Pine Creek Historic Forest Restoration Project

Ironton Ranger District
Wayne National Forest

Chapter Three

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Analysis of Effects

Chapter Three analyzes the effects of the alternatives on the resources, with reference to the issues raised during scoping. This chapter describes the existing condition of the landscape in which the proposed activity would occur and the anticipated impact of each alternative on the resources. While this chapter is organized by alternative and then by resource, it also focuses on issues raised during initial scoping. Some comments and/or issues are covered more thoroughly in the Response to Comments, which is included as an appendix to this EA.

Effects are analyzed for watershed resources (soil, water and air); vegetation (native tree species, threatened and endangered species, non-native invasive species, regional forester's sensitive species; wildlife (threatened and endangered species, regional forester's sensitive species, management indicator species); recreation and archaeology (heritage resources). The first section of this chapter discusses the past and present activities occurring in the analysis area. Subsequent sections are organized by alternative, then by resource. To prevent redundancy in the discussion of effects, an effects discussion from another alternative may be referenced. A summary occurs after each alternative.

"In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one can not reasonably identify each and every action over the last century that has contributed to current conditions.

Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EA is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part: "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present

effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision-making. (40 CFR 1508.7)"

A vicinity map was shown in Chapter One, a small scale map of Alternative Two was displayed in Chapter Two, and a Cumulative Effects or Past Activities map of the planning area may be viewed on the Wayne National Forest website at http://www.fs.fed.us/r9/wayne/reading_room.html. A 24x36"detailed map of Alternative Two is available either hard copy or on the web.

The boundary for a cumulative effects analysis varies based on the activity and the resource. The following table displays the variation in boundaries used for cumulative effects among resources.

Table 3-1: Table shows cumulative effects area for resources analyzed in this chapter.

Resource	Cumulative Effects Analysis Area	Rationale
Indiana bat	Ironton Ranger District	Area is large enough to encompass the home range of bats that may spend part of the spring, summer or fall in the planning area
Botany	Pine Creek watershed	1) it includes all of the streams, tributaries, and forest that could be affected by the restoration of plant communities through timber harvests and prescribed burns and 2) the potential spread of NNIS along trails, streams burn
Water quality and soil effects	Pine Creek watershed	**direct** consequences would be the acres (project areas) where actions are proposed within the analysis area; **indirect** consequences are bound within the project area because effects are not expected to move outside of the sub-watersheds within the project area.
Other wildlife	Pine Creek watershed	Effects are related to those on watersheds
Silvicultural	Specific site	Changes to light and moisture availability are site specific

Concurrent Analyses

The analysis area for this project lies north of the analysis area for another proposed project that was recently analyzed and is now being implemented on the Ironton Ranger District. The Kosmos Trail Addition project lies south of the Pine Creek Historic Forest Restoration analysis area. We analyzed the impact of designating old roads and constructing some new trail for off-highway vehicle use. The interdisciplinary team considered including both projects in the same analysis because the project areas are adjacent to each other and because we looked at both proposals at about the same time. It was decided that analyzing the two project proposals together would create a complicated array of alternatives and complicate the effects analysis. The actions of each of the proposed projects are covered in the cumulative effects analysis of both projects. This chapter references the construction of new OHV trail and the use of existing trail as haul roads for the harvest activity and as fire line for prescribed burning. Project activities overlap when harvest or prescribed burning activities require access or occur adjacent to existing or proposed OHV trails. This rationale is consistent with that given in the Kosmos ATV Trail Extension Decision in 2008.

Existing Condition

Location of the Pine Creek Historic Forest Analysis Area
The Pine Creek Historic Forest analysis area lies on the west side of State Highway 93, extending from Telegraph Road on the north to Charred Hollow on the south. The Kosmos Project Area touches the south end of the Pine Creek Historic Forest Project Area at Howard Ridge. Implementation may be concurrent, so both projects are considered in Cumulative Effects.

The plant communities in the project area have a long history of disturbances that have shaped the assemblages we see on the landscape today. Since at least the 1600's, Native Americans have influenced the landscape of the Ohio hills region (Goebel and Hix 1996). Like modern humans, these people had a profound impact on the landscape through the use of prescribed fire to manage their land for hunting, gathering and traveling. Some of the evidence of management is written in the accounts of early explorers and land surveyors.

"The woods were clear from underbrush, the oaks and black walnut do not grow very compact, and there is scarcely anything to incommode a traveler in riding almost in any direction, in the woods of the Ohio. The Indians have been in the practice of burning over the ground that they may have the advantage of seeing game at a distance among the trees"

-David McClure, eastern Ohio, 1772

Prior to European settlement, frequent burning by the Native Americans coupled with the rolling topography created a gradient of habitats in which dense, shade-casting forests were found on the lower slopes and open, sunny woodlands and savannas were located on the upper slopes and ridges where fires burned intensely. Other disturbances, such as herbivory by large ungulates like bison and elk no doubt had a large impact on plant community dynamics. These herbivores probably maintained low levels of woody understory growth which further opened the understory and created the park-like conditions described above. Prescribed fire by Native Americans and browsing by large ungulate herbivory would have created and maintained environmental conditions favorable for many oak and hickory species, especially on the upper slopes and ridge tops.

Industrial uses of the land have severely altered the landscape over the last 100 years. These disturbances started with clearing of all the forest to produce charcoal for the pig iron industry from the late 1800's to the early 1900's. During this time some of the first invasive species were arriving and becoming established in the eastern United States. Butternut canker and chestnut blight, also introduced during this period, forever removed the butternut and America chestnut tree from the landscape, which as large, mast producing species probably had an impact to wildlife population and forest composition and structure (McCormick and Platt, 1980). Frequent fires were also a part of the landscape during this industrial period and have been linked to pulses in oak forest regeneration (Hutchinson et al. 2008). These intense disturbances of clear cutting and fire would have created perfect conditions for oak forest regeneration by creating high light environments and eliminating faster growing competition that is less adapted to respond after fire. The oldest forest in the Pine Creek area has its origin from this period.

In the 1950's and 60's, as forests were regenerating from the previous clearing and fire, surface and subsurface mining created large tracts of openland and edges which were prime habitat for newly established invasive species. Road building, small timber harvests, off-road vehicles and fire suppression have shaped the plant communities in the Pine Creek landscape. Roads and timber harvest provide corridors for invasive species and fire suppression has led to dense, brushy understories where grasses and forbs once dominated. Most recently in 2003, a major ice storm covered much of the project area and created large pockets of canopy gaps which have been filling in with non-native species such as tree-of-heaven and princess tree.

Today, approximately 70% of the forest has regenerated from the initial clearings of the iron era and is comprised of species that were reported to be present prior to the forest clearing of the late 1800's (Dyer 2001, Shaler and Crandall, 1876). However, today's forest structure does not match the description written by early explorers quoted above. Fire suppression and the absence of large herbivores has led to a dense mid-story of shade tolerant saplings and shrubs. Shade tolerant species such as red maple are altering forest disturbance dynamics such that small low intensity fires will not burn as easily in the understory of the forest (Nowacki 2008).

Legal Description

Lawrence County - Decatur T3N R18W and Elizabeth Township T2N R18W.
Scioto County - Vernon Township T3N R19W.

Physiographic Setting

The entire Pine Creek project area falls within the Pine Creek watershed north and west of Ironton, Ohio, in Lawrence and Scioto Counties, specifically within the sub-watersheds of Little Pine Creek and the middle section of Pine Creek. Pine Creek drains 43,000 acres of the Wayne National Forest, of which approximately 11,000 are in the project area. Pine Creek enters the Ohio River between the Greenup Lock and Dam to the south and the city of Wheelersburg. The planning area for this project includes approximately 15,000 acres in which projects will occur. This represents only 7% of the Ironton Ranger District.

The Pine Creek watershed is located in the un-glaciated portion of Ohio in the Western Allegheny Plateau. Most of the nearly 11,000-acre project area is contiguous blocks of USFS land, with little interspersed private land. Evidence of the land use history is abundant, including a dense network of roads and trails built to harvest timber or move coal and limestone, abundant non-native vegetation, open mine portals, shallow pits, high walls, reclaimed strip mine areas, remains

of structures including bridges, buildings and iron ore furnaces, ponds, and a large abandoned cement factory near the proposed trailheads.

There are nine riparian mapping units (1,867 acres or 7.62 % in the project area) including two hydric soil mapping units (139 acres or < 1 % of the total project area) within in the project area. Mapping units > 25 % slope have a severe erosion potential and units with > 8% generally have a moderate rating. Most soil mapping units have a high compaction potential. Overall, most soil mapping units have a low potential of damage from fire although some have a moderate and high potential. These can be found in the Appendix (Project File 7-14 DePuy).

The project area is currently a mosaic of old fields of fescue, goldenrod and Chinese lespedeza, young oak-hickory woodlands, mixed species of scrub trees and brush which is succeeding into forest, early successional stands of pine, sycamore, box elder and black locust, mature oak-hickory forest and maple-beech forests (Project File 5-8). The Pine Creek analysis area lies north of the heavily disturbed Kosmos (aka Superior or Marquette) area and contains only a small acreage of reclamation north of the cement plant. Five miles south of Charred Hollow, approximately 60 acres in the Fox Hollow drainage was reclaimed in the 1980s to grass cover and is re-vegetating to trees from the outside edges. Another 3500 acres surrounding the Kosmos project area was strip-mined and not reclaimed. Approximately 1200 acres has been underground mined. All of these estimates are based on maps warehoused by the Ohio Department of Natural Resources, Division of Mineral Resources and on USGS topographic mapping (Project File 7-9). Some of this detail is available on Map 2-2 Past Activities.

Large infestations of non-native invasive species (NNIS), especially autumn olive, multi-flora rose, Japanese stiltgrass and Japanese honeysuckle are common. Many dry ridges with thin soils are occupied by native Virginia pine stands. Ponds are frequent south of the project area (see Appendix Four, Map 3-3), and wetlands can be found at the shallow ends of the larger ponds. Most of the existing ponds were created during past mining activities, or are beaver-created. Ponds are often ringed by Typha spp., and full of Potomogeton spp (Project File 5-8).

Socio-Economic Setting

The archival record indicates that the Pine Creek watershed was utilized throughout the pre-historic period, from Paleo-Indian through Late Prehistoric times. This area represents a typical upland-based settlement pattern. In this un-glaciated rolling topography, prehistoric cultures lived primarily on small level areas of stream terraces and ridgetops and within rock overhangs or shelters that served as ready-made housing features. They often buried their dead in small earthen ridgetop mounds or within the rock shelters. The large organized Woodland burial complexes are absent here (Project File 6-5).

There are no towns within the project area. The closest town is Ironton with an estimated population of 12,700. South Webster with a population of 930 and Wheelersburg with a population of 5000 lie west of the project area. The Pine Creek watershed drains parts of

Lawrence, Scioto and Jackson Counties, all three of which are part of Ohio's 29-county Appalachian Region, an area uniquely different from other parts of the State of Ohio. The Appalachian Regional Commission, a national program created in 1965, targets counties for economic development to reverse the damaging trends of chronically high unemployment, net outward migration, and acutely low levels of income. Appalachian Ohio maintains a distinct social and cultural identity from the rest of the State based on its unique geography, history, and patterns of economic development (Pine Creek Watershed Assessment, Project File 9-10).

The project area for the Pine Creek Historic Forest project is located directly north of the project area for the Kosmos ATV Trail Extension Project. The cover type difference between the portion of the area referred to as Pine Creek and the area known as Kosmos to the south is directly related to the making of iron. The Kosmos area had the minerals important to the iron furnaces – iron, limestone and coal –and has the resulting mining-related topographic and vegetation disturbance. The more northern portion of the planning area, referred to as Pine Creek, lacked the minerals but was an important source of wood for making charcoal, the first and primary source of fuel in the furnaces.

Charcoal has been, and is now, the principal fuel used. The vast forests supplying it melted away before the ax of the furnace-men, and already the supply is becoming a matter of serious thought in certain localities. Each furnace consumed an average of 12,000 to 15,000 cords of wood yearly. This immense consumption was slowly replaced by the second growth of timber, at the rate of about two cords per acre yearly. In the case of furnaces owning large tracts of land some could continue their operations with charcoal fuel indefinitely. But with many in the course of the next fifteen years, they must be seriously cramped unless they should draw their supplies from the extensive forests in eastern Kentucky and West Virginia, which of course would largely increase the cost of production. Atlas 1887

Table 3-1: Summary of Land Cover Type in Pine Creek/Kosmos Analysis Area

Pine Creek/Kosmos Analysis Area Summary of Acres by Forest Type	
Total Acres – Telegraph to Little Pine Ck	28,202
FS acres	18,260
Private Acres	9,079
All Hardwood	17,561
Hardwood Acres >60 years	11,330
Hardwood Acres 30-60 years	3,872
Hardwood acres <30 years	2,359
All Pine	745
Native Pine	421
White Pine	324
Special Areas (a subset of hdwd acres)	431 167

Past and Present Activities

See Map 2-1 for a visual display of all past, present and reasonably foreseeable future activities in the project area for the cumulative effects analysis. Past activities occurred in primarily three different categories: road development and the resulting illegal off-road use, mining and vegetation management. The historical and physiographic context discussions above, followed by a description of the past activities, will set the stage for the project impacts and cumulative effects discussions.

In order to analyze cumulative impacts to the resources from the intense period of development in this region, it is necessary to look at impacts in space and time and existing condition. The following table summarizes the extent of past activities in the analysis area. Note that through the remainder of this chapter, each specialist will define the cumulative effects boundary according to the effects to that resource. This means that acreage totals for any past activity may differ between resource analyses.

Table 3-2: Past and Present Activities in the Analysis Area

Transportation-Related Activities	
Kosmos Trail Extension	26 miles of newly designated trails and 7 miles of new trail construction in Kosmos Project Many miles of road development Existing 41 miles of trail system at Ironton
Regular maintenance	Trail and road maintenance
Historic industrial uses	Detroit-Toledo-Ironton Railroad (abandoned) CHD Railroad (abandoned)
Recreation	Illegal off-road vehicle riding
Mining-Related Activities	
Mining 1820s forward	Mining for gravels for cement factory in Kosmos area Limestone mining Iron ore mining for iron furnaces Strip mining for coal
Watershed restoration	Bond Clay reclamation 1990s Fox Hollow reclamation 1980s Kimble Creek AMD Treatment 2000 Lawco Lake AMD Treatment 2008 Bear Run Stream Restoration 2000
Iron Furnaces	road building and clearing to supply furnaces First blast in 1827 Last closure about 1960
Vegetation-related Activities	
Vegetation	wildfires clearing for iron furnaces intensive management 1970-1995 high fuel loadings from storm damage Young's Branch prescribed burn Darby Creek prescribed burn found Running buffalo clover 2004

	NNIS spread from past activities Buckhorn Restoration harvest activity Heavy Fuelwood harvest activity Treatment for NNIS in Buckhorn area, priority areas on forest

Transportation – Development of Road Network

Past and Present Activity: The existing roads within the Pine Creek analysis area were designed and used for mining activities associated with timber extraction, coal mining and the cement plant operations on County Road 41S. Some of the roads in the northern section of the project area were re-constructed in the past 30 years for timber-related activities. Presently, all the roads in the area are closed to the general public but some serve as access to the power line easement that runs through the area. Few new roads have been built in the area since the 1950s.

There are several classifications used to describe the existing road surfaces in the project area. For clarification throughout the analysis, they are defined here. Many national forest-owned roads are **unclassified** and may or may not be visible on an aerial photo, but are visible on the ground. ATV riders will often use these unclassified roads when exploring to create a user-developed system. An unclassified road may not be mapped or inventoried and is not part of the Forest Service road system. A **classified road** is a **system road**, may be visible on the photos, is mapped, usually connects to a larger arterial road, and has been inventoried and assigned a number in the Forest road system.

Mining-related activities

Photo shows a highwall and pond in the Kosmos mining area.

Underground and strip mining for coal and deep and quarry mining for limestone all occurred in the project area. Deep mining occurred as early as 1860, strip mining occurred later in the 1950s through the mid-1980s, and limestone mining occurred from the late 1800s through about 1980. 60 acres were reclaimed in the 1980s, most of the acreage lying southwest of St Rt 522 in the Darby Creek and Fox Hollow drainages. 1600 acres had been underground mined (based on the underground mine locator on the Ohio Division of Mineral Resource Management webpage) and 3200 acres (estimated from stippling on the map) was strip-mined. There has been no new mining in the area since the mid-1970s. Many roads in the analysis area were built to access minerals during the mining era.

The residual effect from these activities include changes in land cover type from forest to grass land or early succession, the residual network of roads for access, and changes in stream shape and bedload (sedimentation).

Vegetation-management related activities

The productive forests of the Pine Creek drainage have been managed for wood products since early in the 19th century. Impacts to the vegetation community in the area have occurred from natural fire, Native American cultural practices, and continued through the era of clearing for iron furnaces and charcoal production, and then stripping for coal, clay and limestone. Since the first iron furnace in the area had its first blast in 1827, there was likely an 80 year period during which timber was harvested for use in the making of charcoal. This is consistent with the age of the older stands of timber in the Pine Creek and Kosmos area, many of which originate between 1852 and 1930. The closest iron furnace was Clinton Furnace, lying ½ mile west of the Wolcott drainage. This iron furnace ceased operation about 1895. The mature timber in the area was likely exhausted by then and the source of fuel had switched to coal, also produced in the Kosmos area. More recent mining has resulted in younger stands, some of which are not in tree cover, but in grass and shrubs.

As the re-growth from the iron furnace era has matured, clearcutting and selection harvesting continued through the 1990s. Table 3-2 above shows the distribution of acres into broad age classes. A majority of acres (11,330 or 62%) remain in the over-60 age class. Some of these acres received a selection harvest in the past 30 years, with no resulting change in age class.

Map 2-1 showing past, present and reasonably foreseeable future activities in the analysis area shows blocks of vegetation less than 30 years of age. Smaller blocks, less than 40 acres in size, form a patchwork in the Pine Creek area, reflecting forest management since 1970. Larger blocks – one being several hundred acres in size, reflect the era of surface mining in which trees are still becoming established. The largest of these is located in the upstream reaches of Delaney Hollow on the west side of the analysis area.

Throughout the District west of State Route 93, approximately 3,580 acres have been cut using even-age management in the past 20 to 40 years. Stands less than 30 years old are being considered for crop tree selection in the Pine Creek decision or in other timber stand improvement decisions on the District. Stands managed under an uneven-aged system do not change in age class and appear as mature stands. The cumulative effects map (Map 2-1) displays the under-30 age class in the Kosmos and Pine Creek project area and the proposed activity in the Pine Creek project.

According to Forest Service re-stocking guidelines, the hardwood stands cut during this active period of management are naturally re-stocked with seedlings, sprouts and advanced regeneration present when the stands were cut. Many of these acres will receive a crop tree release treatment in this project. The stands which are still developing following surface mine reclamation are a mixture of grasses and early succession, including black locust, ash, black gum, and pine. These stands are not considered re-stocked.

The native pine in the area likely originated during old field succession when bare ground was available for pine germination. The white pine occurs in plantations established on farmland or pasture acquired by the Forest Service. Two special areas, Waterfall Cove and Young's Branch,

occur within the analysis area. These were established in 1993 by a plan amendment to the 1988 Wayne National Forest Land and Resource Management Plan.

The 2003 ice storm dropped crowns or whole trees across some old roads. Damage was especially heavy in pines on ridge top roads, and occurred to all species in drainages. A small area near the northern end of this analysis area was treated with a salvage thinning in the 2003 Heavy Fuelwood project. The Buckhorn Restoration Project is being implemented to thin approximately 2000 acres east of State Route 93 and east of this analysis area.

Non-native invasive species were likely introduced to the Kosmos project area purposefully through mining reclamation activities (e.g. autumn olive, tall fescue, Chinese lespedeza etc.) and unintentionally through the use of equipment associated with the mining activities and illegal OHV use. These introductions probably took place over the last 70 years. Activities that could affect the spread and abundance of NNIS, and thus T & E and RFSS in the Pine Creek watershed include timber harvest, road and OHV trail maintenance, prescribed burning, wildfire, tree planting, NNIS control, and trail maintenance (Table 2).

Effects of Alternatives

In this section the existing condition (based on the above discussion of project area history) and effects of the proposed activities will be discussed. Effects from past activities will be included in the discussion of cumulative effects. Information about the past activities above will not be repeated unless important to the discussion.

No Action Alternative

Soil, Water and Air

Cumulative Effects Analysis Area
The spatial boundary used to address **cumulative** impacts was the Pine Creek watershed (11 digit Watershed No. 05090103020). This allows us to assess past and future effects within this boundary and determine threshold impacts to soil quality when added to the proposed actions.

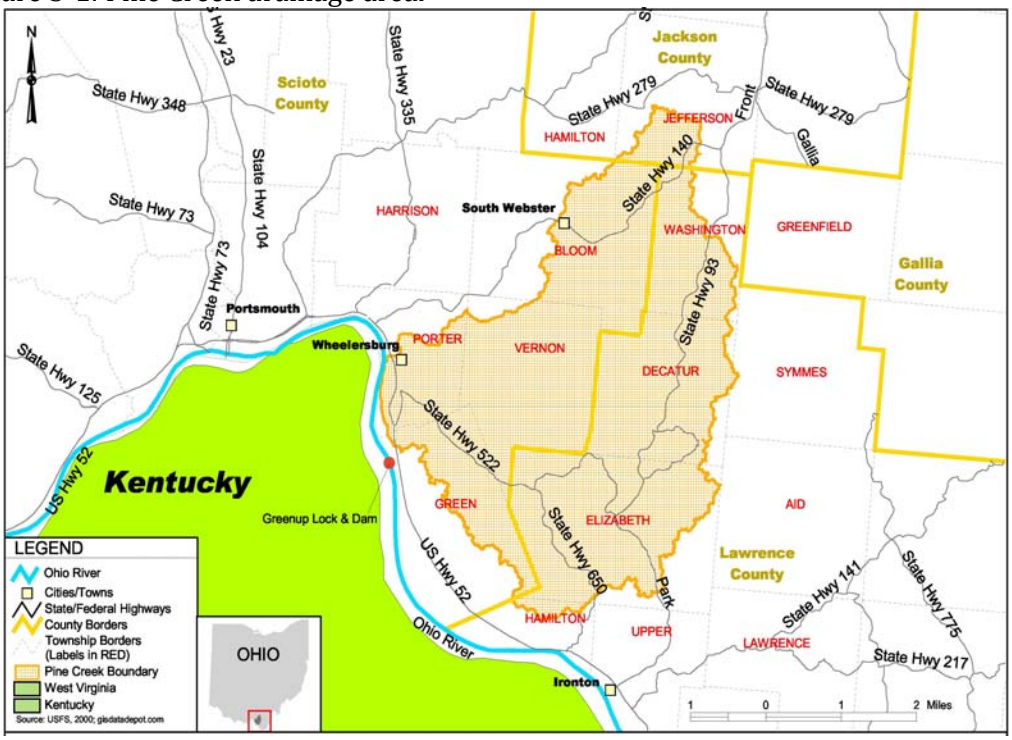
The spatial boundary used to evaluate **direct** consequences would be the acres (project areas) where actions are proposed within the analysis area. Project areas are where harvesting, burning, and where herbicide treatment are proposed. This spatial boundary was chosen because it can be used to determine threshold effects to soil quality from proposed actions associated with this project**. Indirect** consequences are bound within the project area because effects are not expected to move outside of the sub-watersheds within the project area. Please refer to the Alternative Maps (Chapter 2) for the locations of the proposed activities.

Regional Soil Quality Standards (SQS) were used during the monitoring of past activities within the project area. This monitoring is referenced in the Soils Analysis (Project File 7-13). Short term effects to soils are related to a recovery period of one to three years. These effects are apparent until the affected area develops a vegetative cover and responds to site treatments to minimize soil movement and compaction. Long term effects to soils result from soil displacement and would last for more than 100 years. These effects result from the removal of the upper portion of the soil profile. This part of the soil profile contains a large amount of the soil's organic matter and available plant nutrients and therefore, its productivity or quality. The replacement of this part of the soil takes a long time (200-400 years) and depends on local climate and ecological conditions.

Existing Condition

The Pine Creek watershed has a total drainage area of 117,860-acres (184 square miles) that includes the main stem of Pine Creek and its tributaries and drains approximately 43,000 acres of the Wayne National Forest, Ironton Ranger District in southern Ohio. It is located in the un-glaciated portion of Ohio in the Western Allegheny Plateau level III eco-region. Pine Creek enters the Ohio River between the Greenup Lock and Dam to the south and the city of Wheelersburg to the northeast.

Figure 3-1: Pine Creek drainage area.



The current land cover type on abandoned surface mined areas is 84 percent forest, 5 percent agriculture, and 4 percent sparse vegetation/clear-cuts, 4 percent wetlands including ponds, and 3 percent urban development including quarries. This analysis suggests that abandoned surface mines no longer contribute to sedimentation in the Pine Creek watershed due to the extent of re-established forest cover. The Bear Run and Kimble Creek stream restoration projects were implemented in the Pine Creek watershed to remediate stream channel degradation due to sedimentation and flooding and water chemistry degradation due to acid mine drainage. More detail on previous and current projects watershed improvement projects is available upon request.

Table 3-3: Existing Land Use/Land Cover on Surface-mined Areas in Pine Creek Watershed

Table 3-3: Existing Land Use / Land Cover on Surface Mined Areas		
Land Use / Land Cover	**Area (acres)**	**% of Mined Areas**
deciduous forest	3896	70.8%
coniferous forest	557	10.1%
sparse vegetation/clearcuts	242	4.4%
open water	210	3.8%
row crops	161	2.9%
mixed forest	144	2.6%
pasture/hay	130	2.4%
quarries	120	2.2%
emergent herbaceous wetlands	15	0.3%
commercial/industrial/transportation	10	0.2%
low intensity residential	9	0.2%
woody wetlands	5	0.1%
high intensity residential	1	0.0%
Total Surface Mined Area	**5501**	

Water quality within the Pine Creek watershed has been impaired by historical mining, primarily coal. Mining remained an essentially unregulated industry until midway through the 20th century during which most surface and underground mines in the watershed were abandoned. Abandoned surface and underground mines represent a total of 7,577 acres or approximately 6% of the watershed (see the Pine Creek Ecosystem Analysis, USDA FS 1999). Decades of mining and roads associated with all the various mining activities left many streams choked with sediment. Acid mine drainage from underground mines released heavy metals such as iron, manganese, aluminum, and sulfur into the streams, which affected the pH (see Project File 7-7).
In addition to the water quality degradation, the topography was displaced, numerous sediment and acid ponds were created, and domestic waste went untreated.

The potential for erosion from disturbed areas following **historic mining and road building** in the Pine Creek watershed has greatly diminished as vegetation has once again been re-established. The U. S. Forest Service-Wayne National Forest and ODNR Division of Mineral Resource Management have reclaimed many of these mines by grading and re-planting vegetation. To determine the extent of vegetation establishment on abandoned surface mines, a GIS layer of abandoned surface mine areas within the Pine Creek watershed was compared to the GIS layer of 1994 land use/land cover classifications developed by USGS. Table 3-3 above summarizes the existing land use/land cover types on abandoned surface mines in the Pine Creek watershed.

The Forest Service monitors the effect that **logging** could have on soil and water resources to determine if there has been significant soil damage or loss as a result of vegetative management. Based on inspection reports from 2004-2006 (see Project File 4-17 and 7-13), the best management practices (BMPs) that were put in place during the implementation phase of recent

salvage projects were effective in reducing or eliminating soil erosion and transport. Best management practices consisted of constructing water diversions (water bars), grading soil to remove rutting, installing silt fences, spreading sidecast back onto the road, etc. The monitoring results indicate that on all three projects that occurred during this time period, there was no evidence of erosion, no windthrow of residual trees, nor any impact to water quality. The haul roads and log landings were stable. Documentation in the reports indicates that the monitoring took place after several large storm events, most notably Hurricane Frances.

