 65 percent of the Project Area from 17 percent under Alternative B. The result of which could be increased wildfires in the future. Significant damage to forest vegetation could occur with a subsequent increase in erosion potential.

Alternative D: Under the no action alternative, erosion from machinery, fire line construction, or burn treatments would not occur. However, leaving fuels to continue to accumulate could result in a high-intensity, damaging fire in the future. These high-intensity fires could lead to the death of normally fire-tolerant canopy trees, such as oaks. Fire intolerant communities, such as beech-maple forests, which occur on north and east slope aspects and as the understory of oak-hickory forests, could experience substantial damage from uncontrolled wildfires.

With an increasing number of large, uncharacteristically damaging fires, large areas of forest could be destroyed, leading to soil erosion and loss of site stability and productivity (USDA FS 2000c). Also, since wildfires and escaped campfires/arson fires usually occur during dry summer months (as opposed to prescribed burns conducted in winter months), forest fuels burn more readily, resulting in more complete consumption, larger areas of exposed soil and higher erosion rates. Higher rates of soil loss could lead to excessive sedimentation of area streams, which could negatively affect water quality.

7.2.3 Cumulative Effects

The area of consideration for cumulative effects covers the South Fork Salt Creek-watershed and Negro Creek, Henderson Creek, and Tipton Creek sub-watersheds. Roughly 42 percent of the South Fork Salt Creek watershed area is National Forest System (NFS) land (USDA FS 2001e).

It was not uncommon for large areas within the HNF boundary to have burned regularly before their acquisition by the federal government. Some areas were acquired as recently as the 1970's for inclusion into the HNF (Olson 1996). Activities that have occurred in the recent past on NFS land include salvage logging and other timber harvesting, site preparation activities, road building, trail construction, and planting of vegetation. Planting of pines and suppression of fire on federal land has led to high levels of fuel throughout NFS lands, but far reduced rates of erosion and sedimentation (USDA FS 2001e). Recent management activities on Federal land have resulted in only minor impacts to soil and watershed health, probably because of adherence to forest mitigation measures for soil and water (USDA FS 1998b).

Trails built to agency standards for protecting soil and water resources generally allow sustained use without adverse affects to natural resources. However, in March 1996, a National Forest closure order

(No. 09-12-10) limited horses and bicycle use on the HNF trail system (USDA FS 1996c). The closure was meant to reduce effects on soil and water resources. Many trails on the HNF remain obstructed by trees downed by the 1996 storms. Trees were removed from many officially designated trails but left on unofficial trails, which has also reduced erosion in these areas.

There are no future timber removals or fuel reduction activities planned for the treatment areas that should result in soil erosion or degradation of water quality. It is expected that continued vegetation management will occur in these areas in various forms. However, any future soil disturbance involved in daily maintenance activities will be mitigated by *Forest Plan* standards and guidelines and should yield minimal cumulative effects. Positive effects on soil and water quality should occur as a result of ecological restoration and vegetation management activities.

On private land, practices affecting soil have included forest conversion to agriculture, livestock grazing, timber cutting, and abandonment of farms leading to conversion of agricultural areas to old fields in various stages of succession. Agricultural practices and timber harvest practices are expected to continue in the future on private land. Private activities do not necessarily follow standard erosion control practices and water quality protection measures as the HNF does. As a result, many activities on private land could lead to chronic erosion and sedimentation of aquatic resources.

The use of mitigation measures during implementation of the proposed action will yield minimal and temporary effects on soil and water quality. These effects are minimal when added to the effects of past and current practices on public and private land and anticipated effects associated with future activities. Therefore, activities associated with the proposed fuels reduction project are not likely to result in substantial cumulative effects to soil and water resources.

7.3 Fisheries Concerns

There is concern that burning activities within the riparian zone may cause negative effects to fisheries of Project Area creeks. Streams and associated riparian areas will be used as natural firebreaks in several treatment units proposed for broadcast burning in the action alternatives.

7.3.1 Affected Environment

The Project Area lies predominantly within the South Fork Salt Creek watershed, and several proposed fuel reduction treatment units contain or are adjacent to the Starnes Branch of the South Fork Salt Creek. Starnes Branch within the Project Area is generally characterized as valley meanders with gravel beds, with some areas containing large boulders and gradients favoring riffles and rapids (Ewing 2000a). The Starnes Branch within the Project Area is a perennial, third order stream with several intermittent, headwater, second order streams. The substrate of third order streams is generally dominated by gravel, cobble, and boulders, with some areas containing coarse sand, providing diverse habitat (Ewing 2000a). Coarse sand and gravel bottoms, lacking large cobble and boulders, dominate second order streams within the Project Area. Water quality of Starnes Branch streams in the Project Area is good, with levels for pH, water temperature, dissolved oxygen, and conductivity within normal ranges (Ewing 2000a).

Although suitable habitat exists for many aquatic species in the watershed, sedimentation into Project Area streams and stream bank erosion may threaten the habitat of some of these species. The primary source of deposition in the watershed comes from sites other than NFS lands (i.e. agriculture). Historically, large volumes of sediment have entered the watershed from agricultural areas. Sediment has degraded water quality, down cut streams, and filled in pools of streams, reducing habitat diversity and eliminating critical winter habitat for many aquatic species (USDA FS 2001e). Sediment can also fill in gravel interstices of streambeds, which reduces spawning sites, cover for fry, and egg survival of fishes (AFS 2000). Sediment alters availability of fish food, promoting silt-tolerant midges and worms and discouraging aquatic insect species (mayflies, stoneflies, caddisflies etc.) that are not tolerant of silt. However, sedimentation is probably decreasing in recent times due to changes in land use and conversion of farmed areas to natural forested areas. Approximately 74 percent of the South Fork Salt Creek watershed is now forested, with 42 percent managed by the USDA Forest Service (USDA FS 2001e). Despite these improvements in water quality, the South Fork Salt Creek watershed still ranks 19th out of 20 fifth level watersheds on the HNF for overall watershed integrity (USDA FS 2001e).

In addition to sedimentation and associated non-point source pollution from agriculture, the South Fork Salt Creek has been negatively impacted by significant habitat alteration. The Army Corps of Engineers constructed Lake Monroe in the mid 1960's for flood protection, low-flow water augmentation of the White River, to provide a source of drinking water, and as a recreational resource (USDA FS 2001e). Prior to construction of Lake Monroe, the Indiana Department of Natural Resources (IDNR) treated all lake tributaries, including South Fork Salt Creek, with rotenone (USDA FS 2001e). The purpose of the pesticide treatment was to reduce native fish species populations (rotenone is rarely 100 percent effective), thereby reducing competition and benefiting stocked game fish populations in Lake Monroe. The effects of rotenone on overall fish diversity within the watershed are unknown.

Profound changes in both fish species composition and abundance in the South Fork Salt Creek occurred after the impoundment of Lake Monroe (Ridenour and Johnson 1974). Habitat alterations have changed the aquatic species assemblage of the South Fork Salt Creek from one favoring stream species to one favoring lake species. Data indicates declining numbers of stream species such as darters, shiners, and madtoms throughout the basin compared to pre-impoundment records (USDA FS 2001e; Ridenour and Johnson 1974; McReynolds and Aderkas 1962).

In 1998, the USDA Forest Service surveyed for fish along a 230-meter stretch of the Starnes Branch of the South Fork Salt Creek separating proposed treatment units A-3 and B (see Figure 2). Table 12 shows the species of fish collected during this survey, their status within the South Fork Salt Creek watershed, and historical collection information from 1974, 1962, 1942-1943, and 1885.

Table 12: Starnes Branch Fish Assemblage, Status, and Historical Collections

Common Name	Scientific Name	Status Within Watershed*	1998	1974 **	1962**	1942-1943**	1885**
Creek chub	*Semotilus atromaculatus*	A	X	X	X	X	
Central stoneroller (minnow)	*Campostoma anomalum*	A	X	X	X	X	X
Orangethroat darter	*Etheostoma spectabile*	U	X		X	X	
White sucker	*Catostomus commersoni*	U	X	X	X	X	X
Grass pickerel	*Esox americanus*	C	X	X	X		X
Brook silverside	*Labidesthes sicculus*	--	X	X (not in South Fork)			
Spotted bass	*Micropterus punctulatus*	C	X	X	X	X	
Longear sunfish	*Lepomis m. megalotis*	--	X	X	X	X	
Bluntnose minnow	*Pimephales notatus*	A	X	X	X	X	X
Bluegill	*Lepomis macrochirus*	C	X	X	X	X	

* Status determined from South Fork Salt Creek Watershed Analysis (USDA FS 2001e): A=Abundant; U=Uncommon; and C=Common.

** Data source: Ridenour and Johnson 1974; McReynolds and Aderkas 1962. Information for Gerking 1942-43 and Gilbert 1885 fisheries surveys from McReynolds and Aderkas 1962.

In a 1974 survey, no orangethroat darter (*Etheostoma spectabile*) were detected at any of the sample sites within the Salt Creek basin (Ridenour and Johnson 1974). Creek chubs (*Semotilus atromaculatus*) comprised approximately 30 percent of all fish collected at one site in the South Fork Salt Creek in 1974, which is similar to their composition in 1998 in the Starnes Branch.

In 1998, creek chub and orangethroat darter comprised 55 percent and 28 percent, respectively, of all fish collected in the Starnes Branch of the Salt Creek (Ewing 1998). The 2001 South Fork Salt Creek Watershed Analysis listed the orangethroat darter as an uncommon species, which is present in the watershed but not always seen, and creek chubs as a species that is common and numerous within the watershed (USDA FS 2001e). It is not clear why the abundance of orangethroat darter was so high in the Starnes Branch during the 1998 USDA Forest Service survey. However, these fish are known as a mobile, “pioneering” species that can recolonize disturbed areas or formerly dry streambeds, and are more tolerant of increased water turbidity and siltation than other darter species (INHS 1999; OHDNR 2002). Thus, it is possible that orangethroat darters are flourishing in the Project Area following disturbance caused by the 1996 blowdown.

Most fish species found in the Starnes Branch are abundant or common and there are no records of any Federal or State listed fish in the South Fork Salt Creek watershed (USDA FS 2001e). The South Fork

Salt Creek watershed as a whole is ranked in the lower third with regard to fish species composition and diversity when compared to other watersheds in the HNF (USDA FS 2001e). It is not possible to determine effects of the tornado blowdown on fish abundance or species composition within the Starnes Branch or to detect historical trends due to lack of comparable baseline fisheries information for the Project Area prior to 1996. It is probable that the Starnes Branch of the South Fork Salt Creek has experienced the same general shift in species composition and abundance as the Salt Creek basin itself, from stream fish species to lake or game fish species. This is evidenced by the collection of several game species such as the bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis m. megalotis*), and spotted bass (*Micropterus punctulatus*) observed during the 1998 fisheries survey of the Starnes Branch (Ewing 1998).

7.3.2 Direct and Indirect Effects

Implementation of any of the proposed action alternatives would not likely affect fisheries and other aquatic species in the Project Area. Severe effects of fire are not anticipated from prescribed burn treatments due to the low intensity of most prescribed fires and the presence of a riparian vegetation buffer and humid micro-climate near most streams that is largely resistant to fire (USDA FS 2000b). Minor sedimentation into Project Area streams could occur as a result of prescribed burns reaching the riparian zone in some treatment units; however, this increase in sedimentation is expected to be temporary and minimal. Erosion potential and runoff from silty loam soils near Project Area streams should be generally low due to fairly high infiltration and permeability of soils, and primarily flat topography. Some destruction of riparian vegetation could increase sun exposure to the stream, but significant changes in water temperatures are unlikely. The Project Area has already lost considerable vegetation and timber in riparian areas as a result of the tornado blowdown, and preliminary investigations show little difference in stream water temperature regimes between blowdown affected, sunny sites and unaffected, shady forest sites (Ewing 2000b). Vegetation loss near riparian areas and any short-term effects on water temperature from prescribed burns are expected to be minor as compared to effects from the tornado blowdown. Likewise, higher flow rates during storms and increases in woody debris after prescribed burns are expected to be minimal in relation to effects from the tornado blowdown. Recent studies suggest that even in the case of high-intensity fires, local extirpation of fishes is patchy and reinvasion or recolonization of areas is rapid (Gresswell 1999). As a result, it is reasonable to assume that only minor and temporary effects to fisheries should occur as a result of implementation of any of the action alternatives.

While prescribed burns or wildfires could harm individual fish, the fish populations/species most likely to be negatively affected would be locally isolated populations or rare species with low mobility (Gresswell 1999). Since there are no listed fish species within the South Fork Salt Creek watershed, it is unlikely that any sensitive or rare fish would be harmed by prescribed burn activities (USDA FS 2001e). In addition, recent and historical fisheries survey data suggests that the entire watershed is dominated by fairly common lake and stream fish species that are not rare or locally isolated (USDA FS 2001e; Ridenour and Johnson 1974; McReynolds and Aderkas 1962). Orangethroat darters, which were found to be the most common fish species within the blowdown area of the Starnes Branch during a 1998 survey, are very mobile and would likely recolonize any areas temporarily disturbed by fire (Ewing 1998; INHS 1999; OHDNR 2002). Any effects to fisheries would be further minimized by adherence to *Forest Plan* mitigation measures and mitigation measures stated in Appendix B.

Alternative A: Under this alternative, 80 percent of the Project Area would be broadcast burned, 18 percent would be treated by isolation, and two percent would be treated with pile burns. Alternative A has the largest acreage impacted by broadcast burning (1,401 acres), and thus has the greatest potential for negative effects to fisheries. Several treatment units proposed for broadcast burns (A, F, G, and I) contain tributaries of the South Fork Salt Creek. It is not anticipated that broadcast burns would have a negative

effect on fisheries because the riparian buffer is largely resistant to fire. Although some sedimentation and input of ash/nutrients into area streams could occur during storm events following the broadcast burn, negative effects should be temporary and minimal due to the adherence to *Forest Plan* mitigation measures. Portions of fire lines may be constructed adjacent to area streams. However, hand methods would be used, which should minimize sedimentation. When possible, water from creeks could also be withdrawn to wet the burn perimeter, minimize damage to riparian vegetation and limit fire escape potential. Minor water withdrawals from the creek should not affect the water level of the creeks or negatively affect fisheries. Fire can also increase or decrease levels of soil nutrients depending on intensity and duration of the burn and site conditions such as vegetation, soil characteristics, topography, and climatic factors (Higgins et al 2000). In particular, nitrates, phosphate, and ammonia are known to increase in soil after fires (Higgins et al 2000). Runoff of nutrient laden soils into water bodies following broadcast burns could affect water quality and may have some temporary, negative effects on individual fish. However, burning activities are not expected to negatively affect the population viability of locally abundant and common fish species in the Starnes Branch and South Fork Salt Creek tributaries.

The tornado blowdown damaged many trees along the riparian zone, allowing more sunlight to penetrate the water surface of Project Area creeks. Proposed broadcast burns will also remove small woody debris already on the forest floor, and may damage a minimal amount of riparian vegetation. However, effects of this vegetation removal on water temperature are expected to be minimal when compared to canopy opening effects of the tornado blowdown. A recent water temperature study of the Starnes Branch did not reveal a significant difference in water temperatures between a sunny, blowdown-affected site and a shady, unaffected forested portion of the stream (Ewing 2000b). Therefore, broadcast burns are not expected to have a negative effect on water temperature that would subsequently affect area fisheries.

The USDA Forest Service also uses biodegradable fire suppressant foams as control lines during prescribed fires and for fire suppression. Fire suppressant foams contain more than 99 percent water, with the remaining one percent containing surfactants, foaming agents, corrosion inhibitors, and dispersants (USDA FS 2000d). The primary toxic effect to fish from fire suppressant foams occurs from surfactants (wetting agents) that can interfere with the ability of fish gills to absorb oxygen from the water, causing fish to suffocate (USDA FS 2000d). To minimize potential effects on fisheries, the following mitigation measures would be taken: foams would be applied at least 50 feet away from all water bodies; mixing and loading points for foams would be located away from the water; equipment and check valves would be maintained to prevent accidental releases of foam; and portable pumps that draw water out of area creeks will contain check valves to prevent flow of contaminated water back into the creek.

Pile burns would be located away from riparian resources and should have no effects on fisheries. Isolation treatments could have indirect effects on fisheries, if severe wildfires occur in areas of blowdown in the future. However, future wildfires would likely be confined to the isolation units due to a lack of fuel in previously treated adjacent areas. Due to the large distribution and high mobility of fish species within Project Area water bodies, there should be no long-term, negative impacts to fisheries due to prescribed burn activities under this alternative.

Alternative B: Under this alternative, 58 percent of the Project Area would be broadcast burned, 23 percent would be treated with machine pile/burns, 17 percent would be treated by isolation, and 2 percent would be treated by burns of existing piles of woody debris. Effects of proposed broadcast burns on fisheries within treatment units A and F would be similar to those listed for Alternative A above. However, potential negative effects to fisheries would be less due to the smaller area proposed for broadcast burn treatments (1,014 acres).

Machine pile and pile burn treatments are proposed for 25 percent of the Project Area and have potential to cause some soil scarification, erosion, and displacement. However, when possible, these burn

treatments would be located outside of riparian areas and on flat areas or slope contours to minimize possible erosion and sedimentation into nearby surface waters. Thus, effects of pile treatments on fisheries should be negligible. Adherence to *Forest Plan* mitigation measures and mitigation measures in Appendix B would further minimize any potential negative effects to fisheries. There would be no direct effects of isolation treatments on fisheries.

Alternative C: Under this alternative, 65 percent of the Project Area would be treated by isolation, 24 percent would be treated by machine pile/burn, 9 percent would be treated with pile burn treatments, and 2 percent would be broadcast burned. Isolation treatments, machine pile/burn, and pile burn treatments would have no direct effects on fisheries. When possible, pile and machine pile/burn treatments would be located outside of riparian areas. Isolation treatments could cause indirect, negative effects to fisheries in the future should a severe fire ignite in areas of heavy fuel load accumulation.

Portions A2 and A3 of the Starnes Unit are the only areas proposed for broadcast burn treatment (38 acres) in Alternative C. The A2 portion of the treatment unit does not contain a riparian area and thus, there would be no effects on fisheries from a broadcast burn in that area. The western border of Unit A3 (approximately 30 acres) consists of a portion of the Starnes Branch Creek and a road lies on the eastern border. Because these existing features could be used as firebreaks, only a very small amount of fire line would need to be constructed, which should minimize soil disturbance. Although minor sedimentation into the Starnes Branch may occur, it is not anticipated that the broadcast burn will have substantial negative effects on fisheries due to the small area of the proposed burn, and the existence of a riparian vegetation buffer and humid micro-climate near the stream that is largely resistant to fire (USDA FS 2000b).

Alternative D: Fuel reduction treatments would not be implemented under this no action alternative. As a result, there would be no direct effects on fisheries. However, the no action alternative could result in high intensity, stand-replacing fires in areas of high fuel load accumulation, which could have potentially severe indirect effects on fisheries. High intensity fires can burn the entire organic layer of the forest down to bare soil, which often results in soil erosion and runoff laden with ash and other debris. If this runoff reaches surface waters, it can adversely affect fisheries by degrading water quality (dissolved oxygen, pH, etc.), filling in pools of streams, reducing habitat diversity, and eliminating critical winter and spawning habitat. Historically, addition of woody debris from frequent, low-intensity burns was beneficial to the stream system, triggering hydrological changes in streams and adding vital coarse substrates to stream channels, which help provide productive habitats for fish and other aquatic organisms (Rieman et al 1997). However, a severe fire could cause introduction of large quantities of woody debris into streams that cause dramatic hydrological disturbances unlike those of historical low intensity burns. Severe wildfire could destroy the riparian buffer that reduces overland water flow and provides shade. This could lead to a rise in stream flow and water temperatures (Rieman et al 1997). In addition, severe fire can increase landslide potential by killing the anchoring root systems of stream bank vegetation that retain soil. Landslides not only add sediment to streams, but also change the geomorphology and shape of the stream bank, which is important for many fish species. Storm events in areas affected by severe wildfires often result in flash flooding, which can kill fish directly or wash them out of the floodplain, resulting in mortality.

In the future, to ensure firefighter safety, the use of fire retardants and suppressant foams may necessary on large fires. Use of these compounds could result in adverse effects to area fisheries, especially if chemicals are sprayed directly into streams or if they runoff into streams (USDA FS 2000d). Given the difficulties in controlling the overspray from aerial drop of fire retardants/suppressants, it is possible that some of these chemicals could contaminate area streams. The duration of toxic effects on fisheries would depend on the volume of retardant dropped, size of water body, and flow of water in the affected stream or water body (USDA FS 2000d).

Long-term effects of fire on fisheries are not well known; however, recent evidence suggests that even in the case of severe fires, local extirpation of fishes is patchy and temporary. Recolonization of streams in disturbed areas is usually rapid, unless fish populations have very low mobility, are very rare, or locally isolated due to anthropogenic activities. Thus, the no action alternative is not likely to affect the long-term viability of any fish species in the Project Area.

7.3.3 Cumulative Effects

Cumulative effects include consideration of past, present, and reasonably foreseeable future actions that could add to or compensate for effects on fisheries due to the implementation of the proposed action. The effects of prescribed burning activities on fisheries would be minimal when compared to degradation of water quality caused by agriculture and development. Any effects of the proposed treatments would be temporary and minimal in comparison to past alterations to the watershed and effects to area streams caused by the tornado blowdown of 1996.

Implementation of any of the proposed action alternatives, when added to other fires in the foreseeable future has the potential to increase sedimentation, damage riparian vegetation, change water flow, and elevate stream water temperatures. These adverse effects could impact aquatic or aquatic-dependent sensitive wildlife species. However, adverse effects from future prescribed burns or wildfires are expected to be temporary, as recent research suggests that recolonization of fire-affected streams is usually rapid unless fish populations are limited in distribution or very rare (Gresswell 1999). Fish populations within the Project Area are not rare and there are no Federally listed or State listed fish or mussel species known in the South Fork Salt Creek watershed. Therefore, it is not anticipated that the proposed action would have adverse cumulative effects on fisheries.

7.4 Wildfire Threat

Many people believe that lightning-ignited wildfire is not a threat in the moist, deciduous forested conditions of the HNF and this is reflected in a perceived low incidence of fire on the HNF. Some public commenters indicated that they felt the quantity and condition of fuel loads in the blowdown areas does not cause a high enough fire risk to adjacent private property to justify a fuels reduction treatment. Other public comments addressed the fact that past fires have all been quickly controlled due to their small size and a preponderance of community fire fighters in the area.

