United States Department of Agriculture
Forest Service
Shawnee National Forest
Hidden Springs Ranger District

Draft Environmental Assessment Ramsey Branch Restoration of Hardwoods in a Pine Stand

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Summary

The Shawnee National Forest proposes to remove 40-60 percent of the non-native shortleaf pine overstory in Compartment 27, Stands 12 and 13, which is about 53 acres (T12S, R6E, Section 5). The project area is located approximately one mile east of Eddyville in Pope County, and is within the Hidden Springs Ranger District. This action is needed because mature pines are shading out and discouraging oak and hickory regeneration while favoring less desirable shade-tolerant species (maple, elm and others) that will eventually dominate the stand.

The action proposed by the Forest Service is to use a commercial timber sale to harvest much of the overstory non-native pine, allowing for the release of native hardwood species, including existing oak and hickory seedlings and saplings. In addition to the proposed action, the Forest Service also evaluated the no-action alternative, in which no vegetation management would be done other than what is being done currently.

Given the purpose and need, the responsible official, the Hidden Springs District Ranger, will review the analyses of the proposed action and the other alternatives in order to make the following decisions: Whether or not to release shade-intolerant oak and hickory species by removal of some overstory pine and use site preparation as tools to restore the native hardwood forest community.

Chapter 1 – Purpose of and Need for Action

Document Structure

The Forest has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This EA discloses the direct, indirect and cumulative environmental effects that would result from the proposed action and alternatives. The document is organized into three parts:

- ***Chapter 1. Purpose of and Need for Action:*** This section includes information about the purpose of and need for the project and the agency's proposal for achieving that purpose and need.

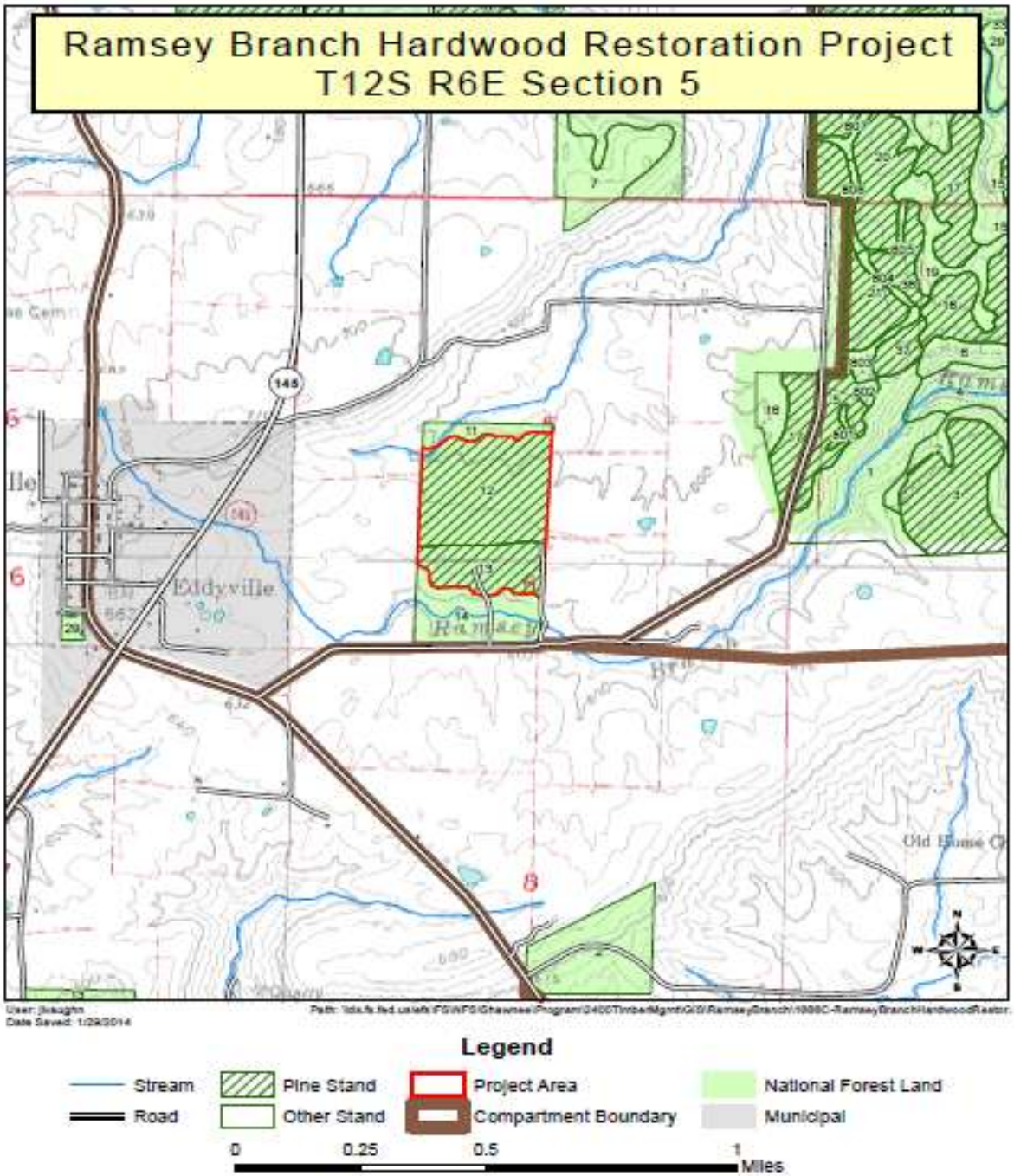
- ***Chapter 2. Alternatives:*** This section provides a detailed description of the proposed action and alternative methods for achieving the stated purpose. These alternatives were developed based on issues raised by the public and other agencies.

- ***Chapter 3. Affected Environment and Environmental Consequences:*** This section describes the environmental effects of implementing the proposed action and other alternatives.

Additional documentation, including detailed analyses of project-area resources, is available in the project record located at the Shawnee National Forest District Rangers Office in Vienna, Illinois.

Background

Figure 1, Ramsey Branch Project Area



The Ramsey Branch project area drains into the Lusk Creek watershed (Figure 1) in the eastern portion of the Forest in Pope County. The area proposed for management consists of a pine stand of about 53 acres originally planted during the 1940's and 1950's to control erosion. The stand is mostly surrounded by hardwood forest that includes a few pines. This area has undergone past commercial harvest that stimulated hardwood regeneration. The area also has a current 80-acre prescribed fire prescription, which includes the proposed 53 acres of pine thinning. The past and future effects of prescribed fire will be included in cumulative effects for the proposal. Based on results of a field inventory there are sufficient hardwoods in the understory to achieve project objectives. Further removal of 40-60% of the pine canopy would stimulate the growth of existing oaks, hickories, and other desirable native species, enhancing the re-establishment of the hardwood ecosystem.