The past restoration and reclamation projects as discussed earlier have had a net positive impact on overall watershed condition. Monitoring demonstrates the effectiveness of implementing forest-wide standards and guidelines and additional mitigation measures to minimize and/or potentially eliminate soil and water impacts. Under the No Action Alternative, no new roads would be constructed, re-classified, closed, or improved. The current practice of illegal OHV riding on non-designated trails and across streams would continue. Erosion from this illegal use will result in soil and water resource damage. Over the next 10 years, there will be a cumulative impact from the creation of additional illegal trails, resulting in some increased sedimentation in adjacent streams.

Effects from the Kosmos project include the some direct impacts from trail crossings in riparian areas. All stream crossings in the Kosmos project will either be hardened or bridged, resulting in only a minimal increase in soil movement into streams.

Acid Deposition/Air Quality

The largest contributors to atmospheric pollutants are fossil fuel burning power generation plant emissions Acid deposition is formed when sulfur dioxide and nitrogen oxides react with water and oxygen in the atmosphere to form acidic compounds These compounds then fall to the earth in either dry or wet forms as sulfuric and nitric acids. Sixty percent of the precipitation acidity in United States is from sulfuric acid (Sparks 2003). Nitric acid makes up the majority of the other 40 percent of precipitation acidity. Acidic compounds are only some of the ions in atmospheric deposition. Others include calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), ammonium ($NH_{4)}$, and chloride (Cl).

There are six sites in Ohio that participate in the National Atmospheric Deposition Program (NADP) to monitor wet deposition inputs. Three of those sites are in the southern half of Ohio: the Oxford site operated by United States Geologic Service (USGS), Deer Creek State Park operated by United States Environmental Protection Agency (USEPA), and Caldwell operated by the USGS. None of these sites is considered downwind from the Ironton Ranger District.

As shown in the Appendix (Project File 7-13 DePuy), the total sulfur deposition has decreased somewhat due to legislated emission controls. However, total nitrogen deposition has remained at relatively steady levels or declined slightly for the same time period. Decreases in the emissions of sulfate and nitrogen oxides were expected to slow acidification of soils and water; however, emissions of base cations, which neutralize the acids, also declined. Therefore, even with the decreases in deposition, the net result is that acidic inputs to soil and water increased. The NADP figures in the Appendix show the atmospheric deposition data from these and other associated sites.

Soil Chemistry

The soil mapping units in the proposed project area were previously rated by the Natural Resources Conservation Service (NRCS) according to riparian and/or hydric soils, forest productivity, erosion potential, compaction potential, and potential of damage to soils from fire. These can be found in the Appendix (Project File 7-13 DePuy). The basis for these ratings is given in the National Forestry Manual (NRCS 2000) and can be found in the Appendix.

The main soil series in the Project Area are Shelocta silt loam, Steinsburg gravelly loam, Latham silt loam,and Morristown channery silty clay loam.

- Shelocta silt loam has a pH range of 4.5 – 5.5,
- Steinsburg has 3.6 – 5.5,
- Latham has 3.6 – 6.5, and
- Morristown has 6.1 – 8.4. (USDA-NRCS 2006)

A pH range of < 4.5 would be considered extremely acid, 4.5 – 5.0 very strongly acid, 5.1 – 5.5 strongly acid, 5.6 – 6.0 moderately acid, 6.0 – 7.3 slightly acid to neutral, and 7.4 – 7.8 slightly alkaline (Sparks 2003).

Buffering describes the resistance a soil has to change in pH when an acid or base is added to the soil. Buffering increases as clay and organic matter of soils increases (Gilmour 2002).

No Action Alternative
Direct and Indirect Effects

No new management activities would take place under this alternative, nor any activities associated with the proposed action. Therefore, no management-related changes in productivity of the land would occur. Soils would be impacted by planned and ongoing natural resource management activities such as road use and maintenance. In the absence of wildfire, current runoff and erosion patterns would be maintained. An upland erosion rate of less than one ton per acre per year is predicted by the Forest Service Water Erosion Prediction Project (FSWEPP) for stands on steep slopes in the absence of fire. Natural processes and functions would continue to occur as dead material decomposes. Dead and dying trees would decay, with carbon released to the atmosphere. Actual soil organic matter may increase with an accompanying increase in microorganisms and fungi. Since there is no burning, no carbon would be removed from the forest from project activities (Project File 7-13 DePuy).

Natural functions that are expected to continue could also include pathogens and insects contributing to oak decline leading to dead and down trees. Dead and down trees would increase fuel levels leading to increased wildfire danger. In the absence of wildfire, dead and down trees would decompose over time, leading to increased macro and microorganism populations carrying out the decomposition process. As decomposition proceeds, dead and down material would eventually be incorporated into the organic horizon and surface horizons leading to increased soil nutrient capital.

Under this alternative, biomass (fuels) will not be removed by prescribed burning. The probability of high intensity wildfires would increase. Fire ignitions would increase relative to historic wildfire frequency because project area fuels are more exposed to sun and wind and may be in a readily combustible state more often. Wildfires that could occur under conditions of increased fuel loading could burn at a higher intensity and over a larger area than would have occurred with the proposed action. The stands where wildfire does not occur would maintain

current runoff and erosion patterns. An upland erosion rate of less than one ton/acre/year would be expected for stands on steeper slopes and near water if fire were excluded. Each occurrence would increase the short-term (3-5 years) erosion from the area affected by the wildfire; however, these fires will likely be separated by space and time. Further information on frequency and size of historic wildland fires and predicted intensity of future wildfire is covered in Project File 10-03, Fire Proposed Action.

Summary: No ecological restoration or vegetation management will occur under this alternative. There would be no direct or indirect effects to soil or water from prescribed burning. Soil quality and productivity would be increased in the long-term as organic matter decomposes and converts to the A horizon, leading to increased soil nutrient capital. Water quality would be maintained at current levels considering anticipated future actions and assuming the inputs from private land remain stable. Some geologic erosion could be expected to continue in the project area and in the cumulative effects analysis area and some of this sediment could be expected to enter the streams. This alternative would likely result in less soil erosion, compaction, sediment load, and percentage of bare ground than the proposed action. There would be no sedimentation resulting from the no action alternative and there would be no cumulative effect. Implementation of this alternative is not anticipated to result in any changes to water quality.

Vegetation

Existing Condition of Hardwood Stands

Oaks have been a dominant component of eastern forests, including the forests of southeastern Ohio, for more than 5,000 years. Prior to Euro-American settlement, written accounts (1700's) described open, park-like forests and the use of fire by Native Americans for hunting and land management (see Project File 4-7). Southern Ohio forests have been researched to determine that the biological rotation of white oak is 200-250 years of age, with red, black, chestnut oaks biologically peaking at 120 years. Scarlet oak is the shortest lived of the oaks at 100 years. On mesic sites, sugar maple, walnut, beech and yellow poplar all attain ages of 200 years in maturity (Barrett, 1995).

Current stands average 104 years old (Appendix C Table 8, Project File 4-13). The ice storm has caused significant damage to the dominant and co-dominant canopy across all stands proposed for treatment. The ice storm was not specific to species, but it did cause significant stress and mortality within the oak species group due to their dominance across the landscape. Mortality could be attributed to the age of the trees. The additional stress will limit the biological rotation age of the trees in comparison to normal growing conditions. Biologically the oak stands are maturing, with black, scarlet, red and chestnut oaks reaching biological maturation.

An ongoing forest ecosystem study (Hutchinson, et al 2003) involving four study sites in southern Ohio, including one in the Pine Creek project area, documents historical evidence for the composition of historic forests in southeastern Ohio. Early land surveys from the time of the Ohio Company Purchase (1796-1802) indicate that 45 to 71 percent of the witness trees were oaks. White oak was the most common species (comprising 40% of observations), with black oak, chestnut oak and hickory also being major components. In several accounts, forests were described as open and park-like.

Forested areas within the analysis area have remained relatively undisturbed for the past 70 years. Currently, the understories of all stands in the Pine Creek analysis area are dominated by shade

tolerant, late-successional species and contain only a small oak component. Previously established oak and hickory trees have continued to grow, but few seedlings reach sapling size before dying. Fire-intolerant but shade tolerant species such as red and sugar maple, yellow poplar and American beech have grown to tree size and become a major seed source. Forest communities across the oak region of the U.S. are converting from mid-successional oak and hickory species to shade tolerant climax mesophytes. This classical secondary successional process has occurred particularly on mesic sites (Fralish, 2004) in the near absence of fire.

Oak regeneration problems are not confined to southeast Ohio and are a concern over most of the species range in the eastern United States. Research has found that oak regeneration problems are not related to the decline of the American chestnut or to forest fragmentation (Lorimer, 1992). Poor oak regeneration is more likely a result of a lack of fire and subsequent replacement in the growing space by more mesic species or other interfering vegetation. It is also a result of acorn predation, deer browse, pathogens or some combination of these factors. If this condition persists well into the next century, oak replacement by more shade-tolerant species will probably occur routinely on all but the most xeric sites.

A high amount of shade on the forest floor (resulting from a closed canopy and dense understory vegetation) helps explain the slow growth and high mortality of understory oak seedlings. Oak species direct energy from photosynthesis to promote seedling root growth at the expense of shoot (top) development. Seedlings can develop a substantial taproot and, if an adequate amount of sunlight is available, a seedling can persist for many years despite repeated shoot dieback. When an opening in the crown allows increased light into the understory, seedlings with an extensive root system can grow rapidly (Lorimer, 1992).

Periodic fire initiated by lightning or early Native Americans seems to be responsible, at least in part, for oak dominance in the original forests (Abrams and Nowacki 1992). An oak dominated forest was maintained through repeated fires that killed less fire adapted/tolerable trees. It is believed that Native Americans frequently burned the forests of eastern North America to facilitate game hunting and to enhance the growth of herbaceous plants (Goebel and Hix 1996). Although numerous factors have been implicated in the widespread decline of oak regeneration, suppression of fire since the 1940s is hypothesized to be a primary cause (e.g. Lorimer 1984; Abrams 1992).

The Project Area has a current condition class of 3 (see Chapter One) due to a lack of fire on the landscape and to heavy fuels resulting from deadfall from the 2003 ice storm. The desired future condition class is 1. The risk of a highly uncharacteristic wildland fire is likely as witnessed during the 2005 Binion Fire located within the Pine Creek Analysis Area (see Binion Fire Report 2005, Project File 10-8). Since the No Action Alternative includes no treatment as proposed in Alternatives 2 and 4, stand-replacing wildfire could result. Replacing stands through fire would not move stands towards the

desired future condition, but set the process of restoring stands to historic conditions as they occurred before European settlement and disturbance of the Project Area.

Mesic Forest: Northern Red Oak – (Sugar Maple) Alliance
The mesic forest, made up of northern red oak/sugar maple alliance is common on low to mid-slopes with northerly aspects and in hollows with western or southern aspects. The less fertile soil types of the Ironton District (compared to the Athens District), deforestation in the late 1800's and periodic fire most likely contributed to the higher presence of white oaks on more mesic sites. Scarlet and black oak make up the red oak species group within the Pine Creek analysis area. Tree species common in the understory are red maple, sugar maple, white ash, and sassafras.

Ice storm damage is common on these sites, leading to a dense understory and shrub growth. During the 2003 ice storm, cooler temperatures on the mesic sites created a temperature inversion that caused greater amounts of ice to build on the branches of trees on the lower slopes. Greater crown damage, uprooting and mortality occurred on these sites and invasive plant communities are taking advantage of the increased sunlight reaching the forest floor. Spicebush is strongly dominant to the point of inhibiting regeneration of shade-intolerant canopy species. Oak regeneration is poor and sugar maple and American beech (*Fagus grandifolia*) are the common understory species in the south-facing hollows.

If the No Action Alternative is selected, the stress induced by ice damage and the overstocking of shade tolerant species will decrease the health and vigor of the forest, inviting disease and insect attacks (see Project File 4-7 and 4-12). Current stands of oak and hickory will likely be replaced by species such as maple and beech. Very dry ridge tops and south-facing slopes will likely retain some oak trees. Without treatments, the oak-hickory forest will eventually disappear (2006 Revised Forest Plan E-22).

Existing Condition of Planted Pine Stands
The white pine plantations within the project area were cleared for agricultural use prior to USFS ownership and are not considered native to the region. Overcrowding has led to stagnation and a decreased resistance to insects and disease. Wildlife benefits are limited since the closed canopy allows very little light to penetrate to the forest floor. Plantations occupy Ecological Land Type Phase (ELTP) alliances associated with hardwood forest types. ELTP alliances are used as a reference to past conditions, but are based on present forest occupation.

Pockets of mortality in these plantations have been monitored by Wayne National Forest employees. Several types of bark beetles have infested the stands along with other insects such as the white pine adelgid. Observations of adelgid have been verified in stands on both the Ironton and Athens Ranger Districts by the USFS Forest Health Protection specialists. These infestations, in conjunction with random stem damage associated with the 2003 ice storm, have led to the decline of the stands.

Dead and dying pines become very dry. A large amount of dead pines in an area can lead to increased fire danger, increased trail and road maintenance as dead trees need to be continually removed from the travel ways, and are a hazard to employees and the public. More information on the cause and result of plantation mortality can be found in the Silvicultural Prescription (4-7) and the Ohio Division of Forestry website: www.ohiodnr.com/forestry/health/whitepine.htm.

White pine stands selected for treatment vary from 31 to 53 years in age. All stands are readily visible to the public. Stands 005 and 025 are visited by many visitors a year riding the ATV trail system and Stand 018 lies on Pine Creek Road, a moderately traveled county road connecting Scioto and Lawrence Counties.

Existing Condition of Native Pine Stands

These stands consist of a scattered component of mature Virginia and shortleaf pine within predominantly hardwood stands. After reviewing aerial photography flown during 1939 of Compartment 424, Stands 18 and 27, it is likely that the pine became established naturally when abandoned farm fields reverted back to forested conditions. The 1939 photographs show large patches of hardwood trees around 11-15 inches in diameter, with scattered trees advancing into open areas. The stands have at least two-age classes and appear to have two distinct timber compositions, a mature oak forest type and random patches of mature Virginia and Shortleaf Pine.

Native pine does not mean that these are old stands, but that the pines (Virginia and shortleaf) contained within these stands are native to the Wayne National Forest. The pines range from 58-71 years of age and have flat tops, reflecting maturity. In addition to being mature, there are pockets of blow down and many of the pines have damage to the branches from the 2003 ice storm. While not old, these stands are senescing. There is very little pine regeneration on the ground, evidence of the lack of disturbance over the past several decades.

Tables displaying the compartment and stand data can be found in the Silvicultural Prescription (Project File 4-7).

No Action Alternative

Forest stands across the middle and northern portion of the Ironton Ranger District suffered damage from the 2003 ice storm and are experiencing considerable mortality (Project File 4-8). The No Action alternative will not provide an ecologically-based frame work (see Project File 4-8, Appendix 1) to improve plant and animal habitat at specific locations through thinning and burning prescriptions. This alternative also will not address the increasing establishment of shade-tolerant species in the understory of the dry-upland and dry-mesic ELTPs, and will lead to eventual stand replacement of the oak-hickory forest type with a mixed mesophytic hardwood forest type (i.e. maple, beech, poplar, etc.)

Given current conditions, the alliances (ELTPs) will blend into one another and characteristics will overlap. We expect to see the following trends when moving through the gradient from the upland alliance (ridgetops and dry southern slopes) to the rich mesic alliance (coves and bottomlands) (Figure 1):

1. Canopy cover will increase
2. Mid-story density will increase
3. Fire frequency and intensity will decrease
4. Importance of oaks will decrease
5. Dominance of maples, poplars, and other shade-tolerant species will increase.

Fire frequency and intensity, light levels and shade levels, which historically varied on the landscape, created diverse vertical and horizontal forest structure (Project File 4-7 pg 7). The role of fire in the landscape varied according to landscape position in the Central Hardwoods region of

the U.S. The lack of prescribed fire will result in a continued decrease in vertical and horizontal forest structure.

If the mid-story is not treated to allow more sunlight to the forest floor, there will be few or no oak and hickory seedlings able to grow into the next size/age class to make a true uneven-aged forest. As the current canopy trees senesce and die, they will be replaced by the beech and maple, which are currently the only species growing into the understory. Gaps created by large trees falling will fail to produce oak and hickory, as no seedlings have been able to develop and prepare to compete with the established beech and maple. Gaps on moist sites will soon be overtaken by the aggressive yellow poplar, a prolific seeder and a tree that grows rapidly in new openings (Project File 4-16).

Pine stands will continue to decline and gradual conversion to hardwoods will occur. While this progression is similar to the effect of the proposed action, it will take longer to occur and will not move the stands toward the desired future condition (as hardwood forest) as promulgated in the Forest Plan. The declining forest represents some threat to human health and safety as many stands are along roadsides and are used by hunters.

The No Action alternative would also not provide management priority for treatment of non-native invasive species (NNIS) occurring within the project area.

Botany

Survey History

The Pine Creek Project area was surveyed for federally-listed and Regional Forester Sensitive Species between May 22nd and July 26th 2006. All sites (old trails) with potential Running Buffalo Clover habitat were surveyed before June 15th. All potential prescribed burn lines were surveyed and each stand proposed for timber harvest was traversed at least once during the survey period. A comprehensive species list from all survey efforts within the project area is included in Appendix 2. Surveys and mapping were conducted for NNIS concurrently with TES and RFSS.

Seventy-two permanent monitoring plots were installed and measured in the Pine Creek project area. There are 18 plots for each management treatment: harvest only, burn only, harvest and burn and control (no management). At each plot the herbaceous plants, seedlings, saplings, overstory trees and fuels were measured so as to assess changes in diversity, structure, composition and fuel loading over time.

It is assumed in the effects analysis that the management prescriptions will maximize the benefit to the federally Listed and RFSS that are likely to occur in specific habitats or Ecological Alliances (pages 7 and 8 and Appendix 1, Project File 4-13), since management actions are driven by site-specific habitat conditions as categorized by the Alliances.

Project-wide cumulative effects

(Relevant to all Threatened & Endangered and Regional Forester Sensitive Species)

Cumulative Effects Analysis Area (also used for all Alternatives)

The cumulative effects analysis area for botanical resources is the Pine Creek watershed (a level 5 watershed) which encompasses the Historic Forest with ORV (HFO) management area and nearly all of the Diverse Continuous Forest with ORV (DCFO) management area. This area is approximately 118,000 acres and includes federal and privately owned property. This area was

chosen because 1) it includes all of the streams, tributaries, and forest that could be affected by the restoration of plant communities through timber harvests and prescribed burns and 2) the potential spread of NNIS along trails, streams burn.

Cumulative Effects Analysis Time Period (also used for all Alternatives)
The time-frames chosen for cumulative effects analysis are a 'past' of 70 years and a 'future' of 10 years. The 70 year past time frame was chosen because this includes the majority of past strip mining, trail and road building activities, and fire suppression activities in the Pine Creek watershed which in turn affected landscape-scale vegetation patterns (i.e. the conversion of mature forest to open grassland, fields or young forest) and NNIS spread and establishment. The future time frame of 10 years was chosen because this is the approximate length of the revised Forest Plan and thus, the amount of time that future management activities can be predicted. After 10 years, a new Forest Plan revision process will begin and planned management activities could change. These past and future time periods combined give an accurate picture of activities that occurred, are occurring, or may occur, within the Cumulative Effect analysis area.

No Action Alternative
The Biological Evaluation for Botany (Project File 5-8) contains expanded information for each species group.

Federally Threatened or Endangered Species
According to the US Fish and Wildlife Service (2005), The Wayne National Forest comprises part of the potential range of four Federally Threatened or Endangered species (Table IV). Those species with no suitable habitat in the project area are assumed to be unaffected by the proposed action, and therefore, would not be carried forward in the analysis.

Table 3-4: Federally Threatened or Endangered Species

Species	Common Name	Habitat	Habitat Present? Y or N	Alliance Type(s)
Aconitum noveboracense	Northern wild monkshood	Moist cliffs w/ cold air drainage	Y	Mesic, Rich-Mesic
Isotria medeoloides	Small whorled pogonia	Open second growth hardwoods	Y	Dry-Upland, Dry-Mesic
Spiraea virginiana	Virginia spiraea	Damp, rocky banks; streambeds	N	Rich-Mesic
Trifolium stoloniferum	Running buffalo clover	Moist, semi-shaded, disturbed woods	Y	Dry-Upland, Dry-Mesic, Mesic

The No Action alternative in which no timber, herbicide or burn activities would occur within the project area would result in no effect on northern monkshood, small whorled pogonia or running buffalo clover or their habitat. See the Project File 5-8 for more detail on habitat conditions for each of these species.

Regional Forester Sensitive Species
According to ongoing revision of the Regional Forester Sensitive Species list, there are twenty-two RFSS currently designated for the Wayne National Forest (USFS 2003). Suitable habitat may exist in the project area for sixteen of the species. None of the remaining RFS species were

considered in the impact assessment, because either there is no suitable habitat for the species in the project area, or the species have a well-known distribution that does not include the project area.

Table 3-5: Regional Forester Sensitive Species Habitat Requirements

Species	Common Name	Habitat	Habitat Present?	Determination
Mature Woodland Species –Alliances: Dry-Mesic^, Mesic# & Rich Mesic*			Y or N	(Proposed Action)
Botrychium biternatum*	Sparse-lobed grape fern	moist, low woods, ravines, thickets and edges	Y	No effect
Carex striatula#	Lined sedge	variety of light levels in dry to mesic woods	Y	No effect
Magnolia tripetala#*	Umbrella magnolia	rich woods; mesic ravines and coves	Y	No effect
Scutellaria saxatilis^#	Rock skullcap	Moist banks/woods; dry slopes & openings	Y	No effect
Juglans cinerea*	Butternut	moist woods and fields; riverbanks	Y	No effect
Semi-Open Woodland Species –Alliances: Dry-Upland#, Dry-Mesic^ & Rich Mesic*				
Gentiana villosa#	Striped gentian	open woods and pinelands; shady places	Y	No effect
Iris verna*^	Dwarf iris	open oak woods, dry open ridgetops	Y	No effect
Phacelia ranunculacea*	Blue scorpion-weed	dry or moist woods; sandy fields, streambanks	Y	No effect
Rhododendron nudiflorum^*	Pinxter flower	moist or dry woods, bogs & shrubby borders	Y	No effect
Open Woodland, Fire Adapted Species –Alliances: Dry-Upland* & Dry-Mesic^				
Carex juniperorum	Juniper sedge	filtered light; second growth forest	Y	No effect
Gentiana alba	Yellow gentian	moist meadows/prairies; open woods; edges	Y	No effect
Cirsium carolinianum	Carolina thistle	open/semi-open woods, bluffs, ravines, thickets	Y	No effect
Clitoria mariana	Butterfly pea	open/semi-open woods, barrens, prairie borders	Y	No effect
Platanthera ciliaris	Yellow-fringed orchid	wet, sandy bogs & meadows, fields & woods	Y	No effect
Scleria oligantha	Tubercled nut-rush	oak barrens; dolomite/limestone based soils	Y	No effect
Scleria triglomerata	Tall nut-rush	open oak woods and oak barrens	Y	No effect
Open Habitat Species –Alliances: Dry-Upland, Dry-Mesic, Mesic & Rich Mesic				
Carex albolutescens	Pale straw sedge	mesic fields, borders, ditches, prairies, fens, bogs	N	N/A

Penstemon laevigatus	Smooth beardtongue	Fields, open woods, roadsides	N	N/A
Verbesina occidentalis	Yellow crownbeard	open woods, borders, thickets, fields, roadsides	N	N/A
Stenanthium gramineum	Featherbells	open, moist woods; fields, meadows, powerlines	N	N/A
Riparian species –Alliances: Rich Mesic				
Triadenum tubulosum	L.Marsh St John's wort	riparian floodplains, banks, seeps, wetlands	N	N/A
Vitis cinerea	Pigeon grape	moist, alluvial soils; low thickets, streambanks	N	N/A

Through field visits and analysis of habitat, it has been determined that this alternative will have no impact on the four species in the Mature Woodland Species Group, the Semi-open Woodland Species Group, or the Open Woodland Species Group.

State-Listed Species
Occurrences and Mitigations for State-listed Species
During the surveys several state-listed species were found. These include Small-flowered Alum-rootroot, Wild Pea, Sweet Goldenrod, White Milkweed, Spring Coral-root, fringe tree and American Chestnut. These should not be negatively affected by this project as long no fringe tree or America Chestnut are cut. Small-flowered Alum-root is restricted to rock shelters which will be avoided during this project. Wild pea, sweet goldenrod and white milkweed will likely benefit from prescribed fire and more light in the understory. A 50 foot buffer will be placed around the Spring Coral-root location.

Wildlife

Survey and Analysis History
Several weeks of on-site visits were made within the project area by a wildlife biologist and biological science technician during 2006. These visits were made to evaluate habitat within the project units for the various wildlife species of concern and to document landscape features that were considered important to the faunal component of the area, i.e. rock outcrops, wetlands, raptor nests, etc. On-site visits were used to assess the potential for any species occurrences or for the availability of potentially suitable habitat.

All federally-listed and Regional Forester Sensitive Species (RFSS) were considered in this analysis. The USFS Natural Resource Information System (NRIS) Fauna and NRIS Water databases and Heritage Program data were reviewed to identify any occurrences. Species viability evaluations, which were developed prior to the 2006 revision of the Forest Plan and referenced in the Plan, were reviewed for each species (USFS 2003). Only the species with suitable habitat present at the site or which could potentially be affected by the proposed action were addressed in the biological evaluation.

Threatened and Endangered Species
Existing condition
The project area is currently dominated by mature oak-hickory forests, approximately 80-120 years old that are remnants of the historical land use as a draw area for local iron furnaces. The near-continuous overstories of these stands are dominated by large oaks. Due to decades of fire suppression, the mid-stories and understories are more dense than historical conditions, and have

a higher component of shade-tolerant, fire-intolerant species, such as tulip poplar and maples. The project area also contains small amounts of early successional habitat near the south end. Although there are some strip ponds associated with the small amount of strip mining at the south end of the project area, overall, upland water sources are rare in the project area. The area is approximately 65% Forest Service ownership, and contains some of the largest blocks of contiguous USFS ownership on the Wayne NF (see Project File 5-6).

The No-Action Alternative can be described as no active management will occur within the project area. This alternative does not address the Desired Future Condition of the Forest Plan. Forest stands across the middle and northern portion of the Ironton Ranger District have suffered considerable damage from the 2003 ice storm and are experiencing considerable mortality. This alternative does not address the ecologically-based framework (Appendix 1, Wildlife BE, Project File 5-6)) which is designed to improve plant and animal habitat at specific locations through thinning and burning prescriptions. This alternative also will not address the increasing establishment of shade-tolerant species in the understory of the dry-upland and dry-mesic Alliances, and will lead to eventual stand replacement of the oak-hickory forest type with a mixed mesophytic hardwood forest type (i.e. maple, beech, poplar, etc.) This alternative would also not provide management priority for treatment of non-native invasive species (NNIS) occurring within the project area. Non-natives have developed a strong presence in the project area due to extra light reaching the forest floor following the 2003 ice storm.

No Action Alternative

Direct and Indirect Effects: Under the No Action alternative, no hardwood or pine harvest, creation of log landings or skid roads, prescribed fire, fireline construction, manual or herbicide mid-story treatments, timber stand improvement, waterhole construction, NNIS treatment, or creation of visitor parking areas would occur, and therefore, there would be no direct or indirect effects to Indiana bats. Under this alternative, the project area would not move toward the desired future condition established in the Forest Plan.

Without overstory thinning, the objective of large, widely spaced trees would not be achieved. The canopy would remain generally closed, limiting solar radiation to potential roost trees. Retaining all trees, including unhealthy and short-lived trees and those damaged by the ice storm, could result in a less vigorous, over-stocked forest more susceptible to stresses such as gypsy moth defoliation, which could eventually negatively affect Indiana bat habitat.

Without mid-story treatment and repeated prescribed burning, the understory and mid-story would remain dense, and would increase in density over time, decreasing quality of Indiana bat roosting and foraging habitat. Increased mid-story density (clutter) will decrease bats' ability to navigate and forage. The understory and mid-story would be increasingly dominated by shade-tolerant and fire-sensitive species such as maple and beech, which are less desirable as future roost trees for the Indiana bat, and would eventually replace the oak overstory. The result would be a more homogenous and less diverse forest that would be more vulnerable to insects and disease, and a long-term decrease in the availability of suitable roost trees.