7.4.1 Affected Environment

The historical occurrence of fire in south-central Indiana and the HNF area is evidenced directly by first-hand accounts of smoke and fire by early European travelers to the eastern United States, and indirectly by the character of existing forests and forests described by early visitors (Olson 1996). It is believed that fires, prior to European settlement of the region, were primarily caused by Native Americans and lightning. Generally, lightning ignited fires occurred in late summer in the Midwest under dry conditions, while fires set by humans occurred most often in spring and fall and were associated primarily with agriculture, hunting, and vegetation control. The writings of early travelers in the United States, including Federal General Land Office surveyors, associate this region with brushy forests that could be attributed to frequent fire (Marks et al 1992; Ladd 1991). Areas within the HNF boundary are known to have burned fairly regularly up until the time that they were acquired by the Federal government in the 1970's (Olson 1996).

The dominance of oaks in the central hardwoods of south-central Indiana is another indication of the importance of fire in the Midwest, as frequent occurrence of fire and creation of openings in the forest

canopy are necessary in order to maintain the diversity and maintenance of oak forests (Olson 1996). Since fire suppression began on the HNF, many oak forests and woodlands have become closed forest stands that are slowly converting to more shade-tolerant maple and beech trees. The *Forest Plan* states that if left alone, the oak-hickory forest type will not regenerate and will move toward the maple/beech forest type (USDA FS 1991a).

Lightning ignited fires on the HNF have been rare since 1973. According to HNF fire data, there have been a total of four fires burning approximately one-third of an acre on Federal property and 2.1 acres on private property. USDA Forest Service firefighting personnel and local cooperating fire departments quickly extinguished these fires. However, if left uncontrolled, these fires could have burned extensive acreage throughout the area. Additionally, a future lightning strike in a blowdown area with a heavy fuel load could cause a high-intensity fire that could be too difficult or dangerous to control.

Although naturally caused fires in the Project Area have been rare in the last 28 years, anthropogenic fires have been frequent. As mentioned in Section 3 of this document, there have been 479 fires on both NFS property and private lands within one mile of HNF lands in the period from 1973 to 2001 (Table 1, page 5). Of these 479 fires, 178 fires burned HNF property. Seventy-four percent of fires in the last 28 years burned an area of one acre or smaller. Only three fires burned over 50 acres and one fire burned over 100 acres of HNF land. Approximately 34 percent of fires that burned over one acre of land occurred in 2001 alone, which may be an indication of increasing flammability and fuel loading on the HNF.

The leading causes of fires from 1973 to 2001 were debris burning, arson, improper discarding of smoking materials, and unattended campfires (Table 2, page 5). Fires caused by arson burned the most acreage both within the HNF and within a one-mile perimeter. Unattended campfires are common on the HNF and burned the second highest acreage of NSF land from 1973 to 2001. The source of the largest fire on HNF land was an unattended campfire, which burned 140 acres of NFS land and one acre of private land in 1988. Fires caused by burning of debris were the primary cause of fire occurrence within NFS and nearby private land and burned the second highest acreage of land. Interestingly, 45 of the 153 fires (30 percent of the fires since 1973) caused by burning of debris occurred in 2001 alone and 88 (58 percent) of these fires have occurred since the April 19, 1996, blowdown date. This may be an additional indication that fuel loads, in combination with environmental conditions, are influencing occurrence of fire on HNF in recent years.

The relatively small area of HNF burned by fires since 1973 is an indication of the effectiveness of fire suppression efforts by the USDA Forest Service and local fire departments. However, the threat of fire continues to be real and constant. Years of fire suppression, combined with an unnaturally high fuel loads in the Project Area, have the potential to fuel fires that would be extremely dangerous to both firefighters and adjacent landowners. High-intensity fires also have the potential to destroy structures on residential properties adjacent to NFS land, which continue to increase each year.

7.4.2 Direct and Indirect Effects

Alternatives A and B: These alternatives emphasize the use of prescribed burns to reduce woody fuel accumulations caused by the blowdown. Broadcast burns, which most closely approximate natural wildfires, would be emphasized with 80 and 58 percent of the Project Area being treated by this method in Alternatives A and B, respectively. However, approximately 17 to 18 percent of the Project Area would be treated by isolation, which means that no burning would be employed directly to these units to reduce likelihood of fire. Instead, surrounding areas would be treated to reduce fuel loads, thus preventing the spread of future fires from isolation units. Pile burns, proposed for two percent of the Project Area, would reduce fuels on the forest floor, which should improve tree, shrub, and herbaceous

plant regeneration, especially for oaks. Since pile burn treatments would restrict burning to localized areas, effects on maintaining vegetative diversity would be minimal with these treatments. Machine pile burns would have the same effect on reducing the likelihood of wildfire as pile burns, but are only proposed for Alternative B (23 percent of the Project Area).

Alternative C: This alternative differs from Alternative A and B in that less area (only two percent of the Project Area) would receive broadcast burn treatments and a greater percentage of the Project Area (65 percent) would be treated by isolation. Alternative C recommends 1,363 and 976 fewer acres of broadcast burn treatments than Alternatives A and B, respectively. Effects of pile and machine pile burn treatments are similar. This alternative would address concerns raised by members of the public who are opposed to large scale burning on the forest. However, Alternative C would still allow treatment of concentrated areas of heavy debris with machine pile and pile burning (578 acres). A total of only 38 acres would benefit from light openings and reduction in understory that broadcast burns provide.

Alternative D: Under the no action alternative, no prescribed burn treatment would be conducted, which would concede to some public opinion that fires are not common and unlikely to cause substantial damage to the HNF and adjoining properties. This alternative would also respond to an opinion expressed by a member of the public during project scoping that money could be better used on other HNF management activities. However, this alternative would not address reduction of fuels in the Project Area that are two to nine times higher than natural conditions in areas not affected by the tornado blowdown.

7.4.3 Cumulative Effects

A February 10, 1993 decision to conduct a prescribed burn on approximately 250 acres in the Fork Ridge Area of HNF was carried out. However, no prescribed burn fuel reduction projects of the large scale proposed by this project have been implemented on the forest. Some debris resulting from past blowdowns, storms, and natural processes has been burned along roads and trails when needed to maintain access or reduce safety hazards in small areas. Prescribed burns have been implemented recently on state-owned property and on the adjacent Maumee Boy Scout Reservation as part of fuel reduction efforts. Burns have also been conducted routinely on private property to reduce fuels associated with storms and to clear forestland for developments and agriculture.

As previously discussed, forests in the region have adapted to fire over a considerable period of time. Natural and anthropogenic fires have been fairly frequent over the last 28 years both on NFS lands and private property. Accumulation of woody debris from blowdown and other natural processes can remain as combustible fuel for a decade or longer, depending on rates of weathering and decay. As a result, wildfires derived from natural and human causes will continue to occur in the future. Fire will continue to be used on private property in the future by citizens clearing their land or when camping and recreating on the HNF.

Cumulative effects associated with the no action alternative include leaving blowdown debris to contribute to the present fuel load on the HNF. Failure to reduce fuel loads may result in uncontrollable, highly destructive fires in the future. Cumulative effects associated with prescribed burn activities under the action alternatives (Alternatives A, B and C) should be minimal when compared to other past, present, and future actions in the region.

7.5 Forest Health Effects and Effectiveness of Fire Management

Several issues were raised concerning the potential impacts that prescribed burning may have on the health of the forest. In the years since the blowdown, some of the downed timber has begun deteriorating and regeneration is occurring at various rates in the proposed Project Area treatment units. Many people feel that the forest would be better off left to regenerate and recover naturally and that burning would negatively affect the current overall health and condition of the HNF.

7.5.1 Affected Environment

Undoubtedly, some deterioration of woody debris has occurred since the 1996 blowdown. Many areas were also salvage logged, which substantially reduced fuel loading in some of the proposed treatment units. However, most of the remaining woody debris is comprised of white oak and white pine, which are very resistant and moderately resistant to decay, respectively. These fuels deteriorate very slowly and can remain on site for an extensive period of time. Fuel loading is still over twice the normal load for hardwood stands and three to four times higher than normal for pine stands affected by the blowdown. Some pine stands have fuel loading over nine times higher than nearby unaffected areas with similar vegetation (USDA FS 2001b, 2001c).

The different treatment units are undergoing varying rates of tree, shrub, and herbaceous plant regeneration. Some areas that have been salvage logged and have had considerable amounts of downed material removed from the forest floor have substantial areas of plant regeneration, while other areas with heavy accumulations of debris have minimal regeneration, as plants cannot penetrate the layer of woody slash. Invasive species are also colonizing many forest openings created by the blowdown. Species such as crown vetch (*Coronilla varia*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*) and garlic mustard (*Alliaria petiolata*) are adapted to invading disturbed woodlands and are quickly displacing native species. These species tend to invade natural plant communities through use of "disturbance corridors", the result of which is a negative effect on forest health through reduction of plant diversity, and degradation of habitat for native wildlife (Hedge 2002).

As previously discussed, forested areas in south-central Indiana have adapted to fire over thousands of years, and therefore should not be negatively affected by low-intensity fires characteristic of prescribed burning activities. Growing consensus is that the central hardwoods may, in fact, be fire dependent (Olson 1996). In fire dependent ecosystems, fire is essential to the health and functioning of the natural system. In such systems, fire is an important factor "that initiates and terminates key vegetation succession, regulates the age structure and species composition of vegetation, produces the vegetation mosaic on the landscape, affects insects and plant diseases, influences nutrient cycles and energy flows, regulates the productivity, diversity, and stability of ecosystems, and determines the habitats of wildlife" (Olson 1996). Specifically, using prescribed burns in the HNF could help mimic natural fire patterns that historically were vital components of these forests. Prescribed burn treatment could also reduce outbreaks of insects and diseases, provide germination sites for shade-intolerant species, release nutrients, and create additional food and habitat for wildlife. However, prescribed fire must be analyzed on a site-specific basis to determine its effects on soil, water, plants, and animals.

7.5.2 Direct and Indirect Effects

Alternative A: Alternative A calls for broadcast burn treatments across 80 percent of the Project Area. Isolation treatment is proposed for 18 percent and two percent would be treated with pile burns. Broadcast burns would most closely resemble natural fire, or fires set by Native Americans that historically affected these forests. Broadcast burns would reduce woody debris and have the potential to reduce outbreaks of

insect and disease, provide germination sites for shade-intolerant species, release nutrients, and create additional food and habitat for wildlife. This type of burn also has an added advantage of potentially controlling or limiting the expansion of non-native, invasive species in the blowdown area. Low intensity broadcast burns stimulate natural regeneration within the treatment units. Pile burn treatments would be confined to localized areas of treatment units. These treatments would still be beneficial to forest health in reducing fuel loads, minimizing the likelihood of stand-destroying or stand-replacing fires, reducing abundance of rotting debris that could increase spread of insects and disease, and increasing sites for shade-intolerant plants to germinate.

Alternative B: This alternative would provide benefits similar to those under Alternative A. Fifty-eight percent of the Project Area would be broadcast burned, 17 percent treated by isolation, and 25 percent and two percent treated by machine pile burn and pile burn, respectively. Therefore, Alternative B offers the same positive effects on woody debris, insects and disease, regeneration, controlling invasive, exotic species and stimulating natural regeneration as Alternative A, but to a lesser extent. Pile and machine pile burn treatments would be confined to localized areas of treatment units and would provide some of the same forest health benefits over a limited area.

Alternative C: Under this alternative, 65 percent of the Project Area would be treated by isolation, which is a 47 and 48 percent increase, compared to Alternative A and B, respectively. The consequences of deferring treatment in these areas could be considerable in areas of heavy fuel accumulation. However, isolation treatments for these areas were chosen largely because of limited access or escape routes for firefighters and/or because of good plant regeneration and deterioration of debris in these areas. Isolation units would need to be monitored over time to identify insects and disease that could spread to nearby areas of the forest. Private landowners that own property near isolation areas and recreational users of the isolation treatment units would need to be made aware of the potential for wildfires in these areas. Accumulation of debris and wildfire hazard would continue to increase in these areas over time. Approximately nine percent and 24 percent of the Project Area would be treated by pile burn and machine pile burn, respectively, under this alternative. These areas would receive the same beneficial direct and indirect effects to forest health as mentioned for pile treatments above. Only two percent of the Project Area would receive broadcast burns, which would limit beneficial effects to forest health that these treatments can provide, as described in Alternative A.

Alternative D: It cannot be assumed that the no action alternative would have no effects on forest health in the Project Area. With selection of any alternative, wildfires will continue to occur, and will reduce fuels and future risk of fires, but also could potentially damage natural resources. Fuel loads will also increase with continued fire suppression activities, adding to risk of fire and threats to forest health. These points are emphasized in the 2000 USDA Forest Service "Protecting People and Sustaining Resources in Fire-Adapted Ecosystems-A Cohesive Strategy," which provides a 15-year treatment schedule to reduce wildland fire risk, protect communities, and restore and maintain forest ecosystem health in the interior West and southern United States (USDA FS 2000c). The document asserts that the public and USDA Forest Service cannot continue to depend on bigger and better fire apparatus, and increasing levels of firefighters to control potentially high-intensity fires in the future. When fuel loading becomes excessive, fire behavior can overwhelm even the best firefighters and fire plans, and suppression becomes dependent on relief from either weather or a break in the fuel layer (USDA FS 2000c). Taking no action to create breaks in the fuel layer now could result in ecological damage to the forest in the future, including stand destruction, erosion, soil nutrient and moisture loss, loss of organic material, irreparable damage to tree roots, and increased susceptibility of forests to insects and disease.

7.5.3 Cumulative Effects

Some debris resulting from past blowdowns, storms, and natural processes has been burned along roads and trails when needed to maintain access or reduce safety hazards in small areas. Prescribed burns are also used to maintain native grasslands and woodland openings for wildlife. However, there have been no large-scale prescribed burns of forests on NFS property for the sole purpose of improving forest health.

Prescribed burns to reduce fuel loading associated with the blowdown have occurred recently on State-owned property and on the adjacent Maumee Boy Scout Reservation. Burns have also been conducted routinely on private property to reduce fuels associated with storms and to clear forestland for developments and agriculture. Past fuels reduction efforts on Federal and private have probably provided cumulative health benefits to area forests by reducing spread of insects and disease, reducing potential for natural or human caused high-intensity wildfires, and providing germination sites for shade-intolerant vegetation.

Natural and anthropogenic fires have been fairly constant over the last 28 years both on NFS and adjacent private property. Fire will continue to be used on private forests in the future by citizens managing their land or when camping and recreating on the HNF. Accumulation of woody debris and wildfires caused by natural and human causes will continue to occur in the future on both public and private land. Wildfires will continue to be suppressed on HNF and adjacent land in the near future, affecting forest health, composition of vegetation, and wildlife habitat.

The no action alternative will allow blowdown debris to remain and contribute to the present fuel load caused by decades of fire suppression activities. The cumulative effects of this action, when combined with past, present, and future actions of public and private interests, could lead to an uncontrollable, highly destructive fire in the future. Alternatives A and B would substantially reduce accumulations of woody debris in the blowdown area, which should lead to a reduced probability of fire in the future and positive cumulative forest health effects. Implementation of Alternative C would also result in positive cumulative effects on forest health due to fuels reduction by pile treatments, but would treat a smaller area than Alternatives A and B. Thus, positive cumulative effects on forest health would be less under Alternative C than Alternative A and B.

7.6 Economic Concerns

Some comments from the public expressed concern that the proposed fuels reduction project is not the best use of HNF funds and that forests such as the HNF with low fire risk were not the intended targets of Federal money allocated for fire control. Another issue raised was that fuel reduction activities to reduce the risk of damage to private land and residential structures would be more effective at the private property-wildland interface.

7.6.1 Affected Environment

The USDA Forest Service National Fire Plan (USDA FS 2001f) includes implementation of program activities in five key areas: firefighting resources; rehabilitation and restoration; hazardous fuel treatments; forest health projects; and community assistance. Funding for Indiana in FY 2001 included money to improve firefighting staffing and resources to provide prompt initial suppression on wildfires; money for targeting fuel management and reduction on high-priority areas (especially wildland-private property interface areas); and money for enhancing community capacity to reduce wildfire risk and expand local economic opportunities (USDA FS 2001f).

There is increasing controversy over the use of Federal funds for fire suppression and fuels reduction activities. Many public commenters felt that wildfires were generally rare in the HNF and that spending money on fuels reduction was based on availability of Federal funds rather than need. Data presented previously in the "Wildfire Threat" and "Purpose and Need" sections of this document emphasize that, although wildfires have been fairly numerous since 1973, most wildfires have been small in extent. This is also true for available data on wildfires on all Federal lands: 58 percent of all fires are ¼ acre or less in size; 88 percent of fires are under 10 acres; and 96 percent of all fires are under 100 acres (Ingalsbee 2001). However, data also shows that 94 percent of all acreage burned every year comes from just two percent of all fires and that this two percent of all fires account for over 97 percent of total nationwide suppression expenditures (Ingalsbee 2001). Thus, it is the type and intensity of the fire and not the quantity that determines costs in many instances.

There is also evidence that the number of fires has decreased, while the amount of acres burned has increased nationwide. Fire suppression costs have also been rising due to increased size of fires, escalating costs of equipment, and increasing reliance on private contract firefighting companies due to reductions in Federal firefighting workforce (Ingalsbee 2001). A press release from Taxpayers for Common Sense reported that from January to September 25, 2001, NFS acreage burned was less than a quarter of the total acreage burned in 2000, but estimated that suppression costs per acre were expected to exceed $1,340 an acre nationwide, an increase of over 270 percent from the pervious year's suppression costs. Due to these economic issues, there is also pressure by many organizations to shift focus in Federal fire/fuels management policies away from fire suppression to reducing fuels through prescribed burning. Timothy Ingalsbee of the American Lands Alliance states "Analogous to the medical profession, we have the ability to spend enormous funds doing amazing emergency interventions in catastrophic situations, but not spend smaller, sustainable amounts of money in preventative measures for forest health" (Ingalsbee 2001).

7.6.2 Direct and Indirect Effects

Despite past levels of fire in the HNF, nationwide data show that it only takes the rare occurrence of fire in an area with a particular combination of conditions to drastically increase fire suppression costs. The action alternatives of the present fuels reduction project address many public economic concerns by using Federal funds to reduce fuels in a more controlled and cost effective manner than potentially costly fire suppression efforts in the future. Action alternatives also attempt to reduce woody debris in wildland-

private property interface areas where possible. However, hazards to firefighter and public safety preclude fuels reduction activities in some interface areas. These areas would continue to be monitored in the future by USDA Forest Service firefighting personnel.

When discussing project alternatives, the economic differences are incremental, so the analysis of effects includes only variable costs. Fixed costs such as general administration, production of the EA, and program management do not change considerably among alternatives, thus these costs are not included. The no action alternative (Alternative D) still includes general administration, EA production costs, and program management costs associated with this project, and could include additional costs in the future if fuel accumulation warrants future action in these areas. The economic analysis estimates only USDA Forest Service costs (See Table 13). Estimates are based on historical costs for similar projects in the Eastern Region of USDA Forest Service (USDA FS 2002a).

These estimated costs per alternative are based on the expense of fuel reduction treatments. The action alternatives also provide other benefits to wildlife habitat and promote biological diversity, as well as possibly improving conditions for gathering products, providing greater hunting access opportunities, providing a safer environment for visitors, reducing threats to forest health, and providing a safer wildfire suppression environment. However, these benefits are not quantified in the economic analysis, since estimating values of these benefits in monetary terms is very difficult and limited accuracy would not allow for comparison.

Table 13: Direct Costs of Project Alternatives

Treatment Option	Cost per Acre	Alternative A Costs	Alternative B Costs	Alternative C Costs	Alternative D Costs
Equipment rental (D-6 or D-7) and operator expenses for raking and piling of blow down material (preparation for machine pile burn treatments)	$500.00	$0	$205,000 (410 acres)	$212,500 (425 acres)	$0
Burning of piles by USDA Forest Service personnel	$20.00	$700 (35 acres)	$8,900 (445 acres)	$11,560 (578 acres)	$0
Broadcast burn by USDA Forest Service	$200.00	280,200 (1401 acres)	$202,800 (1014 acres)	$7,600 (38 acres)	$0
Treatment by isolation	$0.00	$0	$0	$0	$0
Total Costs		$280,900	$416,700	$231,660	$0

Alternatives A, B and C: The economic effects of each action alternative would be similar in nature, so they are addressed concurrently.

Financial Effects

The action alternative with the lowest cost for treating the 1759-acre Project Area would be Alternative C. However, under Alternative A, isolation treatments total 323 acres. Under Alternative B, 300 acres would be treated by isolation and under Alternative C, 1143 acres would be treated by isolation. When taking into account the total area burned, Alternative A costs $195.61 per acre, Alternative B costs $285.61 per acre and Alternative C costs $376.07 per acre treated. This is largely because Alternative A emphasizes treatment by broadcast burn, which is relatively inexpensive as compared to pile and machine pile burn treatments, which are increased by 410 and 543 acres under Alternatives B and C, respectively.

Based on an average wildfire suppression cost of $328 per acre, it would also seem that machine pile burn treatment preparation costs of $500 per acre would not be cost-effective. However, as mentioned above, the costs of delaying action in areas of heavy fuel loading could far exceed these treatment costs when possible increased costs of manpower, firefighting equipment, and loss of property are factored into this economic analysis.

Social Economic Effects

If one of the action alternatives were implemented, the USDA Forest Service would hire a local contractor to rake and pile blowdown material. However, trained USDA Forest Service fire suppression personnel would burn these piles. An engine crew would ignite each pile with a drip torch when conditions permit. USDA Forest Service personnel would carry out the broadcast burning with assistance from other trained personnel at Indiana Department of Natural Resources, USDI Fish and Wildlife Service, and USDI National Park Service. Some government employees and local contractors that would carry out these activities would likely be residents of the local community. Thus, there could be positive economic effects to local communities from implementation of one of the action alternatives.