In the 2006 Shawnee National Forest Land and Resource Management Plan (Forest Plan), the Forest Service adopted goals and objectives to manage and restore about half of the Forest as an oak-hickory hardwood ecosystem, based upon the best available scientific information. The proposed project is intended to move the project area towards the desired condition set forth in the Plan's programmatic framework. This site-specific analysis is tiered to the 2006 Forest Plan Final Environmental Impact Statement (FEIS).

Non-native pines were planted to stabilize the soil and that goal has been achieved. The project area has been managed in the past using commercial harvest and prescribed fire. The project area contains many oak, hickory and other hardwood seedlings and saplings (Figures 2 and 3). The project area understory has an abundance of young, suppressed hardwoods (Figure 4) that would benefit from additional sunlight. The continued removal of the pines would further aid the development of native oaks and hickories by providing additional light and growing space. Field observations show that the pine overstory is suppressing the growth of hardwood trees in the project area, particularly oaks and hickories, the hard mast of which tends to yield the greatest benefit for many wildlife species. Leaving the pines to the eventual conversion to a stand of the most shade-tolerant species will tend to limit native plant and animal community diversity and resilience (Silvicultural Working Paper). Removing up to 60% of the overstory pines will provide adequate light for the most desirable species, oaks and hickories, which flourish in full sunlight. Leaving up to 40% of the existing pine canopy will maintain a forested appearance on the site.

A good illustration of the potential for restoration of hardwoods through active management is seen near One-Horse Gap Lake. At One-Horse Gap, pines were removed about 20 years ago to allow more sunlight to reach the forest floor (Figure 5). The resultant spacing of the remaining pines in the One-Horse Gap area is similar to what is proposed for the project area. The abundant oak and other native hardwood species that now thrive in the understory at the One-Horse Gap site is evidence of the effectiveness of pine removal to allow more light to reach the forest floor. The abundant, well formed, healthy hardwood regeneration at this site is developing at a good pace into a diverse (mixed with pine) oak-hickory ecosystem.

Figure 2. Oak seedlings are present in the understory in the project area.

Figure 3. Oak saplings are present in the understory in the project area.

Figure 4. Project area with relatively dense stand of pines and the understory hardwoods that would benefit from increased sunlight resulting from overstory removal of 40-60 percent of the pines.

Figure 5. Pine stand at One-Horse Gap 20-25 years after removal of overstory pines, showing the developing hardwood understory. The spacing of the remaining pine trees is similar to the proposed spacing in the project area.

The work at One-Horse Gap also demonstrates that increasing the amount of sunlight to the forest floor in pine stands can just as readily stimulate growth of non-native desirable native species that compete with the native hardwoods. Additional management is often beneficial to ensure the development of stand with a diversity of species both tolerant and intolerant of shade. Native hardwood forests dominated by oak and hickory are well adapted to low-intensity fire. Thus, fire (or its absence) can plays a critical role in determining the composition of hardwood tree species, and ultimately the degree of plant and animal community diversity. Fire, burning through hardwood ecosystems, aids in the establishment of fire-adapted oak, hickory and other native species. Research in the project record and cited in specialists reports has shown that fire can reduce the spread and incidence of non-native and shade-tolerant species with the exception of some grasses, allowing the native oak-hickory community to become established. The absence of fire at portions of One-Horse Gap (since overstory removal) has

allowed understory competition to develop at that site to the detriment of the oak-hickory community, which is not the case where the area has been burned.

The Ramsey Branch project area is about 53 acres, which is less than 0.01 percent of the Forest (Figure 1, vicinity map). Other areas of the Forest were evaluated for restoration treatment, but this area was chosen as a site for overstory pine removal because of successful past timber management and the presence of abundant, vigorous oak and hickory seedlings and saplings. The presence of these hardwoods indicates the area has potential to respond to improved growing conditions (e.g., additional light, space). The project area is accessible from developed roads and supported native hardwood forest prior to settlement (Parker, 2004). The soils in the project area are fairly stable and not highly erosive. There are no natural areas, inventoried roadless areas, wilderness areas, classified wild and scenic rivers or other special management areas within or immediately adjacent to the project area. The project area contains no known significant historical or cultural resources, prime farmland or ecologically critical areas.

Purpose of and Need for Action

This proposal is needed and has been designed to improve conditions for the restoration of a native hardwood forest community in Stands 12 and 13, Compartment 27 of the Hidden Springs Ranger District. The intent is to restore the native hardwood forest community that has been suppressed from this site for more than 60 years. Reducing the non-native pine overstory trees would move this area toward the desired condition described in the Forest Plan.

The purpose of the proposed project is to improve native ecological composition, function and structure to the best condition possible. The non-native pines planted to stabilize the soil have accomplished that task, but are now suppressing the native hardwood restoration of the project area. The pines have developed a dense canopy that reduces necessary light intensity to the forest floor, affecting the ability of desirable species to flourish. They also occupy the growing space needed for development of oak, hickory and other hardwood trees that characterize a native, oak-hickory, hardwood forest community. The best available science (Silvicultural Working Paper, Project Record) indicates this unnatural condition (i.e., non-native pines adversely affecting development of the oak-hickory community) is likely to persist for many more decades. This condition will continue to reduce the amount of oak and hickory seedlings as reduced light levels lead to the reduction (and mortality) of native oak and hickory seedlings through time. The proposed project should provide for increased animal community diversity by increasing hard mast for wildlife, escape-cover, forage and micro-site conditions (moisture, light, cover) to favor both native plant and animal population development.

The project is intended to enhance plant and animal diversity by stimulating the release of native hardwood trees by admitting additional sunlight to shaded understory hardwood seedlings and saplings. The project will also provide site conditions favorable for future establishment of shade intolerant tree species such as oaks, hickories and other native trees. Because a wide variety of species could occupy the site as a native hardwood community, the native plants and animals present would be healthier, more diverse and more resilient. The wider variety of species, structures and functions means that the native hardwood community would be better able to withstand natural stresses such as insects, pathogens, wildfire and drought. This action responds to Forest Plan goals and objectives for this area (Even-Aged Hardwood Forest Management Prescription, Forest Plan, p. 59), which provide for restoration of areas planted with non-native pine. This action is needed because the oak-hickory hardwood forest community is an integral part of the central hardwoods ecosystem that was severely affected by human actions from the mid-1800's to the present.