Lack of NNIS control in the area could adversely affect Indiana bat insect foraging. Many insects rely on native plants for part of their life cycle. If no control measures are taken to limit the

spread of NNIS, it is likely that they will out-compete native plant species, decreasing native plant diversity and abundance, and in turn, decreasing native insect diversity and abundance.

Cumulative Effects: The Cumulative Effects Analysis area for the Indiana bat in this project will be the Ironton Ranger District of the Wayne National Forest. This area was chosen because it is large enough to encompass the home range of any Indiana bats that may spend part of the spring, summer or fall in the Pine Creek project area. The USFWS Draft Recovery Plan summarizes past studies of Indiana bat home ranges (p. 51). Although Indiana bat home ranges have not been well studied, and vary between seasons, sex, and reproductive status, the studies described represent the best available science on this topic. I used the largest spring, summer or fall home range found in the studies discussed (3825 acres from Romme et al. 2002) to calculate the diameter of an Indiana bat's home range (2.76 miles), employing the assumption that the home range is circular.

Using the Ironton Ranger District as the cumulative effects analysis boundary ensures that the home ranges of any bats that are directly or indirectly affected by the proposed activities in any part of their spring, summer or fall home range are encompassed. The cumulative effects temporal boundary for this project will be 20 years into the past and 10 years into the future. The future boundary of 10 years was chosen because this timeframe coincides with the current Forest Plan planning cycle, and it is difficult to predict activities beyond this timeframe. The past boundary of 20 years was chosen because this is the timeframe in which we have relatively accurate knowledge of what has occurred, at least on Wayne NF lands.

There are approximately 304,000 acres of land within the proclamation boundary of the Ironton Ranger District. Currently, Forest Service land comprises about 100,000 acres (32.9 %) of that land. The State of Ohio manages about 14,000 acres, and the remainder of the land, approximately 190,000 acres (62.5 %), is in private or other public ownership.

Over the past two decades, approximately 3000 acres of Forest Service property in the cumulative effects area and 346 acres of Dean State Forest were clearcut. Approximately 1150 acres of Forest Service and 650 acres of Dean State Forest were single tree cut, group cut or thinned. These stands now have mostly closed canopies, and are in a condition similar to that prior to any cutting. A severe ice storm in 2003 damaged the crowns of hundreds of acres of mature forest on the Ironton district. Much of the Pine Creek area was affected by this event, which caused varying degrees of crown damage. Timber harvest to remove some of the damaged trees, totaling approximately 830 acres on USFS and 438 acres on Dean State Forest, have occurred since then. The trees that were removed during these sales were mostly dead or dying. Therefore, their removal did not change the stand structure.

Early timber harvest activities may have resulted in direct mortality, disturbance, or the loss of roost trees. More recent harvests and future harvests on Forest Service lands include provisions to avoid the removal of currently suitable roost trees during the maternity season, as well as provisions to provide current and future roost trees. Over the next decade, approximately 8970 acres of timber harvest are expected to occur on WNF lands on the Ironton District, and approximately 600 acres on Dean State Forest (USFS 2005a). This estimate includes the Pine Creek Historic Forest Restoration project. Future projects will also include provisions to avoid the removal of currently suitable roost trees during the maternity season, as well as provisions to provide current and future roost trees.

Approximately 70 percent of the 204,000 acres of "other ownership" on the Ironton district is forested. An estimated 50 percent of that forested land has been logged over the past 20 years; most of this logging has been high-grading or diameter limit cutting. Thus, an estimated 71,000 acres of "other ownership" have been impacted by timber harvest over the past two decades. Because much of the forested areas on private lands have been harvested within the past twenty years, the rate of harvest is expected to slow within the next decade, for an estimated 12,000 acres of additional harvest. The impacts of these activities would be similar to those described for early timber harvest above, though probability of loss of roost trees and direct mortality are likely higher on private timber sales because private timber harvests often do not include provisions to protect Indiana bats or their habitat.

A small amount of prescribed burning has been conducted in the analysis area over the past two decades: approximately 520 acres on Forest Service land, and 140 acres on Dean State Forest. Wildfires occurred on an estimated 6567 acres of USFS lands and other ownerships since 1987. Within the next decade, approximately 69,800 acres of Wayne National Forest Land is expected to be prescribed burned (USFS 2005a). The Ironton District comprises approximately 42% of Wayne National Forest lands. Therefore, a reasonable guess is that approximately 29,300 acres of the Ironton District may be altered by prescribed burning over the next decade, including those acres planned in the Pine Creek project. This is approximately 30% of total USFS lands within the analysis area. Wildfires and prescribed burning on private lands within the analysis can be expected to remain similar to past levels. Therefore, a reasonable estimate for total lands affected by prescribed burning or wildfire in the analysis area over the next decade is 32,650 acres (29,300 acres USFS prescribed burns + 70 acres Dean State prescribed burns + 3284 acres wildfires), or 11% of the analysis area.

Although the majority of wildfires and prescribed burns occur in the early spring or later summer/early fall when bats are volant and able to escape a burn area, some wildfires and early prescribed burns may have resulted in direct mortality to Indiana bats if they occurred during the maternity season when young pups could not fly to escape a burning roost tree. Wildfires and prescribed burns occurring during the spring, summer or fall may have resulted in disturbance to individuals or loss of roost trees, though these impacts are less likely to have occurred during more recent prescribed burns on USFS property, where provisions to protect Indiana bats are incorporated into project development.

The Kosmos Trail Extension Project is planned in the Historic Forest with ORV (HFO) management area directly south of the Pine Creek project. This project is being analyzed simultaneously with the Pine Creek project, and is expected to be implemented over the next several years. The Kosmos project includes improvement and designation of approximately 27 miles of existing closed and unclassified roads as ORV trails, construction of approximately 7.1 miles of new ORV trails that will connect existing unclassified roads, construction of two new trailhead facilities to support the new use, and expansion of one existing trailhead.

The project also includes the following connected actions; close approximately 16 miles of user-developed trails and illegally-used roads, install a wash station for OHVs, install interpretive signs, treat NNIS, and construct or re-construct approximately 60 wildlife waterholes. The project incorporates Forest Plan Standards and Guidelines and Design Criteria to minimize direct and indirect effects to Indiana bats. Analysis of the Kosmos project revealed that implementation may increase noise disturbance to some individuals, and may result in the loss of an undetected secondary roost tree, but that the project is not expected to result in the loss of any primary or

important secondary roost trees, and the project is expected to reduce sedimentation of aquatic habitats, create additional flyways, and improve foraging habitat and water availability through the creation of upland waterholes. This analysis resulted in the determination that modified proposed action (Alternative 3) is not likely to adversely affect Indiana bats.

Approximately 20 miles of designated trails occur within the Pine Creek project area. Since the 1990's, approximately 46 miles of OHV trails have been reconstructed, designated and maintained on the Pine Creek and Hanging Rock OHV trail systems within the Ironton District. Implementation of these earlier ORV projects may have resulted in additional disturbance to individuals, and the loss of suitable roost trees. However, these trail systems were primarily placed on old road beds where tree removal, and the risk of removal of suitable roost trees, would be very low.

Illegal OHV use occurs throughout the cumulative effects area, though it occurs at an above-average rate in the Kosmos area (immediately south of the Pine Creek project). We estimate that OHV trail use began about 30 years ago and has increased dramatically in the past 10 years. OHV use is expected to increase on the forest within the cumulative effects analysis timeframe. Past, present and future illegal use is expected to have negative direct and indirect effects on Indiana bats by increasing disturbance disbursed throughout the cumulative effects boundary, rather than focused in a few areas, and increasing soil erosion and sedimentation into aquatic habitats, thereby reducing water quality and insect production. Implementation of the Kosmos Trail Extension Project is expected to decrease illegal OHV use in that area by focusing use on designated maintained trails where resource damage can be minimized.

Several past projects within the cumulative effects analysis boundary have had beneficial effects on Indiana bat habitat. Erosion control was conducted on approximately 12 miles of old roads during the 1990s, reducing sedimentation into aquatic habitats and thereby improving aquatic insect production. Approximately 118 acres of wetland habitat were restored during the late 1990s and early 2000s, improving foraging habitat and water sources. Seven bat gates were installed, five of which were constructed to protect Indiana bat fall and winter habitat. Tree planting occurred in patches throughout the district, and approximately 400 acres of NNIS were treated. It is likely that some of these activities will continue into the next decade, though it is difficult to predict the amount or locations where they will occur. Many of these projects, such as bat gates and erosion control, are implemented as the need becomes evident. A 17-acre wetland restoration, which will restore foraging habitat and provide additional water, was implemented in the fall of 2008 in the northeast area of the Ironton district.

The Biological Assessment for the 2006 Forest Plan (USFS 2005a) details anticipated effects of other activities that are or will be implemented in the foreseeable future under the 2006 Forest Plan. Activities that may result in a permanent loss of Indiana bat habitat include permanent road and trail construction, recreation facilities and parking lot construction, surface mining, and oil/gas well development. These activities are expected to affect up to 2,088 acres (0.87%) of Forest-wide USFS land over the next decade. Activities that may result in alteration of Indiana bat habitat include timber harvests, crop tree release, prescribed fire, temporary roads/ trails and log landings, mechanical fuels reduction, development of permanent openings, utility corridor development, closure of mine features, and AMD treatments. These activities are expected to affect up to 101,992 acres (42.8%) of Forest-wide USFS land over the next decade. Many of these activities may actually improve Indiana bat roosting and foraging habitat over the short- and

long-term. Hence, findings in the BO report that implementation of the 2006 Forest Plan will not appreciably reduce the likelihood of survival and recovery of the Indiana bat (USFWS 2005a).

It is worth noting that the above estimates of future activities are based on the Forest Plan and are estimates of maximum activity levels, rather than likely activity levels. If the past is any indication, only a portion of the potential projects would actually be implemented on the ground. For example, only about 18 percent of the 1988 Forest Plan's timber harvest was accomplished during the 17 year life of that plan.

Development on non-USFS land in the Ironton District of the WNF in the future may potentially include timber harvest projects, oil and gas extraction, residential development, business development, and other similar actions. The amounts and specific effects of these activities are difficult to predict. Depending on the timing of any of these activities, they could lead to the direct mortality of Indiana bats, if they include tree removal or mine closures. Additionally, these activities could affect Indiana bat roosting and foraging habitat and may permanently convert suitable habitat to other uses.

Table 3-3 below summarizes the above cumulative effects discussion and gives a brief description of impacts of relevant activities to the Indiana bat. Cumulative effects are the cumulative impact of the direct and indirect effects of a proposed action when added to the aggregate effects of past, present and reasonably foreseeable future actions. Under the no action alternative, there would be no cumulative effects because no new federal actions are proposed under this alternative.

Determination: Alternative 1 is *likely to adversely affect* the Indiana bat:

Inaction will result in a continued continuous canopy and increasing understory and mid-story clutter. Eventual replacement of oaks in the overstory by less fire-tolerant species, primarily red maple and tulip poplar, which are less frequently used as bat roost trees, will lead to a long-term decrease in suitable roost trees. This will result in a long-term decrease in the quality of roosting and foraging habitat in the project area. Lack of NNIS treatment in the project area will lead to a simplification of habitat via a reduction in native plant diversity, leading to decreased native insect diversity and abundance.

Figure 3-2: Alternative Two, Proposed Action for Historic Forest Restoration Project

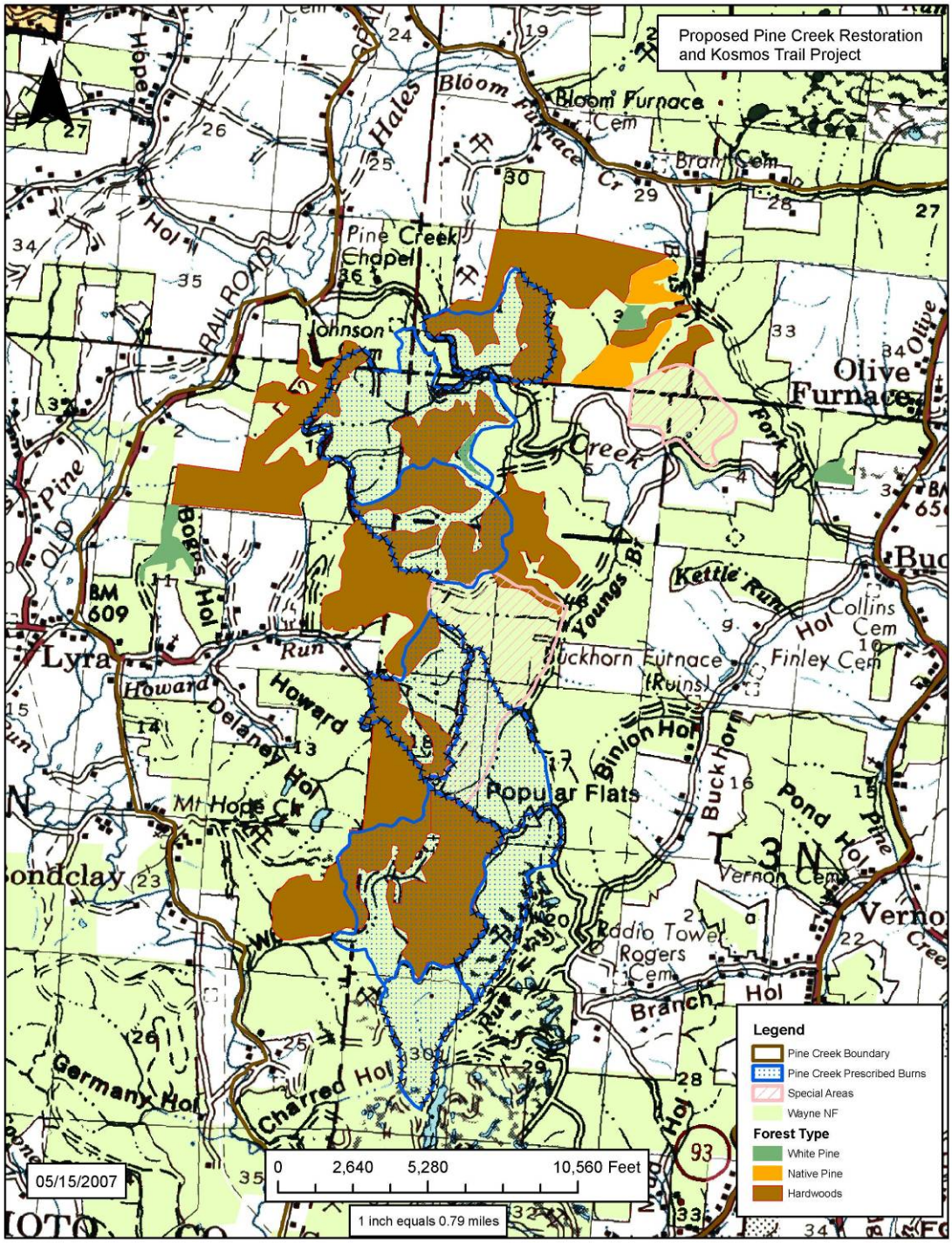


Table 3-3. Relevant Past and Future activities considered in Cumulative Effects analysis and Impacts to Bats.

Activity	Description	Potential impacts to Indiana Bats	Past (past 20 years)	Future (next 10 years)
Timber Harvest (WNF) Single tree selection & Group selection cuts Clearcut Salvage Timber Harvest (Private)		May have resulted in loss of some roost trees. May have increased suitability of other roost trees by increasing solar radiation.	1800 acres 3350 acres 1270 acres 71,000 acres	9570 acres (all types of harvest) 12,000 acres
Midstory treatment	Removal of midstory shade-tolerant species, such as red maple to favor oaks and hickories and open the midstory.	Improves bat habitat by favoring roost tree species. Opening midstory also improves foraging habitat by reducing clutter.		1800 acres (Pine Creek project)
Road building Permanent road Temp roads	Reconstruction = reshaping and grading of existing roads/trails for use.	May result in loss of some bat roost trees. New road construction may impact foraging habitat, and may create new flyways.	Unknown Unknown	196 acres 113 acres
Prescribed burning	Construction of fireline, ignition and control of fire. Primarily in mature oak hickory forest during the non-maternity season.	Temporary displacement of roosting bats. Fireline construction may have resulted in loss of potential roost trees.	660 acres	29,370 acres
Wildfire		May have resulted in loss of potential roost trees, and creation of new roost trees. Because most wildfires take place outside of maternity season, bats expected to be temporarily displaced.	6567 acres	3284 acres
Waterhole construction	Construct small waterholes 6” to 4’ deep.	Improves foraging habitat.	Unknown	Unknown ~130 planned in Kosmos and Pine Creek Projects
Mine land reclamation	Erosion control, shaped, seeded and planted abandoned surface mined land.	Improved water quality and foraging habitat.	~150 acres	

Surface or Underground Mining	Removal of minerals either through removal of ground surface above, or by creating underground network of tunnels.	Loss of roost trees, degradation of water quality	>8000 acres over last 150 years.	Unknown. Possible 1,200 acre surface mine could occur in Pine Creek watershed.
Flood control dam installation	Installed dam across Fox hollow to reduce flooding at Pleasant Valley Church.	Enlarged existing wetland. Created additional foraging habitat, and may have created additional roost trees.	Unknown	unknown
Erosion control on roadways	Reshaping, seeding and mulching of existing old road beds.	Improved water quality and foraging	12 miles, (early 1990's)	Unknown
Wetland Restoration	Restoration of approximately of drained agricultural fields to emergent wetlands.	Improved foraging and additional water source.	118 acres total Pine Creek: 1994-95, 30ac. Superior: 1998, 60 ac. Sand Fork 1997, 28ac.	Unknown 17 acres planned for 2008.
Bat gate construction	Installation of bat-friendly gates Indiana bat hibernaculum and swarming sites	Protection of winter and fall habitat	7 gates (late 1990's to early 2000's)	Unknown
Tree planting	Plant Virginia pines and hardwood species	New source of potential roost trees.	30+ acres	76 acres (Pine Creek)
OHV trails	Reconstruction and designation of old roads and user-developed trails to OHV trails. Construction of some new trails.	May result in loss of some potential roost trees. Maintained flight corridors.	56 miles (early 1990's)	~35 miles (Kosmos- next ~5 years)
Non-native Invasive Species treatment	Mechanical treatment of non-native invasive species	Increased plant diversity supports diverse insect community and quality of Indiana bat foraging habitat.	400 acres (2005 – 2006)	Unknown

Illegal OHV use	Heavy OHV use of closed roads and user-created trails.	Erosion degrades water quality and foraging habitat.	ongoing	Unknown

Note: Data on past projects was gathered from discussions with Ed McFann, Nelson Krueger, and Tom Eaches, Ironton district employees that have each worked on the district for over 30 years, from timber sale records, and from the Wildlife Biological Evaluation for the Buckhorn Restoration Project (USFS 2005b). Dean State Forest information was supplied by Dean State Forest staff. Data on current and future projects was gathered from the current Wayne NF Schedule of Proposed Actions (SOPA), and from the Wayne NF Forest Plan.

Effects of No Action Alternative on Other wildlife
A consideration of the No Action alternative is the most appropriate place to look at the cumulative effects of past activities and the condition of habitat with no additional management activities on the horizon. The following species were considered:

Management Indicator Species
National Forest Management Act regulations direct the Forest Service to select and track species that are of special interest or indicative of management trends. These are called management indicator species (MIS). Eight bird species, in combination with three forest community types or habitats, were selected as management indicators for the Wayne National Forest.

Site-specific monitoring or surveying of a proposed project or activity area is not required by the NFMA regulations. Forest Service direction requires assessment of the effects of management activities on MIS, with the intent of maintaining viable populations of these species and the species with similar habitat that they represent. MIS are usually not rare species, but are common species that can be easily monitored.

Oak-Hickory Forest: Based on modeling completed during the Forest Plan revision process, forest stands dominated by oak-hickory are expected to decline on NFS lands over the next 100 years. The selected alternative of the Forest Plan was expected to maintain the most oak-hickory on NFS land after 100 years, but could still result in a 45% declining trend from current amounts (3-51). A decline in oak-hickory could affect animals which rely upon these species for food or shelter. Under the 2006 Forest Plan, approximately 10,500 acres were proposed to be treated by silvicultural treatments that maintained oak (Forest Plan FEIS 3-50). Under the no action alternative, none of these acres would be accomplished, and existing oak-hickory forests would be expected to slowly convert to stands dominated by less fire-tolerant species, such as maples and poplar (see Project File 5-7).

Early successional forest habitat: Forest stand data shows that early successional forest habitat has been declining on the WNF and throughout Ohio for several decades (3-60). In 1968, 25 percent of NFS land was comprised of early successional forest habitat, whereas only 5.4 percent is covered by early successional forest now. Vegetation management proposed under the 2006 Forest Plan is expected to maintain about as much early successional habitat as is currently present on the Forest (3-65).

Under the no action alternative and Alternative 4, early successional habitat is expected to decrease over time as existing habitat matures and moves into the next age category.

Under the no action alternative and Alternative 3, ruffed grouse habitat is expected to decline over time as the small openings created by the 2003 ice storm mature and become unsuitable as grouse habitat. Under the no action alternative and Alternative 4, early successional habitat is expected to decrease over time as existing habitat matures and moves into the next age category (see Project File 5-7).

Under the no action alternative, no effect is expected to occur to pileated woodpeckers and worm-eating warblers. Under the no action alternative, existing oak-hickory forests are expected to slowly convert to stands dominated by less fire-tolerant species that are more dense than ideal conditions for cerulean warbler nesting habitat. Therefore, under this alternative, cerulean warbler habitat is expected to decline.

Discussion of impacts to additional species from the No Action alternative can be found in Project File 5-7.

Regional Sensitive Species

Black bear and bobcat

Past activities have to some extent altered the habitat for some of these species. Little forestland has been lost due to agency forest management. Alterations of forest habitat from other projects can lead to more intrusion by forest visitors and a loss of den habitat if open mine portals are closed. These species tend to avoid areas with increasing human use and there is an abundance of portals on the Wayne. Impacts from the above list of activities would be short-term in nature and most are considered beneficial to these species over time (USFS 2006). Since no new federal actions occur under the No Action alternative, there would be no cumulative effects from this alternative.

Cerulean warbler

The generally closed canopy and similar tree heights in the project area make for a large area of suitable cerulean warbler habitat. The No Action Alternative would lead to a forest less vigorous and more susceptible to stresses such as gypsy moth defoliation, which would negatively affect habitat. With none of the proposed actions occurring, the project area forest would be more homogenous and less diverse. No cumulative effects would occur.

Henslow's sparrow

This species has expanded its range to include strip mine areas that have re-vegetated to open grasslands. Within the cumulative effects analysis area, defined as the project area, the quality of sparrow habitat is likely to remain the same or decrease slightly over the life of the project. Under the No Action Alternative there would be no cumulative effects because no new federal actions would occur.

Timber rattlesnake and green salamander

Since these species do not range more than a few miles from their natal dens or have very small home ranges, the cumulative effects analysis area is confined to the project area. Standards and guidelines in the 2006 Forest Plan protect rock outcrops, which are important to these species, although some changes to microclimate from canopy alteration may affect basking and foraging areas. These changes are expected to be short-term and no impact is expected form the No Action Alternative.

Blanchard's cricket frogs and four-toed salamanders

Many on-Forest projects, such as wetland restorations, improve or increase suitable habitat for these species. The No Action Alternative creates no cumulative effects on these species.

Mud Salamanders

Past actions such as mining and land clearing, more of which occurred south in the Kosmos project area, may have subsequently reduced the number of springs and seeps which create suitable habitat for this species. Under the No Action Alternative, there would be no cumulative effects because no new federal actions are proposed.

Round hickorynut, little spectaclecase, eastern sand darter and western lake chubsucker

All of these species are known to occur in Pine Creek, which was determined to be the cumulative effects analysis boundary. Activities which increase erosion or may result in pollution from mining or oil and gas activities will affect these species. These activities include road maintenance and uncontrolled stream crossings. The construction of the new trails in the Kosmos project should

ultimately reduce sedimentation from illegal trails as bridges are constructed and crossings are hardened or closed. Projects such as the Superior and Pine Creek wetlands will improve potential aquatic habitat for these species. Alternative 1 will have no impact on these species.

Management Indicator Species (MIS)
In summary, all of the alternatives in the Pine Creek project, including the no action alternative, would have beneficial impacts on some MIS and negative impacts on other MIS. Different species have different habitat requirements, and there is no "one size fits all" type of management that can meet the needs of all species at the same time on the same piece of land. The projects that are implemented under the 2006 Forest Plan provide a variety of habitats, in space and time, which will support viable populations of a wide range of species. A thorough discussion of MIS, their habitats and the impacts can be found in Project File 5-7.

Recreation

The Pine Creek Analysis Area is managed as a Historic Forest with Off Highway Vehicle (OHV) trails. The Analysis Area includes approximately twenty-six miles of existing designated OHV trails and thirty two miles of planned trails. The existing OHV trails included in this area are Telegraph, Lyra and Wolcott trails of the Pine Creek ORV System. The trails receive their heaviest use during weekends and holidays. A conservative estimate of the number of riders who use these trails during one season is 8,000. If the customer use was spaced evenly over all the holidays and weekends days of the trail season, 100 riders would use these trails daily. Since each trail is a dead end, each rider will travel both directions at least once each day.

The proposed trails for the Kosmos area fall within the larger Pine Creek Analysis Area boundary. The No Action Alternative would allow the construction and designation of all the proposed miles of new ATV trails in the Kosmos project, as approved under a separate document. The work approved under the separate document also included closing some roads and a number of illegal ATV trails within the project area

Archaeology

Because no management activities are proposed under this alternative, there would be no effect on heritage resources. It could be argued that the dense undergrowth/cover resulting from the 2003 ice storm is both a hindrance and benefit to heritage resource sites. The thickness of the downed vegetation prevents systematic investigation to locate previously unknown sites, but at the same time provides site protection through concealment, which is a possible deterrent to vandalism or looting. Another possible detriment to sites might be wildfire damage to above-ground cultural features resulting from un-treated undergrowth.

Alternative Two

Alternative 2, the proposed action, is an integrated project that would begin to restore upland sites in the project area to a more open understory with large, widely spaced trees representative of conditions which occurred when European settlers first arrived to this region of the United States. Treatment methods to restore forest conditions include timber harvest, prescribed burning, mid-story control of undesirable tree species, timber stand improvement in young stands, and NNIS control – a combination of treatments with the greatest opportunity to restore mature upland hardwood stands to historic conditions.

Alternative 2 includes ***approximately***

1) 2309 acres of selective hardwood harvest,
2) 2875 acres of prescribed burns,
3) construction of 3.8 miles of new hand line and use of 20.5 acres of existing roads, streams and trails as firelines,
4) 3068 acres of treatment to reduce mid-story density and reduce the component of non-desirable tree species, such as red maple (1036 acres herbicide treatment, 2032 acres manual treatment, such as girdling or felling),
5) 1677 acres of timber stand improvement to reduce competition for desired future overstory trees (839 acres herbicide, 838 acres mechanical treatment, such as felling),
6) non-native invasive species (NNIS) treatment (41 acres herbicide, 199 acres mechanical, such as cutting, pulling or felling)
7) 100 acres of native pine treatment, and
8) 68.5 acres of white pine thinning.

In order to complete the hardwood and pine treatments, ***approximately***

1) 5.8 miles of ORV trails will be temporarily converted to haul roads and later returned to ORV trails;
2) 12.5 miles of Forest Service system roads and 0.8 miles of unclassified roads will be upgraded and used as haul roads; and
3) 1 mile of new roads will be constructed.
4) 48 miles of skid roads and 46 log landings totaling 105 acres will be constructed.

In addition, we propose to

1) Construct ***approximately*** 60 waterholes for wildlife on ridge tops and
2) Harden and improve about 8 visitor parking areas along public or forest roads.

Soil, Water and Air

Impacts and mitigation measures for each activity are discussed below.