Recreational Opportunities

USDA Forest Service crews cleared the multiple-use trails in the area immediately following the tornado in 1996. However, the mobility of recreational users traveling cross-country still remains restricted. For example, mushroom collectors and deer, turkey and squirrel hunters' activities are hindered by their lack of mobility through accumulated debris. However, it is difficult to calculate the cost of lost recreational opportunities in this area because recreational users have access to other NFS lands within two to five miles from the area. Recreational opportunities in the blowdown area would be enhanced by implementation of either of the action alternatives, resulting in savings to the recreational user from traveling further distances. Increases in visitation due to improved access of the blowdown area, and increased feeling of safety on the part of recreational users could lead to corresponding beneficial economic effects on the community.

Community Effects

Local communities that could be affected by wildfire are Maumee, Houston, and the Maumee Boy Scout Camp. The Maumee Boy Scout Camp has already conducted prescribed burns to reduce fuels on their land, which could help isolate their property from future wildfires on Federal land. In addition, nearby landowners in the triangle between Kurtz, Maumee and Houston could be in danger of wildfire. Because most of their structures are near county roads, it is likely that local fire departments could protect these structures in the event of wildfire, unless winds were unusually high. However, croplands, pastures, and woodlots would likely burn if a wildfire occurred. It is difficult to assess total costs of cropland losses that could occur with wildland fire in the blowdown area because the extent of possible cropland loss varies with alternative and farmer rotation schedules. However, cropland loss can be estimated using yield data from 2001 Indiana Agriculture Statistics (Redman 2002) as follows:

- Pasture and/or hayfields valued at $45.00 to $60.00 per acre (would lose one crop (3 to 4 bales per acre @ $15.00 per bale))
- Soybeans valued at $257.00 per acre (48 bushels per acre @ $5.36 per bushel)
- Corn valued at $275.00 per acre (142 bushels per acre @ $1.94 per bushel)

Monetary loss per acre of corn and soybeans alone is higher than the cost of all preventative burn treatments per acre, except for machine pile burns. The average cost of timber loss due to severe or stand replacing fires would, be $2,000 per acre for oak timber stands and $1,000 per acre for pine stands (Thake 2002). These costs would far outweigh the costs per acre of any of the prescribed burn treatments proposed under the action alternatives.

Additional social costs of a wildfire due to delayed action could include:

- **Health care costs**: Fire casualties tend to result in costs to the local health care system. Reducing these casualties will allow money and time to be used on other conditions.

- **Lost output**: Fire victims will often experience a loss of work time. This represents a reduction in production in the economy. Preventing fatalities and injuries will increase the output of the economy.

- **Emotional and physical suffering:** The emotional and physical suffering of victims is a noteworthy cost and the hardest to value. It is not possible to assess the cost to the individual experiencing an incident, since different people would be affected in very different ways. To attempt to value this would demean the trauma suffered.

- **Heritage and cultural costs:** Fire can destroy or damage property with unique cultural or heritage value. It is difficult to replace or repair these properties, and their loss has a greater value to society than merely their replacement cost.

- **Clean-up costs:** Clean-up costs could be large, as residents may have to relocate while damage is repaired. Local authorities would need to remove materials such as burnt-out cars and repair road surfaces. These are just a few examples of the many possible clean-up costs from catastrophic wildfire.

- **Wider economic distortions:** Fire, and arson in particular, can substantially affect local communities. Debris such as burnt-out cars and buildings can discourage new businesses and residents. This, in turn, can lead to higher unemployment and lower property values, reducing the funds available to the community for necessary repairs following fire incidents. Thus, it is not uncommon for a fiscal cycle to emerge that damages communities and increases social exclusion.

Alternative D: The direct costs of the no action alternative (Alternative D) are misleading, as many of the costs of delaying action on forest health are not easily quantified. However, wildlife suppression costs can be used to estimate possible future costs of not reducing fuel loads under this project. USDA Forest Service average wildfire suppression costs are $328.00 per acre according to the 2001 Hoosier National Forest - National Fire Management Analysis System (USDA FS 2002a). Assuming that some form of fire suppression would need to be done over all 1,759 acres of blowdown in the near future with no fuels reduction treatments today, wildfires could cost the Federal government over $576,952. However, this calculation is very conservative, as a wildfire in areas of heavy fuel accumulation would not be an average event and could cost considerably more per acre to suppress.

7.6.3 Cumulative Effects

Ongoing or foreseeable future actions within the Project Area that could add to the economic effects of the project alternatives include fuel reduction activities on private land and possible future prescribed burning and timber activities on adjoining private and Federal lands. Fire suppression on public and private land will continue to increase fuel loading in the Project Area, increasing likelihood of wildfire. Economic effects associated with implementation of one of the action alternatives (Alternatives A, B, and C), in combination with these future actions are not expected to be extensive. There could be positive

effects on local communities as a result of increased visitation of recreational visitors and possible employment opportunities associated with burn activities.

The potential for large, high-intensity wildfires is much larger under the no-action alternative (Alternative D) than the action alternatives. When comparing action alternatives, the potential for wildfire is higher under Alternative C than either A or B. The effects of a large wildfire, that include losses of life and property, loss of infrastructure, and damage of forest stands, could result in long-term changes in recreational use that could potentially effect local communities in a profound manner. Thus, the potential for cumulative effects on communities and local economies is likely to be much higher under the no action alternative than the action alternatives.

7.7 Issues Examined in Less Detail

7.7.1 Air Quality

Several issues were raised regarding the amount of air pollution created by the use of prescribed burns. Prescribed burning may temporarily increase the amount of smoke and particulate matter in the air adjacent to the Project Area and further add to the perceived poor air quality of Indiana.

7.7.1.1 Affected Environment

The climate of the HNF is temperate, with long, warm summers and moderate, mild winters with moderate precipitation. Many people believe that, due to the climate of the HNF, wildfires are not common. However, as discussed in the "Wildfire Threat" section of this EA, natural and human caused fires are common throughout the region. In most instances, a forest fire may only burn debris on the forest floor and understory vegetation beneath the trees, which usually produces light smoke and disperses into the atmosphere without affecting people.

Wildland fires tend to occur during the summer when debris and vegetation are at their driest and are usually completely consumed. These conditions usually result in production of three to five times more emissions than early or late-season prescribed fires (USDA FS 2000c). To further complicate this situation, atmospheric conditions are often stagnant in the summer months, trapping smoke near the ground and exacerbating affects to human health.

Prescribed fires would be set from September through April, when vegetation has more moisture and atmospheric conditions allow for smoke to rise high in the atmosphere and disperse over a wide area without affecting human health. Part of the prescribed burn criteria list, which must be fulfilled before starting any fire, includes verifying that weather and wind conditions are such that negative impacts to air quality would be minimized.

The EPA's Air Quality Index (USEPA 2002) generally rates air quality in the vicinity of the HNF as "good." The region surrounding the HNF is subject to air pollutants created by mining activities, fireplaces and wood stoves, private landowner burning, and emissions from motorized vehicles and machinery. As a result of dissipation by wind, pollutants from these sources are not usually high enough to violate air quality standards. The EPA's Interim Air Quality Policy on Wildland and Prescribed Fires (1998) addresses public health and welfare impacts caused by wildland and prescribed fires and provides guidance on mitigating air pollution impacts caused by fires in wild lands and wildland/urban interface areas. This plan allows for the use of fire to maintain healthy ecosystems while protecting public health and welfare (USEPA 1998). This plan also emphasizes the importance of visibility, which can be temporarily impaired from fires. The HNF has not been declared a Federal Class I area, which would require that visibility be maintained or remedied. However, forest standards and guidelines specify visual quality objectives for the Project Area, which maintain visibility. Forest standards and guidelines also specify the development of mitigating measures that minimize effects on air quality and specify compliance with State air regulations.

7.7.1.2 Direct and Indirect Effects

Alternative A, B and C: The action alternatives could all potentially affect air quality. Smoke from prescribed burning activities could potentially negatively affect air quality, human health, and visibility. The smoke from prescribed fires could temporarily affect visitors to the HNF and residents of nearby populated areas, especially people with asthma or other respiratory problems. There is public concern related to the amount of smoke given off by burn treatments and safety concerns regarding decreased

visibility along forest and adjacent roads.

As previously mentioned, prescribed fires generally produce three to five times less emissions than wildfires. Through prescribed fire, it is possible to replace high-intensity fires that produce high emissions with low-intensity fires that produce low emissions. The size of fires (total acreage burned), and type of fire affect smoke emissions. Generally, pile burn treatments and machine pile burns cost more to implement, but burning is safer and smoke problems are usually substantially reduced because piles burn out much quicker. Additionally, constructing piles to allow for some air movement and minimizing the soil within the pile, will result in a more efficient burn that produces less smoke (USDA FS 1989). More efficient burning and greater heat usually lifts smoke higher, which reduces smoke near the ground that can be harmful to health and cause visibility problems (USDA FS 1989). Backfires and flanking fires were proposed for broadcast burn treatments because they typically produce lower per-acre smoke emissions than head fires that burn with the wind. Thus, prescribed burn treatments for the blowdown area were chosen with regard to air quality concerns.

Alternatives A and B, which emphasize broadcast burns, would have the highest temporary effects on air quality. Alternative A utilizes broadcast burns over 80 percent of the Project Area, while Alternative B proposes treating 58 percent of the area with broadcast burns. Alternative C, which only treats two percent of the Project Area acreage with broadcast burns, would have least effects on air quality. Alternative C treats a seven percent larger area than Alternatives A and B with pile burn treatments, which should have minimal effects on air quality if piles are properly constructed. Effects of all action alternatives on air quality, public safety, and visibility should be minimal when the mitigation measures discussed in Appendix B are followed.

Alternative D: The no-action alternative would not reduce fuel loading in the Project Area, increasing the likelihood of a high-intensity wildfire in the future that could cause negative effects to air quality and human health. This alternative would have no immediate, direct effects to air quality.

7.7.1.3 Cumulative Effects

Prescribed burning of blowdown debris has been completed in the past by adjacent private landowners and the State. Most fuel treatment projects associated with the 1996 blowdown on private property should be completed by the end of 2002. Other fuel treatments will continue to occur outside of the HNF on private properties. The HNF does not currently plan on implementing any additional burn treatments to reduce fuel loading in the Project Area. The HNF does employ prescribed burning on an occasional basis for maintaining woody openings and native grasslands. HFN would burn minimal areas of the forest in the future, as needed, for management purposes. The cumulative impact of outside sources of air pollution along with USDA Forest Service temporary emissions from prescribed burns would be very low. Prescribed burning would take place years after the blowdown and should not be contemporaneous with other fuel reduction treatments on private land. Emissions from fuel treatment activities are also expected to be brief and short-lived. There should be no adverse, long-term consequences to air quality associated with the use of prescribed fire on the HNF under any of the proposed project alternatives.

7.7.2 Recreational Quality

Recreational quality of the Project Area must be maintained and remain consistent with Recreation Opportunity Spectrum (ROS) standards and guidelines directing management of affected Management Areas.

7.7.2.1 Affected Environment

The Project Area consists of portions of MA 2.4 (six percent of the Project Area), 2.8 (94 percent), and 6.4 (less than 0.5 percent). The ROS standards and guidelines for MA 2.4 state that these areas should be semi-primitive motorized, with roaded natural classifications at canoe launch facilities. The ROS classification for MA 2.8 is roaded natural areas, with possibilities to develop some semi-primitive opportunities in remote areas. The ROS classification for MA 6.4 is semi-primitive non-motorized.

There are no developed campsites or recreational areas within the Project Area.

7.7.2.2 Direct and Indirect Effects

There are several forest roads and trails that pass through the Project Area. Woody debris from the blowdown has already been removed from roads and trails to allow passage for recreational visitors.

Alternatives A, B and C: Prescribed burn activities under the action alternatives would cause temporary inconvenience to some recreational users for a period of several days when trails and roads would be subject to closures. Prescribed burns would improve access and recreational opportunities for visitors who hike overland. Burn treatments would also reduce fuel loading in the blowdown area and provide safer conditions for recreational users and adjacent private landowners. When considering acres burned as a criterion for temporary effects to recreational quality in the Project Area, Alternative C would have less temporary effects on recreational users than Alternatives A or B due to less acreage burned.

Activities required to implement the project alternatives should not substantially affect forest compliance with ROS standards and guidelines. The only MA whose classification could be affected by burning activities would be MA 6.4, which has a semi-primitive, non-motorized classification. However, activities in this unit are confined to seven acres of the total Project Area, and any machinery needed would be transported into the area by way of existing access routes. All activities would be temporary in nature, and thus should not result in considerable effects to the quality of recreation or affect visitation to the HNF.

Alternative D: Under the no-action alternative, there would be no direct negative effects on current recreational quality. However, recreational users who hike overland such as hunters, birders, and mushroom collectors would be unable to utilize the proposed project areas due to an abundance of downed, woody debris. The heavy fuel loading of the area would remain a potential safety hazard to recreational users, should a wildfire be ignited by natural or human causes.

7.7.2.3 Cumulative Effects

Recreation within and adjacent to the proposed Project Area consists primarily of hunting, fishing, hiking, horseback riding and gathering of forest products, such as mushrooms and plant material. These activities occur on private, public and HNF lands throughout the region. Recreation on private lands immediately adjacent to the proposed Project Area occurs on the Maumee Scout Reservation. The Maumee Scout Reservation is used by the Boy Scouts of America as a summer camp. It consists of 605 acres in the northwest corner of Jackson County in the middle of the HNF. The camp has a 56 acre lake, 11 campsites, and two cabins available for year-round use. The camp is capable of supporting 200 campers per week and offers recreational activities including boating, camping, fishing and sailing.

Education and public notification procedures associated with prescribed burning activities might cause some recreational users shift their patterns of use in the HNF. However, these effects are expected to be temporary. Due to the lapse of time since the blowdown in 1996, most fuel reduction efforts on adjacent lands have already been completed. Thus, there is limited potential for cumulative effects on recreation due to additional burning adjacent to the Project Area. Reduction of fuel loading under the action alternatives should lessen the future amount and severity of wildfires on both the HNF and surrounding areas, which should have positive cumulative effects on recreation quality.

Since fuel reduction efforts would reduce severity of wildfires and allow for increased recreational use of the blowdown area by overland hikers, hunters, and other recreational groups, it is expected that the long-term cumulative effects of the action alternatives would be beneficial in terms of recreation.

7.7.3 Visual Quality

Visual Quality Objectives (VQO) for the Project Area must be maintained and remain consistent with *Forest Plan* direction for affected Management Areas. Visitors expect a high quality visual experience.

7.7.3.1 Affected Environment

The Project Area consists of portions of MA 2.4, 2.8, and 6.4. The VQO for MA 2.4 is retention, where forest management activities are not apparent to the recreational visitor as viewed from trails, roads, water bodies, and developed recreation sites. The visual character of these areas emphasizes big trees along rivers and bottom lands along with riparian vegetation. MA 2.8 should be characterized by large trees with a continuous canopy. There are a wide variety of management activities allowed in this area, each of which provides for slightly different visual character. Forest management activities should appear visually compatible with adjacent private lands. The VQO for MA 2.8 is retention to partial retention, where activities may be evident to forest visitors, but will look fairly natural and not attract undo attention when viewed from forest roads, trails, water bodies, and developed recreation sites. The VQO for MA 6.4 is retention. In these areas, one should feel a sense of solitude and a feeling of closeness to nature by being isolated from human activities (USDA FS 1991a).

7.7.3.2 Direct and Indirect Effects

Alternative A: Under this alternative, 1436 acres would receive a burn treatment. Implementation of this alternative would have a significant, but temporary negative effect on visual quality. Burn treatments could also cause sections of affected management areas to vary from their VQOs. However, negative effects on visual quality would be temporary and mitigation measures would be employed. These measures are described in Appendix B and include revegetating disturbed areas, which should mitigate effects on aesthetics.

Effects to visual quality would vary with type of treatment. Broadcast burns would most closely mimic natural fires. Understory vegetation would be burned, but fire-tolerant oaks should not be damaged by low to mid-intensity backing and flanking fires. Reduction of woody debris would allow for better visibility of wildlife and should stimulate profuse flowering of wildflowers and regeneration of native trees and shrubs. Pile burn treatments should have fairly minimal effects on visual quality due to scattered distribution of piles. Pile burn treatments would be confined to areas of concentrated debris, so there is less potential for positive ecological effects that can be brought about by broadcast burn treatments.

Alternative B: Under this alternative, the greatest acreage would be burned (1459 acres). This would lead to the most negative effects on short-term visual quality. Burn treatments could also temporarily cause sections of affected management areas to vary from their VQOs. However, as in Alternative A, negative effects on visual quality would be temporary and mitigation measures should effectively lessen the impacts on aesthetics. This alternative would reduce current levels of fuel loading more than any other alternative, which would decrease the likelihood of a high-intensity, stand-replacing fire in the future that could lead to more long-term negative effects on visual quality.

Effects to visual quality would vary with type of treatment. Broadcast burns would most closely mimic natural fires. Understory vegetation would be burned, but fire-tolerant oaks should not be damaged by low to mid-intensity back and flank fires. Reduction of woody debris would allow for better visibility of wildlife and should stimulate profuse flowering of wildflowers and regeneration of native trees and shrubs. Pile burn treatments should have fairly minimal effects on visual quality due to scattered distribution of piles. Machine pile burn treatments should also have fairly minimal effects on aesthetics. Although machinery would be used to pile debris in several treatment units, machines would be

transported into the area using existing timber roads/trails, utility corridors, and forest roads for access. Visual effects of machinery use would be temporary, generally consisting of several days of preparation for each unit. Pile burn and machine pile burn treatments would be confined to areas of concentrated debris.

Alternative C: Effects of Alternative C should be similar to Alternative B, except that less area (616 acres) would be affected by burns and a greater area would be treated by isolation (1143 acres). This alternative would have less direct negative effects on visual quality in the short-term than Alternative B. However, less fuel would be reduced under this Alternative than Alternative B. Therefore, risk of wildfire would be greater, potentially leading to increased wildfire in the future and long-term negative effects to visual quality.

Alternative D: The 1996 storm event drastically affected the visual quality of the blowdown area. Under this alternative, no fuel reduction treatments would be implemented and debris would continue to decompose slowly due to natural processes. Due to the large amount of dead and decaying debris, undesirable insects and disease would be expected to increase in the blowdown area, killing more trees and contributing additional fuel to the area. Fire history for the HNF and natural fire occurrence for southern Indiana indicate that fires occur continuously on the HNF and adjacent areas, but are usually small and quickly controlled. Eventually, natural or anthropogenic wildfires would occur in an area of heavy fuel loading, which could lead to a high-intensity fire that would quickly be too dangerous, too costly, or too severe to suppress. Such a fire could drastically affect the visual appearance of the HNF, killing off canopy trees and leading to areas of bare soil and a resurgence of shrub and new tree growth in affected areas. These areas would probably be invaded by exotic species as well, which could out-compete native vegetation for space and other resources. Effects of such a fire on visual quality of the area would be largely subjective to personal preferences. Such a fire would increase visibility in the area and decrease the desired visual character for MAs 2.4 and 2.8 (large, mature trees and a continuous forest canopy).

However, it is important to note that wildfires often create a diversity of habitat types in an area, which could attract some species of wildlife that are drawn by increased food and habitat. This could be a benefit to many recreational users, who would probably have increased wildlife viewing opportunities. Wildfires are also known to stimulate profuse flowering of native wildflowers, which can be very beautiful (Olson 1996).

7.7.3.3 Cumulative Effects

State, regional/local, and private individuals may use fire as a management tool, and all lands owned by these entities are subject to wildfires. However, by definition, the timing, frequency, location, and severity of wildfires are unknown. Effects of these fires and suppression efforts by the USDA Forest Service and local cooperating fire departments may add to negative effects on visual quality. A high-intensity wildfire in areas of heavy fuel loading could severely damage the forest canopy, change composition of vegetation, and result in loss of ecological processes that could hinder the ability of the forest to regenerate. Such fires could also cause excessive erosion, which could degrade water quality and visual quality of area waterways.

Since the blowdown in 1996, most fuel reduction efforts on adjacent lands have already been completed. Thus, there is limited potential for cumulative effects on visual quality due to additional burning adjacent to the Project Area. However, dead and decaying debris could also increase outbreaks of insect and disease, which could kill additional trees in the area, further degrading visual quality and decreasing wildlife viewing opportunities. Implementation of fuels reduction projects on surrounding private lands will most likely continue into the foreseeable future through timber harvest and salvage, and prescribed burning of woody debris. Cumulative effects resulting from these activities, in combination with actions

proposed by the HNF, would include temporary discharge of smoke, charring of vegetation and ground disturbance. If soil disturbance mitigation measures are followed, the effects of the proposed action should benefit long-term visual quality through stimulation of growth of native species and removal of woody debris that may be obstructing or detracting from the quality of scenic views.

7.7.4 Safety

Hazards exist from the dead, down and severely damaged trees from the April 19, 1996, severe storm and tornado that swept across the Project Area. Effects of proposed action alternatives and the no action alternative on public and firefighter safety must be addressed.

7.7.4.1 Affected Environment

Winds from the 1996 tornado increased the amount of downed debris on the forest floor in the Project Area. This forest fuel increased from 1.5 to 10.7 tons per acre up to 11.7 to 27.7 tons per acre. This increase in fuel loading will allow for higher flammability of the Project Area and greater spread of wildfires. Due to moderate to heavy fuel loading in the blowdown area, high-intensity wildfires are probable, should a fire become ignited. HNF fire policy dictates that all wildfires should be suppressed on National Forest System land (USDA FS 1991a). These fires would be difficult to control under a wide variety of possible weather conditions due to greater flame lengths, fire intensities, and spread of fire. The Project Area is very diverse topographically, and some blowdown areas lack good access and escape routes for firefighters, creating an unsafe situation for fire suppression.

Assessment of safety issues requires an understanding of the potential for a fire to occur on the HNF, as well as the fire behavior or potential of fire to spread to areas that could threaten public safety. To assess the potential for a fire starting in the Project Area, information is presented in the "Proposed Action" section (pages 7-21) and "Affected Environment" portion of the Wildfire Threat section (pages 61-63) of this EA. Generally, there have been 479 total fires on the HNF in the period 1973-2001, 153 of which were caused by burning of debris (unspecified ignition) and 131 of which were caused by arson. Other causes for fires include escaped campfires, improper use of smoking materials, equipment use (sparks from combustion engines), and lightning, among others. Fires were fairly evenly distributed throughout the year and occurred under a variety of weather conditions. Thus, there is a high potential for fires to start in the blowdown area, especially given that burning of debris is the primary cause of wildfires in the HNF (USDA FS 2001a).