Proposed Action

The action proposed by the Forest Service to meet the purpose and need includes the use of a commercial timber sale to remove some of the non-native pine overstory. The proposed removal of 40-60 percent of the pine overstory in the project area will provide the light and growing space needed to

help restore a native oak-hickory hardwood forest community. Similar to other pine stands that have had active management and now support hardwood regeneration, the proposal here is to remove pines and utilize site-preparation treatments to restore a native oak-hickory hardwood forest community (Figure 5).

Additionally, to facilitate natural regeneration, the cutting of small shade tolerant trees (less than 10-inch diameter at breast height [dbh]) in the understory will further increase the amount of sunlight reaching seedlings and saplings. See Alternative 2—the Proposed Action—for a detailed description.

Decision Framework

Given the purpose and need, the responsible official, the Hidden Springs District Ranger, will review the analyses of the proposed action and the other alternatives in order to make the following decisions: Whether or not to release shade-intolerant oak and hickory by removal of some overstory pine and to use site preparation as tools to restore the native hardwood forest community, and how to dispose of, or utilize the felled pine trees.

Public Involvement

The proposal and request for public comment was published in the *Southern Illinoisan* newspaper December 15, 2014. A notice was sent to interested publics and other agencies requesting comments. A scoping letter requesting comments was posted on the Shawnee National Forest internet site December 16, 2014 (http://www.fs.fed.us/shawnee).

Using the comments from the public and other agencies, the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service separated the issues into two groups: key and non-key issues. Key issues are those directly or indirectly caused by implementing the proposed action or alternatives. A list of non-key issues and the rationale for issue-identification may be found in the Project Record. The following were determined to be key issues and within the scope of the project decision.

- Thinning the pine overstory will have undesirable effects on wildlife populations, including migratory birds. Indicators for monitoring these effects are:
  - Changes in species diversity and abundance over time.
  - Numbers and size of snags.

- Thinning the pine overstory will increase the density of non-desirable understory plants (native and non-native) that will compete with the hardwood seedlings and saplings. The indicator identified for monitoring these effects is:
  - Changes in the numbers and frequency of native and non-native plant species including shortleaf pine.

- Soil erosion and compaction resulting from harvest activities will have an adverse effect on soil productivity and water quality. Indicators for monitoring these effects are:
  - The amount of soil displaced (tons/acre/year)
  - Sediment load in the watershed (Project area %)
  - Bare ground (%)

- Thinning the pine overstory will increase climate change and carbon depletion.
  - Climate change effects of the action on global climate change.

Chapter 2 – Alternatives

This chapter includes a description of each alternative and compares the alternatives considered. It also provides a range of alternatives based on the issues brought forward in the public comments.

Alternative 1 – No Action

Under the No-Action Alternative, current management would continue to guide activities in the project area. No management activities, other than those currently being done, would be implemented to encourage establishment and maintenance of shade-intolerant oak and hickory species.

Alternative 2 – The Proposed Action

Commercial Timber Harvest

A commercial timber sale using the shelterwood cutting method is proposed to remove 40-60 percent of the pine overstory trees on about 53 acres. To the casual observer, the removal of trees with the shelterwood method would resemble the type of timber harvest called "thinning." The term "thinning" is used interchangeably with "shelterwood harvest", or "cut" throughout the analysis. Pine trees to be removed will be designated by the Forest Service, leaving about 30 to 40 square feet of basal area of overstory pine trees per acre. Tree spacing after harvest would result in about 15 to 50 feet between mature pine trees. Conventional logging equipment (skidders, feller-bunchers, loaders) would likely be used for harvest.

Skid-trails and log-landings are designated to confine the effects of the skidding operation and limit the amount of ground-disturbance. Logs would be loaded onto trucks at log-landings and hauled to a processing facility. Existing system roads would be maintained and used to remove trees from the project area; no new system roads or temporary roads would be constructed. All landings would be located along the system roads within the stand.

Site Preparation

Site-preparation activity to enhance the development and growth of the hardwoods would be performed within three years following harvest. This would involve cutting small (less than 10-inch dbh), undesirable, shade-tolerant, woody species to increase sunlight to desirable trees. Larger native trees would be left to maintain species diversity. Mechanical shears may be used to remove some small trees. Mechanical and manual treatment would be conducted to uproot or cut the non-native autumn olives within the pine stand. Site-preparation work would also cut back or uprooted other woody invasive species such as burning bush.

Monitoring of Action Alternatives

Monitoring would demonstrate whether or not the management has been implemented as specified and if the design criteria are effective. If monitoring exposes unacceptable resource damage, appropriate measures would be implemented to correct problems (Table 1).

Table 1. Monitoring for Action Alternatives.

Monitoring Activity	Description	Location and Timing
Soil Erosion	Illinois Department of Natural Resource (IDNR) best management practices (BMP) compliance and efficacy checks (Dissemeyer, 1994).	During and after harvest activities are completed in project area.
	Visual inspection for sheet, rill and gully erosion.	Before, during and after activities are completed in project area.

	Inspection of soil disturbance.	Before, during and after activities are completed in project area.
	Visual inspection of log-landings, skid-trails and other disturbed areas.	After harvest and burning activities are completed in project area.
Vegetation	Monitoring plots will be utilized to determine vegetative changes.	Post-harvest monitoring throughout the project area will determine effectiveness in meeting the purpose and need.
Heritage Resources	Ensure that heritage resources are protected and preserved during and after project implementation.	This project will be included in the Forest Monitoring Plan, which annually assesses the thoroughness of inventory methods and mitigation/protection measures.
Wildlife Resources	Number of cavity trees retained post-treatment will be monitored to determine if standards and guidelines are effective.	Cavity trees will be monitored during and after project implementation.
	Snags will be monitored to determine if snag retention standards and guidelines are effective.	Once following project implementation.
	Monitor to determine any changes in diversity or abundance of bats using treated pine areas.	One and five years following implementation.

Design Criteria for Action Alternatives

In order to minimize effects on other resources, several design criteria are included (Table 2).

Table 2. Design Criteria Summary for Ramsey Branch Project.