Harvest Treatments and Road Construction and Reconstruction

The proposed harvest treatments will require construction of approximately 1 mile of new temporary road, 34 acres of log landings, 71 acres of skid trails, and the widening and hardening of approximately 5.8 miles of ORV trails for temporary use as haul roads. Site specific visits to a random number of proposed roads, log landings, and skid trails were made to determine what impacts would occur to the soil and water resources. The proposed roads and log landings are located on existing ridge-tops where the drainage divides occur. However, within the harvest units, the skid trails will cross the upper reaches of several ephemeral streams. In order to minimize any adverse effects to the soil and water resources, the following Forest-wide standards and guidelines, filterstrip requirements, stream crossings, and other mitigation measures will be adhered to during implementation (Project File 7-7).

1. GFW-ARR-5: Where earth-disturbing activities expose mineral soil, establish filterstrips along water bodies:

- Filterstrip width along perennial water bodies should be a minimum of 100 feet, measured horizontally from the edge of the aquatic ecosystem.
- Filterstrip width along intermittent streams should be a minimum of 75 feet , measures horizontally from the edge of the aquatic ecosystem.

- Filterstrip width along ephemeral water bodies should be a minimum of 50 feet, measured horizontally from the edge of the aquatic ecosystem.

2. GFW-ARR-6: Earth-disturbing activities that expose mineral soil may occur within the filterstrip only if effective sediment control measures that minimize and/or mitigate any detrimental effects are employed.
3. GFW-ARR-8: Design stream crossings to be at right angles
4. SFW-ARR-10: Do not allow roads, trails, or log skidding within streambeds except at designated crossings.

For each project, all new construction and/or reconstruction for roads and trails that results in barren soils on side slopes should be seeded and mulched within 14 days of the disturbance. This measure will ensure that soil transport during storm events would be minimized. Additional recommendations, based on site specific field visits with Stephen J. Hamilton, Soil Scientist, Division of Soil and Water Conservation, are described below. Mr. Hamilton's recommendations have been provided to the project file (Project File 7-2).

1) Slope in this area is the number one consideration because skid trails can hold water and cause slippage.
2) Look for breaks and benches and place skid trails in these areas.
3) When locating skid trails, avoid slopes with evidence of landslides.
4) Place log landings on soils with a sandstone base, particularly the Steinsburg and Gilpin units.
5) Plan to use stone where rutting potential is high for both roads and skid trails.
6) Keep equipment on slopes less than 40%.
7) Keep skid trails on level benches.
8) Any disturbance on a 25% or greater slope will be seeded and mulched within 24 hours of the cut.

Note: This is a selection harvest in which the canopy will remain largely intact, retaining vegetative cover to reduce raindrop impact and thus reducing the opportunity for impacts to the soil and water resources.

The Effects of Compaction Due to Timber Harvest Activities:
General timber harvest areas are expected to recover quickly from compaction caused by harvesting activities. The upper few inches of soil recovers quickly from light to moderate compaction (Heninger 2000). This would be due to organic matter additions from logging debris, soil biota activity, freezing and thawing, and plant root growth from existing and new vegetation (See Project File 7-13 DePuy).

Recovery from compaction would be slower in the areas where severe compaction occurs. These areas are associated with log landings and primary skid trails/roads, where equipment has passed over the soil many times. Severe compaction could be mitigated by ripping or soil tillage of the upper 7 to 24 inches (see S &Gs) to break up the compacted soil surface and promote water infiltration and root growth.

Regional Soil Quality Standards recommend that bulk density values be no greater than 1.54 to 1.63 g/cm^3 for loamy soils (range dependent upon specific soil textures). Untreated severely compacted areas have long term (8-40+ years) impacts to soil productivity (Miller et al 2004). Potential areas within units may exist from past activities; however, no areas were identified during field review.

Project areas or harvest units do not have areas of recent soil disturbance readily noticeable via aerial photographs. There may be some remnant compaction from historic logging practices from the early 1900s; however, most of the soil disturbance has recovered. There are some signs of old skid trail systems which may imply that compaction in these areas still persists because few large trees grow in these 75 plus year old corridors.

New areas of compaction on log landing areas may result from blading of the surface and heavy equipment use while stock piling logs. These areas could be ripped after harvesting is completed within the unit to mitigate the compaction during the conversion of the site from a landing to a wildlife opening.

The Effects of Project Activities on Nutrient Cycling:
The above ground nutrient content of the forest stand is relatively small compared to the total nutrient pool of the soil (Fisher and Binkley 2000). Probable effects of proposed harvesting activities on nutrient cycling include:

1) increased mineralization of organic material, resulting in increase available nutrients, particularly nitrogen;
2) increased nitrification of soil nitrogen to nitrate, a more mobile form;
3) increased leaching of soil nutrients (nitrogen, calcium, and magnesium) as uptake by plants decreases temporarily due to partial removal of the overstory; and
4) increased rates of cycling of some nutrients in the upper soil horizons.

Effects of nutrient cycling in thinnings and single tree / group selection cuts are not likely to be detectable in the short-term because of the dispersed nature of the removals. The dispersed removal of trees within the project area has relatively little, if any, effect on microclimate and thus nutrient cycling processes. Also, because the rates of these processes vary considerably spatially within a stand, detecting an effect would be difficult. In areas where tree removal is heavier, increased soil moisture, surface soil temperatures, and increased organic matter produce ideal conditions for rapid decomposition of the organic matter available on the site. Soil organisms responsible for decomposition would benefit from this surge in organic materials (Project File 7-13 DePuy) .

The Effect of Project Activities on Soil Fertility:
The main buffering opportunity for this project appears to be incorporation of organic matter on site for decomposition and larger woody debris on site for long term organic material recruitment. Fertility would be expected to increase from pre-harvest levels as increases in soil moisture and soil temperature from timber harvest contribute to an increase in organic matter decomposition. This effect would produce an increase in nutrients available to plants and soil organisms on the sites. This surge in nutrients, along with additions of nitrogen from the atmosphere and precipitation, would be expected to promote rapid growth on the sites as well as benefiting many soil-borne organisms. Possible losses of nutrients to ground water and volatization are expected to be offset by addition of nutrient-rich leafy tops and woody debris left on-site after harvest. Therefore, no adverse impacts to soil fertility are expected and positive impacts may occur from the proposed treatments as material is left on site to eventually become part of the soil organic layer (Project File 7-13) DePuy).

The Effect of Canopy Removal on Soils:
Canopy removal is proposed to some degree in all action alternatives. An initial surge of nutrients would be anticipated as the canopy is opened. Increasing soil moisture, soil surface temperatures, and an increase in organic matter produce ideal conditions for rapid decomposition. Sprouts from the existing root systems on harvested areas along with new germinations would benefit from the

increase in available nutrients. A surge in growth would occur. Possible losses from leaching of nutrients to ground water and volatilization are expected to be offset by the addition of nutrient rich leafy tops from harvested trees and woody debris left on-site after the harvest. In addition, a decrease in evapo-transpiration would result in increased runoff. These are considered short-term impacts and would be quickly reduced with regeneration of understory species (Project File 7-13 DePuy).

The Effects of Project Activities on Soil Temperature:
Timber harvesting activities temporarily disturb the forest floor by mixing the organic layers with the mineral soil. Removal of a portion of the forest stand by harvesting can result in increased sunlight reaching the forest floor, higher soil temperature and increased soil moisture, as well as increased decomposition and mineralization rates resulting from increased microbial activity. The increase in soil temperatures would occur primarily during the growing season, but once the forest canopy closes in (within ten years), temperatures would return to normal. Soil biota activity would increase in the upper horizons of the soil and decomposition rates would increase temporarily. Bacterial activity assumes a more important role in the latter stages of decomposition. The increase in decomposition rates along with increased sunlight to the forest floor leads to an increase in leguminous plants, which are capable of fixing large amounts of nitrogen (Project File 7-13 DePuy).

The Effect of Road Maintenance on Soil:
Road maintenance activities would include brushing, cleaning culverts, cleaning ditches, blading the road surface and adding surface rock as needed. Short-term effects would include increases of soil movement as the soil on the road surface and in the ditch line would be exposed to surface water. There would be a slight to moderate risk of destabilizing the toe-slope when ditches are cleaned by removal of the soil material. This could cause additional soil movement. However, overall road maintenance would be a positive effect to the watershed. 19.4 miles of this proposal are pre-existing roads under the jurisdiction of some government entity. The amount of erosion and sedimentation (if any) is dictated by the amount of maintenance this road receives. Well-maintained out-sloped roads contribute minimal or no erosion or sedimentation to the watershed.

6.6 miles of unclassified roads and trails could act as conduits for runoff if not maintained. If these roads and trails are employed as access to harvest stands or additional prescribed fire units, additional areas would not need to be disturbed. After completion of the aforementioned and associated activities, these roads could be closed to keep out illegal ATV use. Some of these roads will be maintained as designated trail in the Kosmos trail extension project.

The Effect of Top-soiling on Soils:
There would be an additional indirect effect in areas which receive the topsoil from excavated areas, such as constructing water holes. With this added mineral soil material and organic matter, productivity on these areas would be improved by increasing soil depth, moisture holding capacity, organic matter and nutrients.

The Effect of Prescribed Burning on Soil and Water:
The proposed prescribed burning under this alternative is a low intensity, non-stand replacement surface fire. Four types of fire lines are needed to implement prescribed burning. Most ridge tops already have old or existing roads which can be utilized as fire line. The following table shows the types of fire lines anticipated for the eight different burn units.

Fire lines by type		
	Segments	Miles

Roads used as fire line	22	14.3
Trails used as fire line	4	3.3
Stream used as fire line	2	.4
Proposed hand line	13	8.2
Total miles fire line		26.2
These fire line segments are the combined totals of all like segments for all burn areas. If more than one burn area shares a line, it is only considered once.		

This stream was used as a fire line in the Darby Creek prescribed burn on the Ironton Ranger District a few months prior to the photo being taken. High moisture in drainages makes them suitable as natural fire barriers.

Hand line will be built on slopes not suitable for equipment. Hand line will be approximately 4-6 feet wide and will weave between large trees. Small trees and shrubs will be removed and the duff and litter layers removed to mineral soil. All hand line will be rehabilitated after use by kicking organic matter back onto the mineral soil and installing cross drainage water bars where necessary. It is not expected that seed or mulch will be needed on hand line.

Old roads will be improved by limbing low-hanging branches up to the 10-foot width prescribed. Old roads should not need additional dozer work or rehabilitation, except where also used for timber operations. All terrain vehicle trails will double as fire line where suitable. Some limbing maybe required. No additional equipment work or rehabilitation is expected on these trails.

Fire line along streams implies that fire will be allowed to back down to a riparian area with the creek as a physical barrier to further movement. There will be no soil disturbance along creeks and no rehabilitation expected.

The effects of prescribed burning on soil erosion and nutrient loss are related to the severity of the burn. These effects are complex and depend on a host of factors but certain generalizations seem relatively consistent. Burning has its most pronounced effect on the forest floor where carbon (C), nitrogen (N), and sulfur (S) are volatilized and calcium (Ca), magnesium (Mg), potassium (K), and phosphorus (P), and other elements are left as ash. The ash is leached by rains into the mineral soil which increases its base saturation and pH (Alban 1977). Increased nutrient availability at a higher

pH may result in positive plant responses following fire (Van Lear and Kapeluck (1989). The positive response of plants leads to less soil erosion because plants hold the soil and slow the impact of rainfall. These coincide with results from a variety of other reviews and studies (DeBano 1998) (Liechty, Luckow, & Guldin 2004) (Neary, Ryan, & DeBano 2005).

Timing of prescribed fire can influence the degree of plant responses. Prescribed fire in late fall to early winter may result in nutrients from ash to leach out of the soil due to the higher precipitation events for that season. After their winter dormancy, plants may be able to take advantage of ash in the soil after early spring burns. Erosion can increase as a result of prescribed fire, but WEPP model runs indicate that the erosion levels will be much lower than erosion and sedimentation levels after a high severity stand replacement fire (Project File 7-13 DePuy).

"When fire moves through the landscape, it burns where it's dry, and where it's moist, it doesn't," said Ruffner, an associate professor of forestry at Southern Illinois University Carbondale and a specialist in fire ecology…..There's never 100 percent coverage with fire. There will be islands of untouched vegetation and some spots that are intensely burned mixed in with areas that have burned moderately. This creates a mosaic of habitat with greater biodiversity… Fire is just decomposition speeded up. It's the opposite of photosynthesis — with fire, carbohydrates are broken down into their constituents" (Jaehnig 2007). This mosaic of habitat also creates future recruitment for soil organic matter to aid in buffering the soil (Project File 7-13 DePuy).

Monitoring of impacts to soil and water resources from previous burns (both pre- and post burns where streams were used as fire line breaks) indicates there were no off-site negative impacts to the soil and water resources. A monitoring report and photos have been provided to the project file and are labeled as 10-04a, and 10-4b, respectively.

The Effect of Prescribed Burning on Air Quality:
The major impact to air quality from management on the Wayne would be from wildfires and prescribed burns (see Project File 10-22). Fires emit large amounts of particulate matter and carbon monoxide as well as nitrous oxides and organic compounds. Smoke created from burning is generally temporary. It dissipates and is not considered a significant factor in local air quality. The WNF implements most prescribed burning in the spring and fall when wind and temperature conditions allow smoke to would dissipate quickly. Burning during spring and fall would not affect the attainment status for pollutants, as the non-attainment days normally occur during the summer or periods of stagnant air. To minimize air quality impacts, all prescribed burns have an approved burn plan. These plans include measures to minimize and manage smoke. Prescribed burns also comply with State of Ohio regulations for open burning (see Project File 10-7).

Since the 2003 ice storm killed many trees, the amount of dead and down fuel across the northern 2/3 of the Ironton District increases every year. Prescribed burning at the landscape level across this area helps to decrease fine fuels which carry fire across slopes, decreasing the possibility that wildfire will produce uncontrolled emissions in weather conditions which do not disperse smoke.

The Effect of Timber Stand Improvement on Soils:
Manual treatments are not expected to result in any ground disturbance. As with other actions, there are opportunities for increasing recruitment for long-term soil organic matter. Herbicide treatments are covered below, but as the herbicide is neutralized over time and dead stems fall to the ground, there is the opportunity for increased organic matter incorporation.

Herbicide Use

Herbicides and their breakdown products are transported within ecosystems mainly through the water cycle. Precipitation, evaporation, runoff, leaching, and root uptake are the major water pathways. Runoff, leaching, root uptake, and movement in soil and ground water are the primary hydrologic processes governing herbicide movement (Neary 1989).

Herbicide formulation can directly affect solubility, which in turn affects the application system and the potential for off-site movement. Herbicides with high solubility have the greatest potential to move by storm runoff into streams and lakes or by deep leaching into an aquifer. An exception is glyphosate which, although it is readily soluble in water, its potential to move is very low since it is strongly adsorbed onto organic matter in the soil. Most of the forestry herbicides have low vapor pressures and are not prone to volatilization losses (Neary 1989).

The impact of herbicides on soil and water can be assessed by looking at how the chemical is placed on the foliage, stem, or ground around a target plant, the use of aerial or ground spray systems, the chemical formulation (soil vs liquid), the application rate, the timing in relation to climatic conditions and the growing condition of vegetation, and the intensity of use. These factors are discussed in the following discussion of herbicide impacts.

Many of the impacts in forestry use, especially for the control of individual stems, are judged with regard to the intensity compared to agricultural uses. Forestry use of herbicides is of low intensity compared with agricultural use. Forestry herbicides are normally applied once or twice in a 25-75 year rotation. Agricultural usage is yearly or even monthly during the growing season. The current level of herbicide use on national forests in the Southern Region involves annual applications to only one percent of the national forest land base. The projected use in the Pine Creek Project is one single-stem application on approximately 1036 acres spread over a 10-year period. Individual stems will receive treatment, so the amount of chemical applied will be very low. The opportunity for drift is very low due to the droplet size used for either basal stem application or for hack and squirt. The opportunity for movement into the soil is very low when treatment is planned more than 24 hours prior to expected precipitation.

Two herbicides are proposed for use in this project: glyphosate (primarily for NNIS) and triclopyr (primarily for non-desirable tree species in the understory and in crop tree release in young stands). According to the label for Foresters' Non Selective Herbicide containing glyphosate (Project File 4-15), when this product comes in contact with soil (on the soil surface or as suspended soil or sediment in water), it is bound to soil particles. Under recommended use situations, once this product is bound to soil particles, it is not available for plant uptake and will not harm off-site vegetation where roots grow into the treatment area or if the soil is transported off-site. Under recommended use conditions, the strong affinity of this product to soil particles prevents this product from leaching out of the soil profile and entering ground water. The affinity between this product and soil particles remains until this product is degraded, which is primarily a biological degradation process carried out under both aerobic and anaerobic conditions by soil micro flora.

The herbicides containing glyphosate have no herbicidal or residual activity in the soil. It is bound to soil particles and is not available for plant uptake and will not harm off-site vegetation where roots grow into the treatment area or if the soil is transported off-site (per label 4-14). Glyphosate is the only herbicide proposed for use in this project which will be applied to leaves (on NNIS) and have a higher potential to run off or wash off leaves onto the soil. Since it would fall on a thick layer of

leaves, there is little likelihood that it would be washed off into an ephemeral drainage (see Project File 4-16).

Once an herbicide is applied to a site, it is subjected to natural processes eventually resulting in its degradation (see Project File 4-16). The major degradation pathway is microbial breakdown in the soil although varying rates result in a longer half-life than some of the other herbicides (see Neary 1989). Glyphosate does not photo-decompose to any extent and does not volatilize. It is low in toxicity to aquatic and terrestrial organisms (see Project File 4-16).

Ester and amine salt formulations of herbicides containing triclopyr (i.e. Garlon 3A) (see Project File 4-16), according to EXTOXNET Pesticide Information Profiles 1996 will rapidly convert to the acid form, which in turn is neutralized to a relatively non-toxic salt. It is effectively degraded by soil micro-organisms and has a moderate persistence in soil environments. The half-life in soil ranges from 30-90 days, depending on soil type and environmental conditions. Triclopyr is not strongly adsorbed to soil particles and has the potential to be mobile.

In water, triclopyr is not readily hydrolyzed at pH 5 to 9. Hydrolysis of the ester and the amine salt occurs rapidly and results in formation of triclopyr. Reported half-lives in water are 2.8 to 14.1 hours, depending on season and depth of water. While triclopyr will be used in a high concentration (possibly 100%) in a thinline treatment, the intensity of treatment will be very low and ground contact unlikely. There will be little likelihood for triclopyr to move toward a water channel.

Herbicide use for competition control, even in steep terrain, is not responsible for erosion and is consistent with maintaining good hydrologic function. Herbicides do not disturb the soil and leave intact a good litter layer which mitigates raindrop impact, promotes infiltration, and greatly reduces erosion. In this regard, herbicide control of competing species has much less impact than fire on forest soils.

The micro- and macro-organisms found in the forest floor and soil horizons play very important roles in the functioning of forest ecosystem. Effects of herbicide application on these organisms are much dependent on the herbicide chosen, the application rate, and conditions at time of application. Herbicide usage at normal forestry rates does not tend to reduce the activity of micro-organisms, when applied at normal rates (Neary 1989). Therefore, there is no evidence that the herbicides currently used in forest management produce any adverse effects on site and soil productivity. There is substantial evidence that herbicide usage as a silvicultural tool can increase site productivity. Application instructions are stated here, and are also found in the Botanical BE (Project File 5-8).

Herbicide treatments would follow all applicable federal and state laws and regulations and Forest Plan standards and guidelines.

1) Applications would be supervised by a State-certified applicator.
2) No mechanized or aerial broadcast spray methods would be used. Only hand application methods would be used.
3) Riparian areas along all perennial, intermittent and ephemeral stream channels would not be treated with herbicides. Herbicide application would not be closer than 100 feet from all bodies of free or flowing surface water, unless the herbicide is approved for aquatic use.
4) Application equipment, empty herbicide containers, clothes worn during treatment, and contaminated skin would not be cleaned in open water or wells.
5) Mixing and cleaning water would be from a public water supply and be transported in separate labeled containers.

6) Herbicide mixing, loading or cleaning areas in the field would not be located within 200 feet of private land, open water or wells, or other sensitive areas.
7) Areas to be treated with herbicide will be signed for foot travel at access points.
8) Herbicides would be applied at the lowest rate effective in meeting project objectives. Application rate and work time would not exceed typical levels.

After careful consideration of past and present activities, existing condition, and all proposed actions for each of these projects, I have concluded that herbicides applied according Forest-wide standards and guidelines and additional mitigation measures, will cause minimal impacts to the soil and water resources in the Pine Creek Watershed.

Effects of Herbicide Use on Air Quality
Air quality is not expected to be adversely affected by implementing any of the alternatives (see Project File 4-16) because

1) Burning would not occur for approximately 30 days following herbicide application.
2) The herbicides proposed for use are not on the list of air toxics in the 1990 Federal Clean Air Act amendments.
3) Airborne drift would not be significant because 1) herbicides are applied in large droplets in order to make contact with small stems; 2) herbicides are applied close to ground level where winds are minor; and 3) nozzle size is designed to reduce drift.

Waterholes - Mowing and excavation of 100 sites for waterholes is a part of Alternative 2 & 3. Each waterhole is estimated to be about 1000 square feet and three foot deep. These waterholes may be located along roads scheduled to be closed providing a benefit to the watershed as well as a benefit for wildlife and viewing wildlife by the public.

Parking Areas – The proposed parking areas for wildlife viewing are already disturbed areas. Establishing parking areas would provide maintenance for these areas and reduce the probability that they produce additional runoff and sedimentation.

Indirect Effects from Proposed Activities
There are several indirect effects related to the combination of proposed activities in Alternatives 2, 3 and 4.

Ecosystem Services - Two key words in the management of forests to provide ecosystem services are conservation and stewardship. Conservation denotes wise use and stewardship denotes caring for the land. Partial harvesting has been prescribed to improve forest health. Prescribed fire as proposed does not degrade or eliminate ecosystem service as listed belows and the services continue after a prescribed fire as before. Native Americans used fire for their own ecosystem services: i.e. improved game habitat, facilitated travel, reduced insect pests, removed cover for enemies, enhanced conditions for berries, and drove game. Present day services such as air cleaning services, watershed protection, habitat, scenic beauty, carbon storage, oxygen production and recreation continue as ecosystem services after a burn just as ecosystem services continued after a burn for Native Americans (Project File 7-13 Depuy).

Carbon sequestration - Carbon sequestration would remain stable or slightly reduced. The carbon harvested and taken off-site would likely be converted to wood products, many of which are long-lived. Prescribed burning would result in a short term reduction in carbon and increase in carbon

dioxide in the atmosphere. This may be followed by positive plant responses in succeeding years and an increase in sequestration.

Water quality - Water quality in Pine Creek would be protected through the implementation of BMPs and Forest Plan standards and guidelines. The potential for temporary increases in sedimentation is proportional to the acreage of timber harvested and acres burned in relation to the size of the watershed. The project area proposed for thinning is a small portion of the whole watershed. This suggests there will be a slight to minor decrease in water quality of adjacent streams if Alternative 2, 3 or 4 are implemented. This would be a short-term effect (3 years), and water quality would be maintained in the long-term.

Overall, based on the predicted erosion rates (FSWEPP modeling) soil erosion and sedimentation would not impair the productivity of the land nor impair the quality of water (Soil and Water Working Paper). While there may be short term increases in erosion and sedimentation, these changes will be relatively minor and of short-term (1-3 years). Low-intensity prescribed fire in combination with the group selection/individual selection cut would not be expected to have an adverse, long-term affect on the quantity of water flow, nutrient budgets, or soil quality.

Vegetation

The primary purpose and need for this project is to move the forest from the existing to the desired future condition. Effects from the proposed action are compared to

1. effects from not doing the project (No Action);
2. attempting to satisfy the purpose and need without prescribed burning (Alternative Three); and
3. without harvest or herbicide use (Alternative Four) in the following descriptions.

Effects from harvest treatment

Silvicultural practices implemented in Alternative 2 (and 3), including individual (single) tree selection and group selection, are designed to create the conditions necessary to perpetuate oaks in the Dry-Upland and Dry-Mesic Forest Alliances and to enhance the vigor, condition, and growth of the residual trees. A combination of harvesting, prescribed burning, and/or mid-story treatments as proposed in this alternative will be necessary to achieve desired regeneration in the mid-story canopy. Without post harvest treatments the openings or gaps will be filled by the species present in the understory and by species with seeds on the site, such as yellow-poplar and maple.

Because of the life histories (growth rate, longevity, etc.) of the various species in our forest and other factors, such as timber market conditions and forest pest conditions, the appropriate cultural treatments are complex (Hicks 1998, pg 188). A major problem during the regeneration phase is maintenance of sufficient light to assure oak survival, but not enough to encourage the regeneration of competitors. Oaks dominate much of the forest canopy, but small oak seedlings less than one foot in height have low stocking levels. Few oaks and hickories reach the pole stages or mid-story canopy, which is usually dominated by yellow poplar, red and sugar maple and other hardwood species. Red maple is dramatically increasing on a variety of sites over pre-European settlement forests (Abrams 1998). In order to develop sufficient size and vigor to survive competition following release, seedlings should be greater than 0.6 inches in diameter at the ground line and 4.0 feet in height (Sander et al. 1976). This may require 10 to 20 years or longer.

Single tree selection as a method of cutting by itself is unlikely to be effective in maintaining the predominantly mixed-oak stand conditions. Shade-tolerant species are likely to occupy the site in the future because, with openings left by the removal of a single tree, not enough light reaches the forest floor to allow the oak seedlings to develop and compete successfully. Individual tree selection will create a varied age class distribution, which will serve to perpetuate existing stand compositions. The residual canopy should occur as a mosaic throughout the stand, with irregular crown openings. Initially the crown closure will be reduced to 60 – 70 percent but as the seedlings become established and begin to develop it will be necessary to maintain a 15-20% canopy openness to encourage the perpetuation of the regeneration. The relatively open stand conditions will mimic what was historically documented for this region. An uneven-aged stand condition with a variety of tree ages and diameters is desired (Project File 4-7).

Group selection can be used to reproduce oaks satisfactorily, assuming (Sander, Graney, 1992):

1) The oak advanced reproduction is adequate
2) Culls and small trees within the groups are cut or killed, unless specifically retained for wildlife or other purposes.

Group selection can increase the oak component in the future stand, but will likely result in less than the amount created with single tree selection due to the advantage shade-tolerant species have along the shaded edges of the groups. Oaks may thrive in the centers and northern edges of each group. Eventually, the amount of oak in the entire stand will decrease until only the dry south slopes and ridgetops would be stocked with significant numbers of oaks.

Harvesting as a treatment by itself in these stands will increase sunlight to the ground allowing shade tolerant non-oak mid-story trees to expand their crowns. Given current stand composition, selective harvesting along with prescribed use of fire and selective use of herbicides, will shift species composition in the understory. It is important to note that although regeneration of oak and hickory is integral to the dynamics of future stands, it is only a secondary focus of the efforts to restore the forest to historic conditions. Alternative Two applies the most favorable combination of treatments to create the desired future condition.

Effects from prescribed fire

1) Prescribed fire is very effective in restoring and maintaining oak in areas that have adequate light reaching the forest floor. Primarily, fire advanced oak regeneration out-compete male and yellow poplar.

2) Fire removes excessive litter buildup from the forest floor, thereby preparing a favorable seedbed. Squirrels and blue jays prefer areas of thin litter for acorn burial. Also, jays collect and disperse only sound nuts. This important ecological finding implies that acorns which escape predation can result in well-established first-year seedlings. Seedlings from freshly germinated acorns cannot emerge through a heavy litter cover. Germination and first-year survival are best when acorns are buried about three centimeters deep in mineral soil (Van Lear, Watt, 1992). The humus layer is retained to keep the soil surface porous, so that un-cached acorns can more easily penetrate the soil, retain moisture, and provide support for the new seedling.