The USDA Forest Service uses a fire danger rating system comprising 20 different fuel models (USDA FS 1997). The National Fire Danger Rating System (NFDRS) is a method used to determine fire danger indices using fuel models to calculate or predict fire behavior. The primary criteria for choosing a fuel model depends on what forest stratum is most likely or best conditioned to start a fire (i.e. grass, shrub, timber, or slash). The Project Area is dominated by deciduous broadleaf forest and fire behavior would typically be calculated using various fire models for dormant overstory (model E-moderate surface litter fire) and leafed-out overstory (model R-slow burning ground fire), with varying models being applied to pockets of evergreen vegetation within the deciduous forest types. Under dormant conditions with high quantity of downed leaves, flame lengths would normally be about 2.6 feet and rate of fire spread would be 7.5 chains (495 feet) per hour. Under leafed-out conditions typical in spring and summer, flame length is expected to be around 1 foot and rate of spread of fire is confined to 1.6 chains (106 feet) per hour (Calvert 1998).

HNF fire staff analyzed wildfire potential within the blowdown area during 1996 and 1997 (USDA FS 2001b, 2001c). It was determined that fuel models for areas of moderate to heavy slash (NFDRS fuel models J, K, and I) should predict fire behavior in the blowdown area (see Table 3, page 9). Rate of fire spread is difficult to predict in these areas due to lack of uniformity in vertical arrangement of debris, stress fractures of vegetation due to wind damage, and splintering damage to trees, which would create large surface area to volume ratios that would dramatically increase fire intensity. Interestingly, in blowdown areas where fuel has begun to break up and decompose due to insect infestation and general weathering, potential of fire can actually increase due to larger surface area to volume ratios.

Fire behavior models for medium slash predict rapidly spreading fires with high intensities that can spread 13 chains (858 feet) per hour for medium slash and consist of flame lengths up to eight feet. Fire behavior in heavy slash can be characterized by rapidly spreading fires and active flaming for long periods of time. Under such fuel models, the rate of fire spread could be 13.5 chains (891 feet) per hour and flame lengths could exceed 10.5 feet (Calvert 1998).

It is important to analyze flame lengths and spread to determine threats to firefighter safety. Firefighters generally fight fires on the ground at the head or flanks of fire by constructing fire lines using hand tools. Pump trucks are generally on site to add an additional line of defense against fire and to protect firefighters, but are largely ineffective in controlling large wildfires because of equipment access limitations. Firefighters are generally only able to work safely next to flame lengths less than four feet (Rothermel 1983). Thus, natural or anthropogenic fires under typical fuel loading conditions are easily controlled, while flame lengths of 8 to 10.5 feet, typical of areas of moderate to heavy fuel loading such as in the blowdown area, are too intense for direct attack by firefighters. In this case, fires would need to be controlled using machinery, fire line construction adjacent to burning areas, or by disruption in the fuel layer caused by prescribed burns. Generally, these flame lengths are high enough to cause crown fires, which could be extremely difficult, if not impossible, to control.

High-intensity wildfires started in these areas of heavy debris would likely spread past the wildland-private property interface and threaten public safety and property including state, county, and private lands. Local communities that may be affected include Maumee, Houston, and the Maumee Boy Scout Camp. In addition, the nearby landowners in the triangle between Kurtz, Maumee, and Houston could be in imminent danger of wildfire. Since most of the private structures in this area occur near county roads, it is likely that local fire departments could protect these structures in the event of a wildfire, unless winds were unusually high. There is also high potential for loss of private croplands and timberlands with spread of a high-intensity wildfire ignited in the blowdown area (USDA FS 2002a).

The tornado blowdown affected many of these privately owned areas outside of the HNF, leading to fuel treatment projects on some areas. Some fuel reduction treatments, including prescribed burns and salvage logging, have already been completed on several private properties including the Maumee Boy Scout Camp, which is adjacent to several treatment units. These actions would minimize the spread of any potential wildfires to this property, which is probably the most at risk from unplanned wildfires and prescribed burn activities within the proposed Project Area.

High-intensity wildfires could also threaten recreational users who could become trapped when passing through the blowdown area. Due to the lack of developed campsites and recreation areas within the Project Area, recreational use is usually limited to day-use. Therefore, the possibility of igniting fires by campfire and other human causes should be minimal.

The safety of recreational users, USDA Forest Service fire personnel, and cooperating local firefighters during implementation of prescribed burns is also of great concern. Treatments were selected per unit, largely to minimize threats to firefighter and public safety. Some areas of the highest fuel loading that need treatment to minimize threat of wildfire and potential catastrophic effects to forest health cannot be treated due to safety concerns.

7.7.4.2 Direct and Indirect Effects

A description of fuel treatments associated with the project alternatives is provided earlier throughout this document. The direct and indirect effects of alternatives on safety are highly subjective and often conflicting. While some alternatives would provide increased safety to private individuals and structures through fuels reduction, implementation of the fuels reduction treatments could potentially result in decreased safety for firefighters in the short-term. However, when performed in a controlled fashion by

trained firefighters, fuels reduction is far safer and preferable to controlling wildfires.

Alternative A: Under this alternative, the second largest acreage (1,436) of blowdown would be treated to reduce fuel loading. Thus, direct negative effects to firefighter safety could occur during implementation of prescribed burns. These effects should be minimal since prescribed burns are only conducted under the safest conditions to produce low intensity, easily controllable fires. Indirect effects to firefighter safety would positive and considerable over the long-term, as the potential for uncontrollable, high-intensity fires that could harm firefighters would be drastically decreased.

Alternative B: Under this alternative, the largest acreage of blowdown would be treated to reduce fuel loading. Thus, as in Alternative A, direct negative effects to firefighter safety could occur during implementation of prescribed burns, but should be minimal due to the conditions under which prescribed burns are executed. Indirect effects to firefighter safety over the long-term under this alternative would be positive and the greatest, as the potential for uncontrollable, high-intensity fires that could harm firefighters would be decreased over the largest area (1459 acres).

Alternative C: Under this alternative, direct adverse effects to firefighter safety would be less than Alternatives A and B because less acreage would be treated for fuels reduction. However, delayed action in many areas chosen for isolation under this alternative could result in higher risks to firefighter safety in the long-term due to increased potential for high intensity wildfires. This alternative would pose less indirect negative effects to firefighter safety than the no action alternative (Alternative D) because high fuel levels would still be treated, largely by pile and machine pile burn treatments.

Alternative D: Under this no-action alternative, there would be no direct negative effects to firefighter safety, as no fuel reduction treatments would be implemented. However, indirect effects of delayed action could result in more severe safety hazards in the future due to potential fire ignition in the blowdown areas. Additionally, deterioration of downed debris could lead to outbreaks of insects and disease that cause more trees to die and add to existing fuels loads. Greater potential for high intensity wildfires caused by excessive fuel loads would increase safety hazards to public recreational users and adjacent landowners.

7.7.4.3 Cumulative Effects

Extensive areas adjacent to the HNF were also affected by the 1996 tornado blowdown. Fuel reductions have already been performed in many of these areas in the form of salvage timber logging and prescribed burn treatments (Appendix A). The collective treatment of these adjacent areas would result in safer conditions for firefighters to initiate fire suppression activities, should a wildfire ignite in the blowdown area. These fuel reductions also reduce the risk to the public from spontaneous wildfires and prescribed burn activities and reduce the likelihood of damage to privately owned structures.

Over the long-term, lack of fuel reduction treatments on the HNF may compromise safety by allowing an unnaturally high fuel load to remain until it has decomposed and its fuel potential is reduced. Lands and structures within and adjacent to the proposed Project Area could all be affected if a fire were to ignite. When either of the action alternatives is added to additional fuel reduction projects in adjacent areas, the combination would result in substantial cumulative reductions in risk to firefighter and public safety. In the long-term, the greatest beneficial cumulative effect on reducing safety risks would be with Alternatives A and B. In the short term, Alternative C would have the least potential to create a direct adverse effect on firefighter safety.

7.7.5 Heritage Resources

Under the National Historic Preservation Act of 1966, as amended, Federal agencies must take into account the effect of their undertakings on historic and prehistoric properties (16 U.S.C. § 470f and 36 C.F.R Part 800). It is the policy of the Federal government to provide leadership in the preservation of prehistoric and historic resources of the United States.

Indiana State law requires that work stop immediately if sites or artifacts are discovered during project implementation. Information regarding sites and surveys is kept at the district office and access to the information is restricted to protect site integrity. All sites requiring protection must be flagged for identification and/or avoidance by the forest archaeologist (Krieger 2002).

7.7.5.1 Affected Environment

The majority of the treatment areas have been surveyed for heritage resources (Table14). Seventeen previously recorded historic and prehistoric sites occur within the treatment areas. Nine of these sites have been determined to be ineligible for listing on the National Register of Historic Places (NRHP) and require no further work or protection. However, eight of these sites are considered potentially eligible for listing on the NRHP and must be protected from ground disturbing activities. The eight sites include two prehistoric open air sites (12 J 0345 and 12 Lr 0493); one prehistoric isolated find (12 J 0346); one historic cemetery and church (12 Lr 0492); one historic cemetery (12 Lr 0132); one historic farmstead (12 J 0363); one historic village (12 J 0354); and one multi-component prehistoric open air site / historic farmstead (12 J 0348).

The following information discusses the treatment areas and surveys conducted within them. The treatment areas labeled "treated by isolation" and "treatment of the surrounding areas" will not be subjected to ground disturbance under any of the action alternatives and were not considered in this analysis.

Table 14: Treatment Areas with Heritage Resources Requiring Protection

Treatment Area	Sites Surveyed By
Starnes A (Broadcast Burn Alt. A & B; Machine Pile Burn A-1, Broadcast Burn A-2 and A-3 Alt. C)	Dorwin and Claflin 1986; Morris 1985; Krieger 1996; and Waite 1996.
Salt Creek F (Broadcast Burn Alt. A & B; Isolation Alt. C)	Dorwin and Claflin 1986; Krieger 1996; Waite 1996; Peters 1981; and Morris 1993
Pipeline G (Broadcast Burn Alt. A; Machine Pile Burn Alt. B & C)	Morris 1985
Pipeline H (Broadcast Burn Alt. A & B; Isolation Alt. C)	Morris 1985; Waite 1996; and Krieger 1997
Pipeline I (Broadcast Burn Alt. A; Machine Pile/Burn Alt. B & C)	Morris 1985; and Waite 1996
Hickory K (Broadcast Burn Alt. A; Machine Pile Burn Alt. B & C)	Krieger 1996
Hickory L (Isolation Alt. A; Machine Pile/Burn Alt. B & C)	Morris 1993; Krieger 1996; and Waite 1996
Fork Ridge N (Broadcast Burn Alt. A & B; Pile Burn Alt. C)	Waite 1996; Albright 1989

7.7.5.2 Direct and Indirect Effects

Alternatives A, B and C: Broadcast burns and machine piles/burns under the action alternatives are ground disturbing activities that have the potential to adversely affect historic properties. Broadcast burn fires would adversely affect cemeteries and sites with standing buildings and/or wooden features and artifacts. Broadcast burn fires would not adversely affect prehistoric or historic archaeological sites whose features are located completely below the ground subsurface. Broadcast burn fire lines, whether created to contain the fire or to exclude areas, would adversely affect all site types if created within their boundaries.

Similarly, machine pile/burn treatments would adversely affect all site types if occurring within their boundaries. The use of heavy equipment would disturb the soil, disrupting the architectural features and artifacts both horizontally and vertically.

There would be no substantial effects to heritage sites if areas are flagged off and other mitigation measures are followed. All sites would be flagged by the forest archaeologist for identification and would be avoided by all potentially ground disturbing treatments. Heavy machinery would not be used within the boundaries of a protected site area. All fire lines, whether dug to contain a broadcast burn or to exclude heritage areas from fire, would be established with the assistance of the forest archaeologist. A 30-foot (10-meter) buffer zone would be maintained around each protected site area under all of the action alternatives.

Other mitigation measures to protect heritage resources are included in Appendix B of this EA.

Alternative D: The no-action alternative should have no direct effects on heritage resources because no prescribed burning would be implemented. Indirect effects to heritage resources could result from delayed action to reduce fuel loading in the area, which could lead to high-intensity wildfires that could potentially destroy heritage resources in the future.

7.7.5.3 Cumulative Effects

There would be no cumulative effects to heritage resources under any of the project alternatives if mitigation measures were implemented.

DOCUMENT PARTICIPANTS

USDA Forest Service
Chris Peterson - Forest Fire Management Officer/Aviation Officer, Project Manager
A.S. Natural Resources, Lake Superior State University, 1991

Deb Albright - GIS Coordinator
B.A. Geography, Indiana University, 1997

Lito Contreras – Assistant Fire Management Officer

Angie Krieger - Forest Archaeologist/Heritage Resources Specialist
B.A. Anthropology, University of Minnesota, Duluth, 1985

Wilma Reed Marine – Planning & Public Affairs Program Manager
B.A. Journalism, Eastern Kentucky University, 1977

Steve Olson - Natural Resources Specialist
B.A. Zoology, Southern Illinois University, 1982

Kelle Reynolds – Wildlife Biologist
B.S. Wildlife Science, Purdue University, 1989

Maggie Scheutter – Assistant Fire Management Officer
A.S. General Forestry, Hocking Technical College, 1991

Regis Terney - Forest Planner/NEPA Coordinator
B.S. Forest Science, Penn State University, 1974

T N & Associates, Inc. Participants
Rose Chmielewski- Project Manager / Senior Ecologist
M.S. Biological Science, University of Wisconsin – Milwaukee, 1996
B.S. Biological Aspects of Conservation, University of Wisconsin – Milwaukee, 1992

Barbara Eisenberg- Wildlife Biologist
B.S. Biological Aspects of Conservation, University of Wisconsin – Milwaukee, 1986

Tony Rinaldi-Forester
M.S. Wildlife Management, University of Maine, 1970; B.S. Forest Management, SUNY College of Forestry at Syracuse, NY, 1967 (cum laude); A.A.S. Forest Management, Paul Smiths College, NY

Scott Horzen- Botanist
B.S. Biological Aspects of Conservation, University of Wisconsin - Milwaukee, 1994

Cheryl Nenn- Ecologist
M.S. Resource Ecology and Management, University of Michigan, 1999
B.S. Biology, University of Illinois – Urbana-Champaign, 1994

REFERENCES

Albright, R. 1989. Cursory Survey of Opportunity Area #3. USDA Forest Service Cultural Resource Reconnaissance Report No. 09-11-02-0114. Bedford, Indiana.

American Fisheries Society (AFS). 2000. AFS Policy Statement #4: Sedimentation (Full Text). Available on : http://www.fisheries.org/Public_Affairs/Policy_Statements/ps_4.shtml

Brown, J.K. 1974. Handbook for inventorying downed woody material. USDA Forest Service Technical Report INT-16. 24 pp.

Calvert, V. 1998. Memorandum from Valdo Calvert to Thomas R. Thake, Forest Silviculturist, Hoosier National Forest on May 26, 1998. Subject: Reassessment of storm damage and logging on potential wildfire occurrence within the Pleasant Run/Maumee-Polk Patch salvage zone.

Dorwin, J.T. and J.K. Claflin. 1986. Cultural resource survey of compartments 10, 20, 39, 42, 47, 50, and 52 in the Hoosier National Forest, Indiana. RAI-1603. Resource Analysts, Inc. Bloomington, Indiana. Filed in USDA Heritage Resource Files as Cultural Resource Reconnaissance Report No. 09-11-02-0080.

Dunning, John B. Jr. and C.M. Rea. 2001. Results of the breeding bird monitoring survey, Hoosier National Forest, spring, 2001. A report to the USDA Forest Service, September 30, 2001. Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana.

Ewing, R. 1998. Fish Survey Information for the Starnes Branch of the South Fork Salt Creek. Hoosier National Forest. Tell City, Indiana.

Ewing, R. 2000a. Starnes Branch of the South Fork Salt Creek Survey Data (Cross Sections, Pebble Counts, Stream Classifications, Water Quality Data). Hoosier National Forest. Tell City, Indiana.

Ewing R. 2000b. Starnes Branch Water Temperature Data for the Tornado Blowdown Area. Hoosier National Forest. Tell City, Indiana.

Ewing, R. and P. Merchant. 2000. An analysis of watershed integrity for the Hoosier National Forest. USDA Forest Service. Bedford, Indiana.

Gresswell, R.E. 1999. Fire and Aquatic Ecosystems in Forested Biomes of North America. Transactions of the American Fisheries Society 128: 193-221, March 1999. American Fisheries Society. 1999.

Hedge, Cloyce L. 2002. Inventory and control recommendations for invasive plant species on selected areas of the Hoosier National Forest. Indiana Department of Natural Resources Division of Nature Preserves. Indianapolis, Indiana.

Higgins, K.F., A.D. Kruse, and J.L. Piehl. 2000. Effects of fire in the Northern Great Plains. U.S. Fish and Wildlife Service and Cooperative Extension Service, South Dakota State University, Brookings, South Dakota. Extension Circular 761. Jamestown, ND. Northern Prairie Wildlife Research Center Home Page. Available on: http://www.npwrc.usgs.gov/resource/2000/fire/fire.htm

Homoya, M.A.1995. Delineations and description of the ecological subsections of Indiana. Indiana Department of Natural Resources, Division of Nature Preserves, Indianapolis, Indiana. Administrative

report. On file with P. Merchant, Soil Scientist, Hoosier National Forest, Bedford, Indiana. 38 pp

Illinois Natural History Survey (INHS). 1999. Species Spotlight: Orangethroat Darter. Written by Susan Post, Center for Economic Entomology. INHS Reports May-June 1999. Available online at: http://www.inhs.uiuc.edu/chf/pub/surveyreports/may-jun99/darter.html

Indiana Department of Natural Resources (IDNR). 1993. Indiana's rare plants and animals: a checklist of endangered and threatened species. Division of Fish and Wildlife General Publication. 26 pp.

Indiana Department of Natural Resources (IDNR). 2002. Indiana Natural Heritage Data Center, Division of Nature Preserves. Indianapolis, Indiana.

Ingalsbee, T. 2001. Money to burn: the economics of fire and fuels management. Western Fire Ecology Center, American Lands Alliance. Available online at: http://www.americanlands.org/Forestweb/fire.htm

Krieger, A.R. 1996. Pine Salvage. USDA Forest Service Cultural Resource Reconnaissance Report No. 09-12-02-0168. Bedford, Indiana.

Krieger, A.R. 1997. Maumee-Poke Patch Environmental Assessment. USDA Forest Service Cultural Resource Reconnaissance Report No. 09-12-02-0174. Bedford, Indiana.

Krieger, A.R. 2002. Memorandum from Angie R. Krieger, Heritage Resource Specialist, Hoosier National Forest to Regis Terney, NEPA Coordinator, Hoosier National Forest. March 7, 2002. Subject: Fuels reduction in tornado blowdown, Hickory Ridge area Environmental Assessment, heritage resources.

Ladd, P. 1991. Reexamination of the roles of fire in Missouri oak woodlands. In: Olson, S., 1996. The historical occurrence of fire in the central hardwoods, with emphasis on south-central Indiana. Natural Areas Journal 16:248-256.

Lyons, J. and C. C. Courtney. 1990. A review of the fisheries habitat improvement projects in warm water streams, with recommendations for Wisconsin. Wisconsin DNR Technical Bulletin 169.

Marks, P.C., S. Gardescv, and F.K. Seischab. 1992. Late eighteenth century vegetation of central and western New York State on the basis of original land survey records. In: Olson, S., 1996. The historical occurrence of fire in the central hardwoods, with emphasis on south-central Indiana. Natural Areas Journal 16:248-256.

McReynolds, H.E. and E. Aderkas. 1962. Pre-impoundment Survey of Salt Creek Basin. Indiana Department of Conservation. Division of Fish and Game. Fisheries Research Section. Completion Report for F-4 R-9 (Work Plan 1, Job M).

Morris, D. 1985. Fork Ridge timber sale. USDA Forest Service Cultural Resource Reconnaissance Report No. 09-11-02-0088. Bedford, Indiana.

Morris, D. 1993. Hickory Grove prescribed burn. USDA Forest Service Cultural Resource Reconnaissance Report No. 09-11-02-0137. Bedford, Indiana.

Mumford, R.E. and C.E. Keller. 1984. The birds of Indiana. Indiana Univ. Press. 376 pp.

North American Breeding Bird Survey (BBS). 2001. Raw BBS data. Available online at: http://www.mp2-pwrc.usgs.gov/bbs/retrieval/menu.cfm

Ohio Department of Natural Resources (OHDNR). 2002. Orangethroat Darter (Etheostoma spectabile). Ohio Division of Natural Areas and Preserves webpage. Available online at: http://www.dnr.state.oh.us/dnap/rivfish/orthroat.html

Olson, S., C.L. Hedge, M.A. Homoya, and C.M. LeBlanc. 1991. Inventory of endangered, threatened, and rare plants species in the Pleasant Run unit Brownstown District of the Hoosier National Forest. Indiana Department of Natural Resources, Division of Nature Preserves. iii + 93 pp.

Olson, S., 1996. The historical occurrence of fire in the central hardwoods, with emphasis on south-central Indiana. Natural Areas Journal 16:248-256.

Olson, S. 2002. Personal Communication between T N & Associates, Inc., and Steve Olson, Botanist, USDA Forest Service on March 18, 2002.

Peters, G. 1981. Squirreltown Timber Sale. USDA Forest Service Cultural Resource Reconnaissance Report No. 09-11-02-0033. Bedford, Indiana.

Peterson, C. 2002. Personal communication between Chris Peterson, Fire Management Officer, Hoosier National Forest and T N & Associates, Inc. March 4, 2002. Subject: Cooperative fire agreement between U.S. Forest Service and local agencies.

Redman, D. 2002. Personal communication between D. Redman, Purdue University Cooperative Extension Service and Regis Terney, NEPA Coordinator, Hoosier National Forest on February 21, 2002. Subject: 2002 Indiana Agricultural Statistics.

Ridenour, R.L. and D.A. Johnson. 1974. Salt Creek Stream Survey Report. Indiana Department of Natural Resources. Division of Fish and Wildlife. Fisheries Section.