Resource Area	Design Criteria	Rationale / Effectiveness
Non-native Invasive Species	Remove mud, dirt, and plant parts from project equipment before moving it into a project area.	FS policy; use equipment-cleaning contract provisions WO-C/CT 6.36 (Appendix 1 Guide to Noxious Weed Prevention Practices (2001) and BT6.35 (Project Record).
Rare Plants	Protect known locations of listed rare plant resources from mechanical treatments.	Protection of Federal, Regional Forester Sensitive and state-listed plant species in accordance with Forest Plan.
Soil and Water Resources	Illinois Forestry BMP's will be followed to guide and design logging operations.	Illinois Forestry BMP's are designed to ensure that timber-harvest operations do not degrade the forested site and that waters associated with these forests are of the highest quality (IDNR *et al.* 2000). The BMP's focus on measures to minimize site-disturbance, erosion and sedimentation. We have monitored the effectiveness of mitigation measures on several past timber sales. Logging facilities such as skid-trails, log-landings and logging-roads were monitored. These reports show that the mitigation measures prescribed were effective for all the facilities, with the exception of one landing at the Ridge Top Sale. Monitoring exposed this shortcoming, and mitigation occurred. The FS management activities at these sales did not adversely affect soil productivity or water quality (FS Monitoring and Evaluation Reports 1998, 1999, 2000, 2001 and 2002). A March 16, 2006 summary of NRCS guidelines for the project is part of the project record.
	Skid-trails will be designated by the Forest Service, reusing previous skid-trails and log-landings. Skid-trails will normally be less than 8 percent grade and will avoid crossing streams when practical. Skid-trails and log-landings will be seeded and mulched as soon as practical after disturbance where needed.	
	Water-control structures will be constructed and maintained to divert water off the skid-trails.	
	Heavy equipment will not be operated in a manner that causes excessive soil-displacement, rutting or compaction.	This is in accordance with the Illinois Forestry BMP's and the USFS - Region 9 Soil Quality Standards (FSH 2509.18).
	Bare-soil exposure is limited to ten percent within riparian-corridors filter-strips.	This will minimize soil impacts and disturbance and is in accordance with Forest Plan (page 41).
Wildlife Resources	#1- Avoid removal of suitable Indiana bat and northern long-eared myotis roost trees (live or dead) greater than 5"dbh, from 4/1 through 9/30 unless necessary for human safety or resource objectives. Removal can only proceed after exit counts have determined non-occupancy by roosting bats. Removal must take place within 48 hours from time exit counts were conducted.	-Required "*reasonable and prudent measures*" in Dec. 2005 USFWS Biological Opinion to minimize the impacts of incidental take of Indiana bats. -To maintain availability of suitable summer Indiana bat roost trees. -To avoid direct adverse effects to northern myotis.-To avoid potential for direct impacts to nesting neo-tropical migratory birds

	#2- Avoid removal of cavity trees >5" dbh from 4/1 through 9/30. Where such cavity trees need to be removed during this time period, conduct exit counts to determine non-occupancy by roosting bats. If roosting bats are found, consult with the USFWS, or delay removal of tree until after 09/30 or 11/15, depending upon distance from known hibernacula.	- Required "*reasonable and prudent measures*" in Dec. 2005 USFWS Biological Opinion to minimize the impacts of incidental take of Indiana bats. -To avoid adverse effects to northern long-eared myotis.
	#3- Retain a minimum of cavity trees in clumps within the harvest area. Identify large existing or potential cavities or snags and reserve a portion of the stand around them. Retain all snags as required by guidelines for Indiana bat. Follow "Snag and Cavity Management for Thinning and Timber-Stand Improvement, Tables H-1 and H-2, and standards listed on pages 288-290, 2006 Forest Plan Appendices, Appendix H-Strategies and Guidelines for Conservation of Biological Diversity.	-To provide for cavity-dependent wildlife. - Forest Plan standards and guidelines to provide for the conservation of biological diversity.
Heritage	The Area of Potential Effects will be inventoried to ensure that all heritage resources are adequately protected from project-related impacts.	Following inventory methodologies provided by the Illinois State Historic Preservation Office has proven to be effective way to record archaeological sites. The inventory was completed within the project area recorded two archaeological site were recorded, neither of which are eligible for inclusion on the National Register of Historic Places. These determinations were concurred with by the State Historic Preservation Officer.
	The project area will be monitored upon project implementation to assess the thoroughness of the present inventory.	Project monitoring from 1991-2005 has indicated that few sites have been missed using the archaeological inventory methods required by the Illinois State Historic Preservation Agency. (McCorvie: A Decade of Monitoring).

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative (Table 3).

Table 3. Effects of the Alternatives on Key Issues.

Issue: *Thinning the pine overstory will have undesirable effects on wildlife.*

Indicator	Alt. 1	Alternative 2
Species diversity and abundance.	No change (Low species diversity)	*Short-term*: increase in early-successional species; slight increase in nest-predation and parasitism. *Long-term*: increase in late-successional and interior species; decrease in habitat fragmentation.
Snags	No change	Decrease in small snags; slight decrease in large snags.

Issue: *Thinning the pine overstory will increase the density of non-desirable understory plants that will compete with the hardwoods.*

Indicator	Alternative 1	Alternative 2
Number of non-desirable plant species	Increase predicted	Increase predicted
Non-desirable plant species frequency	Increase predicted	Increase predicted

Issue: *Soil erosion and compaction resulting from harvest activities will have an adverse effect on soil productivity and water quality.*

Indicator	Alt. 1	Alternative 2
Amount of soil erosion (tons/acre/year)	No change	Slight increase in erosion for 2-3 years past treatment.
Sediment load delivered to the stream system (tons/acre/year)	No change	Slight short term increase in sediment load.

Issue: Thinning the pine overstory will increase climate change and carbon depletion.

Indicator	Alt. 1	Alternative 2
Climate change effects of the action on global climate change.	No change	No change

Alternatives Considered but Eliminated from Detailed Study

Fell and Leave or Girdle Non-native Pine

The goal of forest ecosystem health and sustainability includes the production of some timber products as a by-product of vegetation-management activities (Forest Plan, pages 21 and 22). This alternative would not utilize a renewable forest resource and would not support the growing need for wood products. The alternative does not appear to be achievable with current or projected budgets for management of our natural resources on the Forest. In addition, to make use of a renewable forest resource, we would prefer the Forest Service make pine trees available for uses such as utility poles, paper, and house construction, as provided for in Alternative 2. This same alternative was analyzed and disclosed in the Decision Notice and Finding of No Significant Impact for the Harris Branch Restoration of Hardwoods in a Pine Stand, dated 5/30/2009. Analysis conducted on the Ramsey Branch proposed action has not identifies and significant impacts associated with the use of a commercial timber sale to remove a portion of the non-native pines.

Clearcutting the Ramsey Branch Pine Stand

Clearcutting is a harvest method which has been used in the past to remove non-native pine. The Forest Plan (pp. 38 and 60) and FEIS (page 110) define conditions where clearcutting may be optimal. The interdisciplinary team determined, based on the Forest Plan criteria, that the shelterwood method would adequately move this pine stand toward the desired condition.

Winter-Season Harvesting for Nesting Birds and Roosting Bats

In order to minimize effects on nesting birds, roosting Indiana bats and other species, we considered an alternative that would harvest only between November 1 and March 31. However, this time of the year is usually wet and the opportunity to harvest would be limited by the design criteria for soil protection. In addition, the winter weight-limitations on public roads would limit movement of logs from the site. The interdisciplinary team determined that restricting harvesting to this period would cause more resource impact and would not greatly benefit these species compared to the action alternatives, through design criteria and mitigation.