3) Fire helps to control insect predators of acorns and new seedlings. Insect pests act as primary invaders, secondary invaders, parasites, or scavengers on acorns. Many of these insects spend all or part of their lives on the forest floor. Infestations, which can vary from year to year and even from tree to tree, are a major contributor to the oak regeneration problem. Annually, about 50 percent of the acorn crop in Ohio is destroyed by the larvae of Curculio weevils, acorn moths, and gall wasps. Studies indicate that prescribed burning may reduce populations of oak insect pests and would allow more acorns to be scattered and buried by jays and squirrels. This enhances the probability of successful germination and helps subsequent seedlings become established. Burning may also reduce rodent habitat, eliminating another source of acorn predation. (Van Lear, Watt, 1992)

4) A fire from low intensity up to medium intensity will damage thin-stemmed mid-story and understory trees up to 3” in diameter. Control of undesirable hardwoods in this size class will increase light to the understory, increasing both the growth of forbs and the opportunity for oak seedling germination and establishment (see Project File 4-7).

5) A regime of frequent understory burns, perhaps including both growing-season and winter burns during a period of 5 to 20 years prior to harvest, should promote a favorable root/shoot ratio during oak seedling establishment (Van Lear, Watt, 1992). This fire frequency would replicate fire-returns from the mid-1800s to 1925 that are likely an important reason why mature oaks are here now, as discussed in this document earlier. With a fire regime based on historical norms, the harvest of the overstory should release the established seedlings from the dense shade of the overstory, and oak seedlings could then develop into a future oak stand. Burning will favor fire-adapted species, such as oak and hickory, over thinner barked hardwoods, such as beech and maple.

The effects of using prescribed fire are not simple and breed some controversy (see Project File 4-7). Working in similar stands in the Great Smoky Mountains National Park, Harmon (1984) found that reintroduction of fire may decrease red maple importance, but suggested that restoration of pre-suppression stand structure is a long-term process. Furthermore, interpreting pre-suppression fire regimes is extremely difficult, if not impossible (Harmon, 1984).

Other studies in the central hardwoods (Franklin et al., 2003; Hutchinson et al., 2005) also suggest that fire alone usually has not restored oak forest structure or improved regeneration, at least in the short term in sites that have been subjected to long-term fire-exclusion. The many ways fire affects stand structure makes using fire complicated. In Blankenship 2006, it was observed that repeated fire successfully reduced densities of red maple and white pine, but the effects on oak regeneration were not as clear. They found the long-term results of burning alone may or may not support the goal of promoting oak regeneration through prescribed fire. They concluded managers must carefully

consider their specific management objectives before deciding how to use prescribed fire in eastern forests, as well as consider additional or alternative silvicultural methods for the promotion of oak stands.

The amount and location of fuel in these ice-damaged stands will be used to establish control boundaries and ignition patterns for prescribed burning. Much of the ice damage occurs in coves where there are presently higher fuel loads in all size classes. Coves also have higher fuel moistures based on air circulation and available sunlight, so fire will burn cooler, less fuel will be consumed and more coarse woody debris will accumulate (see Project File 4-7).

Research cited in the discussion of fire impacts does not discuss the impacts of fire line construction. The main impacts are the displacement of the duff and litter layers to the side of a swath of exposed mineral soil. Rehabilitation after burning can replace these layers of organic matter, but they will remain exposed for several months during preparation and the actual burning. There is some opportunity for soil compaction due to raindrop impact, although this would occur primarily on old roads where use by vehicles will already be compacting soils during use. Little compaction will occur on hand lines due to the absorption of raindrops by the canopy. There is also some opportunity for seeding by non-native species, but the impact from this will be discussed in the botanical report.

Our use of fire will be adaptive and long-term. Prescribed burning should occur as a follow up treatment to harvests. Burning should be avoided prior to harvesting because charring could affect marketability for forest products. Charring on the boles of the trees or picked up from the forest floor during harvesting is a serious complication to primary wood manufacture of fine paper products. Charred wood is prohibited in these facilities because it can increase operating costs and affect paper quality. Burning after harvesting eliminates this concern. Typically, six months after a burn, the charcoal residues will be incorporated into the soil and two years after a burn charring on boles is no longer an impact. If burned within the fire prescription, charring on boles should not exceed five feet in height.

Effects from harvesting in pine

Pine will not be a major component but will still be represented in the stand. Without some form of disturbance the pine will continue to deteriorate. The longer the delay in treating these stands the more difficult it will be maintain the scattered pine.

The proposed mid-story treatment will reduce the number of residual undesirable stems, sprouts and un-merchantable stems not meeting the Desired Future Condition of the Historic Forest management area. The first priority is **mechanical** treatment of the under and mid-story red and sugar maples in the Upland and Upland/Mesic sites. Mechanical treatment methods applied should include girdling and felling smaller diameter trees not meeting DFC. NNIS treatments should also be evaluated and applied at this step (Project File 4-7).

Controlling non-oak competitors in the understory and mid-story with **herbicide** is very effective in restoring and maintaining oak seedling populations. Herbicide use allows targeted control of selected species. Some associated damage to non-targeted species can be expected. Although not being analyzed in this project, if successive years of unacceptable burning weather results in a backlog of areas needing to be burned, herbicide treatment can allow mangers to “catch-up” in promoting the conditions for advanced oak regeneration.

The reduction of competing vegetation can significantly increase tree growth well into mid-rotation (e.g., Zutter and Miller 1998). Controlling both woody and herbaceous vegetation provides the greatest increase in tree growth.

Herbicides can result in some of the same ecological effects as fire (Wigley 2002). Herbicides can injure or kill the above-ground portion of plants, selectively eliminate part of a plant community, influence community composition and successional stage, and temporarily reduce competition among plants for resources. Herbicides cannot perform every ecological function of fire. They cannot directly and immediately alter a seedbed by removing litter and humus and creating bare soil, although herbicides can contribute to this indirectly over time. Herbicides cannot scarify leguminous seeds to enhance germination or stimulate seed release in species responsive to fire. The reduction of competing vegetation can significantly increase tree growth well into mid-rotation (e.g., Zutter and Miller 1998), and controlling both woody and herbaceous vegetation provides the greatest increase in tree growth.

Controlling non-oak competitors in the midstory using **mechanical** methods is effective in maintaining and restoring oak only when used in combination with prescribed burning. Some larger trees in the understory are less likely to be killed by prescribed fire. Fire treatments alone would leave them free to out-compete the oaks. Re-sprouting is expected in areas which do not burn effectively as a mosaic throughout stands. Mechanical treatment is not as efficient of a treatment as herbicide and is being considered in this project to reduce the use of herbicides on the landscape as requested by the public. Mechanical treatments are very labor intensive and will be best to target midstory trees. Understory competition will need to rely on prescribe burning for control, as mechanical methods are expected to be too labor intensive to implement. If successive years of unacceptable burning weather results in a backlog of areas needing to be burned, mechanical treatment allow mangers limited control in promoting the conditions for advanced oak regeneration.

Cumulative Effects

Cumulative effects will be negligible, except for the unlikely scenario where a worker applies herbicides at home on the same day and at the same rate of a previous exposure resulting from this proposed project. The proposed use of herbicides could result in cumulative doses of herbicides to workers or the public. Cumulative doses of the same herbicide result from additive doses resulting from various routes of exposure from this project; and additive doses if an individual is exposed to other herbicide treatments. Additional sources of exposure could include herbicides on adjacent private timber lands or home use by a worker or member of the public.

Since these herbicides persist in the environment for only one to twelve months, do not bio-accumulate, and are rapidly eliminated from the body, we do not anticipate any additive herbicide doses from re-treatment in following years. Areas within stands selected for treatment will probably only receive one treatment, and may be treated after, but not prior to burning.

Effects of other connected or similar actions

There is no silvicultural effect from road construction, re-construction or maintenance, as most of these routes are presently dedicated as access into the project area. The construction of water holes, visitor parking lots and fire lines will likewise not change the silvicultural condition of these stands. The treatment of NNIS will have a positive effect on the condition by eliminating another source of competition for growing space and moisture.

The cumulative effects of past harvest activities, the 2003 ice storm, and fire suppression have been described above in the current condition of these stands. The cumulative effect of treating these stands as proposed combined with past effects will move them toward the desired future condition of a more open stand with desirable species continually recruited into the pool of regenerants (small seedlings) and successively into larger size classes, poised to continue oak and hickory dominance of the canopy. The cumulative effect of repeated prescribed burns will be to reduce the number of thin-barked competitor species in the understory (maple, beech), resulting in a more open understory condition. There is not expected to be any residual effect from the herbicide treatments, and therefore no cumulative effect from periodic herbicide application to individual stems or to NNIS.

Botany

General Effects of Project Activities in Alternative Two on Botanical Resources

Timber Harvest

Overall, timber harvests could impact areas by:

1) opening canopies and allowing more light penetration to forest floors,
2) compacting soils along roads, log landing and skid trails, and
3) increasing the probability for NNIS to establish, or spread, in areas disturbed during the timber removal process.

Common and rare native species adapted to partial sunlight will benefit from extra light created by the timber harvests in Dry-Upland and Dry-Mesic sites (Appendix 1, Pearcy et al 1999). Native species adapted to conditions created by shade (Appendix 1, Pearcy et al 1999) will benefit in the Mesic and Rich Mesic areas where shaded conditions will prevail and the canopy will only be lightly thinned.

Prescribed Burning

Prescribed burning would impact areas by:

1) disturbing and compacting soils during fireline construction,
2) reducing understory woody vegetation and woody debris.

Common and rare native plants adapted to fire and the open understory conditions fires create will benefit from the re-introduction of fire on these sites (Appendix 1). Native species not adapted to fire will not be affected by prescribed fire since fire does not typically burn low, wet and mesic areas where these species dominate.

Herbicide Application

Herbicides could be used as a silvicultural treatment to eliminate undesirable tree species (species such as maple growing in dry-upland and upland-mesic sites) to promote oak/hickory forests and to control non-native invasive species. Use of herbicides for these activities would involve selective, spot spraying to avoid affecting non-target vegetation. For silvicultural treatments this would include 1) frilling and girdling a tree with an axe or chainsaw and applying herbicide to the cut from a hand-held spray bottle or back-pack sprayer, 2) injecting herbicide with a hypo-hatchet or tree injector, 3) basal spraying the lower 12-18 inches of the trunk of small trees (less than 6 inches dbh) with backpack sprayer, or 4) cutting the trees down with a chainsaw and applying herbicide to the stump with a hand-held spray bottle or back-pack sprayer. Triclopyr (ester formulation) is often used for this application.

Following Forest standards and guidelines (Forest Plan, SFW-FH-17 through GFW-FH-26) for herbicide use would reduce the potential for herbicides to drift onto non-target vegetation. Combined with the Project Design Criteria listed in the Wayne National Forest NNIS Control EA (2007) (also

see Appendix 4), the chances for drift of herbicides that would eliminate non-target vegetation will be minimal. Herbicides may be applied before or after timber harvesting. Application of herbicides for silvicultural treatments would predominantly occur during leaf-off season, thus minimizing any inadvertent application or spray drift affecting non-target vegetation. The impacts of these and other herbicides are analyzed in the Wayne National Forest Non-Native Invasive Species Control Environmental Assessment (2007) (see Project File 9-5).

For NNIS tree and shrub species, similar approaches would be used as the silvicultural treatments; however, there could also be individual plant foliar applications to treat invasive herbaceous, vine or shrub species. The primary effects of herbicide application to non-target terrestrial plants could be from

1) un-intended direct application and
2) spray drift during application.

Unintended direct spray would result in an exposure level equivalent to application rate and the loss of some plants. The impacts from herbicides to non-target organisms are further discussed in the NNIS Control EA (2007).

Other Project Activities

Waterhole construction is projected to involve the construction of 100 waterholes and vernal pool. Waterholes are small in size (GFW-WLF-16) and would be built in already disturbed log landing areas or along skid roads. Tree removal would not be required in most cases. The impact of waterhole construction would be discountable since it would occur in already disturbed areas, of which the other activities (e.g. landing construction and skid roads) would have a larger impact on habitat than waterhole construction. These waterholes would be less than three feet deep and less than 60 feet in diameter, and would be constructed primarily on ridge tops.

Visitor parking areas may involve additional clearing and grading of the already existing sites with heavy machinery. Size of these areas will be no larger than 20’ x 20’ in size. Activities would be similar to those discussed in log landing construction above, with the exception that these areas would be permanent structures and not closed or re-vegetated after project completion. The impacts from upgrading these already compacted and heavily used sites would be discountable since potential habitat is marginal if at all existent after road construction and use.

See Appendix 1 or the Botanical BE for further discussion of effects of Alternative 2 on all plant species.

Summary of Effects on All Botanical Species

For the proposed action, the management prescriptions will maximize the benefit to the Federally Listed and RFSS that are likely to occur in specific habitats or Ecological Alliances (pages 7 and 8 and Appendix 1) since management actions are driven by site-specific habitat conditions as categorized by the Alliances.

Federal Species

While no individuals were found, potential habitat was identified for running buffalo clover, small whorled pogonia, and northern monkshood. Since all areas of the project were not surveyed, there is the possibility that an individual exists within the project area. Therefore, the Pine Creek Historic Forest project may affect habitat, but **is not likely to adversely affect** northern monkshood. The proposed project may affect habitat, but **is not likely to adversely affect** small whorled pogonia and running buffalo clover. Conversely, opening of canopy with fire and semi-permanent construction

(roads, landing, mechanical firelines) **may benefit habitat** for small whorled pogonia and running buffalo clover. Likewise, control of non-native invasive species (NNIS) will benefit all three species by protecting potential habitat from invasion.

Regional Forester Sensitive Species (RFSS)
Pinxter flower and Butternut were the only RFSS were found, however, potential habitat does exist for eleven RFS species within the Pine Creek Historic Forest project. The project **may impact individuals or habitat, but is unlikely to cause a trend toward federal listing or a loss of viability** for sparse-lobed grape fern, lined sedge, rock skullcap, umbrella magnolia, butternut, Striped gentian, Dwarf iris , Blue scorpion-weed, Pinxter flower, juniper sedge, yellow gentian, Carolina thistle, butterfly pea, yellow-fringed orchid, Tubercled nut-rush and Tall nut-rush.

Some beneficial effects could also occur for these species. Burning and thinning could improve habitat for rock skullcap, butternut, juniper sedge, yellow gentian, butterfly pea, Striped gentian, Dwarf iris, Blue scorpion-weed, Pinxter flower, Carolina thistle and yellow-fringed orchid. Herbicide control of non-native invasive species (NNIS) will benefit all species by preventing degradation of potential habitat.

State-listed Species
During the surveys several state-listed species were found. These include Small-flowered Alum-root, Wild Pea, Sweet Goldenrod, White Milkweed, Spring Coral-root, fringe tree and American Chestnut. These should not be negatively affected by this project as long no fringe tree or American chestnut are cut. Wild pea, sweet goldenrod and white milkweed will likely benefit from prescribed fire and more light in the understory. Small-flowered Alum-root is restricted to rock shelters which will be avoided during this project. A 50 foot buffer will be placed around the Spring Coral-root location.

Summary of Mitigations and Standards and Guides

1) If any access road locations are altered, these areas will be reviewed, as possible, by a botanist prior to construction. If rare species are found, the botanist shall work with project and contract coordinators to determine appropriate mitigations or alternatives for construction sites.

2) To reduce the likelihood of new non-native invasive species (NNIS) introductions or spread of current infestations, it is recommended that all off-road equipment used for road construction, timber harvesting, pond construction and parking lot construction shall be cleaned of soil, seeds, vegetative matter or other debris that could hold seeds, before entering the project area (SFW-FH-8 and 9).

3) Treat stiltgrass infestations along skid roads, haul roads and fire lines prior to any timber or fire activities in order to reduce spread immediately after implementation. Otherwise the size of area and cost of treatment will increase and the restoration efforts will not be as effective after allowing spread of stiltgrass. Running buffalo clover is along a trail connected to the project area and the clover and Asiatic stiltgrass prefer similar habitats. Running buffalo clover may also be present in the seed bank along skid roads so it is necessary to protect that habitat as the restoration treatments will create habitat favorable to running buffalo clover.

4) Treat known infestations of tree-of-heaven and princess tree prior to or within 12 months of any timber or fire activities in order to reduce spread immediately after implementation. Otherwise the size of area and cost of treatment will increase after allowing spread of these problem species.

5) Seeding and mulching activities to prevent erosion should be cleared with a Forest botanist in order to choose seed mixes of desired species, and mulches (e.g. straw) that minimize NNIS seed introductions (SFW-FH-10 and 11).

6) Do not cut any umbrella magnolia, butternut, fringe or Southern red oak trees.
7) Consult with Botanist on the locations of state-listed plant species that should be avoided.

Non-native Invasive Species (NNIS) and their control

Non-native invasive species pose a threat to plant and animal community health and diversity. Since exotic species, by definition, have been transplanted outside their original range, they often lack natural controls (e.g., disease, predators, parasites, or climate), which allows them to out compete and eventually replace more sensitive native species. Once NNIS become established, they are extremely difficult to eradicate, and the resulting change in community plant composition can alter ecosystem dynamics and functions over time. With any management activity that requires the use of heavy equipment brought in from off-site, or that disturbs the soil and increases sunlight exposure to the ground, there is a high risk of transporting and spreading NNIS into the project area. If these NNIS are allowed to establish, they could easily compromise habitat quality, and thus jeopardize any existing, or future establishment of, rare species in the project area.

Under Executive Order 13112, Federal agencies whose action may affect the status of invasive species shall not authorize, fund, or carry out action that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless the agency had determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species.

Integrated pest management to prevent or minimize the development of pest problems, including non-native invasive plant species, is required (Forest Plan, SFW-FH-2). NNIS are one of the primary threats to many federal-listed, RFS and state-listed plant species. Control of invasive species would overall benefit all of the rare species (federal and RFSS) discussed in this document by conserving natural ecosystems and biodiversity. Not integrating NNIS management as part of the proposed project could have negative impacts on native plant species and any potential habitat for rare plant species.

Mechanical removal methods would cause localized soil disturbance (e.g. hand pulling, weed wrenches) that could uproot adjacent vegetation in the process. Grubbing activities that might occur to remove shrub species, such as multi-flora rose, could involve mechanical equipment, soil compaction and the likelihood for seed transport of other NNIS to the area. However, if equipment is cleaned prior to entry, the new NNIS potential will be reduced, if not completely removed.

While soil compaction and loss of adjacent native vegetation could occur, these impacts would be small and confined to infested areas. To not control would mean the eventual spread of the invasive species to a wider area and the loss of not only adjacent native vegetation, but entire areas of native species habitat. Delayed control efforts, after letting invasives establish and spread, would likely

involve impacting a larger area. Therefore, mechanical control efforts should be immediate, when identified necessary, to reduce the amount of area impacted, and treat NNIS before they become strongly established and more difficult and costly to treat.

Herbicide impacts from NNIS chemical control are described above in the Herbicide Application section.

Contract Clause Requirement

All contracts shall include the following provisions:

According to the BT6.35 Equipment Cleaning Clause (see Project File 5-08, Botany BE, Appendix 3), it is the responsibility of the Forest Service to prevent the introduction and spread of NNIS on federal lands. The revised contract provision states that:

1) A list and map of current NNIS be shown on the Sale Area Map.
2) Purchaser shall not move any off-road equipment, last operated in an area that is infested with 1 or more NNIS of concern onto Sale Area without first taking measures to make each piece of equipment free of soil, seeds, vegetative matter or other debris that could contain or hold seeds. Likewise purchaser shall take measures to clean equipment before moving from one cutting unit known to be infested with an NNIS to another that is free of that species of non-native invasive.
3) Purchaser must advise Forest Service of measures taken to clean off-road equipment and arrange for Forest Service inspection.
4) Off-road equipment includes all logging and construction machinery, except for log trucks, chip vans, service vehicles, water trucks, pickup trucks, cars and similar vehicles.
5) If cleaning of equipment is to occur on national forest land, Purchaser and Forest Service must agree on location for cleaning and control any off-site impacts.
6) New infestations of NNIS of concern to Forest Service, identified by Purchaser or Forest Service shall promptly be reported to the other party and operation delayed until an agreement between parties on treatment methods.
7) This clause does not serve as warranty that all location of NNIS of concern have been described herein, elsewhere in the contact, or designated on the ground.
8) Any off-road equipment used for road construction, timber harvesting, pond construction and parking lot construction shall be cleaned of soil, seeds, vegetative matter or other debris that could hold seeds.

Table 3-4: Relevant Past and Future activities considered in Cumulative Effects analysis for Botany.

Activity	Description	Past (past 70 years)	Future (next 10 years)
Timber Harvest (WNF)			
Single tree selection		100 – 150 acres	2100 acres*
Group selection cuts		200-300 acres	
Clearcut		3200 acres	
OHV trails	Hanging Rock, Wolcott and Pine Creek Trail systems Built in the early 1990's	46 miles	35 miles (Kosmos)
Road building	Reconstruction = reshaping and grading of existing roads/trails for use.	336-841^ miles	
Reconstruction			19.18*
New construction			1.0*
Prescribed burning	Construction of fireline, ignition and control of fire. Primarily in mature oak hickory forest during the non-maternity season.	~500 acres	2800 acres*
Wildfire	Private and public land combined	~ 970 acres	
Mineland reclamation	Erosion control, shaped, seeded and planted abandoned surface mined land.	~60 acres (late 1980's)	
Erosion control on roadways	Reshaping, seeding and mulching of existing road beds.	~12 miles	unknown
Tree planting	Plant Virginia pines and hardwood species	~30 acres	76 acres*
Coal and Limestone Mining	Surface and subsurface mining for coal and limestone (1940's to 1980's).	8000 acres	unknown
NNIS treatment	Mechanical and Chemical Control (2005 to 2006)	~400 acres	1000 acres
Illegal OHV use	Heavy OHV use of closed roads and user-created trails.	ongoing	unknown
Trail maintenance	Grading, graveling, and maintaining erosion control structures with heavy equipment (started in 2002, currently maintaining 28 miles/year).	112 miles	280 miles

Note: Data on past projects was gathered largely from discussions with Ed McFann, Nelson Krueger, and Tom Eaches, Ironton district employees that have each worked on the district for over 30 years. Data on current and future projects was gathered from the current Wayne NF Schedule of Proposed Actions (SOPA), and from discussions with program managers. Wildfire estimates based on an average of 308 acres of wildfire per year on private and public land within the Ironton Ranger District. Wildfires occurred on an estimated 2648 acres of Forest Service land on the Ironton District and on 3519 acres of other ownerships within the district between 1985 and 2005 (Flegel, 2005). *Future amounts for Timber Harvest, Road Building, and Prescribed Burning, are taken from the Pine Creek proposed action. Based on conversations with timber program managers and the fact that the Mid-level Assessment team has ranked the DCFO as medium priority, it is unlikely that other timber harvest and related road-building activities will take place in the HFO or DCFO management areas will take place within the next ten years. ^Road miles were calculated from a roads GIS layer based on the cumulative effects boundary, however the Cindy Henderson (District Engineering Technician) thought that this number could be off by as much as 60% which accounts of the lower end of this range. **Based on controlling ~100 acres per year in the future

Cumulative Impacts Leading to Existing Condition of Non-native Invasive Species
Non-native invasive species were likely introduced numerous times during the past 70 years during mining reclamation activities (e.g. Autumn Olive, tall fescue, Chinese lespedeza etc.) and through the use of equipment associated with the mining activities, timber harvests and illegal OHV use. Awareness of non-native invasive species and mitigations to prevent their spread, have only recently became elements of project planning on the Wayne National Forest in the last decade.

The project area contains NNIS populations scattered along many of the old access roads (now illegal trails). Tree-of heaven and Princess tree are becoming very abundant in areas with heavy ice storm damage. Areas with heavy interior infestations are the pine stands, old strip mines and areas with illegal OHV use. These infestations are likely higher due to their heavy historical use and may also be linked to the planting of non-native species (i.e. autumn olive and fescue).

Past activities
The cumulative effects table above summarizes the past activities that have occurred in the cumulative effects area. These activities are identified here because cumulatively, the activities likely changed the vegetation cover and composition (e.g. the introduction of NNIS, fire suppression which led to degraded forests) in this area over time.

Roads
There are approximately 336-841 miles of road in the cumulative effects boundary (Table 2). Given the magnitude of the roads network, it is not feasible to determine when these roads were constructed.

There are at least 57 miles of legal (46 miles) and user-developed (estimated 11 miles) of OHV trail in this area. The number of user-developed miles was estimated based on a review of winter ortho-photography and existing access into the Kosmos project area. If an area had been strip-mined, for instance, or is well-roaded, there is likely to be a higher number of miles of user-developed trail. There is no map of this trail network.

Roads and trails primarily impacted this area by serving as corridors for invasive species and by fragmenting the landscape such that wildfires were not able to spread easily at landscape scale as they may have done in the past. The lack of fire over the last 70-100 years in the cumulative effects boundary has played a key role in degradation of the plant communities found in the Pine Creek project area.

Mining
Underground and strip mining for coal and deep mining for limestone all occurred in the cumulative effects area. Deep mining occurred as early as 1860, strip mining occurred later in the 1950s through the mid-1980s, and limestone mining occurred in the early part of the 20th century. 8000 acres have been reclaimed (the Forest Serviced reclaimed~500 acres in the cumulative effects boundary), most of the acreage is southwest of St Rt 522 in the Darby Creek, Smith Hollow, and Fox Hollow drainages.

The Forest Service purchased the 4,700-acre Kosmos tract, south of the Pine Creek Restoration project, from private mining concerns in 1996. The area was described then as having numerous old mining improvements, including approximately 60 miles of un-maintained roads. The tract

was known for limestone reserves and supported a concrete plant for 40 years from 1923 through 1960's.

The property had last been actively mined in 1965 and the village of Superior at the site of the Kosmos cement plant had been abandoned by 1972. Due to vandalism and lack of maintenance, no structures existed after 1975.

The primary impacts from these activities include changes in land cover type from forest to grass land or early succession, the network of roads for access, and impacts to soil and water resources from the ground disturbance.

Iron Furnaces
There are records of several iron furnaces within or near the project area. Much of the project area and the surrounding land was stripped of trees 80-120 years ago to supply wood to make charcoal for the furnaces. The primary impacts were changes of habitats to early successional habitat and vegetation type, and an increase in soil erosion.

Vegetation Management
Vegetation was stripped from areas where surface mining occurred, approximately 8000 acres in the cumulative effects area. Much of this area has naturally re-vegetated. Throughout the district west of State Route 93, approximately 3350 acres have been cut for even-age management and are now 20-40 years old. Stands managed under an uneven-aged system do not change in age class and appear as mature stands.

In some clear-cut stands invasive species are present, however due to low light levels, many invasives are excluded in old clear cut stands with dense canopies. Stands that have been managed for uneven-aged management might be less dense in the overstory (depending on what slope position they were cut) but usually have a thick and brushy understory typical of the area as a whole due to fire suppression.

Illegal OHV Use
Off-road vehicle use probably began in this area following WWII when the first Jeeps returned from the war. They would have been used, along with heavy duty trucks, to haul personnel and coal, limestone or ore out of the hills. When the mining communities and mine sites were abandoned, from the 1920s through the 1970s, and as all-terrain vehicle became more available, use escalated. We estimate trail use began 30 years ago and has sky-rocketed in the past 10 years. There are many access points around the project area and as some are closed due to private development or Forest Service action, many others are opened.

These un-maintained trails have served as conduits of NNIS spread and cause erosion. The Kosmos ATV trail expansion project seeks to deal with these issues in the south-central part of the cumulative effects analysis area.

Other past actions that may influence the spread and proliferation of NNIS include wildfire, prescribed burning, tree planting (provided competition for invading species) and minor amounts of NNIS treatment (Table 2).

Reasonably Foreseeable Actions

Within the project area and other future Forest Service timber, fire, mineral and gas and recreation projects, the primary direct impact causing the spread and proliferation of NNIS will be the disturbance caused by heavy machinery use (road, log landing and fireline construction). Indirectly, the forested stands next to the trail and road corridors may experience NNIS invasion in the future as these infestations take hold and spread.

Considering past, present and future activities within the cumulative effects area, the present level of infestation of NNIS will likely continue to spread at current or greater rates in the reasonably foreseeable future for all alternatives discussed above. Alternatives 2 and 3 include timber stand improvement and mid-story treatments that will more effectively kill NNIS through the use of herbicides

The cumulative effects of the proposed Pine Creek Restoration project combined with other past and present activities could affect NNIS spread and abundance. However, the commitment of the WNF timber and botany programs to deal with NNIS in restoration areas should greatly reduce this impact. Further discussion of the future of NNIS on the Forest is included in Appendix 1 and the Botanical BE.