Rieman, B., D. Lee, G. Chandler, and D. Myers. 1997. Does Wildfire Threaten Extinction for Salmonids? Responses of Redband Trout and Bull Trout Following Recent Large Fires on the Boise National Forest. USDA Forest Service, Intermountain Research Station, Boise, Idaho. Proceedings – Fire Effects on Rare and Endangered Species and Habitats Conference, November 13-16, 1995. Coeur d' Alene, Idaho. IAWF, 1997.

Rothermel, R.C. 1983. How to predict the spread and intensity of forest and range fires. General technical report INT-143. USDA Forest Service. Intermountain Forest and Range Experiment Station. Ogden, Utah. 161 pp.

Thake, T. 2002. Personal communication between Thomas Thake, Forest Silviculturist and Regis Terney, NEPA Coordinator, Hoosier National Forest on February 21, 2002. Subject: monetary loss of oak and pine timber stands.

Thake, T., L. Contreras, and P. Merchant. 2002. Resource Report on stand conditions and explanation of alternative treatments for Units C, I, K, and L. Hoosier National Forest. Tell City, Indiana.

T.N. & Associates, Inc. (TN&A) 2002. Biological Evaluation for the Tornado Blowdown Fuels Reduction Environmental Assessment. Milwaukee, Wisconsin. 50 pp.

Tiedman, A.R., C.E. Conrad, J.H. Dieterich. J.W. Hornbeck, W.F. Megahan, L.A. Viereck, and D.D. Wade. 1979. Effects of fire on water. USDA Forest Service. General Technical Report WO-10. 28 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1989. Prescribed fire guide for southern forests. Technical Publication R8-TP-11. 56 pp. Available online at http://www.bugwood.caes.uga.edu/pfire/reasons.htm

U.S. Department of Agriculture, Forest Service (USDA FS). 1990. Land and Resource Management Plan, Draft Environmental Impact Statement. Hoosier National Forest. 294 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1991a. Land and Resource Management Plan, Plan Amendment, Hoosier National Forest. 90 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1991b. Land and Resource Management Plan, Final Environmental Impact Statement. Hoosier National Forest. 177 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1991c. Land and Resource Management Plan, Record of Decision. Hoosier National Forest. 30 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1996a. Environmental Assessment, Pleasant Run Emergency Hardwood Salvage Project. 60 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1996b. Environmental Assessment, Pleasant Run Emergency Pine Salvage Project. 91 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1996c. Forest Service supervisor setting forth restrictions of horse and bicycle use. Order No. 09-12-10 dated March 29, 1996. Hoosier National Forest. Bedford, Indiana. 1 p.

U.S. Department of Agriculture, Forest Service (USDA FS). 1996d. Land and Resource Management Plan, Monitoring and Evaluation Report for Fiscal Year 1995, Hoosier National Forest. November 26, 1996. 48 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1997. Fire Information Retrieval Evaluation System - A Program for Fire Danger Rating Analysis. General Technical Report INT-GTR-367. 64 pp. Available online at: http://www.fs.fed.us/rm/pubs/int_gtr367/index.html

U.S. Department of Agriculture, Forest Service (USDA FS). 1998a. Environmental Assessment, Maumee – Poke Patch Salvage Project II. 22 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1998b. Environmental Assessment, Maumee – Poke Patch Salvage Project II. 118 pp.

U.S. Department of Agriculture, Forest Service (USDA FS). 1999. Environmental Assessment - Forest Openings Maintenance. Brownstown and Tell City Ranger Districts. Hoosier National Forest. Bedford, Indiana.

U.S. Department of Agriculture, Forest Service (USDA FS). 2000a. Tech sheets for white oak and white pine. Available online at:
http://www2.fpl.fs.fed.us/Techsheets/HardwoodNA/htmlDocs.quecussp.html
http://www2.fpl.fs.fed.us/Techsheets/Softwoodna/htmlDocs/pinusstrobus.html

U.S. Department of Agriculture, Forest Service (USDA FS). 2000b. Programmatic Biological Assessment for Land and Resource Management Plan. 109 p. + appendices (33 pp.)

U.S. Department of Agriculture, Forest Service (USDA FS). 2000c. Protecting people and sustaining resources in fire-adapted ecosystems—a cohesive strategy; notice. Federal Register Volume 65, Number 218, pp. 67479-67511.

U.S. Department of Agriculture, Forest Service (USDA FS). 2000d. Land and Resource Management Plan Monitoring and Evaluation Report, Fiscal Year 2000. Hoosier Nation Forest. Bedford, Indiana.

U.S. Department of Agriculture, Forest Service (USDA FS). 2001a. Fire history data for the Hoosier National Forest, 1973-2001. Hoosier National Forest. Bedford, Indiana.

U.S. Department of Agriculture, Forest Service (USDA FS). 2001b. Downed woody material computation summaries for the tornado blowdown area. Hoosier National Forest. Bedford, Indiana.

U.S. Department of Agriculture, Forest Service (USDA FS). 2001c. Downed fuel inventory sheets for USDA Forest Service surveys of tornado blowdown area, May 29-June 1, 2001. Hoosier National Forest. Bedford, Indiana.

U.S. Department of Agriculture, Forest Service (USDA FS). 2001d. National Fire Plan, Hazardous Fuel Reduction. Available online at: http://www.na.fs.fed.us/nfs/hazfuel/hazful_overview_text.htm

U.S. Department of Agriculture, Forest Service (USDA FS). 2001e. South Fork Salt Creek watershed analysis. Prepared by Chad Stinson, Aquatic Biologist, Tell City Ranger District, Hoosier National Forest.

U.S. Department of Agriculture, Forest Service (USDA FS). 2001f. Smoke management and prescribed burning: where there's fire, there's smoke. Available online at: http://www.superiornationalforest.org/july4thstorm1999/prescribed_burning/Smoke_from_fire.pdf

U.S. Department of Agriculture, Forest Service (USDA FS). 2002a. Notes on tornado blowdown project, February 21, 2002. Memorandum from Regis Terney, USDA Forest Service to T N and Associates, Inc. Milwaukee, Wisconsin.

U.S. Department of Agriculture, Forest Service (USDA FS). 2002b. Tables of estimated length of fire break provided by existing features and length that would be constructed prior to burn treatment for each three action alternatives. Hoosier National Forest. Bedford, Indiana.

U.S. Department of Agriculture, Soil Conservation Service. 1985. Soil survey of Lawrence County, Indiana. 173 pp.

U.S. Department of Agriculture, Soil Conservation Service. 1990. Soil survey of Jackson County, Indiana. 238 pp.

U.S. Department of the Interior Fish and Wildlife Service (USFWS). 1983. Recovery plan for the Indiana bat. Rockville, Maryland. 80 pp.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS). 2001. Biological Opinion on the Land and Resource Management Plan, Hoosier National Forest, Indiana. Prepared by Scott Pruitt. 24 pp.

U.S. Environmental Protection Agency (USEPA) Air Quality Strategies and Standards Division. 1998. Interim air quality policy on wildland and prescribed fires. Washington, D.C. 8 pp. Available online at: http://www.epa.gov.ttn/oarpg/t1/memoranda/firefl.wpd

U.S. Environmental Protection Agency (USEPA). 2002. U.S. Environmental Protection Agency Air Quality Index. 10 pp. Available online at: http://www.epa.gov/airnow/aqi_bw.pdf

Waite, Gerald. 1996. Hardwood Salvage Sale. USDA Forest Service Cultural Resource Reconnaissance Report No. 09-12-02-0169. Bedford, Indiana.

Wells, C.G., R.E. Campbell, L.F. DeBano, C.E. Lewis, R.L. Fredriksen, E.C. Franklin, R.C. Rooelich, and P.H. Dunn. 1979. Effects of fire on soil. USDA Forest Service. General Technical Report WO-7. 34 pp.

Zwokinski, Malcolm J. 2000. The role of fire in management of watershed responses in land stewardship in the 21st century: the contributions of watershed management: synthesis papers USDA Forest Service proceedings RMRS-P-13 (Ffolliott et al.) 2000. pp. 367-370.

APPENDIX A:

PUBLIC SCOPING COMMENTS

APPENDIX A

Public Scoping Comments

The ID team categorized each response received during the scoping process to identify specific comments, issues, and concerns. These comments were identified and sorted. Following each comment is a summary of how the comment was addressed in the Environmental Assessment.

Name	Organization	Response Number
Ryan Amtmann		18
Jim Bensman	Heartwood	26
Lucille J. Bertuccio		19
Adam Bump	Ruffed Grouse Society	14
Sarah Butler		25
Mary Ellen Clinton and Diana Kaye		9
Gerald Coomer		4
Robert M. Craig, Ph.D.		8
Stephen W. Creech	Indiana DNR, State Fire Coordinator	30
James Cross		3
Sara Earle	Hoosier Horsemen, Indiana Trailriders Association	1
Kristy Edmunds		5
Carl Eisfelder	Indiana Sportsmen's Roundtable	20
Nancy E. Fay		15
Sarah E. Frey		7
Ann B. Frutkin		16
Donald J. Hammond		6
Jennifer Marie Hanink	Indiana University Student Action Coalition	24
Ralph Harrell		2
Bill Hayden		17
Charles Hughes		28
Hal and Tracy Kaina		27
John Maier	Protect Our Woods	12
Joshua Martin	Indiana Forest Alliance	21
M. Murphy		10
Dana Nixon		13
Phil T. Seng	Wildlife Society	29
Donald L. Snider, M.D.		11
Aleksandra Surzycki		22
Penelope Waggoner		23

On the following pages, comments are grouped by issues. There is also a "general comments, opportunities and alternatives for consideration" heading which lists non-specific issue comments. "C" indicates a comment. "R" indicates the USDA Forest Service response. Direct quotes are within quotation marks. Paraphrased comments are without quotation marks. In parentheses, we list the

comment source code (response number - comment number). When we list several comment source codes the quote is from the first comment source code, however, the ID team believes the quote represents the additional comments.

Approximately 437 groups, individuals, and neighbors were contacted regarding the proposed project. The following lists those who responded during the public scoping process. A complete listing of the individuals contacted can be found in the HNF project file.

Wildlife Habitat

G-1 Concern about impacts to Indiana bats and their habitat, as well as other wildlife species that utilize standing dead timber and downed logs

C. Comments expressed concern about impacts on wildlife and wildlife habitat. Many responses specifically mentioned the Indiana bat. (04, 09, 10, 11, 13, 15, 17, 18, 19, 23, 24, 25, 26 and 28). Responses included: "This project puts unnecessary risks on wildlife areas. There is great uncertainty as to the impacts to endangered Indiana bats and other wildlife, soils and regenerating vegetation." and "When fire passes through it destroys the hollow trees that is home for squirrels, birds other animals, food for woodpeckers…"

R. There are no known Indiana bat hibernacula within the Project Area. However, Indiana bats were recently identified during a summer survey along the Starnes Branch of South Fork Salt Creek, but they should not be affected by the proposed project if mitigation measures are implemented. These mitigation measures, such as conducting burns only between September 15 and April 15, leaving preferred roost trees, and utilizing burn techniques that maintain snags and at least 60 percent canopy cover, when possible, will be taken to minimize the potential impact to individual bats or bat roost trees in the Project Area.

The low intensity burns that occur during prescribed burn activities sometimes destroy a few snag trees, but others are usually created, leaving the forest with no net loss of snag trees available for roosting or denning wildlife. In addition, a large portion of the Project Area will not be burned due to the type of treatment (i.e. by isolation or pile/burn). Therefore, a portion of the area will remain in its existing condition, with the current type and quality of wildlife habitat.

Soil Effects and Water Quality

G-2 Concern about damage to vegetation and soils

C. Respondents expressed concern about damage to regenerating vegetation and soils, and suggested that fire would stimulate the growth of undesirable species (11, 13, 15, 26, and 28). Comments included: "After the fire up come the briars, sumac, wild grape, sassafras, and wasteland including erosion…Fire will destroy all the young oak, maple and desirable trees just starting life" and "…impacts to soil and plant structure is uncertain".

R. If prescribed burns are conducted under the proper conditions, a low intensity fire is produced. When fire opens up the forest understory, growth of shade tolerant species, such as maples, will be inhibited, while the growth of light favoring species, such as oaks, will be stimulated. Invasion of exotic species is more likely when there is prolonged absence of fire in areas where, historically, fires were frequent, such as the central hardwoods of Indiana (Olson 1996).

Prescribed burns are not likely to harm the canopy and usually leave the forest floor with a layer of duff that protects the soil from erosion. In addition, according to *Forest Plan* guidelines, mitigation measures are required to protect riparian corridors in and adjacent to the Project Area. Therefore, the burn treatment should not affect water quality. In addition, portions of the Project Area are proposed to be treated by isolation or by machine pile/burn or pile/burn. These treatments involve no burning or burning of only a localized region in the treatment area. Treatments that involve construction of fire lines or the use of machinery to construct burn piles have the potential to cause soil compaction, damage vegetation and increase erosion. However, timing the treatments during the colder winter months will help minimize the impacts and many of the fire lines will be constructed by hand.

Wildfire Threat

G-3 Concern that the wildfire threat is not great enough to warrant this type of treatment

C. Commenters expressed a belief that Indiana's forests are not prone to large fires or fires caused by lightning strike and thus, fires do not present a major threat to the forests (04, 05, 07, 09, 16, 17, 18, 19, 21, 24, and 26). Responses included: "There is no real major fire threat. The Hoosier is not susceptible to forest fires like national forest in the west…" and "The Hoosier National Forest is of low risk since this area does not have frequent drought extremes, high lightning rainless storms, or high altitude conditions like forest out west."

R. Although fires caused by lightning are a very small percentage of the total (<1 percent during the 1973-2001 period), fire itself is not an uncommon occurrence on HNF and the surrounding private land. Over 4,000 acres on NFS land and within one mile of NFS land burned between 1973 and 2001 (USDA FS 2001a). This indicates that although natural-caused fires are not a major threat to NFS lands, fires caused by, or related to human activities, do pose a threat for wildfire. Suppression of fire in the past, in addition to the blowdown damage, has created conditions in the Project Area where current fuel loads are from 1.6 to 9.7 times that of the background fuel load. More than one-half of the fires caused by debris burning, the primary cause, occurred in the years since the blowdown. This is another indication that there is a higher wildfire risk now than before the blowdown.

G-4 Concern that the current fuel loading condition has caused an increased risks for wildfire and, subsequently, a threat to firefighter safety.

C. One response agreed that the blowdown area presents a risk to firefighter safety (30): "This unnatural fuel loading increases the risk to fire suppression personnel and to adjacent landowners…"

R. Unlike a wildfire, prescribed burn treatments allow firefighters a high degree of control over burn conditions. Determining when, and under what conditions, a fire occurs permits firefighters to better predict the behavior of the fire and, subsequently, creates safer working conditions.

Forest Health and Effects/ Effectiveness of Fire Management

G-5 Convey preference for allowing the forest to naturally regenerate

C. Comments expressed opposition to prescribed burning (05, 07, 17, and 18). They included: "there is no reason to burn this area," "The areas…would be better left to recover naturally," " The

tornado damaged areas are providing a vegetative diversity that should be left alone," and "The tornadoes that roared through HNF damaging and felling trees created a natural laboratory for the FS which if left unlogged would show the advantage of letting NATURE renew itself."

R. Allowing the area to continue to regenerate naturally perpetuates a high fuel load condition that is prone to burn at a high intensity and would be more difficult to control than a prescribed burn. This puts firefighters at risk when trying to suppress a wildfire that may ignite in the Project Area in the future. Regeneration without the use of fire leads to a climax community type in which shade tolerant species dominate and there is less diversity.

G-6 Concern that commercial logging has degraded the forest and [fuels reduction treatment] will further degrade the area.

C. Comments related to the belief that logging has degraded the area and that the proposed fuels reduction treatment will also degrade the area (17, 19, 21, 22, and 26). Responses included: "Salvage logging did not reduce the build-up of fuels as the Forest Service promised, but in fact made it worse. This area has already been degraded by commercial logging and economically motivated management will only further degrade the area."

R. Concerns about the effect of previous salvage logging are beyond the scope of this document. However, comparing higher current fuels loads to background fuel loads can identify the risk of high intensity wildfires that could potentially cause much more damage than proposed burn treatments.

Concerns regarding degradation of the area can be refuted by the fact that the growth of many herbaceous and woody plant species, which prefer a more open understory, is stimulated after a burn. Native, shade intolerant species, such as oaks, are likely to thrive following prescribed burns due to increased light levels, release of nutrients into the soil, reduced quantities of woody debris on the forest floor, and reduced competition from exotics and shade tolerant species.

G-7 Supports the reduction of fuel load and or the use of fire as a forest management tool

C. Several comments mention the benefits of fire, whether natural or prescribed, and agree with the use of fire in forest management (20, 27, and 29). Comments include: "…support controlled burning, not only because it will reduce potential hazards to other forest resources and humans, but also because it will provide additional wildlife habitat benefits in enhancing the diversity of vegetation and potential habitats in the burn area." and " I do, however, understand the benefits of periodic fire in Eastern forest communities. Timber and wildlife management has for years benefited form periodic burns of hardwood understory."

C. Two responses acknowledge the importance of reducing high fuel loads (14 and 30). One stated: "Fuel load reduction is an essential component of forest management for forest health and human safety." Another responded: "… in situations where the natural fuel load had been altered…In all cases it would have been much safer, easier, and more cost effective to have deal with the situation using prescribed treatment rather than through suppression action."

R. Comments acknowledged.

Economics

G-8 Concern that the proposed project is not an appropriate use of taxpayer money

C. A number of comments expressed the belief that spending money on this project is wasteful, that the money was not intended for use in eastern forests or would be better spent in another fashion (04, 05, 06, 10, 11, 13, 17, 21, 22, 23, 24, 25 and 26). Some comments included, "This project is a bureaucratic response to the availability of taxpayer money delivered by Congress, rather than in response to a real threat to people or the forest." And, "money for hazardous fuels reduction plans should be applied directly to the urban wildland interface, helping landowners better prepare their land and homes for fire hazards."

R. Increasing costs of suppressing wildfires have made it more sensible to spend a smaller portion of the budget now to reduce fuel loads. If a wildfire ignites in the future, the costs to contain or control it will be greater, and there may be additional losses if firefighters or private property are harmed in the process.

Air Quality

G-9 Concern that the prescribed burn treatment will add to the pollution problem in Indiana

C. One respondent expressed a concern about burn treatments adding to air pollution in the region (23): "…should take into account the release of toxins into the air and water."

R. Unlike a wildfire, conditions for prescribed burns will be chosen to allow for the least smoke production, and the greatest smoke dispersal. In addition, prescribed burn treatments will only take place on a portion of the Project Area, whereas a wildfire could burn a much wider area, causing considerably more pollution.

General Comments, Opportunities, and Alternatives for Consideration

Timber management

G-10 Concern that wood cutting or harvest would be a better way to deal with the tornado damage

C. Two respondents expressed the opinion that more harvesting of timber should be permitted to reduce the high fuel load (02 and 27). Those comments included, " …allow and advertise to all people for cutting wood in the area!" and "It makes better sense to remove this material while it is still usable by Indiana citizens for building materials and wood products."

R. Allowing citizens to remove the downed timber is not practical, given the lack of good public access and steep terrain in some of the areas. It is also not likely that the amount of material taken out by the public would reduce the fire hazard in areas with moderate to high fuel loads.

G-11 Concern that illegal harvest of timber took place during past salvage harvest

C. One respondent expressed the belief that the USFS should focus on investigating the illegal harvest that took place during the past fuels reduction treatment that consisted of a salvage timber sale (21). That comment included, "Instead of burning this area with taxpayer funds, it would be

more appropriate for the Forest Service to pursue the evidence in this case, and to use the recovered money for scientifically based restoration."

R. This issue is beyond the scope of this project-specific Environmental Assessment.

Documentation

G-12 Concern that proper documentation of effects of the project has not been provided to the public

C. A number of respondents commented that an Environmental Impact Statement (EIS) should be completed to properly document the effects of the project on forest resources (07, 17, 18, 19, 21, 22, 24, 25, and 26). Comments included, "The Forest Service should conduct a thorough Environmental Impact Statement before taking any action on this proposal, as required by the National Environmental Protection Act."

R. We appreciate site-specific facts that allow us to make the best decision. Normally, prescribed burning would not require an environmental impact statement, as this is a category of action that may be categorically excluded from documentation in an environmental impact statement or an environmental assessment (Chapter 30 of USDA Forest Service Environmental Policy and Procedures Handbook, FSH 1909.15). The USDA Forest Service Environmental Policy and Procedures Handbook 1909.15, Chapter 20, requires environmental impact statements in four classes of actions:

1. Proposed actions for which an EIS is required by law or regulation. The *Forest Plan* revision is an example.
2. Proposed actions to carry out aerial application of chemical pesticides.
3. Proposed actions those substantially alter the undeveloped character of an inventoried roadless area.
4. Proposed actions that take major federal action that may significantly affect the quality of the human environment. Examples include:

   - Approving the use of 1,500 acres of federal land for an all-season recreation resort complex

   - Approving the lease of oil and gas beneath 400,000 acres of federal lands that historically had a high potential of discovery

   - Approving the construction and operation of an international gas pipeline beneath an undeveloped 30-mile long, 1,000-foot wide corridor within an ecologically sensitive area

The effects of prescribed burning were thoroughly analyzed in this environmental assessment and in the Draft and Final Environmental Impact Statements, Land and Resource Management Plan Amendment, Hoosier National Forest (USDA FS 1990, 1991a, and 1991b). This analysis is tiered to both EIS's and to the *Forest Plan*. On pages 2-38 of the 1991 EIS, we stated "Since this activity [prescribed burning] is site-specific, no projections for any of the alternatives have been made." However, the 1991 EIS estimated the *Forest Plan* effect to include much more disturbance than has actually occurred since 1991. For example, the EIS estimated 140 miles of road construction, 4,000 acres of maintained forest openings, 1,131 acres of maintained barrens, 12,500 acres treated for

timber harvest, including 2,000 acres of clearcutting. We have constructed less than 10 miles of road, maintained less than 200 acres of barrens, maintained approximately 3,311 acres of openings, and treated less than 2,000 acres for timber harvest. Therefore, the disturbance from this proposal is well within the size and scope of those analyses.

APPENDIX B:

MITIGATION MEASURES

APPENDIX B

Mitigation Measures

Mitigation Measure A - All heritage sites which are potentially eligible for the National Register of Historic Places require protection and must be avoided. Each of these potentially eligible heritage sites will be flagged for identification and avoidance by the forest archaeologist.