Chapter 3 – Affected Environment and Environmental Consequences

This chapter describes by resource area the physical, biological and socioeconomic conditions that may be affected by the proposed action and its alternatives. As directed by the Council on Environmental Quality (CEQ) implementing regulations for NEPA, the discussion focuses on resource conditions associated with the key issues. The discussion of environmental consequences forms the scientific and analytical basis for comparing the alternatives. Environmental consequences are discussed in terms of direct, indirect and cumulative effects.

Cumulative Effects

Resource specialists analyzed the cumulative effects of implementing the proposed action on their respective resource areas. These cumulative effects are discussed in each resource section of this chapter. The spatial and temporal boundaries for the cumulative effects analysis vary for each resource area. Rationale for these boundaries is presented within each resource section. Table 4 summarizes the details for each boundary. The analysis of cumulative effects considers all known actions, past, present, proposed and reasonably foreseeable future action.

The following discussion describes past, present and reasonably foreseeable future actions used in the cumulative effects analysis in each resource area. The cumulative effects analysis complies with the June 24, 2005 CEQ guidance on cumulative effects.

Past Actions

Southern Illinois, including the Forest, has a rich agricultural history. Settlers cleared the land for fields and homestead development, and some of this land eventually became the Forest. Both active and passive management have shaped the Forest today. Shortly after the Shawnee National Forest was designated, pine and hardwoods were planted to stabilize old fields and to help establish the Forest.

Activities occurring on National Forest and private lands in the project-area watershed throughout the years include, but are not limited to, farming and grazing; mining; timber harvest (primarily on private land); wildfires and prescribed fires; development and use of system and non-system equestrian and hiker trails; wildlife management, including wildlife openings and pond and waterhole construction; outdoor recreational use, including picnicking, hunting, fishing, hiking; use of all-terrain vehicles (ATVs), authorized and unauthorized, and off-highway vehicles; artifact hunting and collection; issuance of special-use permits; recreational facilities construction and maintenance; road construction, maintenance and use; tree-planting and timber-stand improvements, including tree-thinning; power-line construction and maintenance, and electrification of rural areas.

Table 4. Summary of Spatial and Temporal Boundaries for Each Resource and the Rationale for Boundaries.

Resource	Boundary	Rationale
Vegetation	Spatial: The stand itself	The effects of the proposed action will not extend beyond the stand.
	Temporal: From the existing condition to stand condition at 20, 50 and 100 years	These periods reflect changes in habitat quality that would result from the proposed action.
Wildlife	Spatial: 1. Indiana bat: 3-mile radius from project area; 2. MIS birds: 5-mile radius from project area; 3. Aquatic animals: 5 miles downstream from project activity area	Because wildlife species have differing levels of mobility and home ranges, the analysis of cumulative effects on wildlife has been applied at different spatial levels. 1. Indiana bat: Research studies suggest that the bats will travel as far as 2.5 miles from individual summer roost trees. A 3-mile radius extending from the project-area boundary is appropriate to include any potential Indiana bats roosting outside of the project area that might forage or roost in the project area. 2. MIS birds: Since many Neotropical migratory birds are long-distance migrants subject to actions that occur on their wintering grounds, the appropriate cumulative effects analysis area is the entire Forest. Additionally, cumulative effects on Neotropical migratory birds have been analyzed using a 5-mile radius extending out from the project area. .
	Temporal: From 5 years in the past to 50 years in the future	Going back beyond five years would not provide useful information because the effects of projects previous to five years ago are not readily apparent. Fifty years into the future was chosen because the full effects of the proposed action should be realized in about 50 years.
Botany (Rare Plant Resources)	Spatial: The project area	The effects of the proposed alternatives would be confined to this area.
	Temporal: From 1940's to a point 10 years into the future	The existence and extent of rare plant species, rare plant communities or non-native plants are not known before the pine was planted during the 1940's; 10 years into the future corresponds to the life-span of the Forest Plan and is long enough to accurately gauge the management effects and short enough that any unforeseeable deleterious effects resulting could be addressed, reversed or mitigated.
Soil and Water	Spatial: HUC-6 watershed containing project area	Watershed-based cumulative effects are best addressed within the watershed since erosion and sedimentation is not supplied across watershed boundaries.
	Temporal: 15 years	15-year timeframe provides solid basis for measuring soil disturbance; soil erosion from project and associated activities returns to pre-project levels within 3-5 years.
Heritage	Spatial: The project area	Earth-disturbing project activities are confined to the project area and other heritage resources beyond the project boundary are protected by law.
	Temporal: From 30 years in the past to 10 years in the future	This period addresses activities from 1980 to the present, including two inventories for past effects, as well as project actions to 10 years in the future.

Present Actions

Many of the past activities that occurred in the project-area watershed are still occurring; however, the prevalence of many of the past activities has changed. Present actions in the project area watershed include, but are not limited to, trail reconstruction, maintenance and use; power-line maintenance; ATV use (authorized and unauthorized, see below); timber harvest (mostly on private lands); agricultural management on private lands (row-cropping and pasture); prescribed and wild fire and fire suppression; use of non-system trails; road maintenance and use; equestrian use; public visitation and outdoor recreational use (hiking and hunting).

Reasonably Foreseeable Future Actions

On national forest land in the project-area watershed, activities similar to past activities are reasonably foreseeable in the future. In the next 15 years, the Forest plans to continue to maintain roads and trails, issue special-use permits ranging from access-road and utility permits to outfitter-guide permits, suppress wildfires as they occur and implement 80 acres of prescribed burning on forested land. In general, special-use permits allow activities such as communications; outfitting and guiding for hunting, hiking and horseback riding; roads; water, power, gas and telephone utilities; commercial and non-commercial recreation events; and cemetery and church access. Reasonably foreseeable future actions include those activities that are awaiting implementation, planned or listed in out-year schedules such as the Schedule of Proposed Actions or might be expected to occur in the area.

It is difficult to quantify the extent of future damage that could be caused by unauthorized ATV use or cross-country horse riding because of the nature of off-trail use. It is impossible to predict where this use will occur and the extent of damage to various resources. We have examined this incomplete information using the procedure outlined in 40 CFR 1502.22. Knowledge of the extent of this damage in the analysis area is incomplete and we have no scientific means to predict or quantify these effects. Therefore, it is not possible to quantify how many plants, plant populations, or other resources could be affected.