Determination for Project-wide Cumulative Effects
In the Pine Creek Restoration project, the management actions of where and how much timber harvest and prescribed burning takes place is driven by the Alliance type found in a specific area. By planning our management around Alliance types and presumed historical vegetation, the proposed actions in Alternatives 2 and 3 will have a net benefit to plant and wildlife habitat. Areas with invasive species will be treated before, after or during the project, especially in areas where heavy equipment will be operated and in heavy ice storm damage units. Also, the equipment cleaning clause (Appendix 3 of Project File 5-08) will also help lessen the spread of NNIS. Therefore the design of this project should minimize, if not eliminate, any cumulative impacts of the restoration project on native habitat and will not add cumulatively to past, present and reasonably foreseeable future activities with respect to the spread and proliferation of NNIS or wildlife and plant habitat degradation.

Wildlife

Threatened and Endangered Species
Direct & Indirect Effects: Under Alternative 2, approximately 2309 acres (2.2% of USFS land on the Ironton District) of hardwood forest will be selectively harvested. Midstory treatment to control shade-tolerant, fire-sensitive species that compete with oaks and hickories will occur on approximately 3068 acres; 1036 acres through use of herbicides, and 2032 through use of manual treatments. Timber stand improvement, a tool used to decrease competition for favorable tree species, will occur on 1677 acres, 838 acres through the use of herbicides and 839 through manual treatment (cutting). Approximately 2875 acres would be prescribed burned (1,098 of these acres included in the selective harvest).

Native pines would be thinned on approximately 100 acres, and white pine thinning would occur on approximately 64 acres. Approximately 1.0 miles of new roads would be constructed, and 5.8 miles of ORV trails and unclassified roads would be widened and improved for use as haul roads. Approximately 46 log landings (1/3 acres each) and 48 miles of skid roads would be constructed. Approximately 100 wildlife waterholes and vernal pools would be constructed after harvest activities, and eight visitor parking areas would be improved along the sides of roads. Total acres

cleared for construction of roads and landings and widening or improvement of ORV trails and unclassified roads is approximately 90 acres. The potential direct and indirect effects of each of these activities to Indiana bats are described below.

Hardwood treatment: Direct effects could occur if an occupied tree is removed either during harvest activities, or during activities associated with harvest, such as widening or construction of temporary roads, skid roads and log landings. However, forest-wide standards and guidelines are in place to avoid or minimize direct impacts to Indiana bats during timber harvest activities. The following S&G provide protection of roosting and foraging habitat now and into the future: SFW-TES-7, SFWTES-8, GFW-TES-9, SFW-TES-10, and SFW-TES-12. During all timber management activities, shagbark and shellbark hickories, and all live or dead trees >6' dbh with roost tree characteristics will be retained unless they area safety hazard (GFW-TES-9, SFW-TES-10). Because all currently suitable potential roost trees and hickories will be retained, it is unlikely that a roost tree would be removed during timber harvesting.

Potential direct effects also include disturbance from noise and/or human presence. Response of Indiana bats to noise and other human disturbance during timber harvests are expected to be behavioral and include temporary abandonment of the project area. Although individuals may flee a specific roost during the harvest activities, we anticipate the disturbance will be temporary. In addition, because harvest units are small in comparison to the size of an individual's home range, and because individual bats are expected to have several alternate roosts within their home range, it is expected that bats will be able to move to an alternate roost, and will not have to expend energy searching for a new roost.

Timber harvesting is a tool used to achieve desired future terrestrial and riparian habitat conditions, and to maintain a component of oak-hickory in the landscape. It can improve short-term and long-term foraging habitat for the Indiana bat, but at the same time, it can alter the condition of forest stands to where optimal foraging conditions are reduced for a period of time. Uneven-aged methods, such as the selective harvest proposed in the Pine Creek project, can open the canopy to a desired level to improve foraging. An established Forest-wide standard (SFW-TES-8), which has been incorporated into this project, directs the Forest Service to maintain at least 60% canopy cover in all hardwood cutting units treated with uneven-aged methods to promote quality foraging habitat.

Harvesting some trees in stands that are even-aged (as most of the stands in the Pine Creek area are) reduces the density of trees on the site, and encourages healthier and larger individual trees. The single-tree selection and group cuts proposed in this alternative would retain sufficient trees that foraging habitat would not be expected to be detrimentally affected. MacGregor et al. (1999) reported male Indiana bats were roosting, during the autumn pre-hibernation period, in forest stands that were harvested by the two-age timber harvesting methods 0-5 years prior to the study. If the character of a bat's traditional foraging area is temporarily reduced in quality by timber harvest, bats are expected to respond by searching for a new foraging area within their traditional home range or nearby.

This project is taking place over the course of several years within a heavily forested landscape. At any given time, only a fraction of the project area will be affected by timber harvest, and it is expected that the majority an Indiana bat's home range within the project area will remain unaltered by timber harvest. Although locating a new foraging area can lead to increased energy expenditure, we expect that Indiana bats will be able to locate alternative foraging areas within

their home range without extensive searching. Therefore, we do not anticipate the impact to rise to the level of injury or mortality.

Opening the canopy with the use of uneven-aged harvest methods may improve foraging habitat for the Indiana bat. Indiana bats forage among the tree canopy; foraging habitat quality declines as canopy cover approaches 100%, but is assumed to be optimal when canopy cover is between 50-70% (Rommé et al., 1995). The hardwood harvest proposed in this alternative will reduce canopy from nearly continuous to a range closer to optimal.

Implementation of the proposed hardwood harvest is expected to improve structural habitat conditions for Indiana bats by opening gaps in the canopy and reducing mid-story clutter. Opening the canopy benefits Indiana bats by increasing the degree of exposure of suitable maternity roost trees to solar radiation, thereby providing improved thermal conditions for raising young during a wide range of weather conditions. According to the USFWS (1999), exposure to sunlight is important during development of fetal and juvenile young. Maternity colonies use multiple alternate roosts which are located in the open or in the interior of forest stands (USFWS 1999). The important factor associated with roost trees is their ability to protect individuals from the elements, and to provide thermal regulation of their environment. Male Indiana bats may also benefit from an uneven-aged management regime that creates gaps in the canopy. A radio telemetry study on the WNF found roost trees used by male Indiana bats were more likely to be located in a canopy gap than in a shaded location (Schultes 2002).

The Pine Creek area has a high proportion of dead and dying trees as a result of the ice storm that occurred during 2003. Some of these trees have already died, and some are in the process of dying. Marking guidelines will be written in consultation with a Forest Service biologist, with the objectives to improve the availability and suitability of current and future roost trees in the harvest units, and to ensure that potentially suitable roost trees are not removed. Because harvest may occur during the non-hibernation season, live trees or snags >6” dbh with Indiana bat roost tree characteristics will be retained unless they area safety hazard (GFW-TES-10). Snags that do not have roost tree characteristics, and which are still marketable as timber, may be removed.

Marking guidelines will also incorporate SFW-TES-12, which provides for a supply of future roost trees by specifying that all hardwood harvest units must retain a minimum of 12 live trees per acre (averaged over the cutting unit) of any species that are 6 inches dbh or greater with large areas of loose bark (unless they pose a safety hazard), and 3 live trees per acre that are greater than 20”dbh. If three trees per acre of this size are not present in the stand, a higher number of smaller trees will be retained (see SFW-TES-12 above for details). In addition, potential primary roost trees within the stands will be identified, and trees around them will be removed in order to improve their suitability as potential roost trees. Timber markers will receive training from a Forest Service biologist in order to ensure that they are able to distinguish between trees that are potentially suitable roost trees and those that are not suitable as roost trees.

Summary

Timber harvest may result in some short-term potential adverse effects to Indiana bats. However, due to the incorporation of forest-wide S&G and additional design criteria, the risk and expected duration and magnitude of these effects have been minimized. In addition, these potential adverse effects are offset by the anticipated benefits, including oak regeneration, increased solar exposure, and reduced understory clutter. Indiana bats may respond to these impacts by having increased roosting success (via increase in the diversity of thermal roosting opportunities),

improved foraging success, less torpor, and ultimately increased pup and adult fitness. Oak regeneration will improve roosting habitat in the long term for the Indiana bat by providing ample suitable roosts, while reduced understory clutter will improve travel corridors and foraging opportunities.

Maternity roost trees may receive additional solar exposure as the result of harvest activities, reducing the amount of time pups need to develop, and reducing the amount of heat energy needed to keep a colony warm. This thermoregulatory benefit can increase survival of adults and pups due to lower energy demands. All of these beneficial effects help offset, in the long-term, any potential population level adverse effects due to loss of potential roost trees, reduction or temporary alteration to traditional foraging areas, and disturbance due to noise/human presence.

Mid-story treatments and TSI: Mid-story treatment and timber stand improvement activities are expected to have similar direct and indirect effects as those potential effects described above for hardwood harvest. Mid-story treatment will remove non-merchantable stems of species that do not meet the DFC. Timber stand improvement will take place in younger stands, removing stems of undesirable species, usually <6”dbh. This will release resources to species that meet the DFC, and which will eventually likely become suitable roost trees, such as oaks and hickories.

Potential direct effects of mid-story treatment and TSI include disturbance from noise and/or human presence. Response of Indiana bats to noise and other human disturbance during timber harvests are expected to be behavioral and include temporary abandonment of the project area, as described in the Hardwood treatment section above. Direct effects to Indiana bats resulting from removal of trees are not expected. Both treatments are unlikely to remove suitable roost trees because the trees that are removed are typically small, and are not favored roost tree species.

Mid-story treatment and TSI are expected to result in beneficial indirect effects to Indiana bats over the long term. Both treatments will favor mid-story oaks and hickories, which will eventually become part of the overstory, increasing the availability of future suitable roost trees. Mid-story treatment and TSI will also reduce clutter in the mid-story, improving foraging habitat for Indiana bats, and increase sunlight within the canopy, improving suitability of roosting habitat.

Mid-story treatment and TSI would be implemented using both mechanical treatment (cutting) and herbicide. Use of herbicides for these activities will involve cut-stump applications or basal bark spray. These very selective application methods minimize potential effects to non-target organisms, and prevent application of herbicides to soils or water resources.

Herbicides have the potential to affect insect (Indiana bat prey) abundance and diversity. The herbicides proposed for use for NNIS treatment, midstory treatment and TSI are considered to pose little risk of toxicity to aquatic organisms, with the exception of the ester form of Triclopyr and the surfactants used with the terrestrial form of glyphosate which both can be highly toxic to aquatic organisms (USFS 2007a, Table 11, pp. 18-19). Applying these materials following their label specifications, Forest-wide standards and guidelines, and the following design criteria will reduce the risk of potential harm to aquatic life:

1) Triclopyr (ester formulation) or surfactants used with glyphosate (terrestrial version) will not be applied within ephemeral, intermittent, or perennial stream corridors (as defined by GFW-ARR-1), within 100 feet of lakes, ponds, or wetlands.

2) Application of herbicides will be conducted using cut-stump applications or basal bark spray, which limits application to only the target trees, and any small amounts reaching water sources would likely be diluted and therefore not harmful to aquatic life. For these reasons, this potential indirect effect is considered insignificant and would not rise to the level of take.

Indiana bats could be indirectly exposed to herbicides through ingestion of contaminated insects or contaminated drinking water. The likelihood that an Indiana bat would consume a terrestrial insect that had encountered herbicides is low, especially when one considers the small surface area that would be treated at any one time. Should herbicides enter surface water used by Indiana bats for drinking, herbicide concentrations would quickly decline because of mixing and dilution, volatilization, and degradation by sunlight and microorganisms (USFS 2007a). Research suggests there is low risk of bioaccumulation in the food chain from use of the herbicides proposed for use in this project (USFS 2007a, Table 11, pp.18-19). This potential indirect effect is considered insignificant and would not rise to the level of take. It is very unlikely that herbicides applied to selected plants would affect Indiana bat water sources or prey.

Construction of Temporary Roads, Log Landings and Skid Roads: In order to implement the proposed hardwood treatments, approximately 5.4 miles of existing ORV trail/FS System roads will be hardened. Approximately 0.4 miles of ORV trails will be widened from a clearing width of approximately 7-8 feet to a width of approximately 16 feet, and hardened to accommodate wider vehicles for hauling timber. Approximately 0.8 miles of unclassified roads will be cleared and reconstructed, and 1.0 mile of new temporary road, 48 miles of skid roads, and 46 landings will be constructed. The total area committed to temporary access and log landings will be approximately 125 acres. However, approximately 10.5 of these acres are existing ORV trail/FS system roads and FS System roads that will require only brushing and hardening.

These activities have the potential to remove suitable roost trees, and could temporarily alter suitable foraging habitat. The potential impacts of suitable roost tree removal and alteration of foraging habitat are discussed in the Hardwood Treatment section above. However, these activities, particularly temporary haul and skid road creation could also create conditions beneficial for foraging individuals. The temporary roads and skid roads are narrow and linear, and the forest canopy is usually retained over the road, which could make them suitable travel corridors, especially if a water source, such as the waterholes that are proposed as part of this project, is located nearby. A log landing is small in size, but may create a gap in the canopy that would be suitable for foraging or increase solar radiation to a potential roost tree. These activities would open the canopy and understory, thereby moving localized conditions closer to optimal foraging habitat conditions.

After the project is complete, these landings and roads will be closed off with water bars and left to revert back to forest habitat. ORV trails that were altered for temporary use as hauls roads would be reshaped, and the widened corridor would be narrowed through use of brush piles and other barriers to encourage ORV riders to ride only on the re-established ORV trail. The temporary, short term, loss of approximately 109 acres of habitat is small in the context of the heavily forested landscape, and is offset by the potential benefits of travel corridor creation, long-term improvement of foraging and roosting habitat, and creation of new upland water sources.

Prescribed Fire: While prescribed fire can be a beneficial tool to aid in the regeneration of oak-hickory and to open up the understory for improved foraging habitat, prescribed fire may have direct and indirect effects on Indiana bats. Potential direct effects to Indiana bats from prescribed burning include exposure to smoke and heat, and disturbance from noise and human presence. Indiana bats leave their hibernacula by mid-April, and begin to travel to their summer habitat, but this timing can be earlier or later, depending on weather. Females become pregnant and give birth to their single pup during early summer. The female can only carry the pup for a short period of time, after which time the pup must remain at the maternity roost until it can fly on its own. It is during this time that smoke and heat could have the greatest negative impact on these immobile individuals.

The primary prescribed fire season generally occurs during the late-winter and early spring, often times ending by mid-April when the forest vegetation begins to leaf out. Depending on environmental conditions, a small amount of prescribed fire could occur as late as the end of April. However, the "spring green-up" that occurs by mid-April limits the use of fire. The secondary prescribed fire season runs from fall and through the winter if weather conditions are appropriate.

Forest-wide standard SFW-TES-11 states that summer prescribed burning will be conducted after August 15th to provide time for juveniles to strengthen their flying skills and to account for possible late birth events resulting from colder spring weather (TES-11). Prescribed burning of this project area will be conducted prior to leaf-on in the spring (generally before mid-April) and after August 15th. No fires will be conducted during the Indiana bat maternity season. Thus, Indiana bats will only be directly exposed to fire while roosting in trees during the late summer. During this time, all Indiana bats are expected to be volant. Response of volant bats to human presence, noise, smoke, and heat during, and in preparation for prescribed burns is expected to be behavioral and include temporary abandonment of roost areas. It is anticipated that individual volant bats could escape a burn area or a burning roost tree without injury or mortality.

Potential direct effects of fire to bats in their winter habitat include dispersal of smoke and particulate matter into hibernacula and swarming sites. Forest-wide standard SFW-TES-4 requires that all prescribed fire burn plans specify weather conditions that would prevent smoke dispersal into known hibernacula. There is one known hibernacula, which is located approximately 1.5 miles southeast from the southernmost burn unit. There are three known fall swarming sites in the same general area as the hibernaculum, the nearest one being approximately 1.3 miles southeast of the same burn unit.

Due to the proximity of the southernmost burn unit to known Indiana bat winter habitat, the following design criteria has also been incorporated into the design of this project:

1) Prescribed fires should be planned when convection patterns would lift smoke relatively straight up, never allowing it to reach the vicinity of swarming sites or hibernacula; OR when winds are blowing from the west, south or east, which would push smoke away from the numerous portals located to the south, as well as known swarming sites and hibernacula.
2) Coordination with biologists should occur prior to commencement of any burn to ensure that known or suspected hibernacula would not be jeopardized.
3) The preparation of a burn plan is a normal procedure in a prescribed fire program and these design criteria should be incorporated into prescribed burn plans for this project.

Due to the incorporation of the above design criteria and forest-wide requirements for burn plans, the proposed prescribed burns are not expected to directly impact Indiana bats in their summer or winter habitat.

Potential indirect effects of fire to summer habitat include temporary alteration of foraging habitat, and loss of roost trees (USFWS 2005). Indiana bats are insectivores. Prescribed fire can create vegetation conditions favorable for increased insect production or activity. Yet, the abundance of organisms in the leaf litter and upper soil layers can be temporarily reduced after a prescribed fire, although they re-colonize the area as it re-vegetates (Boerner 2000). Re-colonization of the site by insects may be in part due to changes in the plant community after a prescribed fire. Hutchinson and Sutherland (2000) reported that long-term studies of forest communities subjected to prescribed fire show the understory vegetation response can be variable, but for the most part small increases in plant species richness or diversity occur in the central hardwoods region. A shift in plant species composition may occur in the understory due to the reduction in leaf litter and exposure of mineral soil. Environmental consequences to alteration of foraging habitat may include short term reduced foraging efficiency due to loss of prey base. However, it is expected that an individual bat will have ample unburned foraging areas within its home range, and will not be significantly harmed by the temporary alteration of some foraging habitat.

Over the long term, prescribed fires can improve foraging habitat. Carter et al. (2000) reported that fires that cause overstory mortality can create canopy gaps which can allow for more effective foraging. However, the low-intensity prescribed burns that will be conducted in the proposed actions are unlikely to cause overstory mortality; they are expected to kill stems up to approximately 3”dbh.

During a prescribed fire, there is potential for snags that are suitable roost trees to catch fire and be destroyed. However, prescribed fires on the WNF are typically low intensity, ground burning fires in which the possibility of burning a snag is not reasonably certain to occur. Carter et al (2000) noted that depending on fire intensity, tree species susceptibility, and tree canopy position, roosting cavities can be created. There is a small chance that live trees could be damaged by a prescribed fire, creating new suitable roost trees. However, this is also not reasonably certain to occur. Therefore, it is expected that some suitable roost trees could be lost during prescribed burn operations, but additional roost trees may be created.

When employed in conjunction with selective hardwood harvest, timber stand improvement and mid-story treatment, prescribed fire is expected to improve stand composition over the long term by promoting oak regeneration, and limiting regeneration of fire-intolerant tree species that are not favored roost species. Potential beneficial effects of prescribed fire to Indiana bats also include snag creation, reduced understory clutter, and reduced size and intensity of wildfires. Indiana bats may respond to these environmental consequences by having improved foraging success and roosting success.

Fireline construction: Implementation of prescribed fire activities requires construction of firelines. The majority of firelines planned in the proposed project are existing features, such as roads, trails and streams. However, the proposed project under Alternative 2 will require creation of approximately 3.8 miles of new hand line. Hand lines are narrow segments where firefighters use rakes, leaf blowers and ATV mowers to remove fuels.. At approximately 4-6 feet wide, the

total area disturbed through the creation of handline will be approximately 4.79 acres. However, many of these handline segments will be used multiple times over the course of the project.

Construction of handline requires clearing a swath of leaf litter and herbaceous plants approximately 4-6 feet wide, and removal of small shrubs and trees. Handline weaves between large trees, and therefore would not require removal of any live potential roost trees. After a fire, handlines are rehabilitated by kicking leaf litter and duff back over the bare soil. Due to this rehabilitation, and the small, linear nature of handlines, this activity is expected to result in very little erosion, and will therefore have little effect on the quality of water sources in the project area.

The potential effects of constructing handline-type firelines include loss of an undetected roost tree, and disturbance from noise and/or human presence. We expect that exposure and response to these environmental consequences will be as described above for hardwood harvest.

Hazard trees represent a significant danger to firefighter safety. Therefore, hazard trees are felled along firelines. Fire lines can be constructed and maintained any time of year, however, removal of hazard trees that are potentially suitable as roost trees will be accomplished during the non-maternity season (GFW-TES-9, SFW-TES-10). In the unlikely event that an unknown primary or an important secondary roost is removed during a prescribed burn or fire line construction, we do not expect any negative population-level fitness consequences. Indiana bats will have other roosts within their home range to use. Given the forested landscape, Indiana bats are anticipated to know of and locate new roosts easily within their home range or nearby.

It is possible, but very unlikely, that an occupied undetected secondary or lesser important roost tree could be removed during prescribed fire operations for firefighter safety. Given that the majority of prescribed burns take place in early spring and fall, as described in the previous section, it is very unlikely that suitable roost trees felled for firefighter safety during burn operations would be occupied. Because hand lines are small and linear in nature, and because the majority of hazard trees will be cut during the non-maternity season, the risk of direct effects to Indiana bats is very low.

Pine Treatments: Direct and indirect effects to Indiana bats resulting from pine treatments include loss of unknown roost trees, short-term disturbance from noise/human presence, and temporary alteration of foraging habitat (USFWS 2005). The potential effects of suitable roost tree removal, disturbance and alteration of foraging habitat are discussed in the Hardwood Treatment section above. Potential benefits are also expected through oak regeneration, increased solar exposure of potential roost trees, and reduced understory clutter, which improves both roosting and foraging opportunities for Indiana bats (USFWS 2005).

The pine stands in the Pine Creek project area are dense and overstocked. They have a very cluttered and dense canopy and midstory, with the exception of patches of hardwoods and some very open patches where pine mortality has occurred.

White pines are not considered a native species in southern Ohio. They are not conducive to providing suitable roosting space for bats, unless they are large-diameter, dead, dried out with exfoliating bark or splits present, and located in a gap in the canopy. This tree species tends to be limby, and in the overcrowded conditions found in the project stands, the dead limbs below the

crown reach across most open space and reduce flight space for bats under the canopy, resulting in high vertical clutter.

Vertical clutter renders both native and white pine stands largely inconducive to both bat roosting and foraging activity. According to the Indiana Bat Draft Recovery Plan (USFWS 2007), 97% of maternity trees are in deciduous trees, except in the Great Smokies and New England. In addition, no Indiana bats were found to be using pine as diurnal roost trees during telemetry studies conducted on the Forest in 1999 and 2000 (Schultes 2002). Thinning of these stands will allow hardwood regeneration to become established, paving the way for eventual conversion of the stands to native hardwoods.

Conversion of non-native pine stands to hardwood habitat would benefit Indiana bats by creating additional hardwood stands with more suitable roost trees and foraging habitat. An exception exists in small pockets where pine mortality has occurred. Some of the snags in these gaps may represent suitable Indiana bat roosting habitat, where the snags still have exfoliating bark and receive solar radiation. While it is possible that bats would use these trees, it is unlikely that this habitat is significantly important to Indiana bats, particularly in a landscape dominated by oak-hickory forests, such as the WNF. Suitable roost trees would be protected during pine thinning operations in accordance with Forest Plan Standard SFW-TES-10. Thinning these stands will increase solar radiation to existing snags, increasing their suitability as roost trees. Eventual conversion from pine to a hardwood or mixed pine/hardwood habitat would benefit Indiana bats, especially in the long-term, by increasing the diversity of vegetation, improving conditions for insect production foraging, and producing more suitable future roost trees.

Non-native Invasive Species Control: Non-native invasive species control is expected to improve Indiana bat foraging habitat. Non-native species tend to reduce biodiversity, degrade habitats and disrupt natural processes due to the lack of established natural controls or predators. Many insects rely on native plants for part of their life cycle. However, NNIS can out-compete native plants, reducing native plant diversity and abundance and in turn, decreasing native insect diversity and abundance. Control of NNIS through mechanical and chemical means is expected to improve Indiana bat habitat. NNIS treatments were analyzed in detail in the WNF NNIS Control EA (USFS 2007b). The procedures, mitigations and project design criteria in the WNF NNIS Control EA will be followed for NNIS treatments in the Pine Creek project area.

Waterhole construction and visitor parking areas: Implementation of Alternative 2 will provide additional and improved water sources for Indiana bats, in accordance with GFW-TES-14. Insectivorous bats typically obtain 20 to 26 percent of their daily water from drinking (Kurta et al., 1989, 1990). Upland water sources are rare in the project area, and are particularly important for lactating females. The proposed waterholes and vernal pools will provide drinking water and foraging habitat where insects are abundant. The proposed waterholes will be a mixture of ephemeral pools (approximately 12” deep) and permanent water holes (3’ to 4’ deep), and will be constructed in accordance with Forest Plan GFW-WLF-16. The majority will be located near landings and skid trails, which places them near flyways that bats use for travel and foraging. By placing the new waterholes near landings and skid trails, which Indiana bats use as flyways, Indiana bat foraging habitat and drinking water availability will be improved.

Improvement of visitor parking areas is not expected to directly impact Indiana bats. No trees will be removed in order to improve visitor parking areas. Therefore, there is no risk of removal of an occupied or unoccupied roost tree. If Indiana bats are present in the project area during

construction activities, they may be temporarily disturbed. However, bat response is expected to be behavioral and include temporary abandonment of the area. Indiana bats are expected to be able to find alternate roosts or foraging sites within their home range during the duration of activities.

Table 3-5. Potential Direct and Indirect Effects of Connected Actions on Indiana bat

Activity	Potential Direct or Indirect Effects
Hardwood Treatment including landings and skid roads, temporary road construction	Potential loss of undetected suitable secondary roost tree Noise disturbance Short-term reduction/Long-term improvement of foraging habitat Increased solar radiation to potentially suitable roost trees with special focus on improving radiation to potential maternity trees. Reduced midstory/understory clutter Oak regeneration will lead to increased future availability of roost trees.
Midstory Treatment & TSI	Noise disturbance Improved foraging habitat via decreased midstory clutter Increased solar radiation to potentially suitable roost trees Perpetuation of oaks and hickories into the canopy will improve future roost tree availability. Very low risk of exposure to herbicides
Construction of Temporary Roads, Log Landings and Skid Roads	Potential loss of undetected suitable secondary roost tree Short-term reduction of foraging habitat. Creation of flyways for travel and foraging Increased solar radiation to potentially suitable roost trees
Prescribed Burn	Exposure of volant bats to noise, smoke & heat Short-term reduction of foraging habitat. Potential loss of suitable roost trees/Creation of new roost trees Reduced clutter in midstory/understory Improved regeneration of oaks and hickories – greater future roost tree availability Reduced size and intensity of future wildfires
Fireline Construction	Noise disturbance Potential felling of undetected unoccupied or occupied roost trees along firelines during non-hibernation season if prescribed burns conducted in late spring.
Pine Treatments	Eventual conversion to more suitable (hardwood) habitat Increased solar radiation to potentially suitable roost trees
Construct waterholes for wildlife	Additional water sources near summer roosting habitat Additional insect production (improved foraging)

Visitor parking areas	Temporary disturbance

Cumulative Effects: Cumulative effects are the cumulative impact of the direct and indirect effects of a proposed action when added to the aggregate effects of past, present and reasonably foreseeable future actions. The direct and indirect effects of Alternative 2 are described above and summarized in Table 8. The relevant past, present, and reasonably foreseeable future actions are described in the Cumulative Effects section under Alternative 1.

The above section describes potential adverse direct and indirect effects of the proposed activities, and the design criteria that have been incorporated to minimize the risk, duration and magnitude of those effects. The amount of area affected by the proposed action, approximately 4000 acres, is small in relation to the cumulative effects area. In addition to the potential adverse effects, we anticipate long-term beneficial effects to Indiana bats under Alternative 2. In the long term, the proposed hardwood and pine treatments (including TSI and mid-story treatment) will result in additional suitable roost trees within the treatment stands.