Mitigation Measure B - Fire lines, whether dug to contain a broadcast burn fire or to exclude heritage site areas which are potentially eligible for the National Register must be established with the assistance of the forest archaeologist.

Mitigation Measure C – For heritage sites, maintain a 10-meter protective buffer zone around all flagged site boundaries.

Mitigation Measure D - Surveys for rare species have been conducted. Known populations of rare species are marked, and all operations will stay outside of the flagged boundary. If new populations of rare species are found, operations will cease until appropriate mitigation can be determined.

Mitigation Measure E - To reduce the amount of soil compaction the normal operating season for machine piling downed debris will be between May 1- October 31 (firm ground conditions). Operation of all heavy equipment would be limited to periods when the soil is frozen or not saturated. Machine Operators may operate outside the operating season only if other mitigation or suitable conditions exist that would protect the soil resource.

Mitigation Measure F - To reduce the amount of soil pushed into the burn piles a root rake dozer blade should be used.

Mitigation Measure G - Informational signs will be posted along the multiple use trail during activities (or when working within 100 feet of the trail). The signs will inform trail users about the activities and if the trail is temporarily closed for safety. Administration will ensure that at least 75 percent of the trail system be kept open at all times.

Mitigation Measure H - If active raptor nest is discovered during operations, we will suspend operations in a buffered area around the nest until 3 to 6 weeks after the young have fledged depending on the species found.

Mitigation Measure I - Exposed mineral soil (if any) such as on trails would be seeded using either a native plant seed mix or a seed mix of non-invasive, non-persistent species when the project is completed. Exposed mineral soil would be seeded and mulched to prevent erosion until vegetation becomes reestablished on the site. These actions would be taken as soon as practical after disturbance. Seed mixes for sunny and shady locations are as follows:

For SUNNY locations :

Spring (March 15-May 15): spring oats (1/2 bushel/acre), red clover/alsike clover (6 lbs/acre), orchard grass (4 lbs/acre), redtop (3 lbs/acre), and timothy grass (3 lbs/acre)

Summer (May 15-July 31): winter wheat (1/2 bushel/acre), alsike clover (3 lbs/acre), perennial rye (2 lbs/acre), and orchard grass (4 lbs/acre)

Fall (August 1-October 15): winter wheat (1 bushel/acre), perennial rye (1 lb/acre), timothy grass (4 lbs/acre), and white/alsike clover (3lbs/acre)

For SHADED locations:

All seasons: winter wheat (1 bushel/acre), alsike/white clover (3 lbs/acre), orchard grass (4 lbs/acre)

Clovers should not be sown after September. No mulch is necessary on shady areas unless slopes are greater than 15 percent.

Mitigation Measure J - Soil movement into the aquatic systems will be minimized by requiring effective erosion control measures to be employed during and after the machine piling operation. Some effective erosion control measures include installing water bars on trails; temporary mulching, permanent seeding and mulching; use of diversion ditches; placement of check dams in ditch lines and ephemeral channels; sediment fences; placement of straw bales in diversion ditches and small drainages, and others. Erosion control measures to reduce sediment movement from trails and roads into stream channels will be required (*Forest Plan*, p. J-5, K-1 and K-2, USDA FS 1991a).

Mitigation Measure K - There will be a minimum number of temporary stream crossings, with locations designated by the USDA Forest Service. Where needed, crossings will utilize approved structures to be removed after the project is complete.

Mitigation Measure L – If stream crossings are necessary, construct crossings during the dry months of the year (May 1 to October 31). This minimizes the potential for erosion from high water events.

Mitigation Measure M - USDA Forest Service administrators will design stream crossings to allow fish passage during low water (*Forest Plan*, p. 2-8, USDA FS 1991a)

Mitigation Measure N - USDA Forest Service administrators will locate crossing approaches to minimize erosion and sediment introduction to the stream. For example, they locate crossings where the stream banks or side-slope grades are gently sloping or where past disturbances have occurred (old roads or fords).

Mitigation Measure O - Contractors will return stream crossings to the same elevation they were before construction, removing rock placed in the channel during use so it does not block fish passage or flow.

Mitigation Measure P - USDA Forest Service administrators will not allow heavy equipment within streambeds (*Forest Plan*, p. J-4, USDA FS 1991a).

Mitigation Measure Q – Contractors shall protect ephemeral channels by using existing roads and trails to cross these areas to minimize adverse effects. Operators will avoid piling uphill within the ephemeral channel.

Mitigation Measure R - The USDA Forest Service administrator will limit machine piling when short wet periods occur, through increased inspection.

Mitigation Measure S – Piling will occur on slope contours where possible to prevent downhill soil movement, which would encourage soil displacement during water run-off periods.

Mitigation Measure T– Debris will not be piled in riparian areas. Root wads will be kept attached to stream banks. Root wads, when anchored in or against the bank, provide stability to the riparian area and

cover for aquatic organisms. Large Woody Debris (LWD) used, as a bank cover must not be removed to prevent bank erosion.

Mitigation Measure U - In sections of the stream with sand, gravel, and cobble substrates, digger logs or scour logs will be maintained by securely anchoring them to the bank. These are trees without treetops, or partial treetops, that are stable (large and anchored). The logs need to be facing downstream. Digger logs are generally located in existing pools, or in sections of the stream in which pools are desired. They are used to change the scour and depositional pattern, and increase the depth of the pool (Lyons and Courtney 1990). Maintaining one of these per meander, when appropriate LWD is available, may improve pool depths and complexity, and provide a nutritional source for macroinvertebrates.

Mitigation Measure V - Fallen, stable logs will be left at periodic intervals along the length of the stream to improve riparian habitat for terrestrial and semi-aquatic species.

Mitigation Measure W

To minimize the likelihood of taking an Indiana bat roosting in a tree, areas with standing damaged trees will be treated September 15 through April 15. This period of time is outside the Indiana bat summer roosting season.

It is possible that during project implementation, conditions will require the removal of a hazard tree or a tree that blocks operations. If a tree must be cut during the Indiana bat reproductive season (April 15-September 15), a bat exit survey should be conducted during the evening to determine if the tree is an active roost tree. If bats are detected in the tree, the Bloomington Field Office of the USDI Fish and Wildlife Service should be contacted for additional measures to minimize take of those individuals.

Snags shall not be removed, unless they pose safety hazards.

APPENDIX C:

PROPOSED ACTION ALTERNATIVES

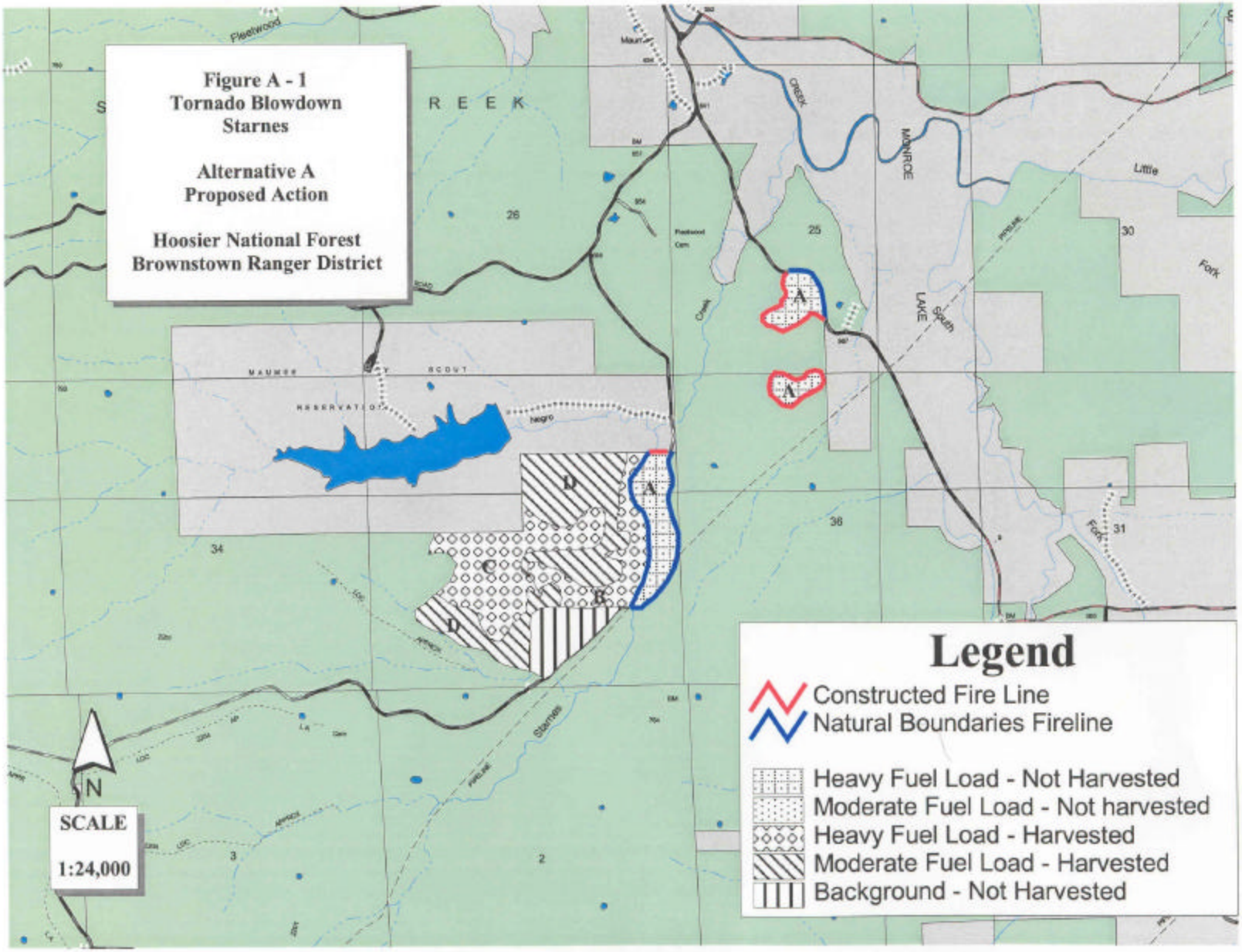


Figure A - 1
Tornado Blowdown
Starnes
Alternative A
Proposed Action
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
SCALE
1:24,000
N

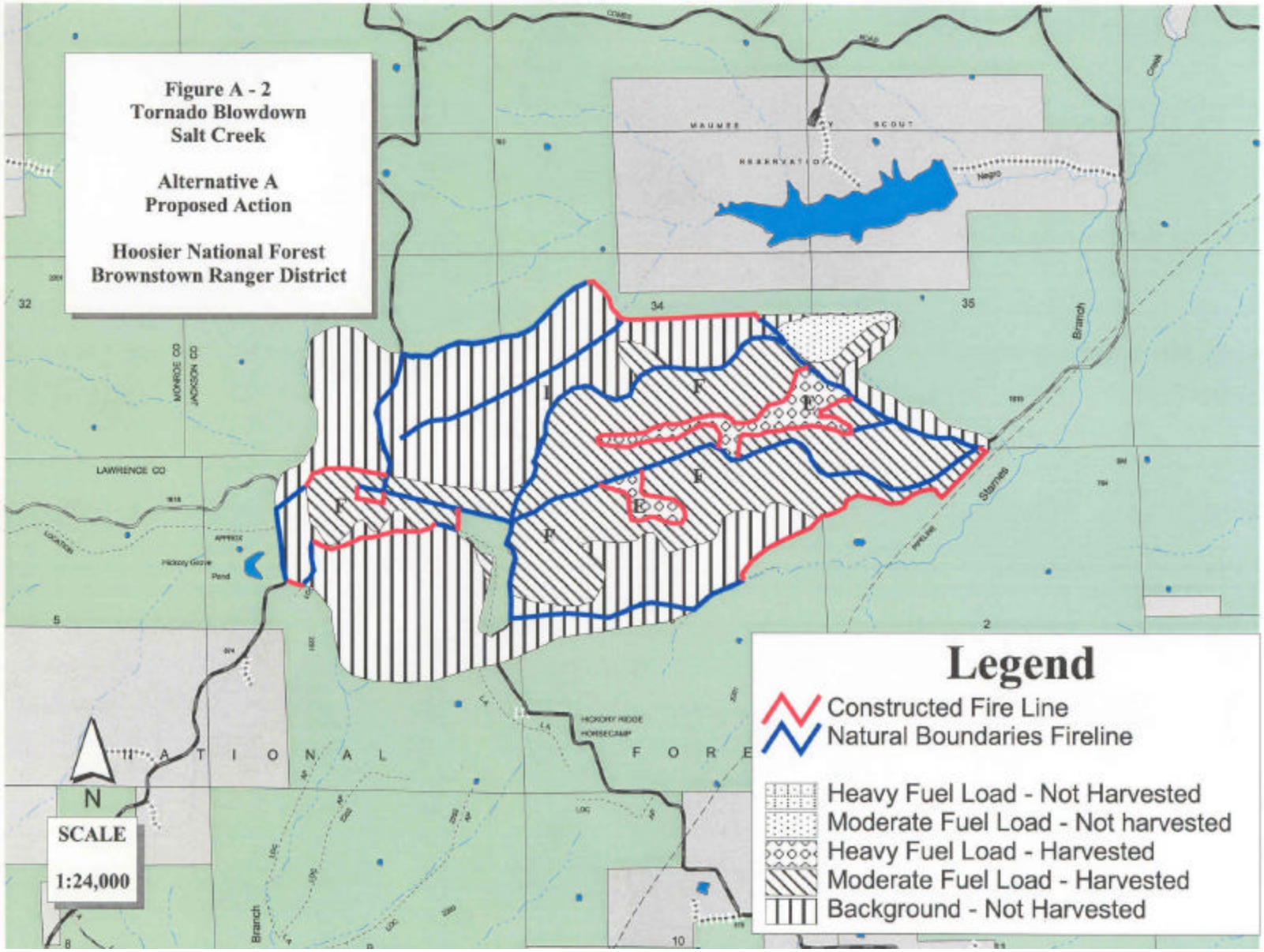


Figure A - 2
Tornado Blowdown
Salt Creek
Alternative A
Proposed Action
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
N
SCALE
1:24,000
LAWRENCE CO
MONROE CO
JACKSON CO
Negro
Branch
Starnes
Pond
32
34
35
5
2
10

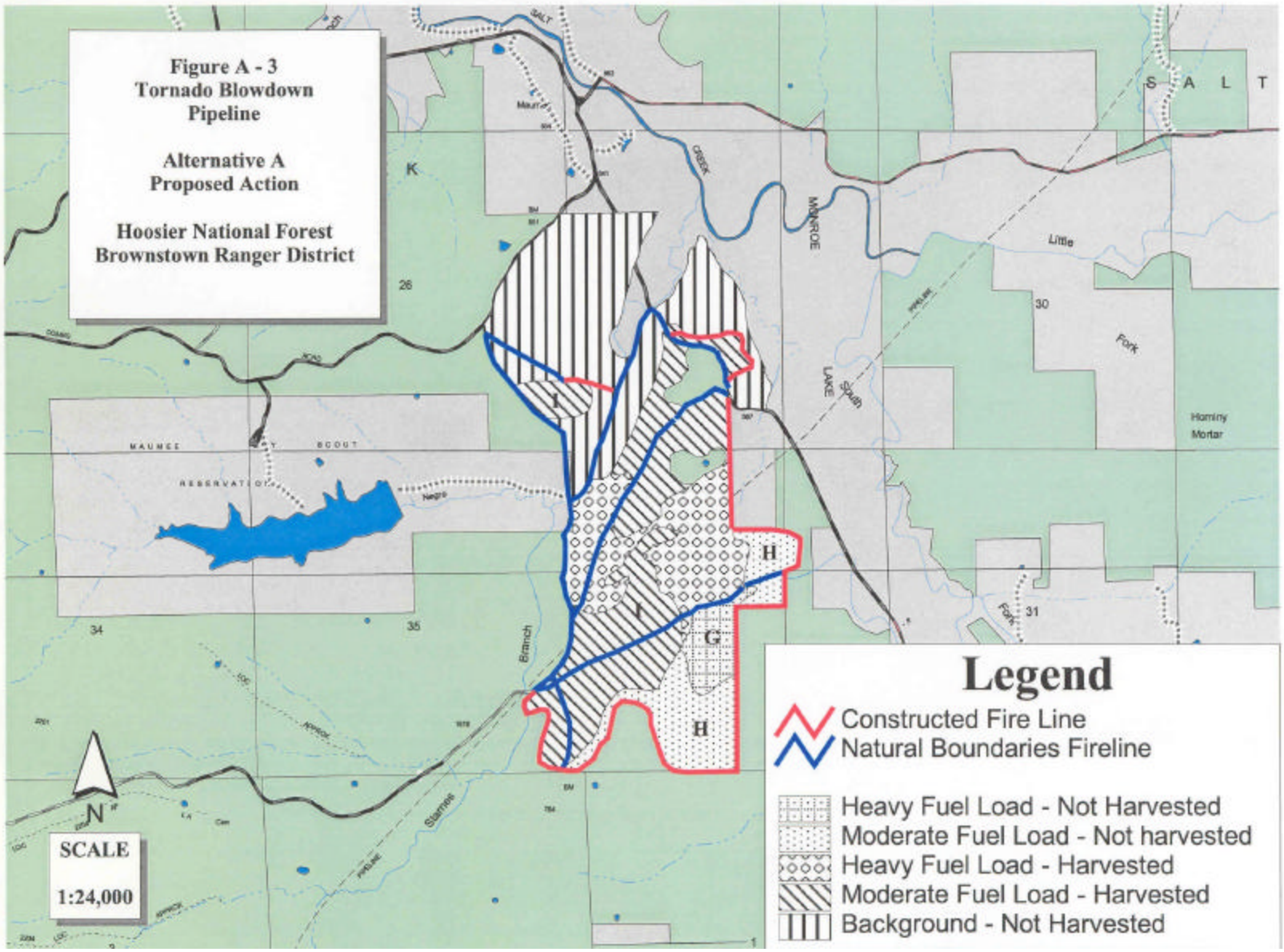


Figure A - 3
Tornado Blowdown
Pipeline
Alternative A
Proposed Action
Hoosier National Forest
Brownstown Ranger District
SCALE
1:24,000
N
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
S A L T
MONROE
LAKE
Little
Fork
Hominy
Mortar
MAUMEE
RESERVATION
BOY SCOUT
Branch
Starner
K
I
H
G
26
30
31
34
35

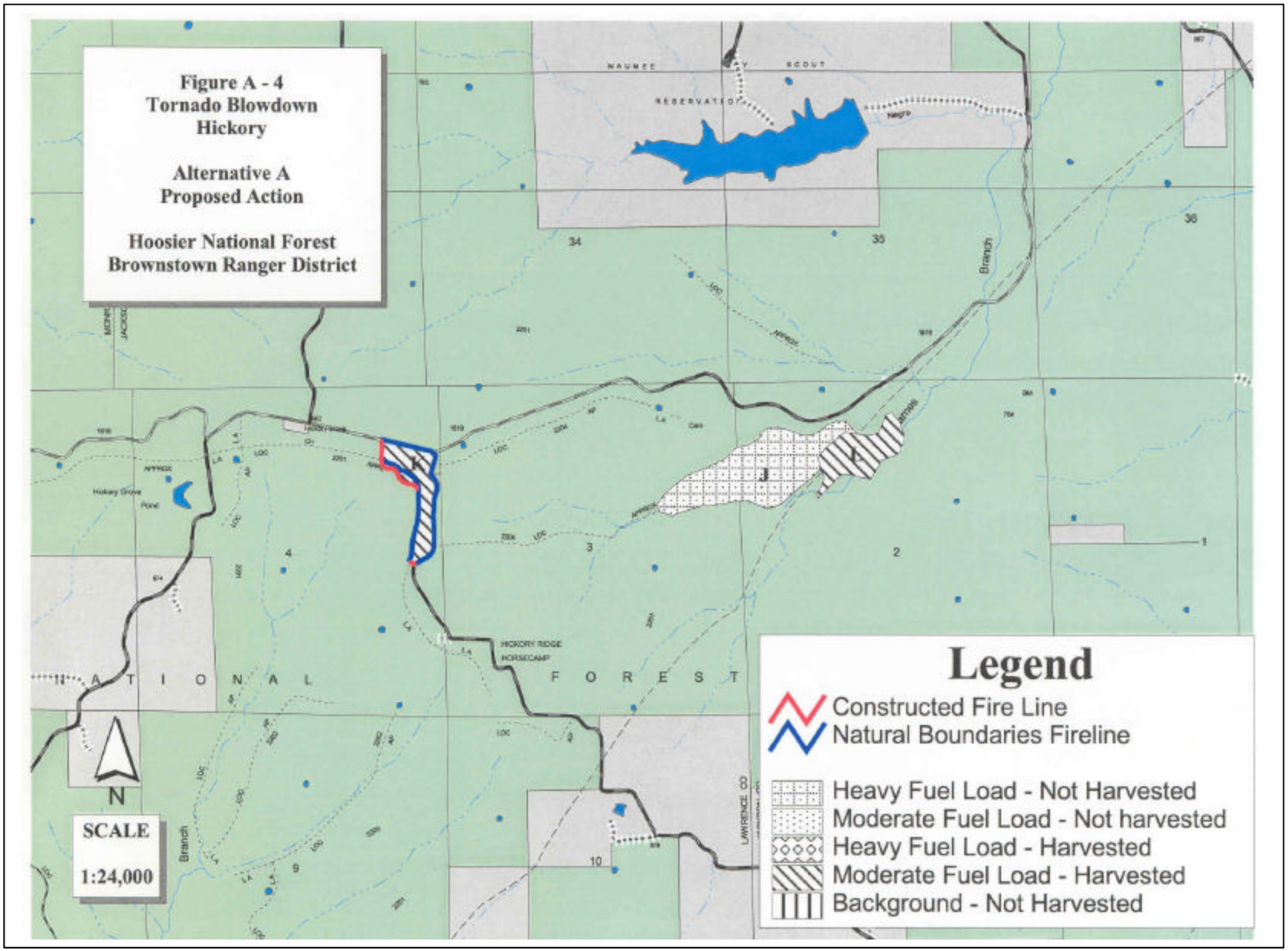


Figure A - 4
Tornado Blowdown
Hickory
Alternative A
Proposed Action
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
SCALE
1:24,000
N
HICKORY RIDGE
HORSECAMP
F O R E S T