Vegetation Resources

For the cumulative effects analysis, the spatial boundary for vegetation effects is the stand itself because the effects of the proposed action will not extend beyond the stand. The temporal boundary extends from the existing condition to stand condition at 20, 50 and 100 years. These periods were chosen to reflect changes in habitat quality that would result from the proposed action. A more detailed discussion can be found in the Vegetation Resources Working Paper (Project Record).

Existing Condition

The existing 53-acre pine stand is a mosaic of relatively dense pine trees that dominate the stand canopy. The midstory (growth greater than 4.5 feet high and up to the crowns of the overstory) includes mostly native hardwoods like oaks, hickories, sassafras, tulip poplar, maple, ash, elm, and others. The understory is a mixture of native and non-native hardwood trees, shrubs and woody species. Past management in the area has included one thinning in 1978 that opened the canopy and allowed hardwood species to become established in the understory. The stand was burned in 2004. The past disturbance appears to have been effective in encouraging the establishment of native hardwoods, based on the presence of oak and hickory seedlings and saplings.

In the pine stand, pine seedlings and saplings were not observed in the stand inventory plots, although it is expected that a few occur within the stand. Existing overstory tree densities averages about 370 mature pine trees per acre. Most overstory pine appear to be in good health and continue to expand their crowns into unoccupied space or mesh with adjacent pine crowns, increasing the amount of shade to the forest floor.

The past thinning was not uniform across the stand; some areas were thinned more heavily than other areas. In areas where the thinning was heavy and ample sunlight is available, the native hardwood seedlings and saplings appear to be larger and have fuller crowns. Based on field surveys, the stand has about 370 trees per acre (about 226 square feet basal area) in the overstory and midstory. Regeneration surveys for this stand have shown numerous oak, hickory and other native seedlings and saplings occur in the stand at a density of about 108seedling/saplings per acre. Of these 108 seedlings/saplings per acre, about 50 are oak and hickory. Advanced hardwood regeneration is important to ensure the successful establishment of the hardwoods.

Figure 6. Oak seedlings in understory.

Conversely, in areas where past thinning was lighter and the resulting crown-closure is higher, less sunlight reaches the forest floor. In these areas, partial or complete overstory crown-densities are providing sufficient shade to inhibit desirable native tree species. The limited sunlight reaching the forest floor retards the growth and persistence of existing seedlings and saplings namely the oaks and hickories.

Effects of the Alternatives

The following effects analysis assumes that the design criteria (Table 1) will be implemented under the action alternatives.

Alternative 1

The effect of no action would be the continued growth of overstory and mid-canopy tree crowns, increasing shade to the ground. Shade-tolerant tree species in the understory would continue to develop, further increasing shade. Many developing, oak and hickory tree species would be suppressed or die due to lack of sunlight. The lifespan for shortleaf pine on these sites is unknown, but it could be possible for pine to continue to dominate the overstory for the next 100-200 years. As individual pines die, the shade-tolerant species would rapidly respond to the increased sunlight, filling in gaps in the canopy created by the dead trees. Oaks and hickories, which are slow growing, would also respond to the increase in sunlight, but do not compete well with the shade-adapted species. The shade-tolerant trees would eventually dominate the site, shading out most of the oaks, hickories and other more desirable species (Johnson, Shifley and Rogers, 2002).

Based on knowledge of stand dynamics and development, within 20 years the overstory crowns of pine would continue to develop laterally, filling some of the open space between crowns and decreasing the amount of sunlight reaching the forest floor. The midstory trees would continue to grow laterally and vertically. Where there is insufficient sunlight coming through the overstory, oaks would be suppressed and many would die. The midstory would eventually be dominated by maple,

elm and other shade-tolerant species. The developing overstory and midstory would increasingly provide more shade to the forest floor, favoring shade-tolerant species such as maple, elms, and tulip popular and limiting growth of trees requiring sunlight such as oak and hickory.

In 50 years, the lateral growth of limbs in the overstory pine crowns should have decreased substantially. Competition with adjacent trees, insect damage, pathogens, wind-throw, or a combination of these factors would have caused some of the pine overstory to die. The midstory trees should be about 40-60 feet tall and respond to any opening in the canopy, increasing lateral growth and, thereby, increasing the amount of shade on the forest floor. Shade-tolerant trees such as maple would be the dominant species in the midstory. The developing overstory and midstory would increasingly provide more shade to the forest floor, favoring shade-tolerant species such as maple and elm and limiting the growth of trees requiring sunlight, such as oak and hickory.

In 100 years the midstory trees would have grown to the height of the existing pine, filling in holes in the canopy created by past management and individual pine mortality. Individual oak and hickory trees should maintain their dominant position where adequate sunlight exposure exists. The overstory species would be pine, shade-tolerant hardwoods (maple, elm, ash and others) and some oak and hickory. The midstory and understory would be dominated by plants adapted to dense shading (Pierce, Parker and Rabenold, 2006; Zaczek, Groninger and Van Sambeek, 2002).

Alternative 2

Removing overstory pine trees using a shelterwood harvest method would result in an increase of sunlight to plants in the understory. The Forest Plan correctly identifies the shelterwood harvest as an appropriate method to regenerate oak understory (16 U.S.C. 1604(g)(3)(F)(i), FEIS page 109, Forest Plan page 40). The additional sunlight would encourage the health and vigor of existing, native species, such as oaks and hickories. Additionally, conditions for germination should also improve, adding to the existing stocking levels. An example of effective overstory removal can be observed in the One-Horse Gap area, where a similar cutting regime has been successful in promoting desirable native species' growth and regeneration (Figures 5 and 7).

Figure 7. Hickory in understory at One-Horse Gap area.

The current prescribed fire would continue to be used and temporarily remove the ground-surface litter, providing ground conditions conducive to the regeneration of oaks and hickory. Acorn germination occurs most successfully on mineral soil with a thin layer of leaf-litter (Van Lear and Watt 1992). This would allow for the continued recruitment of oak and hickory seedlings. Repeated fire would also reduce or kill some species that compete with the oak and hickory community (Brose, Van Lear, and Keyser, 1999). The use of fire will also limit the development of pine in the stand. Shortleaf pine seedlings may re-sprout, but as a seedlings would eventually compete poorly with hardwood stems with larger, established root systems. The effects of prescribed fire have been addressed in the

FEIS for the Forest Plan, and are incorporated by reference (FEIS Chapter 3, pp. 72-75, 90-96, 133-117).

Disturbance from logging activities would damage or kill some understory tree species. Oak species would re-sprout from damaged stems, maintaining their presence in the stand. Other species, primarily the shade-tolerant species (elm and others) that are less inclined to sprout, may die, increasing direct and indirect sunlight to the ground. The post-harvest activity of cutting small-diameter, shade-tolerant trees and non-native species would further reduce competition. Bare soil created by logging disturbance may increase the potential for pine seeds to germinate. Observations and inventory in this pine stand during 2013, which has been thinned and burned in the past, revealed no pine seedlings within the stand, but it is likely that a few scattered seedlings may exist. Based on these observations, it is not expected that pine seedlings would be a major component in this stand in the long term.