The proposed hardwood harvest activities, along with mid-story treatment and TSI will increase the proportion and future abundance of species that are favored roost trees, such as oaks and hickories. Trees considered less suitable as roost trees will become less abundant, in favor of those that are suitable as roost trees. The combination of prescribed burning and timber harvest is expected to improve forest structure by reducing mid-story clutter and canopy density and increasing solar radiation to roost trees, and lead to more successful oak regeneration in the treatment stands, providing for future roost trees over the long term. Creation of temporary access roads, skid roads and log landings may create small amounts of optimal foraging habitat and flyways for Indiana bats.

Non-native invasive species treatments will improve native insect diversity and abundance, and creation of waterholes will improve foraging and water availability. On balance, it is expected that the short-term potential adverse effects will be outweighed by the long-term potential benefits of the proposed project, and the project as a whole will offset the cumulative adverse impacts of past, present and future activities.

Anticipated effects from the proposed project are similar to those anticipated in the programmatic BO for the proposed activities. Potential for direct and indirect impacts to the Indiana bat have been limited by incorporation of Forest-wide standards and guidelines and design criteria. With the incorporation of these design criteria and S&G, the potential impacts of this proposed action are essentially small, are offset by the expected long term habitat improvement described above. Therefore, implementation of Alternative 2 is not expected to result in any appreciable increase in cumulative loss or long-term degradation of Indiana bat habitat.

Determination: Alternative 2 is *likely to adversely affect* the Indiana bat:

Although direct effects to Indiana bats are not likely to occur, there is a small chance that an occupied roost tree could be removed or destroyed during prescribed burning operations. Firelines are generally constructed prior to the prescribed fire season (mid winter and mid-late fall), but could occur to a lesser degree during the spring and summer months. Hazard trees are usually removed during construction of the firelines (during the Indiana bat hibernation season).

However, a small number of hazard trees may be felled during a prescribed fire, which may occur as late as late as the end of April, to ensure firefighter safety. While most hazard trees are removed during the hibernation season, there is potential for removal to occur between April 15 and September 15. Therefore, there is a small chance that short-term adverse effects may occur during prescribed burn operations.

We expect that hazard trees that would be removed during prescribed burn operations would be secondary or lesser roost trees. The removal of these trees may result in individual fitness consequences, but would not be expected to result in colony or population level consequences. Although there is a small chance of short-term adverse consequences as a result of the proposed project, these potential impacts minimized by the incorporation of S&G and Design Criteria, and are strongly offset by the expected long-term habitat benefits. The proposed hardwood harvest activities, along with mid-story treatment and TSI will increase the proportion and future abundance of species that are favored roost trees, such as oaks and hickories. Trees considered less suitable as roost trees will become less abundant, in favor of those that are suitable as roost trees.

The combination of prescribed burning and timber harvest is expected to improve forest structure by reducing mid-story clutter and canopy density and increasing solar radiation to roost trees, and lead to more successful oak regeneration in the treatment stands, providing for future roost trees over the long term. Creation of temporary access roads, skid roads and log landings may create small amounts of optimal foraging habitat and flyways for Indiana bats. Non-native invasive species treatments will improve native insect diversity and abundance, and creation of waterholes will improve foraging and water availability.

Management Indicator Species

Oak-Hickory Forest: Under the 2006 Forest Plan, approximately 10,500 acres were proposed to be treated by silvicultural treatments that maintained oak (Forest Plan FEIS 3-50). Implementation of Alternatives 2 and 3 would accomplish 2309 of these acres. However, the inclusion of prescribed fire in Alternative 2 would complement the vegetation management, and would make this alternative most effective at maintaining oak-hickory forest.

Native pine Forest: Under Alternatives 2 and 3, native pine treatment will remove much of the existing native pine, but will open up pockets within those stands that are large enough to regenerate some pine. Under these two alternatives, white pine stands would be converted to hardwoods over time. We would expect pine warbler populations to decline with pine warbler habitat under all Alternatives of this project.

Early Succession Habitat: Under Alternatives 2 and 3, some early successional habitat will be lost as it matures, while new habitat is created in the form of log landings and temporary access roads.

Further discussion of the effects of Alternative 2 on specific MIS can be found in Project File 5-7.

Regional Forester Sensitive Species

Direct & Indirect Effects: Direct effects could occur if individuals are disturbed or harmed during harvest, stand treatments, prescribed burning, parking lot or waterhole construction, invasive plant control, or any other activities associated with the proposed action. Hibernating

bears or bobcat kittens in a den would be particularly vulnerable**.** Therefore, the following design criteria has been incorporated into all action alternatives: Contractors shall report bear or bobcat sightings (individuals, prints, scat) to the CO/COR when discovered. The CO/COR will then report this to a Forest Service Biologist within one business day. All activities should stop in the event a bear or bobcat in its den is discovered.

It is possible that a black bear or bobcat could be physically harmed if the animals were, for example, in a den in a tree when it was felled, or in a hollow log on the ground or under a root wad during prescribed burning. Indiana bat protection measures described above prohibit the cutting of hollow trees (unless a safety hazard), lessening the likelihood that an individual would be harmed in its den. It is also likely that an animal would be warned by the noise associated with project activities, and would be able to vacate the den prior to harm. It is also possible that bears or bobcats could be present during a prescribed burn. However, bears and bobcats can move quickly and would be expected to be able to outrun a typical low intensity surface prescribed fire.

Direct effects could also occur if a bear or bobcat were hit by a motor vehicle on the roads constructed for use during timber sales. However, this is unlikely because these roads are gravel and are typically narrow and winding. As a result, vehicles travel slowly, allowing drivers sufficient time to brake to avoid hitting wildlife. In addition, the temporary roads would be open only to the loggers and Forest Service vehicles, and only during brief periods when the sales are active.

Harvest activities may have both positive and negative indirect effects on both black bears and bobcats. Hardwood and pine harvest, particularly group selection cuts, would create a partially open canopy and tree gaps that would allow sunlight to reach the forest floor. The increased sunlight will stimulate growth of understory plants such as blackberry, increasing spring and summer food availability for black bears, and for bobcat prey. Thinning will also increase light, water and nutrient availability for the most vigorous trees, which will be better able to produce mast and to survive stresses such as gypsy moth infestations.

Thinning and eventual conversion of pine plantations to native hardwoods would benefit black bears over the long term by increasing the availability of hard mast. Habitat will also be improved for bobcats, which will have higher prey abundance in openings created during harvest, and in the hardwood stands that will eventually replace the pine plantations.

In areas that are prescribed burned, understory cover for bears and bobcats may be reduced, but fire tolerant plants such as blueberry are likely to increase, providing additional food for bears and bobcat prey. Prescribed burning is also expected to reduce the risk of uncontrolled wildfires that would endanger bears and bobcats, and their habitat. Prescribed burning could result in the loss of some hollow trees (possible den sites) but would also create new ones. Over the long term, thinning and burning would encourage oak regeneration, ensuring a future supply of hard mast for bears, and for bobcat prey such as squirrels.

The presence of people and noise from chainsaws, vehicles, fire, bulldozers, etc. during project activities could disturb bears or bobcats that may be in the project area. Response to this disturbance is expected to be behavioral and to include temporarily avoidance of the area. Because only a small portion of the project area is planned for harvest and/or prescribed burns,

and because proposed activities will be spread out over the course of approximately 5 years or longer, abundant undisturbed habitat should remain within an individual's home range.

New roads and log landings may provide travel corridors and temporary early successional foraging/hunting habitat for black bears and bobcats. Encounters between people and bears and bobcats could increase slightly along new temporary roads and log landings. Bear and bobcat responses to such encounters are likely to be behavioral and include temporary abandonment of the area.

Fireline, parking area, and waterhole construction are not expected to cause significant indirect impacts to black bears or bobcats. All new firelines proposed as part of this project are handlines, and will not require the removal of trees unless those trees pose a hazard to firefighters. The proposed visitor parking and waterholes will typically be constructed in previously disturbed areas, minimizing the likely hood that a suitable den tree would need to be felled. The improved parking areas may slightly increase the number of people entering the areas, leading to more encounters between people and bears and bobcats. Waterhole construction should also have beneficial indirect impacts on bears and bobcats by providing water sources for drinking and hunting. Invasive plant control should have beneficial indirect impacts on the bear and bobcat in the long term by reducing the amount of exotic species, and restoring native plant species.

Use of herbicides for mid-story treatment and timber stand improvement should not result in any physical harm to black bears or bobcats. These species could come in contact with herbicide residue remaining on treated vegetation, ingest prey that had come in contact with the herbicides, or drink water from contaminated sources. However, herbicide toxicity data presented in the Non-native Invasive Plant Control Project Biological Evaluation (USFS 2007a, p. 56) suggests that the herbicides proposed for use in this project are generally safe to wildlife if used in accordance with the manufacturer label. Research suggests there is low risk of bioaccumulation in the environment and food chain from use of these herbicides (USFS 2007a).

These animals should not be harmed even by direct exposure to herbicides, such as by inadvertently brushing against the individually sprayed plants. If glyphosate and triclopyr are used, they are thought to have very low toxicity to mammals, even if a bear were to consume, for example, autumn olive fruits that had been sprayed. Since triclopyr (ester formulation) or surfactants used with glyphosate (terrestrial version) will not be applied within ephemeral, intermittent, or perennial stream corridors (as defined by GFW-ARR-1), or within 100 feet of lakes, ponds, or wetlands, water sources are not expected to be contaminated. Should herbicides enter surface water, their concentration would quickly decline because of mixing and dilution, volatilization, and degradation by sunlight and microorganisms.

Cumulative Effects: Though this project may result in the loss of a few suitable den sites, the number of potential den sites removed during this project will be insignificant in the context of the available habitat within the cumulative effects boundary. In addition to large logs and snags, bobcats and black bears may use abandoned mine portals, which are abundant on the Ironton district, as den sites.

Anticipated effects from the proposed project are similar to those anticipated in the programmatic BE for timber harvest, prescribed fire, temporary roads, skid trails and log landings and the other connected actions. Implementation of this alternative is expected to improve habitat for both species over the long term by maintaining a healthy oak-hickory ecosystem. This alternative may

lead to temporary disturbance of individuals in parts of the project area, but disturbance will be short-term and should not affect the long-term health of individuals or the populations. In addition, the amount of habitat affected by the proposed actions is small relative to the amount of available habitat in the cumulative effects analysis area.

> **Determination:** Alternatives 2 may impact individuals but is not likely to cause a trend to federal listing or loss of viability for black bears of bobcats.

Cerulean Warbler

Direct & Indirect Effects: Direct impacts to cerulean warblers could occur if a tree containing a nest were removed during the nesting season. Noise and human disturbance during timber harvest, prescribed burns or other associated actions could cause adults and fledglings to temporarily abandon an area. Nestlings would be unable to leave an area where disturbance occurs. Disturbance is likely to be short-term in nature, and cerulean warblers are expected to be able to find unaltered habitat nearby.

The open to semi-open character of the forest stands that will result from the combination of hardwood harvest, prescribed burning, and mid-story and timber stand improvement is expected to be ideal for cerulean warblers. Timber harvests will create gaps in the canopy and promote the growth of residual trees, which will be primarily large, healthy, long-lived oaks, improving habitat for cerulean warblers over the long term.

Prescribed fire is expected to improve habitat conditions for cerulean warblers by creating conditions favorable for oak regeneration, and reducing the risk of catastrophic wildfires. Prescribed fires will also contribute to the maintenance of a more open understory in hardwood stands, improving habitat conditions for cerulean warblers.

Additional analysis for the cerulean warbler can be found in the Project File 5-6.

Cumulative Effects: Anticipated effects from the proposed project are similar to those anticipated in the programmatic BE for timber harvest, prescribed fire, temporary roads, skid trails and log landings and the other connected actions. The proposed project may impact individuals through noise and disturbance, and possible removal of nest trees during the nesting season. However, these potential impacts are offset by the long-term benefits of improved forest structure and composition, and perpetuation of large oaks in the overstory, which will improve cerulean warbler habitat over the long term. Although these effects will be significant over approximately 2200 acres, they are small in relation to amount of habitat and the activities that are currently occurring and expected to occur within the analysis area over the next 10 years (described above under Alternative 1).

> Determination: Alternatives 2 may impact individuals but is not likely to cause a trend to federal listing or loss of viability for cerulean warblers.

Henslow's Sparrow

Direct & Indirect Effects: No direct effects to Henslow's sparrows are expected under any of the action alternatives. All proposed activities will be taking place in forested habitat, or in small patches of early successional habitat that are not large enough to be suitable as Henslow's sparrow habitat. None of the proposed activities are expected to directly or indirectly affect Henslow's sparrows.

Cumulative Effects: Cumulative effects are the cumulative impact of the direct and indirect effects of a proposed action when added to the aggregate effects of past, present and reasonably foreseeable future actions. Because Alternatives 2, 3 and 4 are expected to have no direct or indirect effects to Henslow's sparrows, no cumulative effects are expected under these alternatives.

> **Determination:** Alternatives 2, 3 and 4 will have no impact on Henslow's sparrows.

Timber Rattlesnakes

Direct & Indirect Effects: Alternative 2 proposes a combination of hardwood and pine treatments, use of existing roads, temporary road and log landing construction, prescribed fire and handline construction, mid-story treatment (herbicide and manual), timber stand improvement (herbicide and manual), NNIS treatment, and waterhole and visitor parking area construction. Alternative 3 is similar, but does not include prescribed burning or fireline construction, and proposes a higher proportion mid-story treatment to be accomplished with herbicide use. Alternative 4 is similar to Alternative 2, but does not include hardwood or pine harvest, or road, log landing, waterhole or visitor parking area construction, and all mid-story treatment and timber stand improvement would be done manually.

Forest-wide standards and guidelines designed to minimized impacts to species dependant on rock faces have been incorporated into all three action Alternatives. These include SFW-TES-33 and SFW-TES-34, which limit activities within 50 feet of rock faces. Activities proposed under all three action alternatives are therefore not expected to directly impact green salamanders, which are not thought to range far from the rock faces they inhabit. All three alternatives may result in direct impacts to timber rattlesnakes if snakes are present during proposed activities. In order to minimize the risk of potential direct effects to rattlesnakes, the following design criteria have been incorporated into all three action alternatives:

1) Contractors will be advised at pre-work meetings of the potential to encounter rattlesnakes and what steps he/she should take to avoid killing, harming, or harassing any individuals. Any sightings should be reported to the CO/COR as soon as possible, no longer than one business day after the sighting. The CO/COR will report the sighting to a Forest Service biologist immediately, if possible, and no later than one business day after the sighting is reported to them.
2) Firelines may not be constructed within 50 feet of rock outcrops unless necessary to protect human safety or to avoid excessive soil disturbance.
3) If rattlesnakes are determined to be present in the project area, avoid conducting burns after mid-April or prior to mid-October within 200 meters of known or suspected den sites when rattlesnakes may be active. If any rattlesnakes are encountered during prescribed burn activities, every effort should be made to avoid the snake but protect it from fire, and any sightings should be reported to a Forest Service Biologist as soon as possible, and no longer than one day after the sighting.

4) Disturbance due to noise associated with timber harvest and prescribed burning may disturb snakes, causing them to temporarily leave the area, or seek shelter under rocks or in rock features. It is possible, though unlikely, that an individual could be harmed or killed inadvertently during timber harvest, prescribed burning, or other proposed activities. Snakes are relatively slow moving animals and could not easily avoid a falling tree, bull dozer, motor vehicle, or fire. Removal of trees will occur during hardwood and pine thinning, construction of temporary roads, skid roads and log landings. There is a small chance that a timber rattlesnake could be in a cavity in a tree when it was cut. However, this chance is small given that hollow trees will not be marked for removal during timber harvest operations (see Silviculture Prescription) and temporary roads, skid roads and log landings will only affect approximately 88 acres within the project area (Alternatives 2&3), and because rattlesnakes are quite rare and are not known from the project area.

Additional effects to the timber rattlesnake, green salamanders, frogs, Blanchard's Cricket Frog, mud salamanders, other salamanders can be found in Project File 5-6.

Recreation

The northern two sections of the Kosmos trail development area fall within the Pine Creek project activity boundary including Telegraph, Lyra and Wolcott trails of the Pine Creek ORV System. The proposed action would utilize approximately 5.8 miles of existing OHV trail and 2.2 miles of planned OHV trails as road locations. Forest Road 132D and FR 54A2 are included in timber activities and are included as part of the Kosmos Trail Extension project. The use of the existing OHV trails for timber activities has the potential to impact the recreation use of 18 miles of OHV trails for the duration of the project.

The trails receive their heaviest use on weekends and holidays. A conservative estimate of the number of riders who use these trails during one season is 8,000. If the customer use was spaced evenly over all the holidays and weekend days of the trail season, 100 riders would use these trails daily. Since each trail is a dead end, each rider will travel both directions at least once each day (see Project File 6-2).

The impacts from the proposed vegetation treatment to recreation activities will be temporary and may be reduced even more when the Kosmos trail construction is completed and the new system is opened prior to restricting the use of the existing ORV trails in the Pine Creek System.

1) Closing the trail segments that will be within the harvest boundary for the duration of the sale would be offset by opening the newly-designated trails in the Kosmos area.
2) The proposed timber harvest could delay the opening of approximately 2.2 miles of planned trails where the Pine Creek project area and the Kosmos trail addition overlap.
3) The distances of the trail segments that will be impacted by the harvest activities are relatively small, with the exception of the Lyra trail, but the fragmentation of these trail corridors will limit the use of long sections of trail.
4) Closing the trail segments within the harvest boundary for the duration of the sale will reduce use and may result in the closure the entire trail.
5) If the harvest operation would allow the trails to be open on holidays and weekend days during the annual trail season, impacts to the trail users would be minimized.

6) If the timber operation is scheduled when the trails are closed to OHV use, December 16 to April 14 annually, there would be less impact to the recreating public and reduce the potential conflicts.
7) If the timber harvest is started in the area that has the Telegraph trail passing through it, at the north end of project area, and is moved to the Lyra trail next and then finish with the south end of the Wolcott trail and migrate to the north end of Wolcott, this could reduce the length of time the users will be impacted by the harvest activities.

Mitigations:

1) To mitigate the delay of opening the new OHV trails, the logging operator needs to close and rehabilitate the roads as close to their pre-logging condition as the timber sale contract allows, avoiding wide and straight sections as much as possible. Operator will install drainage dips instead of waterbars.

2) To mitigate the use of existing OHV trails, different measures will be required for the Lyra, Telegraph and Wolcott trails. Signs must be placed at each end of the impacted trail segments and at the trail heads notifying OHV riders of the trail closures during operations. Physical barriers will need to be placed in the trail during active timber harvest and prescribed burn activities.

3) Upon completion of the timber removal, the impacted trails will be restored as close as possible to Forest Service OHV trail specifications and standards by the operator as part of the rehabilitation and closeout of each unit. This will include replacing the rock and gravel surface that was in place for the trail segments prior to the harvest activities.

4) To minimize the impact of logging activities on the operation of the designated trails, the following requirements should be included in the contract specifications:

- Skidding down the trail corridor is prohibited. As needed, trail crossing locations will be designated for skidding.
- When cutting a unit which includes a designated trail, cut the area along the trail first so that the trail can be reopened while timber activities continue in the rest of that unit.
- Slash must be removed from a zone five feet each side of the designated trail, and lopped and scattered to within two feet of the ground outside of that trailside zone. Lopped and scattered material should be allowed to form a blockage at the edge of the five foot slash-free zone to discourage motorized vehicles from leaving the designated trails.

5) Impacts will be lessened if prescribed burns take place between December 16 and April 14. If it is necessary to perform the prescribed burns during the OHV trail season, signs must be posted at trailheads and actual locations along the trails to show which trails are impacted and for what period they will need to be closed in order to complete the project. Fire lines intersecting with designated trails must be effectively blocked to discourage illegal OHV use of the fire line.

6) All roads constructed, reconstructed, or reopened for the proposed activities should be closed effectively to keep out illegal motorized vehicles.

7) Herbicide applications along designated trails during trail season must be coordinated with the District Recreation Manager to minimize the impact to trail riders.

8) If waterholes are to be constructed or located within view of the designated or proposed trails, construction plans should include fencing and signs to discourage ATV riders.

9) Piled logging slash around landings will discourage illegal ATV trails as well as provide potential wildlife habitat.

Archaeology

The current forest condition, with extensive areas of fallen and broken timber and hazardous conditions, make it difficult, if not impossible, to conduct normal heritage investigations. Therefore, in accordance with 36 CFR 800, the Forest has consulted with the State Historic Preservation Office (SHPO) on an acceptable approach to assessing the affect of this undertaking (for both proposed treatments) on heritage resources with an emphasis on site protection.

As per a letter dated January 14, 2005, the Forest and the SHPO's office have agreed to the following methodology to fulfill its requirements under Section 106 of the National Historic Preservation Act. This methodology will be implemented for both treatments (harvesting or burning):

1. Complete a background review of the area of potential effect, to determine the presence or likely presence of heritage resources. The background review may include data from Ohio Historic Preservation Office inventories.

2. Flag the locations and boundaries of known significant heritage sites wherever possible prior to salvage or burning activities in order to protect these resources.

3. On-site monitoring of salvage and burning activities by a professional archaeologist (who meets the Secretary's Standards) to: a) protect and reduce adverse effects to heritage sites throughout the APE especially emphasizing areas of known heritage sites and also including newly identified heritage sites, b) record/document as appropriate newly identified sites, c) record/document observed site damage especially emphasizing significant heritage sites, and d) conduct selected post-harvest/post-burning investigations where feasible.

Although the proposed methodology focuses on the protection of known heritage sites, the use of data from inventories and on-site monitoring enables the Forest Service to also include newly identified sites in protection efforts. Given the ongoing stewardship of heritage sites within the project area by the Forest Service, the proposed methodology places relatively more emphasis on site protection and relatively less emphasis on broad-based reconnaissance level surveys, identification of sites, and evaluation of newly identified sites for National Register eligibility. That is, pursuant to regulations at 36 CFR 800.3(g) and 36 CFR 800.4(d)(1), site protection will be based on available information, and intensive level surveys and completion of inventory forms will be employed selectively in areas of high probability with significant sites.

Through the implementation of this prescribed and sanctioned methodology, the Forest will fulfill its requirements under 36 CFR 800 and mitigate the adverse effects of harvesting and burning by on-site monitoring and site protection.

Within those portions of the project area that have been previously investigated, 22 sites have been identified. None of these sites are listed on the National Register of Historic Places, but they are potentially eligible pending further evaluation. All will be physically marked for protection and avoidance prior to project implementation (as per item 2 above). The number of sites to be marked differs amongst the different Alternatives: Alternative 2 (burning/timber harvesting) – 22 sites, Alternative 3 (timber harvesting) – 7 sites, and Alternative 4 (burning) - 20 sites.

Cumulative Effects
Project monitoring, mitigation and site protection efforts on the Forest have been generally effective. Looting and erosion pose much greater threats to sites than Forest projects. Consequently, it is assumed that successful site protection will occur in this project area resulting in long term maintenance and protection of heritage resources. Timber access roads, skid trails, and fire lines should be closed as feasible to further ensure site protection.

Alternative Three

Soil, Water and Air

Direct effects are the same as for Alternative 2 except for deletion of prescribed burning, fire lines and access that supports the burns. This alternative includes more herbicide application and less manual treatment in the mid-story treatment. The deletion of prescribed burning would mean that fewer cations would enter the soil as ash in the short term, preventing the soil from getting a jump on the buffering process. The ash may have resulted in a better population of micro-organisms, which would be better able to break down and degrade the increased amount of herbicides. Although erosion effects are expected to be minimal from the previous alternative, with the lack of soil disturbance from firelines and the potential loss of duff layer from burning, there would be less erosion in this alternative.

Indirect Effects - Carbon sequestration would be changed. Prescribed burning commonly results in a flush of new growth meaning plants are sequestering additional carbon, which would not happen without burning. Increased charcoal with a prescribed burn results in a source of carbon.

Cumulative Effects – Buffering capacity would be reduced temporarily compared to Alternative Two and Four, which include burning.

Effect on Air Quality
Air quality is not expected to be adversely affected by implementing Alternative 3 (see Project File 4-16). No burning would occur and the herbicides proposed for use are not on the list of air toxics in the 1990 Federal Clean Air Act amendments. Airborne drift would not be significant because herbicides are applied in large droplets in order to make contact with small stems and do not become airborne; herbicides are applied close to ground level where winds are minor; nozzle size is designed to reduce drift.

Vegetation

Effect on regeneration

If oak advanced reproduction is not adequate and if there are no post harvest treatments such as burning or herbicide, harvest activity to create openings is not likely to result in oak reproduction.

Fire removes excessive litter buildup from the forest floor, thereby preparing a favorable seedbed. Squirrels and blue jays prefer areas of thin litter for acorn burial. Also, jays collect and disperse only sound nuts. This important ecological finding implies that acorns, which escape predation, can result in well-established first-year seedlings. Seedlings from freshly germinated acorns cannot emerge through a heavy litter cover. Germination and first-year survival are best when acorns are buried about three centimeters deep in mineral soil. While removal of thick litter may expedite germination by encouraging squirrels and jays to cache acorns, some humus layer needs to be retained. The humus layer keeps the soil surface porous, so that un-cached acorns can more easily penetrate the soil, retain moisture, and provide support for the new seedling (Van Lear, Watt, 1992). The absence of fire limits our ability to provide a good seed bed and control competition for desirable seedlings.

Effect on mid-story competition
Mid-story treatments including prescribed burning target the undesirable beech and maple component which is threatening to replace the canopy in the near future. Harvest alone will not fully address this issue. An aggressive treatment schedule is necessary to begin to address current overstocking of undesirable species such as red maple and to give recruited oaks and hickories the space and sunlight to prosper. Harvests in conjunction with prescribed burning over the long term will bring much needed sunlight to the forest floor.

Letting this mid-story layer advance in the absence of periodic burning over the long term is likely to result in a forest composition change. Mechanical treatments (girdling and/or cutting) will be used in the proposed harvest/burn and burn only areas and will target stems one to approximately 8 inches in diameter. In the absence of fire, more expensive and repetitive mechanical and herbicide treatments will be necessary to control undesirable seedling composition, to prevent re-sprouting and to individually kill the root systems of targeted stems.

The combination of harvesting and mid-story treatments could result in restoring stands to historic conditions on upland sites. However, without the benefit of fire on the landscape, implementing frequent mid-story treatments becomes more critical and could be overwhelming across a landscape level project area, resulting in a less than open understory (see Project File 4-12).

BOTANY

For direct, indirect and cumulative effects of the activities prescribed in the action alternatives, see Alternative 2, same species groups, above.

Federal Threatened and Endangered Species
Determination for Monkshood, Alternative 3: (Timber harvesting, no prescribed burning and manual & herbicide treatment of mid-story species). While timbering could result in the opening of the forest canopy in the Alliance where this species would be found, the openings would not be persistent because the canopies would fill-in with-in 10 years and shade from mid-story species would also be provided. While herbicide application activities could result in the temporary opening of the forest canopy and drying of the understory, these activities would not occur within 50 to 100 feet of potential habitat. There is potential for indirect effects from herbicide drift, but the use of herbicides with short half-lives and low soil activities (glyphosate and triclopyr) would

make indirect effects highly unlikely. Since herbicide and timber activities are highly unlikely to affect habitat, this alternative may affect habitat, but is not likely to adversely affect northern monkshood.

Determination for Small whorled Pogonia, Alternative 3. Fireline areas were emphasized during 2006 surveys and no small whorled pogonias were found. A dormant individual of this species could be impacted if it occurred in an area where large equipment would be used. Herbicides would predominantly be used during leaf off seasons, reducing the likelihood of inadvertent herbicide application or spray drift to affect individuals of this species. This alternative may affect habitat, but is not likely to adversely affect small whorled pogonia. Conversely, opening of canopy through timber harvest and herbicide application may benefit habitat for this species, though with-out fire to maintain an open understory this effect will be topographically constrained to the driest and rockiest sites.