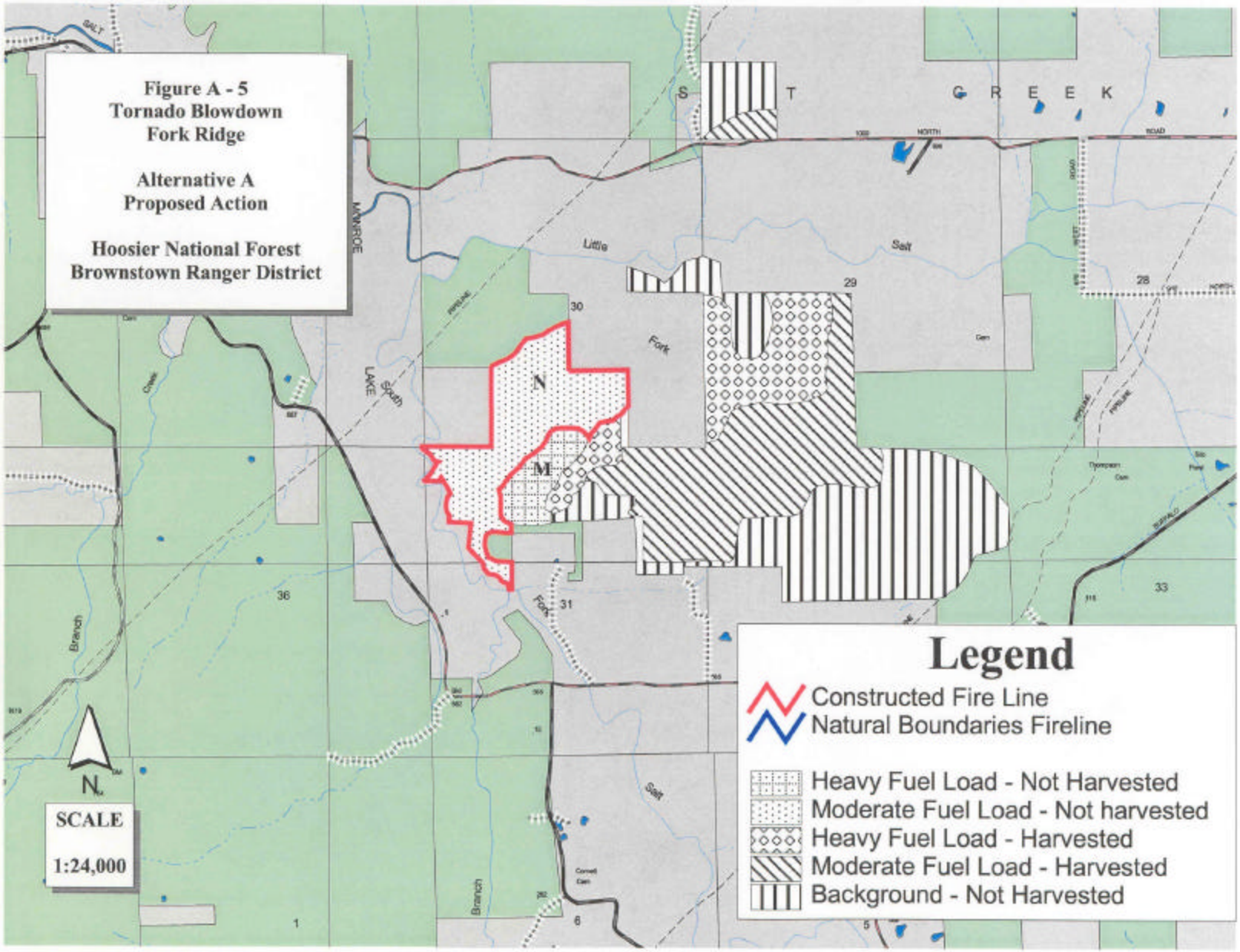


Figure A - 5
Tornado Blowdown
Fork Ridge
Alternative A
Proposed Action
Hoosier National Forest
Brownstown Ranger District
SCALE
1:24,000
N
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested

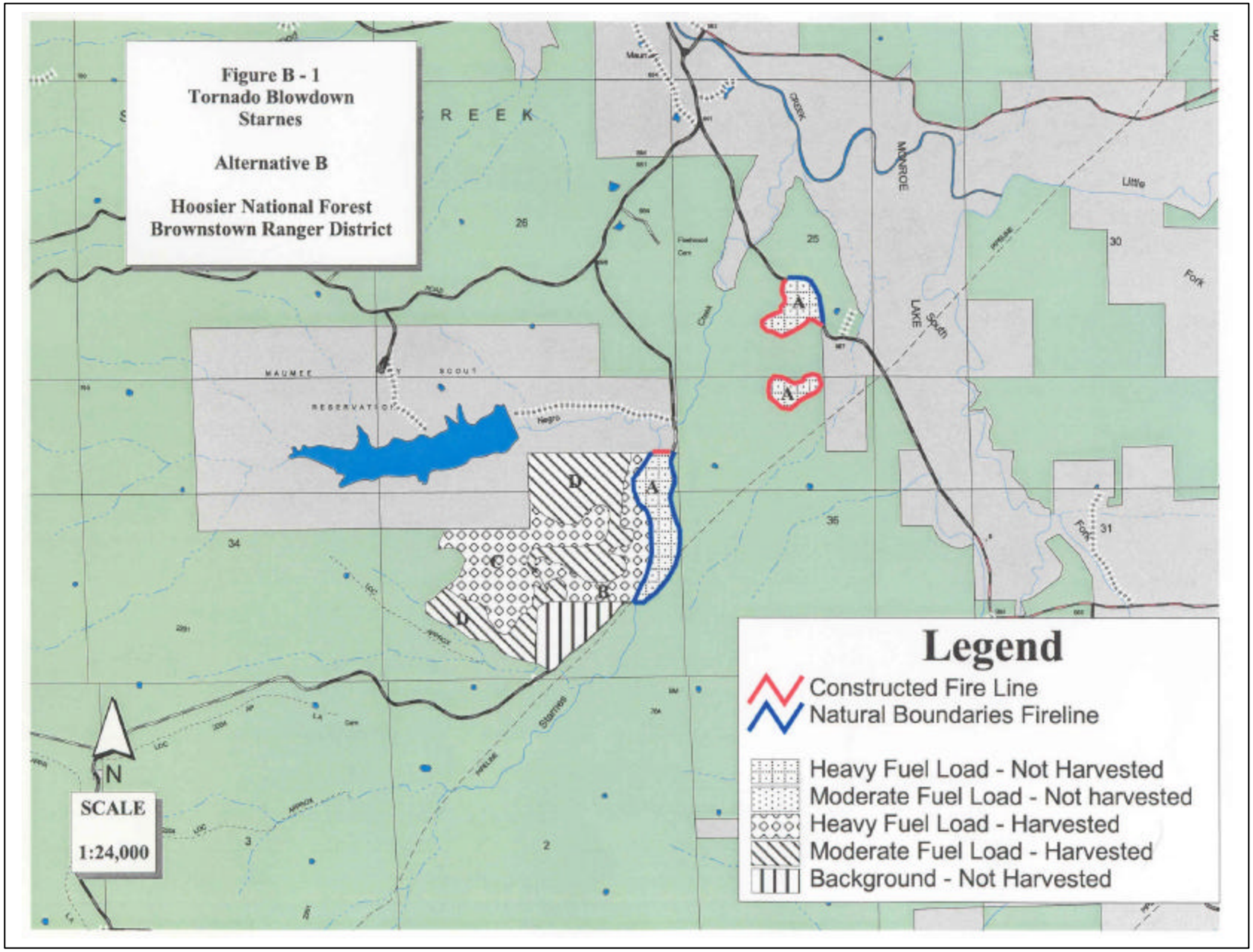


Figure B - 1
Tornado Blowdown
Starnes
Alternative B
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
SCALE
1:24,000
N
A
B
C
D

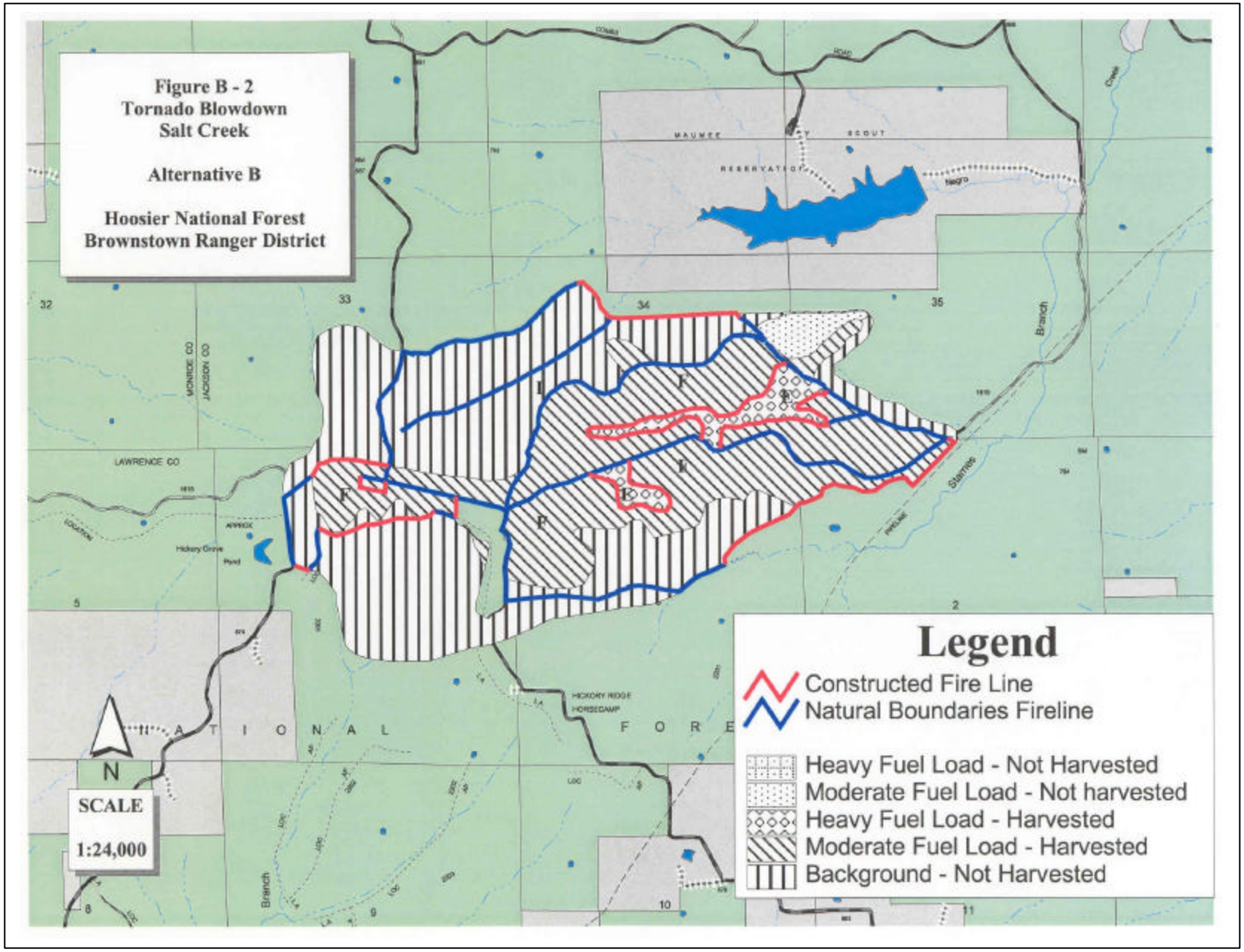


Figure B - 2
Tornado Blowdown
Salt Creek
Alternative B
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
SCALE
1:24,000
N
LAWRENCE CO
MONROE CO
JACKSON CO
MAUMEE
SCOUT
RESERVATION
Negro
Branch
Starnes
Hickory Grove
Pond
HICKORY RIDGE
HORSECAMP
NATIONAL
FOREST

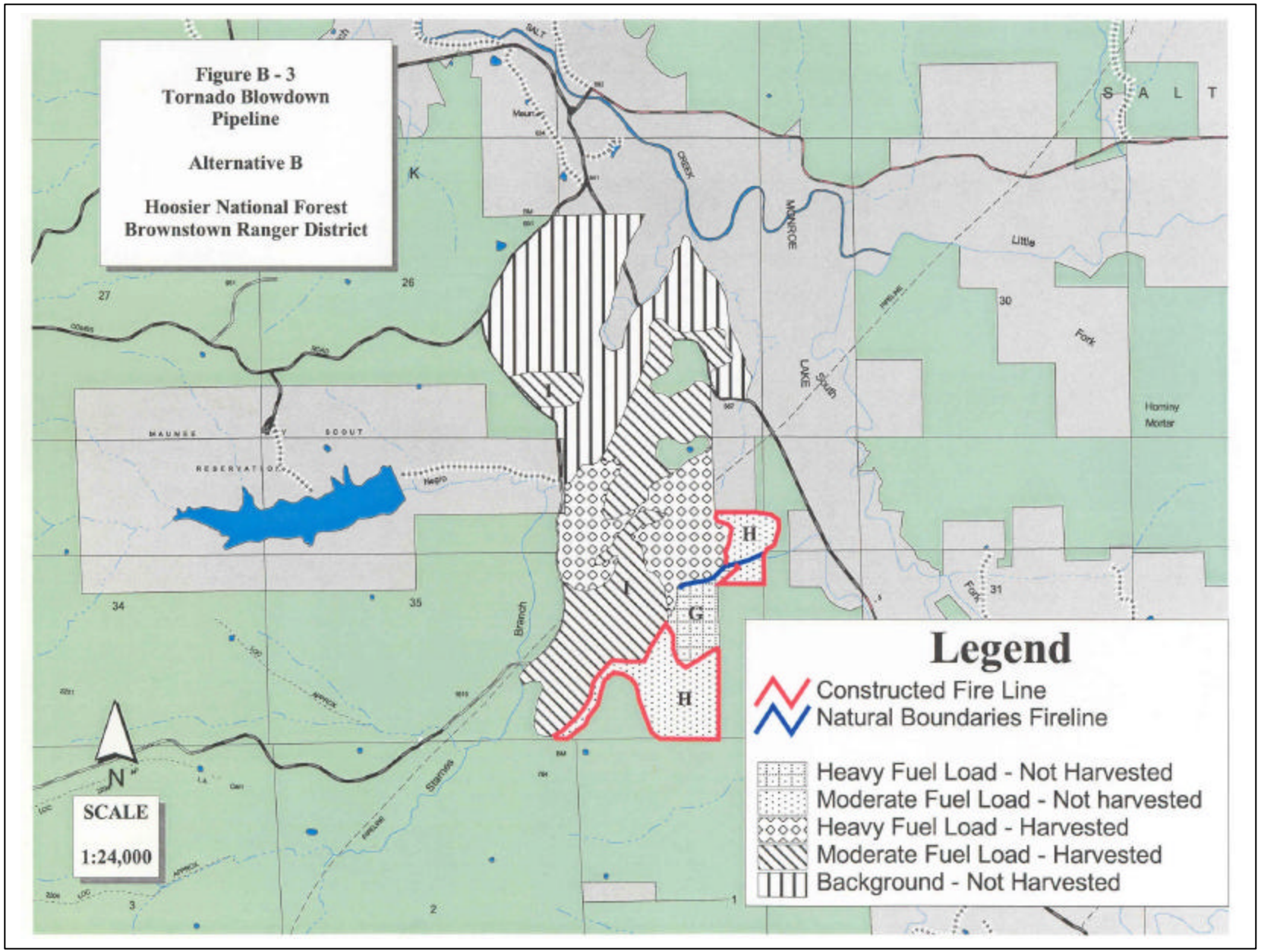


Figure B - 3
Tornado Blowdown
Pipeline
Alternative B
Hoosier National Forest
Brownstown Ranger District
SCALE
1:24,000
N
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
S A L T
MONROE
LAKE
Little
Fork
Hominy
Mortar
MAUNEE
SCOUT
RESERVATION
Branch
Starnes
H
G
I
K
26
27
30
31
34
35
2
3

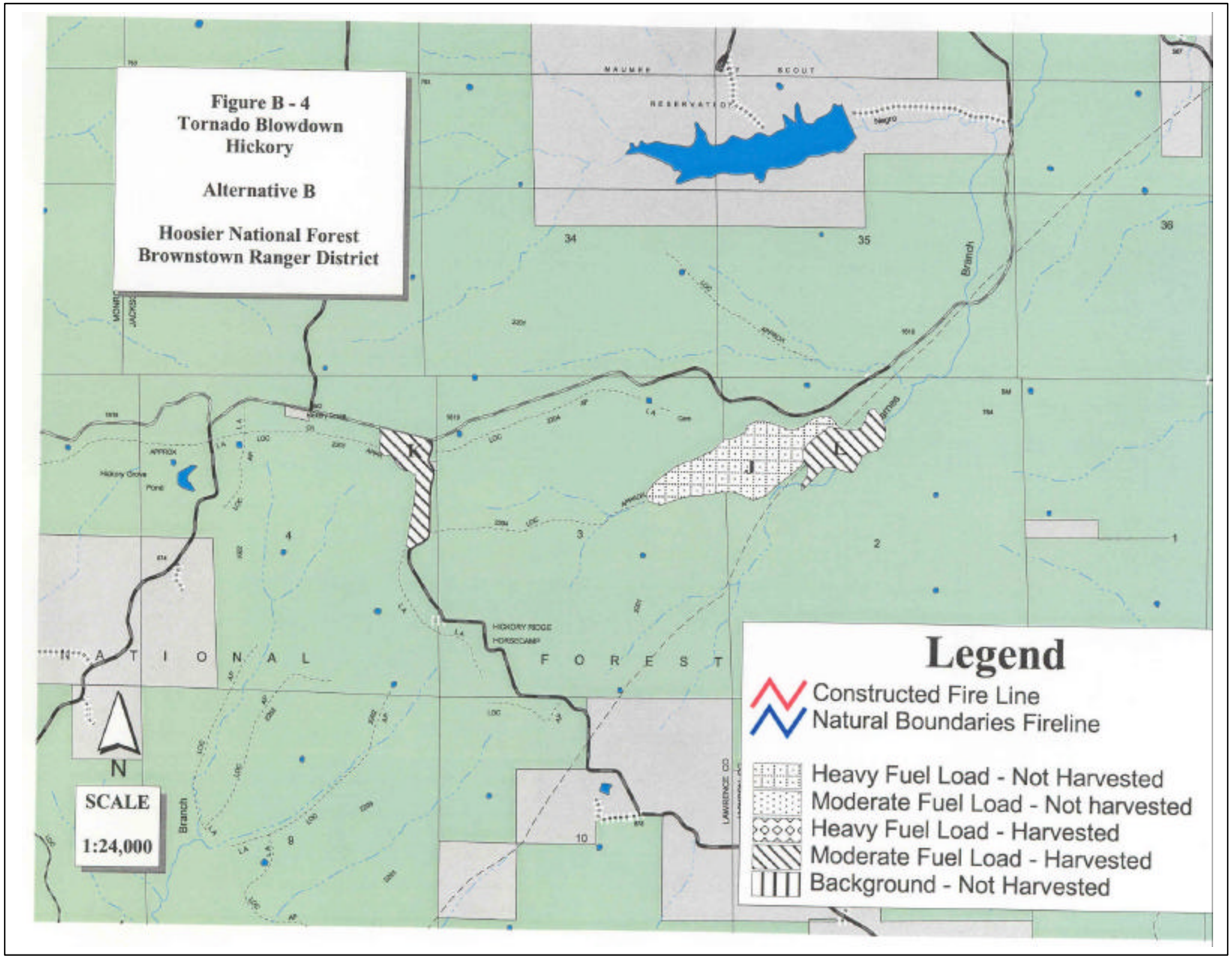


Figure B - 4
Tornado Blowdown
Hickory
Alternative B
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
N
SCALE
1:24,000
A T I O N A L
F O R E S T
HICKORY RIDGE
HORSECAMP
Hickory Grove
Pond
Branch
LAWRENCE CO
34
35
36
4
3
2
1
10
8
K
J
A

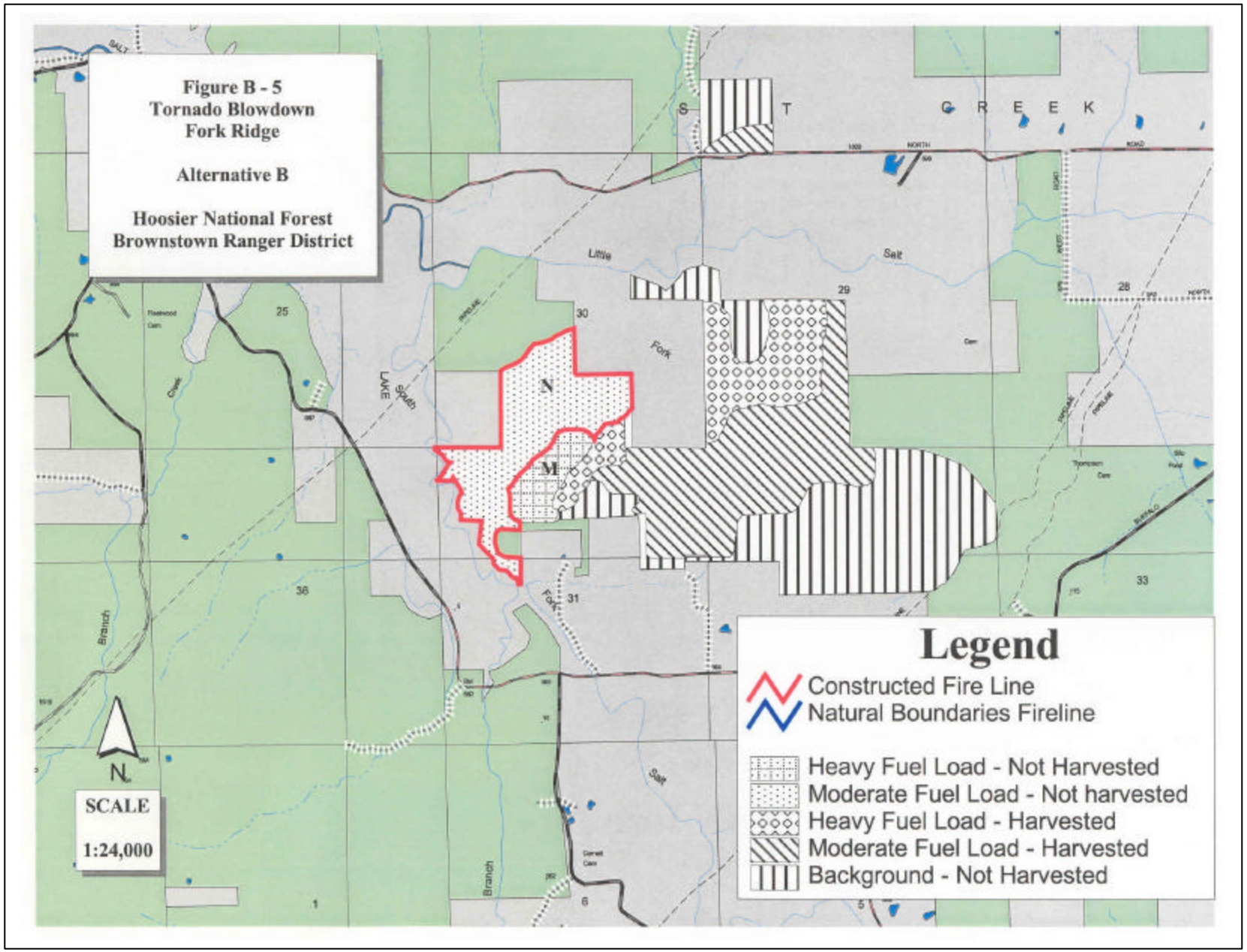


Figure B - 5
Tornado Blowdown
Fork Ridge
Alternative B
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
SCALE
1:24,000
N
S T G R E E K
Little
Salt
Fork
South
LAKE
Branch
25
30
29
28
36
31
33
1
6
5