Based on stand dynamics and development, we expect that within 20 years the overstory of individual pine crowns would be about 10 to 30 feet apart, allowing a substantial amount of sunlight to reach the midstory and forest floor. The midstory trees would be comprised of a diverse mix of oaks, hickories, and other trees (maple, elm, ash, tulip poplar and others). These trees would have developed from lower midstory trees and seedlings/saplings that have responded to the increased sunlight. The understory species would contain a mix of shade-intolerant and -tolerant seedlings and saplings.

Within 50 years, the diverse mix of midstory trees mentioned above should be about 40-60 feet tall and growing into gaps in the overstory canopy created by the thinning and any additional die-off of the remaining pine trees. The developing midstory would increasingly provide more shade to the forest floor, favoring shade-tolerant species such as maple and limiting the growth of trees requiring sunlight, such as oaks. Periodic prescribed fire could be used to reduce the numbers of shade-tolerant species, favoring sun-loving species.

In 100 years the midstory trees would have grown to the height of the existing pine, filling in holes in the canopy created by past management and individual pine mortality. The overstory species would be a diverse mix of pine, oak, hickory, maple, elm, ash and others. The composition of the midstory and understory would be dependent upon what future management actions occur on the site, with prescribed fire and thinning favoring the oaks and hickories.

Cumulative Effects of All Alternatives

Because the effects of the proposed project on vegetation resources would be restricted to the stand itself and not have effects beyond the boundaries of the stand, there would be no cumulative effects. No other management actions by the Forest, other agencies or private individuals are anticipated to have any effect on the vegetation resources within the project area (more detail can be found in the Silvicultural Working Paper in the Project Record).

Terrestrial and Aquatic Animal Resources

The information provided in this document is a summary of the information provided in the Terrestrial and Aquatic Animals Working Paper prepared for the Ramsey Branch Hardwood Restoration Project. Refer to the working paper for a more detailed description of existing condition, listing of species potentially effected/impacted, and a discussion of the analysis of effects/impacts.

Existing Condition

No unique wildlife habitat features (i.e. caves, karst, wetlands, spring seeps, bogs, rock outcrops, boulder fields, cliffs, etc.) are known to exist within the project activity area, and any wildlife species associated with these unique wildlife habitats should be absent from the affected project area.

Consequently, these wildlife habitat features and associated wildlife species should remain unaffected by the implementation of either of the action alternatives.

Aquatic habitat is very limited within the project area. No permanent watered ponds are present within the project area. Ramsey Branch, which is a somewhat narrow stream, is located just to the south of the project area. Forest Service road 1751 crosses Ramsey Branch by means of a graveled ford. During the summer, the vast majority of the section of Ramsey Branch dries up, leaving only scattered shallow pools of water and exposed bedrock. During extremely dry times, such as the summer of 2012, Ramsey Branch is basically dry, with very few stream stretches comprised of cobble or smaller stream aggregate material. No other aquatic habitat is present within the project area.

So as to have some quantitative index on the type, size, and density of snags present within pine areas, a random meandering transect was run through the pine stands proposed for hardwood restoration activities. Only snags that could represent suitable bat roost trees were selected. Snags were selected randomly, and measurements were recorded for each. The percentage of closure of the stand canopy was also recorded at each point. Data was collected at a total of 33 points. Points were not marked on the ground. A summary of the snag data collected is presented in Table 5.

Table 5. Summary of inventory data from random wandering transect snag points (1).

Pine Snags		**Hardwood Snags**		**Ave. Percent Canopy**	
Number	**Average DBH**	**Number**	**Average DBH**	**Hardwood**	**Pine**
30	7.9	3	7.9	70.6%	71.9%
No. of Snags 3.0-4.9""dbh		**No. of Snags 5.0-8.9"dbh**		**No. of Snags >9"dbh**	
Pine	**Hardwood**	**Pine**	**Hardwood**	**Pine**	**Hardwood**
0	0	21	3	9	0

(1) The data presented does not represent snag densities in the pine areas proposed for hardwood restoration activities. The data only represents a "snap-shot" of a very small sample of snags available.

The snag data presented in Table 5 suggests that pine snags are distributed throughout portions of pine areas proposed for hardwood restoration activities. While scarce, suitable bat roost trees are present in portions of the pine areas proposed for treatment. However, the vast majority of the pine snags are in the smaller size classes (less than 9"dbh). The pine overstory canopy is somewhat dense due to the dense spacing of the trees.

Habitat needs for wildlife species dependent upon larger hardwood snag and cavity tree habitat is more abundantly available in the hardwood areas located adjacent to the project area, but are somewhat absent from the pine areas proposed for hardwood restoration activities.

Larger diameter downed logs are not abundant within pine areas proposed for treatment, but are more plentiful in adjacent hardwood areas. Some smaller diameter pine logs are widely scattered within pine areas. However, pine trees do not persist very long once they fall to the forest floor.

Traditional Popular Game Species: The Ramsey Branch Project Area is believed to support low to moderate populations of traditional game wildlife species, such as white-tailed deer, eastern wild turkey, and gray squirrel. White-tailed deer sign was not abundant within the pine stands, but more common in areas occupied by mature hardwood forest. The deer population in the Ramsey Branch Project Area is believed to be moderate, based on the amount of deer sign (trails, droppings, buck rubs). The Illinois Department of Natural Resources 2005-2007 Deer Density Estimates by County Maps indicated a white-tailed deer density for Pope County of 38.67 (2005), 40.18 (2006), and 34.18

(2007) deer per square mile. The weighted three year average deer density (2005-2007) is approximately 37.68 deer per square mile. However, several EHD (epizootic hemorrhagic disease) outbreaks have taken place in Pope and surrounding counties since 2010, resulting in reduced deer densities throughout most of the counties in southern Illinois. The most recent EHD outbreak took place in the summer of 2012. It is conceivable that deer densities could be 15-20 percent lower than the 2005-2007 estimates. The IDNR was contacted about the availability of more current deer density estimates for counties in southern Illinois, and indicated that presently they do not have any estimates of the current deer density for Pope County.

Oftentimes, the reported deer harvest may provide a gross indication of any changes in the deer population. The most recent deer harvest data shows a 22 percent reduction in reported deer harvest from 2005-2012, further suggesting reduced deer densities at the present time.

The turkey population is also believed to be low to moderate within the project activity area. Turkey sign was non-existent within the pine areas, and scattered and light in hardwood areas (turkey tracks, turkey feathers, scratching in hardwood leaves, etc.).