Determination for running buffalo clover, Alternative 3: Timber harvesting will result in opening of the overstory and midstory canopy on Dry-Upland and Dry-Mesic sites but without fire to maintain the open undestory long-term benefits to running buffalo clover habitat are unlikely. Herbicides would predominantly be used during leaf off seasons, reducing the likelihood of inadvertent herbicide application or spray drift to affect individuals of this species. This alternative may affect habitat, but is not likely to adversely affect running buffalo clover. Conversely, opening of canopy through timber and herbicide application may temporarily benefit habitat for this species.

Regional Forester Sensitive Species

Determination for Mature Woodland Species Group including umbrella magnolia, butternut, sparse-lobed grape fern, and rock skullcap, Alternative 3: Since fire is not included in this alternative, it will not affect these species. However, salvaging or light thinning in the Mesic Alliance may temporarily impact habitat until the canopy closes. Fireline construction areas were emphasized during surveys and no individuals of the three species were found. Since all areas of the project area were not surveyed, some unknown individuals may exist within the project area. This alternative may impact individuals, but is unlikely to cause a trend toward federal listing. Some herbicide activities may improve habitat for the rock skullcap and lined sedge by reducing understory competition.

Determination for Semi-open Woodland Species Group, Alternative 3: (Timber harvesting, no prescribed burning and manual & herbicide treatment of mid-story species). Since fire is not included in this alternative, it will not affect these species. Habitat for these species will likely further decline without the re-introduction of fire. Salvaging or light thinning in the Mesic Alliance may temporarily impact habitat of blue scorpion weed until the canopy closes. Fireline construction areas were emphasized during surveys and no individuals of the three species were found. Since all areas of the project area were not surveyed, some unknown individuals may exist within the project area. This alternative may impact individuals, but is unlikely to cause a trend toward federal listing. Some herbicide activities may improve habitat for the rock skullcap and lined sedge by reducing understory competition.

Determination for Open Woodland Fire-Adapted Species, Alternative 3: (Timber harvesting, no prescribed burning and manual & herbicide treatment of mid-story species). With-out prescribed burning the restoration of these species habitat is unlikely. Timber harvest may temporarily open

the undestory but without fire it will quickly fill in with shrubs such as green briar and maple-leaf viburnum. Thus this alternative may impact individuals, but is unlikely to cause a trend toward federal listing of these RFSS. Some timber and herbicide activities may benefit habitat for these species by reducing understory competition, preventing succession and controlling non-native species.

State-listed species
During the surveys several state-listed species were found. These include Small-flowered Alum-rootroot, Wild Pea, Sweet Goldenrod, White Milkweed, Spring Coral-root, fringe tree and American Chestnut. These should not be negatively affected by this project as long as no fringe tree or America Chestnut are cut. Small-flowered Alum-root is restricted to rock shelters which will be avoided during this project. Wild pea, sweet goldenrod and white milkweed will likely benefit from prescribed fire and more light in the understory. A 50-foot buffer will be placed around the Spring Coral-root location.

Wildlife

Management Indicator Species
Oak-hickory forest: Under the 2006 Forest Plan, approximately 10,500 acres were proposed to be treated by silvicultural treatments that maintained oak (Forest Plan FEIS 3-50). Implementation of Alternatives 2 and 3 would accomplish 2309 of these acres. **Pine forest:** Under Alternatives 2 and 3, native pine treatment will remove much of the existing native pine, but will open up pockets within those stands that are large enough to regenerate some pine. Under these two alternatives, white pine stands would be converted to hardwoods over time. **Early succession forest habitat:** Under Alternatives 2 and 3, some early successional habitat will be lost as it matures, while new habitat is created in the form of log landings and temporary access roads. Additional analysis of individual MIS species can be found in Project File 5-7.

Threatened and Endangered Species
Direct & Indirect Effects: Alternative 3 is similar to Alternative 2, but does not include prescribed burning or creation or use of fireline. Use of herbicides for mid-story treatment would be increased in order to treat re-sprouting that would be limited by fire under Alternative 2. Anticipated effects of Alternative 3 are expected to be the same as those described above for Alternative 2, with the following exceptions. The risk of loss of suitable roost trees will be lower due to lack of fireline use and construction. In addition, there would be no temporary alteration of foraging habitat and a somewhat lower chance of disturbance to individuals in summer or winter habitat from human activity, noise and smoke associated with prescribed fire. The long-term habitat improvement described under Alternative 2 would also be less pronounced under Alternative 3 because those benefits associated with prescribed fire, including decreased understory and mid-story clutter, creation of snags and oak regeneration would not be fully realized under Alternative 3.

Cumulative Effects: The cumulative effects of Alternative 3 would be expected to be the same as those described under Alternative 2. However, the potential indirect and direct effects would be offset to a lesser degree by the lesser long-term benefits of the project under Alternative 3. Therefore, the project under Alternative 3 would also offset the cumulative adverse effects of past, present and future actions to a lesser degree than Alternative 2.

Anticipated effects from the proposed project are similar to those anticipated in the programmatic BO for the proposed activities. Potential for adverse direct and indirect impacts to the Indiana bat have been limited by incorporation of Forest-wide S&G and additional design criteria. With the incorporation of these design criteria and S&G, the potential adverse impacts of this proposed action are essentially small, and are offset by the expected long term habitat improvement described above, though to a lesser degree than under Alternative 2. Therefore, implementation of Alternative 3 is not expected to result in any appreciable increase in cumulative loss or long-term degradation of Indiana bat habitat.

> **Determination:** Alternative 3 is *not likely to adversely affect* the Indiana bat:

Prescribed burns do not take place in this alternative. Therefore, there is no risk of removal or destruction of an occupied roost tree during prescribed burning activities that occur during the non-hibernation season.

The potential adverse effects are minimized by the incorporation of Forest Plan S&G and project-specific design criteria, and are offset by the long-term habitat improvement resulting from the proposed activities.

Although this alternative is expected to improve habitat for Indiana bats over the long-term by reducing midstory clutter, creating snags, improving solar radiation to existing potentially suitable roost trees, and creating flyways and additional water sources, the degree of improvement is significantly decreased from that which is expected under Alternative 2 due to the absences of prescribed fire.

Regional Forester Sensitive Species

Direct & Indirect Effects: Alternative 3 is similar to Alternative 2, but does not include prescribed burning or creation or use of fireline. Anticipated effects of Alternative 3 are expected to be the same as those described above for Alternative 2, with the following exceptions. The risk of loss of suitable den trees will be lower under Alternative 2 due to the lack of fireline use and construction. In addition, there would be a lower chance of disturbance to individuals from human activity, noise and smoke associated with prescribed fire. The long-term habitat improvement described under Alternative 2 would also be less pronounced under Alternative 3 because those benefits associated with prescribed fire, including improved foraging, den tree creation, reduced wildfire risk and oak regeneration would not be realized.

Cumulative Effects: Though this project may result in the loss of a few suitable den sites, the number of potential den sites removed during this project will be insignificant in the context of the available habitat within the cumulative effects boundary. In addition to large logs and snags, bobcats and black bears may use abandoned mine portals, which are abundant on the Ironton district, as den sites.

> **Determination:** Alternatives 3 may impact individuals but is not likely to cause a trend to federal listing or loss of viability for black bears of bobcats.

Cerulean Warbler

Direct & Indirect Effects: Alternative 3 is similar to Alternative 2, but does not include prescribed burning or creation or use of fireline. Anticipated effects of Alternative 3 are expected to be the same as those described above for Alternative 2, with the following exceptions. There would be a lower risk of disturbance to individuals from human activity, noise and smoke associated with prescribed fire. In addition, the long-term habitat improvement described under Alternative 2 would also be less pronounced under Alternative 3 because those benefits associated with prescribed fire, including improved oak regeneration and reduced wildfire risk would not be realized.

Cumulative Effects: Anticipated effects from the proposed project are similar to those anticipated in the programmatic BE for timber harvest, temporary roads, skid trails and log landings and the other connected actions. Implementation of this alternative is expected to improve habitat for cerulean warblers over the long term by maintaining a healthy oak-hickory ecosystem, though this benefit will be lesser than the benefit of the combined actions in Alternative 2. This alternative may lead to temporary disturbance of individuals in parts of the project area, but disturbance will be short-term and should not affect the long-term health of individuals or the populations. In addition, the amount of habitat affected by the proposed actions is small relative to the amount of habitat available and the other activities occurring in the cumulative effects analysis area.

> **Determination:** Alternatives 2 may impact individuals but is not likely to cause a trend to federal listing or loss of viability for cerulean warblers.

See Project File 5-6 for additional analysis for frogs and salamanders, round hickorynut, little spectaclecase, eastern sand darter and western lake chubsucker. Also see effects as described under Alternative Two.

Recreation

Alternative 3 would eliminate the mitigations needed for the prescribe burn activities described in Alternative 2, but all other impacts and mitigations would be the same. There may be less time during which trails would be closed since no burning would be done.

Archaeology

There would be no change in effects from Alternative Two. Burning only affects sites with surface exposure and those sites have been identified for protection in all alternatives.

Alternative Four

Soil, Water and Air

Under this alternative, no timber harvest or herbicide use will occur.
Direct Effects – Similar to effects for Alternative 2 except for no harvest, no herbicides, and no roads, waterholes, parking areas, or skid roads. No harvesting results in less recruitment of woody debris for future soil organic matter for soil buffering but also results in less site disturbance. Manual treaments in the mid-story would result in woody debris being left on site for future soil organic matter. Although erosion is expected to be minimal in Alternative Two, less road work is likely to result in less erosion and sedimentation. No work on the water holes

and the parking lots disturbs fewer acres within the analysis area, but fails to enhance existing habitat where those holes would have been constructed on roads scheduled to be closed.

Indirect Effects – The provision of ecosystem services would not be affected by road work. The lack of water hole construction has positive and negative aspects for ecosystem services.

Carbon storage would initially be maintained if there is no harvest. A more open stand after harvest would have resulted in larger trees in Alternative 2 and 3 and the carbon lost during harvest would have been made up by increased growth on residual trees. Prescribed burning would reduce carbon sequestration initially until the increased growing space in the understory results in increased growth on residual plants. Burning will increase organic matter availability for soil development, increasing cations and thus nutrient capital for an expected increase in growth.

Prescribed burning may temporarily reduce micro-organisms; however, when the ash is incorporated in the soil, numbers of micro-organisms increase again.

Cumulative Effects – Opportunities for immediate soil buffering are similar to Alternative 2; recruitment of long-term soil organic matter is less than Alternative 2. Ecosystem services would continue and carbon sequestration and micro-organisms would stabilize.

Effects on Air Quality

Air quality is not expected to be adversely affected by implementing Alternative Four (see Project File 4-16) because prescribed burning operations controls and smoke mitigations reduce the impact of prescribed burning to undetectable levels. No herbicides are used in this alternative, so were not analyzed. Harvesting produces some air pollutants which generally do not escape the forest cover at the harvest site.

Vegetation

In this alternative, mechanical treatments (girdling and/or cutting) will target stems one to approximately 8 inches in diameter, and prescribed fire will be used to control undesirable seedling composition and stem re-sprouting following mechanical treatments. In the absence of harvest and herbicides, mechanical treatments will need to be repeated frequently to remove mid-story trees that have grown too large to be killed by low-intensity fire. A combination of frequent mechanical treatments (specific to species and size) and prescribed fire will be necessary to promote oak regeneration and allow it to maintain its vigor in mixed hardwood forests (Van Lear and Watt, 1992).

Fire will assist in controlling the understory layer composition and assist in controlling competition to advancing oak seedlings. Oak recruitment will occur and stage to out-compete undesirable stems. Some setback to oaks and hickories may occur with repeated fire until they reach sizes greater than one inch, but the benefits far outweigh the consequences as roots will continue to persist while undesirable stems are eliminated from the understory.

In areas where no prescribed burning occurs, stem sprouting is likely. It is important to note that without use of herbicides, mid-story control will be less effective in areas that are not also treated with prescribed burns (e.g. those areas identified as harvest only in Alternative 2). In these areas, it will be difficult to move toward the desired future condition of historic forest restoration

because oak-hickory regeneration is dependent on light gained by mid-story control, along with canopy gaps created by natural mortality and effects of the 2003 ice storm.

This alternative loses the benefit of combining treatments and may or may not achieve the desired future condition. If the use of frequent fire and mechanical treatment let the mid-story layer advance, forest composition is likely to change.

Effect on regeneration
Harvesting is critical to open the overstory to create the canopy openings and increased light necessary to the long-term recruitment of oak/hickory regeneration. An advancing layer of undesirable species of trees was established and prospering from before the ice storm and now has a strong competitive advantage to replace the current overstory without control.

With this alternative, regeneration of desired species will depend on openings created by the ice storm and natural mortality as damaged trees die from the long-term effects of the ice storm. Monitoring shows that this is already occurring throughout the Pine Creek and Buckhorn Project Areas. The Desired Future Condition will not be met in mechanical treatment-only due to the failure to successfully recruit desired regeneration.

Recent studies indicate that prescribed burning may reduce populations of oak insect pests when conducted under proper conditions. A reduction in insect predation would allow more acorns to be scattered and buried by jays and squirrels. This enhances the probability of successful germination and helps subsequent seedlings become established. Burning may also reduce rodent habitat, eliminating another source of acorn predation (Van Lear, Watt, 1992).

A regime of frequent burning over a long period creates a more open understory. In hardwood stands, long-term burning tends to eliminate small understory stems outright and gradually reduces the mid-story and overstory canopies through mortality resulting from fire wounds. Increased light reaching the forest floor in these open stands will maintain the vigor of oak advanced regeneration.

More discussion of the effects of fire, the absence of fire, and canopy opening can be found in the silvicultural prescription Project File 4-7.

Effect on mid-story
The lack of herbicide use will not allow us to target the advancing component of undesirable beech and maple threatening, which will replace the current canopy in the near future. Burning *alone* will not fully address this issue. An aggressive treatment schedule including herbicides is necessary to begin to address current overstocking of undesirable species such as red maple and to give recruited oaks and hickories the space and sunlight to prosper. Harvests in conjunction with mid-story control will bring much needed sunlight, currently not reaching the forest floor.

Herbicide is preferred over mechanical treatments for effectiveness of a single application to kill the root systems of undesirable trees and prevent the root sprouting expected from mechanical treatments in areas where fire will not be planned in this project. Mid story treatments will only be used in the Upland forest alliances of Dry Upland and Dry-Mesic ELTP's.

Effect on residual stand vigor

Harvests will retain long-lived species. Harvests proposed in this project are designed to target short-lived, unhealthy trees, along with undesirable species of trees on the landscape. Harvesting is critical to open the overstory and create the widely spaced effect critical to recruitment of oak/hickory regeneration, especially on the upland sites where this species mix is a greater priority for retention (Project File 4-7 pp. 1-2). The combination of harvesting and using mid-story treatments could result in the future success of restoring stands to historic conditions. However, without the benefit of harvest activity in the canopy, the frequency of mid-story treatments becomes more critical and could be overwhelming to implement across the project area.

Botany

Determination for Monkshood: Alternative 4 (Prescribed burning, no timber harvesting and manual only, no herbicide, treatment of mid-story). While burning activities could result in the opening of the forest canopy and a temporary drying of the understory, only minimal burning, if any, would occur within the potential Alliances for this species. While fireline construction would not occur within areas of potential habitat for this species, actual burning could. Due to the high humidity of preferred habitat for this species, it is unlikely that fire in the dormant season would burn intensely enough in these areas to impact any individuals or habitat. Therefore, prescribed burning and manual midstory activities are highly unlikely to affect habitat, this alternative may affect habitat, but is not likely to adversely affect northern monkshood.

Determination for Small Whorled Pogonia: Alternative 4: Prescribed burning alone may create an open understory to benefit this species. Herbicides would predominantly be used during leaf off seasons, reducing the likelihood of inadvertent herbicide application or spray drift to affect individuals of this species. This alternative may affect habitat, but is not likely to adversely affect small whorled pogonia. Conversely, opening of mid-story canopy through fire and herbicide application may benefit habitat for this species.

Determination for running buffalo clover, Alternative 4: Prescribed burning alone may create an open understory to benefit this species and burning would occur when this species is dormant. Herbicides would predominantly be used during leaf off seasons, reducing the likelihood of inadvertent herbicide application or spray drift to affect individuals of this species. This alternative may affect habitat, but is not likely to adversely affect small whorled pogonia. Conversely, opening of mid-story canopy through fire and herbicide application may benefit habitat for this species.

Determination for Mature Woodland Species Group of RFSS including umbrella magnolia, butternut, sparse-lobed grape fern, and rock skullcap, Alternative 4: (Prescribed burning, no timber harvesting and manual only, no herbicide, treatment of mid-story). Since timber harvesting is not included in this alternative it will not affect these species, prescribed fire would have the potential to burn in a mosaic pattern at low intensities in the Mesic Alliance. Therefore, this alternative may impact individuals, but is unlikely to cause a trend toward federal listing. Skullcap and lined sedge may benefit from additional light and reduced competition created by prescribed fire.

Determination for Semi-open Species Group of RFSS, Alternative 4: (Prescribed burning, no timber harvesting and manual only, no herbicide, treatment of mid-story) Since timber harvesting is not included in this alternative it will not affect these species, prescribed fire would have the potential to burn in a mosaic pattern at low intensities in the Mesic Alliance and open the

uderstory and reduce competition in the Dry-Upland and Dry-Mesic Alliances. Therefore, this alternative may impact individuals, but is unlikely to cause a trend toward federal listing. Striped gentian, dwarf iris, blue scorpion weed and pinxter flower may benefit from prescribed fire because it would open up the understory and mid-story.

Determination for Open Woodland Fire Adapted Species Group, Alternative 4: (Prescribed burning, no timber harvesting and manual only, no herbicide, treatment of mid-story). Prescribed fire will likely benefit these plants. However, thinning of the overstory to reduce tree density will also be necessary to decrease shading. Midstory trreament using mechanical only methods will not likely be effective in control mesic and shade tolerant native species and non-native species that are invading the understory. Thus this alternative may impact individuals, but is unlikely to cause a trend toward federal listing of these RFSS. Prescribed fire may benefit habitat for these species by reducing understory competition, preventing succession and controlling non-native species.

State-listed species
During the surveys several state-listed species were found. These include Small-flowered Alum-rootroot, Wild Pea, Sweet Goldenrod, White Milkweed, Spring Coral-root, fringe tree and American Chestnut. These should not be negatively affected by this project as long as no fringe tree or America Chestnut are cut during any project activities. Small-flowered Alum-root is restricted to rock shelters which will be avoided during this project. Wild pea, sweet goldenrod and white milkweed will likely benefit from prescribed fire and more light in the understory. A 50 foot buffer will be placed around the Spring Coral-root location.

Wildlife

Threatened and Endangered Species
Direct & Indirect Effects: Alternative 4 includes many of the same activities as Alternative 2, but does not include hardwood or pine treatments (and associated temporary road, skid road and log landing construction), construction of waterholes, or construction of visitor parking areas. Under Alternative 4, all mid-story treatment and TSI will be accomplished mechanically, without the use of herbicides. Anticipated effects of activities in Alternative 4 are expected to be similar to those described above for Alternative 2 with the following exceptions. Without hardwood treatment, the potential for human disturbance, temporary alteration of foraging habitat, and removal of suitable nest trees is reduced. However, the short- and long-term benefits associated selective hardwood harvest, including canopy gap creation, creation of flyways, reduced midstory clutter, improved foraging habitat, regeneration of oaks, and maintenance of healthy oak-hickory forests will not be fully realized under this alternative.

Under Alternative 4, all mid-story and TSI treatments will be done manually, rather than with herbicides. In areas where prescribed fire is not also applied, these treatments are likely to be less successful than herbicides due to re-sprouting that will occur. Re-sprouting will contribute to a more cluttered mid-story than the desired future condition, and a higher component of non-desired tree species in the overstory. In the long-term, this will decrease habitat suitability for Indiana bats.

Under Alternative 4, pine stands will not be treated. These stands will continue to be unsuitable as Indiana bat habitat in the short term. These stands are expected to age and eventually deteriorate and convert to hardwood species. However, this process will take longer than the

conversion that would be expected under Alternatives 2 & 3. Therefore, these stands will remain unsuitable as Indiana bat roosting or foraging habitat for a longer time under this alternative.

Waterholes and vernal pools will not be created under Alternative 4. Therefore, the potential beneficial impacts of this activity, including additional upland water sources and increase prey production, will not be realized under this Alternative.

Cumulative Effects: The cumulative effects of Alternative 4 would be expected to be similar to those described under Alternative 2. However, the potential indirect and direct effects would be offset to a lesser degree by the lesser long-term benefits of the project under Alternative 4. Therefore, the project under Alternative 4 would also offset the cumulative adverse effects of past, present and future actions to a lesser degree than Alternative 2.

Anticipated effects from the proposed project are similar to those anticipated in the programmatic BO for the proposed activities. Potential for adverse direct and indirect impacts to the Indiana bat have been limited by incorporation of Forest-wide S&G and additional design criteria. With the incorporation of these design criteria and S&G, the potential adverse impacts of this proposed action are essentially small, and are offset by the expected long term habitat improvement described above, though to a lesser degree than under Alternative 2. Therefore, implementation of Alternative 4 is not expected to result in any appreciable increase in cumulative loss or long-term degradation of Indiana bat habitat.

Determination: Alternative 4 is likely to adversely affect the Indiana bat:

Although direct effects to Indiana bats are not likely to occur, there is a small chance that an occupied roost tree could be removed or destroyed during prescribed burning operations, as described in Alternative 2. While most hazard trees are removed during the hibernation season, there is potential for removal to occur between April 15 and September 15. Therefore, there is a small chance that short-term adverse effects may occur during prescribed burn operations. The potential adverse effects are minimized by the incorporation of Forest Plan S&G and project-specific design criteria, and are offset by the long-term habitat improvement resulting from the proposed activities.

Although this alternative is expected to improve habitat for Indiana bats over the long-term by reducing mid-story clutter, creating snags, regenerating oaks and hickories, and improving solar radiation to existing potentially suitable roost trees, the degree of improvement is significantly decreased from that which is expected under Alternative 2 due to the absences of hardwood harvest. The short- and long-term benefits associated selective hardwood harvest, including canopy gap creation, creation of flyways, reduced midstory clutter, improved foraging habitat, regeneration of oaks, and maintenance of healthy oak-hickory forests will not be fully realized under this alternative. In addition, new water sources and foraging habitat would not be created through the construction of water holes and vernal pools in this alternative.

Regional Forester Sensitive Species

Direct & Indirect Effects: Alternative 4 includes many of the same activities as Alternative 2, but does not include hardwood or pine treatments (and associated temporary road, skid road and log landing construction), construction of waterholes, or construction of visitor parking areas. Alternative 4 also does not include use of herbicides for mid-story treatment or TSI. Anticipated effects of activities in Alternative 4 are expected to be the same as those described above for

Alternative 2. However, without hardwood treatment, the potential for loss of roost trees is lower.

The short-term and long-term benefits associated with opening the canopy using hardwood treatment, including regeneration of oaks, improved understory forage for **bears and bobcat** prey, temporary early successional foraging and hunting habitat along roads and log landings, and maintenance of healthy oak-hickory forests will not be realized under this alternative. Prescribed fire alone will not be sufficient to kill mid-story trees of shade-tolerant species. Therefore, the existent stems in the mid-story will continue to mature and will eventually become overstory trees, slowly converting the forest type from oak-hickory to one dominated by maple, tulip poplar and other less fire-tolerant species. Over the long term, this will lead to a decrease in the amount of hard mast available to black bears and bobcats. Without timber harvest, the risk of loss of suitable den trees will be lower under Alternative 4. In addition, there would be a lower chance of disturbance to individuals from human activity and noise associated with timber harvest.

Under Alternative 4, all mid-story and TSI treatments will be done manually, rather than with herbicides. In areas where prescribed fire is not also applied, these treatments are likely to be less successful than herbicides due to re-sprouting that will occur. Re-sprouting will contribute to a denser mid-story than the desired future condition, and a higher component of non-desired tree species in the overstory. In the long-term, this will decrease mast and other forage availability for black bears and bobcat prey.

Alternative 4 does not include construction of waterholes or visitor parking areas. Therefore, this Alternative will not improve habitat through the creation of additional water sources.

Cumulative Effects: Though this project may result in the loss of a few suitable den sites due to prescribed fire, the number of potential den sites removed during this project will be insignificant in the context of the available habitat within the cumulative effects boundary. In addition to large logs and snags, bobcats and black bears may use abandoned mine portals, which are abundant on the Ironton district, as den sites.

Anticipated effects from the proposed project are similar to those anticipated in the programmatic BE for prescribed burning, firelines, midstory treatment, TSI and the other connected actions. Implementation of this alternative is expected to improve habitat for both species over the long term by maintaining a healthy oak-hickory ecosystem, though this benefit will be lesser than the benefit of the combined actions in Alternative 2. This alternative may lead to temporary disturbance of individuals in parts of the project area, but disturbance will be short-term and should not affect the long-term health of individuals or the populations. In addition, the amount of habitat affected by the proposed actions is small relative to the amount of available habitat in the cumulative effects analysis area.

Determination: Alternative 4 may impact individuals but is not likely to cause a trend to federal listing or loss of viability for black bears of bobcats.

Cerulean Warbler

Direct & Indirect Effects: Alternative 4 includes many of the same activities as Alternative 2, but does not include hardwood or pine treatments (and associated temporary road, skid road and log landing construction), construction of waterholes, or construction of visitor parking areas.

Alternative 4 also does not include use of herbicides for mid-story treatment or TSI. Anticipated effects of activities in Alternative 4 are expected to be the same as those described above for Alternative 2 with following exceptions. Without hardwood treatment, the potential for removal of nest trees is lower. The short-term and long-term benefits associated selective hardwood harvest, including canopy gap creation, regeneration of oaks, and maintenance of healthy oak-hickory forests will not be realized under this alternative.

Prescribed fire alone will not be sufficient to kill mid-story trees of shade-tolerant species. Therefore, the existent stems in the mid-story will continue to mature and will eventually become overstory trees, slowly converting the forest type from oak-hickory to one dominated by maple, tulip poplar and other less fire-tolerant species. Over the long term, this will lead to a decrease in the amount of suitable cerulean warbler habitat.

Without timber harvest, the potential loss of nest trees will be lower under Alternative 4. In addition, there would be a lower chance of disturbance to individuals from human activity and noise associated with timber harvest.

Under Alternative 4, all midstory and TSI treatments will be done manually, rather than with herbicides. In areas where prescribed fire is not also applied, these treatments are likely to be less successful than herbicides due to resprouting that will occur. Resprouting will contribute to a denser midstory than the desired future condition, and a higher component of non-desired tree species in the overstory. In the long-term, this will decrease habitat suitability for cerulean warblers.

Cumulative Effects: Anticipated effects from the proposed project are similar to those anticipated in the programmatic BE for prescribed burning, firelines, mid-story treatment, TSI and the other connected actions. Implementation of this alternative is expected to improve habitat for cerulean warblers over the long term by maintaining a healthy oak-hickory ecosystem, though this benefit will be lesser than the benefit of the combined actions in Alternative 2. This alternative may lead to direct effects to some individuals, such as disturbance from noise and human presence, and exposure to smoke. However, the likelihood of these effects is low because most prescribed burns are expected to occur outside of the nesting season, when cerulean warblers are not present. These potential negative effects are offset by the long-term benefit of maintenance of healthy oak-hickory forests. In addition, the amount of habitat affected by the proposed actions is small relative to the amount of available habitat in the cumulative effects analysis area.

Determination: Alternatives 4 may impact individuals but is not likely to cause a trend to federal listing or loss of viability for cerulean warblers.

Additional analysis of effects to other species can be found in Project File 5-6.

Recreation

The prescribed burns should take place between December 16 and April 14. If it is necessary to perform the prescribed burns during the OHV trail season, signs must be posted at trailheads and actual locations along the trails to show which trails are impacted and for what period they will need to be closed in order to complete the project. Fire lines intersecting with designated trails must be effectively blocked to discourage illegal OHV use of the fire line.

Upon completion of the prescribed burning, any impacted trails will be restored to standard specifications as part of the rehabilitation and closeout of the unit. This will include replacing the rock and gravel trail base that was in place for the trail segments prior to the activities.