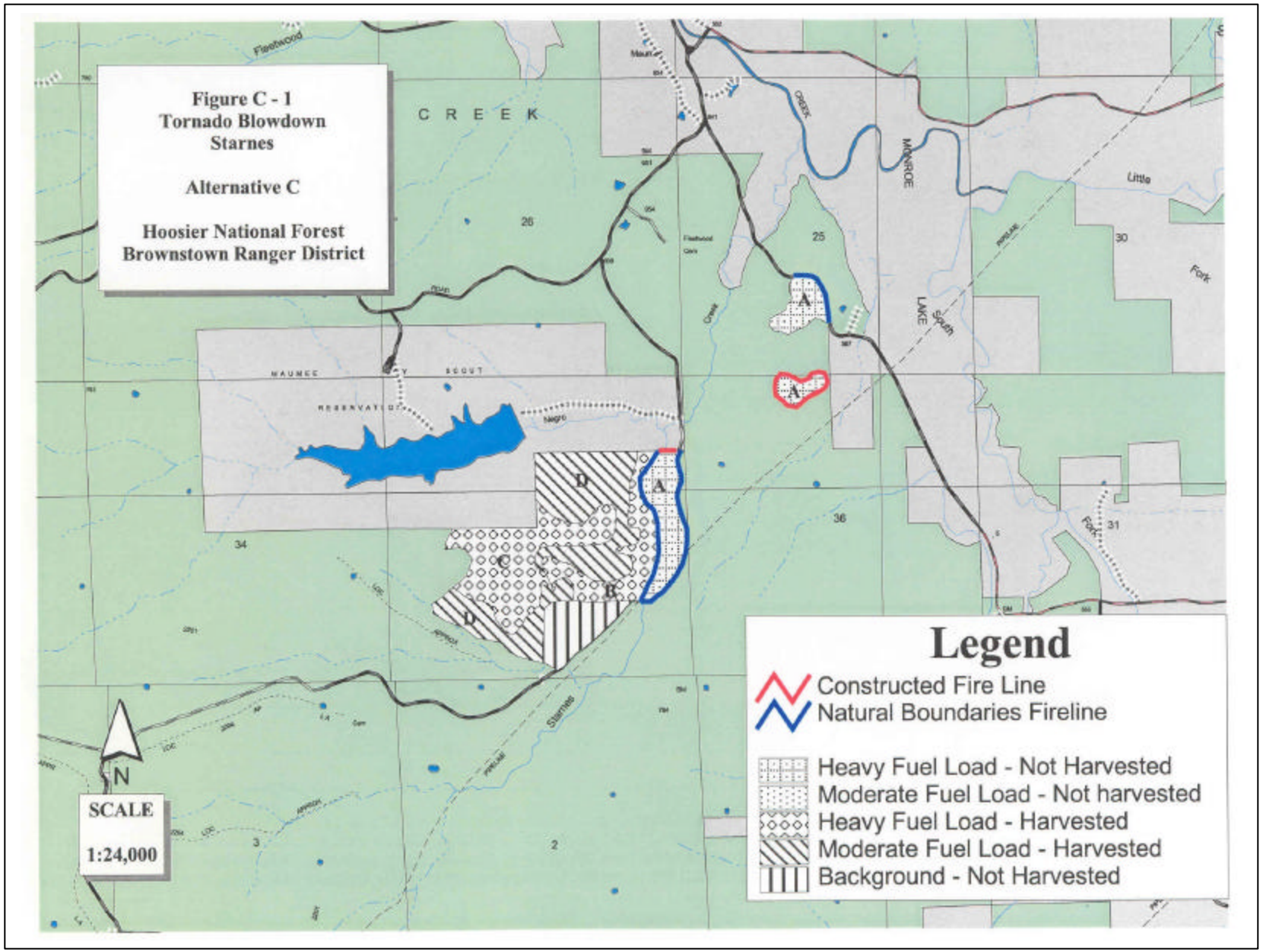


Figure C - 1
Tornado Blowdown
Starnes
Alternative C
Hoosier National Forest
Brownstown Ranger District
CREEK
MONROE
LAKE
South
Little
Fork
Starnes
26
25
30
31
36
34
3
2
A
B
C
D
N
SCALE
1:24,000
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested

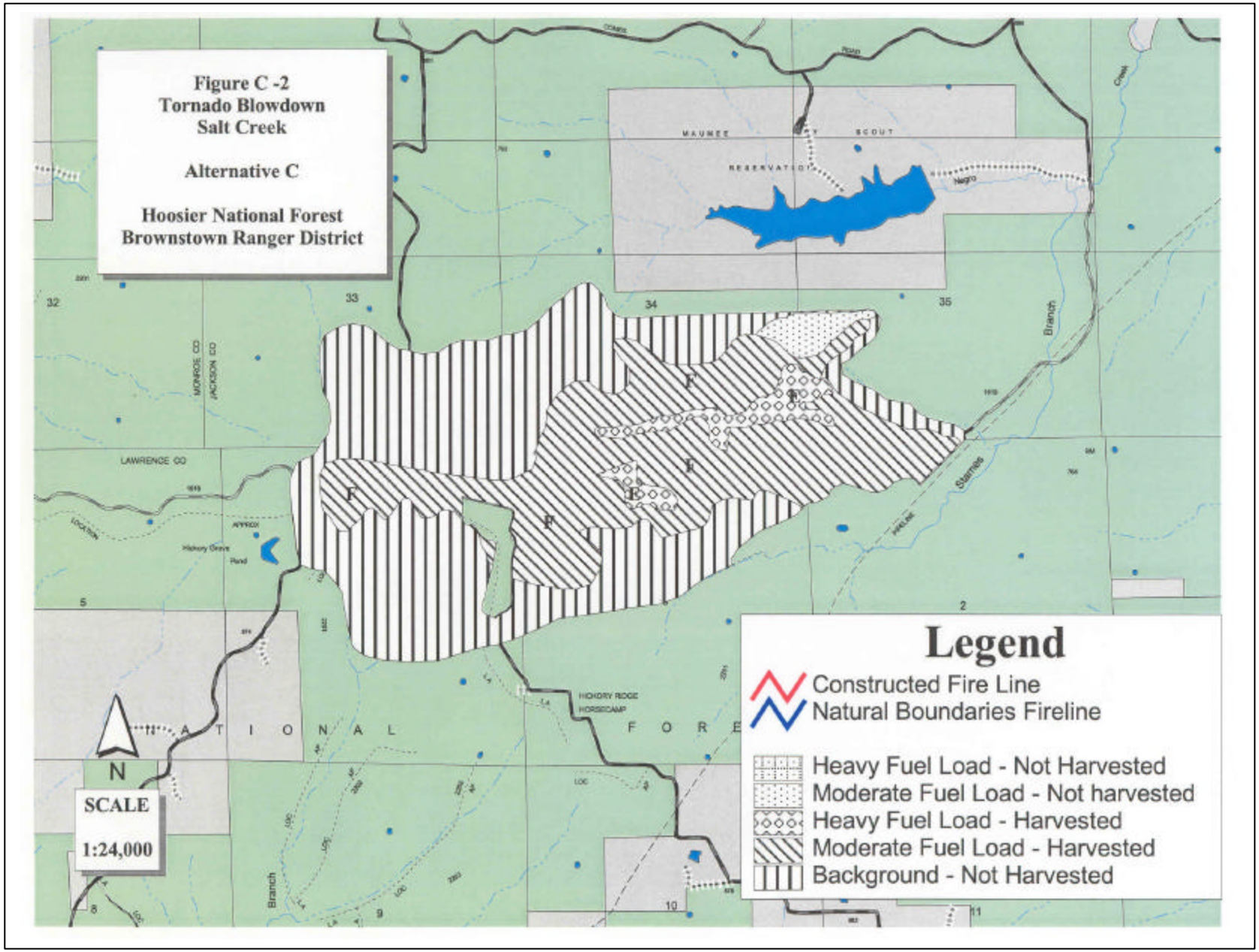


Figure C -2
Tornado Blowdown
Salt Creek
Alternative C
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
SCALE
1:24,000
N
MAUMEE
SCOUT
RESERVATION
LAWRENCE CO
MONROE CO
JACKSON CO
HICKORY RIDGE
HORSECAMP
F O R E
A T I O N A L
Branch
Stamps
Hickory Grove
Pond
32
33
34
35
5
2
8
9
10
11

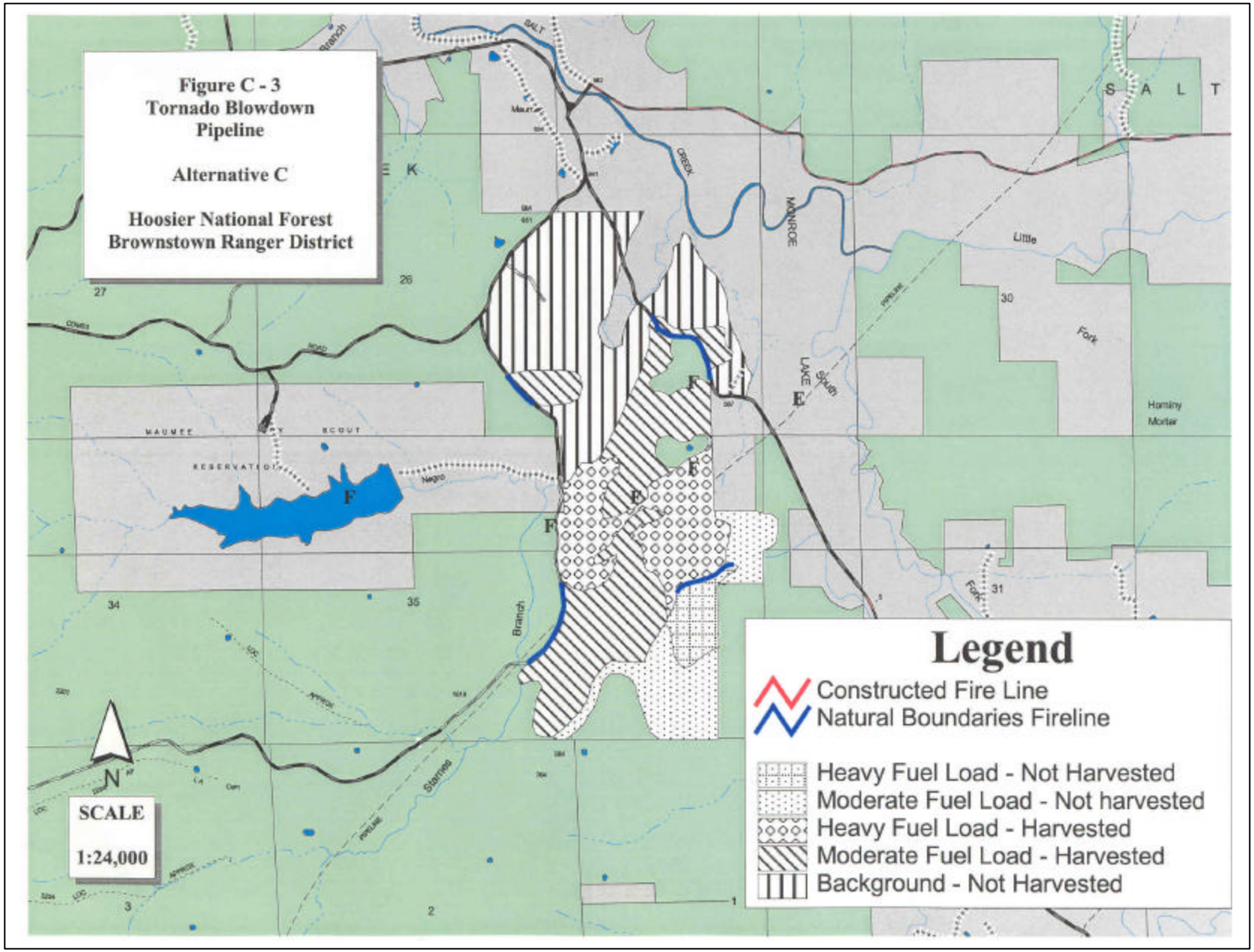


Figure C - 3
Tornado Blowdown
Pipeline
Alternative C
Hoosier National Forest
Brownstown Ranger District
SCALE
1:24,000
N
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
S A L T
MONROE
LAKE
Little
Fork
Hominy
Mortar
MAUMEE
SCOUT
RESERVATION
Negro
Branch
Starved
27
26
30
34
35
31
3
2
1

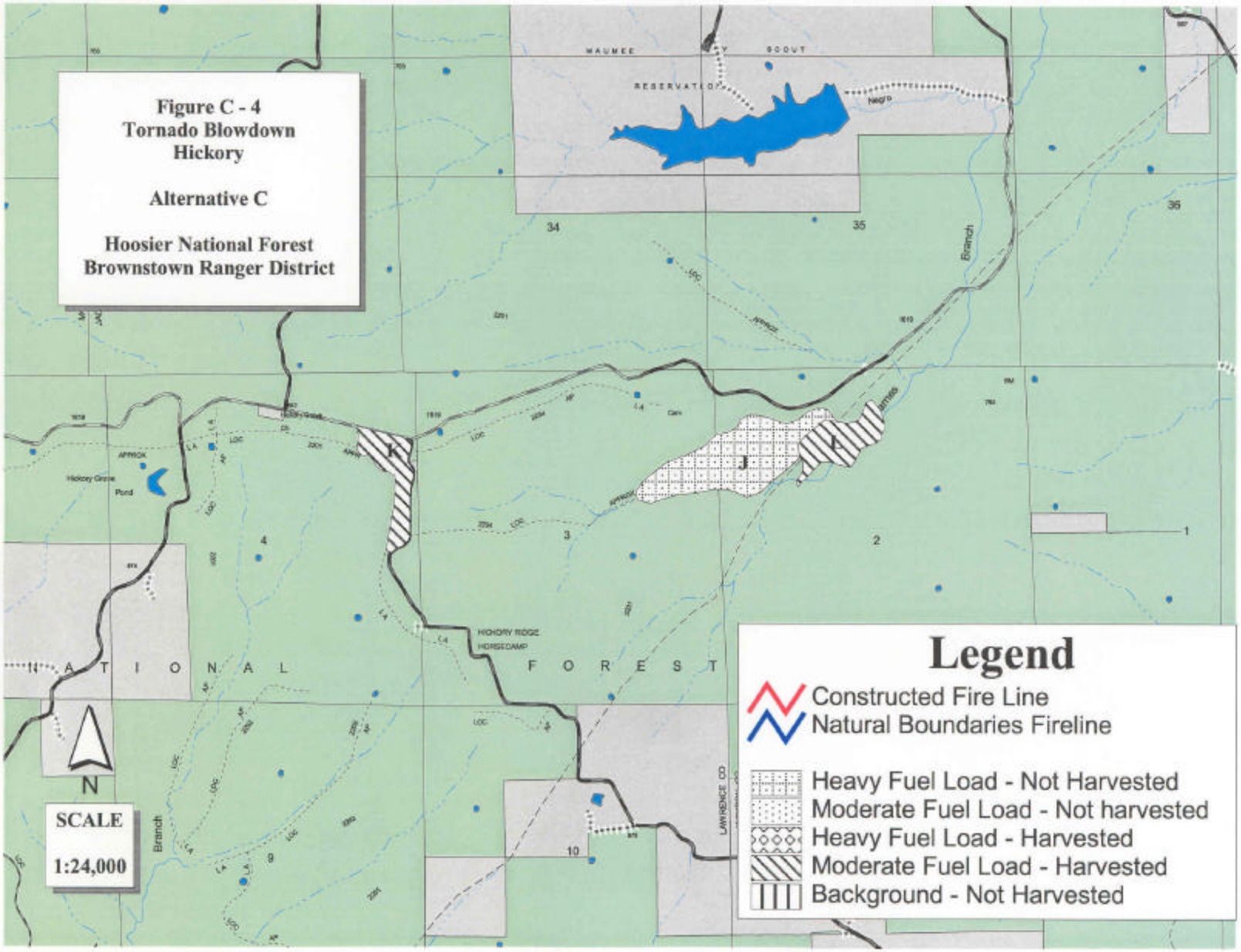


Figure C - 4
Tornado Blowdown
Hickory
Alternative C
Hoosier National Forest
Brownstown Ranger District
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested
SCALE
1:24,000
N
MAUMEE
SCOUT
RESERVATION
HICKORY RIDGE
HORSECAMP
LAWRENCE
Branch
Hickory Grove
Pond
34
35
36
2
3
4
8
9
10
J
K
L

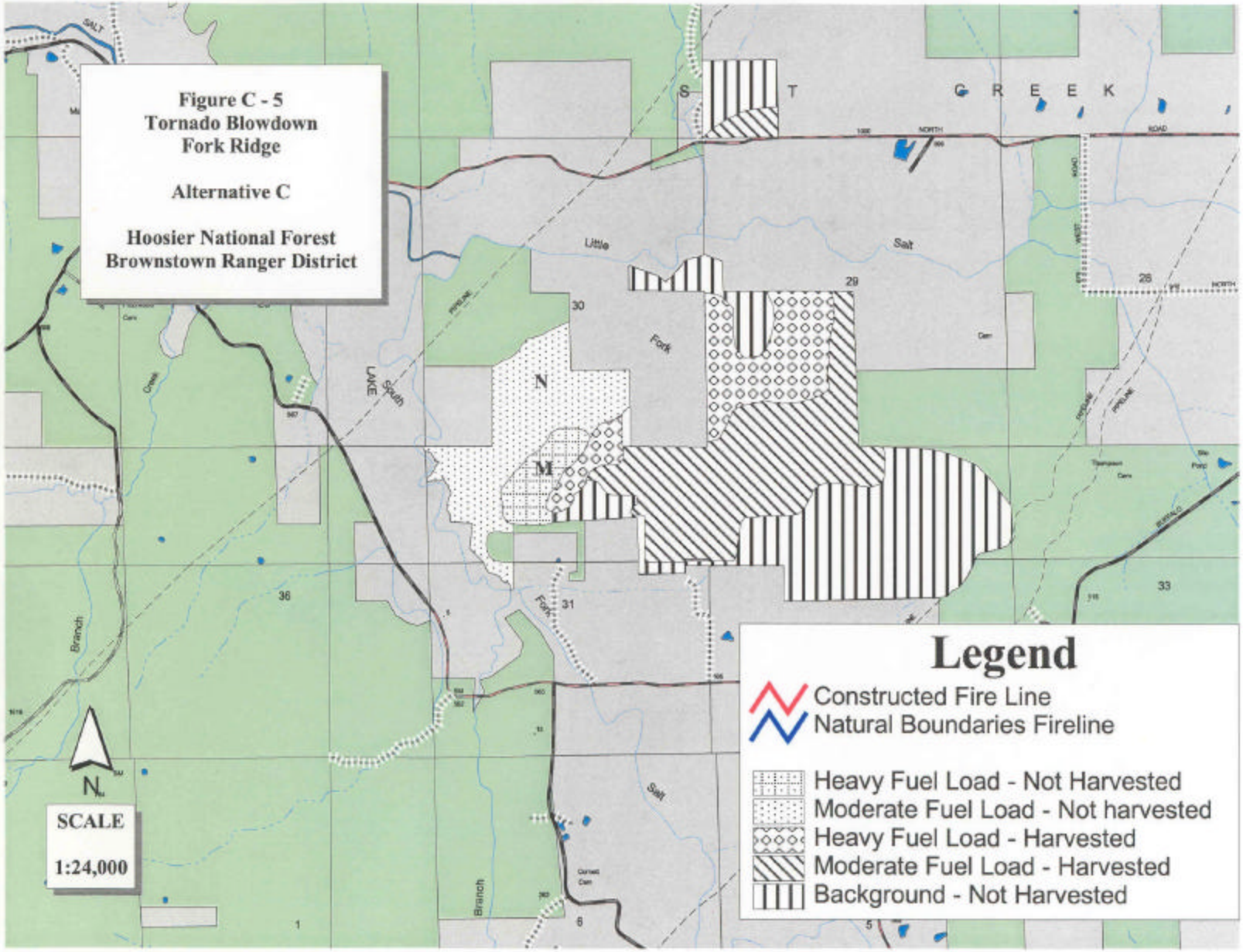


Figure C - 5
Tornado Blowdown
Fork Ridge
Alternative C
Hoosier National Forest
Brownstown Ranger District
S T G R E E K
Little
Salt
Fork
LAKE
South
N
M
Branch
Salt
Branch
Fork
30
29
28
36
31
33
1
6
5
N
SCALE
1:24,000
Legend
Constructed Fire Line
Natural Boundaries Fireline
Heavy Fuel Load - Not Harvested
Moderate Fuel Load - Not harvested
Heavy Fuel Load - Harvested
Moderate Fuel Load - Harvested
Background - Not Harvested