Habitat for gray squirrel, and other animals dependent on a supply of hardmast for food is for the most part absent from pine areas, but abundantly available in adjacent hardwood areas.

Federal Animal Species

Aquatic Animal Species: Several aquatic animal species listed by the USFWS as "endangered" or "threatened" occur in southern Illinois in the Ohio and Mississippi Rivers. These include the sheepnose (*Plethobasus cyphyus*), pink mucket (*Lampsilis abrupta*), orangefoot pimpleback (*Plethobasus cooperianus*), fat pocketbook (*Potamilus capax*), rabbitsfoot (*Quadrula cylindrica cylindrica*), spectaclecase (*Cumberlandia monodonta*), and pallid sturgeon (*Scaphirynchus albus*). None of these aquatic species are known to occur within or near the project area, nor are they expected to be located downstream of the project area in Lusk Creek. No habitat for these aquatic animals is present within, or adjacent to the project area.

Terrestrial Animal Species

Indiana bat (Myotis sodalis): Moderate to high quality roosting habitat (mature open-canopied forests containing trees of suitable size and species with exfoliating bark characteristics, snags with exfoliating bark, and/or tree cavities) for use by summer maternity colonies is, for the most part, absent from pine areas proposed for hardwood restoration. Low quality summer roosting habitat for single male Indiana bats, consisting of smaller-diameter snags and dense canopy cover, does exist throughout pine areas. Moderate to high quality summer maternity roosting habitat is available within areas occupied by mature upland hardwood forest adjacent to the project area. Suitable summer maternity roost trees are uncommon within pine areas, consisting primarily of small-diameter pine and hardwood snags from 5"-9"dbh. Pine or hardwood snags greater than 10"dbh are very uncommon. Hardwood snags are very uncommon in pine areas. Smaller-diameter pine snags (5"-9"dbh) could serve as summer roosting habitat for bachelor male Indiana bats. The highest quality summer roosting habitat is located along hardwood areas and no timber thinning activities are proposed to occur within hardwood areas.

For the most part, and for this habitat analysis, predominately mature upland pine stands having high canopy density, such as those proposed for thinning, are considered to represent low quality summer maternity roosting and foraging habitat, and as such, have a very low potential for use by Indiana bat maternity colonies. Young pine/hardwood sapling/pole timber stands, old fields, grasslands, and woody thickets are considered to represent unsuitable summer maternity roosting habitat for Indiana bats. Unless pine trees possess roosting features (tree cavities, knot holes, lightning damage, broken tops/limbs, etc.) live pine trees are not traditionally considered to represent suitable summer roosting

habitat. Pine snags greater than 9 inches in diameter have been documented as being used as Indiana bat summer maternity roosts in the Southeast. Solitary male Indiana bats have been found using snags as small as 3- 5 inches in diameter as roosting sites. While younger-aged hardwood or mixed pine/hardwood stands may provide smaller diameter snags (less than 9 inches), these snags are not considered to be large enough to serve as summer maternity sites, but could possibly could be used by individual roosting male bats. Literature summarized by Romme et al. (1995) shows the smallest roost trees where female Indiana bats have been found were in the range of 9 inches.

No winter roost sites (hibernacula) are known to occur within the project area, nor within a five mile radius of the project area boundary. The closest known Indiana bat hibernacula to the project site is located over six miles to the east (Ellis Cave), which is located on the Shawnee National Forest (SNF).

No Indiana bat summer maternity roosts are known to occur within or near the proposed project area. The closest summer Indiana bat records are over 6 miles to the east on Grand Pierre Creek in eastern Pope County.

The structural complexity of a forest, such as the amount of vegetative clutter (e.g. tree trunks, branches, leaves) significantly influences the foraging activity of bats, which in turn influences the presence of bats in a forest (Avina et al. 2006). The amount of vegetative clutter is an aspect of all forests that can produce varied levels of bat activity depending on its density. Researchers have found that closely spaced trees and high densities of certain forest types can be a hindrance to flying bats by impeding detection and capture of prey. Too much vegetative clutter may also increase the risk of predation by obstructing a clear path of escape (Avina et al. 2006). High canopy density can also reduce the amount of solar radiation to summer roost trees, rendering them undesirable for use by summer roosting bats.

Several studies have indicated lower bat activity and insect abundance in coniferous forests compared to hardwood forests (Tibbels and Kurta 2003). Studies by Krusic (1995) in Vermont indicated lower bat activity and insect abundance in coniferous stands than in hardwood forests (Tibbels and Kurta 2003). A study of bat activity in thinned and un-thinned red pine stands in Michigan concluded: 1) red pine plantations provide little in the way of roosting and (or) foraging habitat for insectivorous bats; and, 2) thinning does not improve or worsen the suitability of monoculture red pine stands for bats. Loeb and Waldrop (2008) studied the effects of thinning and burning on bat foraging and commuting activity in pine stands in the Piedmont of South Carolina. The results of this study suggests that treatments that reduce clutter, particularly thinning, increase the suitability of pine stands for bats foraging and commuting activity in the Piedmont region of South Carolina. Thus, use of these treatments (i.e. thinning and/or prescribed burning) may help to preserve the biodiversity of managed pine forests.

The stand density and closed canopy condition of pine areas proposed for thinning provide relatively poor quality Indiana bat summer foraging habitat. However, within the vicinity of the project activity area, potential foraging habitat is available in the form of road corridors, utility corridors, somewhat open-canopied hardwood slopes and bottoms, natural forest openings, and abandoned farmland on adjacent private lands. Summer foraging habitat is not considered to be limiting on the Forest, with the possible exception of the larger and more remote tracts of mature hardwood forest (i.e. wilderness areas, etc.). However there is a biological benefit in having quality summer foraging habitat located within a several mile radius of summer roost sites so that bats can be most efficient in the conservation of food energy, growth and development of young of the year, and enhanced summer fat build up.

Since the literature suggests that bats, especially Indiana bats, prefer forested areas with more open stand structure for foraging, it is highly unlikely that any Indiana bat maternity colonies would be present within the proposed project area.

Northern long-eared bat (Myotis septentrionalis)*:* Suitable northern long-eared bat habitat is abundantly available across the Forest. Northern long-eared myotis have been reported using a variety of forested habitats and are more adapted to using more cluttered mature forests, including mature pine stands. Northern long-eared myotis have been reported using similar pine stands in southern Illinois.

Based on the presence of suitable habitat, this analysis concludes that the Indiana bat (*Myotis sodalis*) and northern long-eared myotis (*Myotis septentrionalis*) are the only federal TEPC terrestrial or aquatic animal species that have the potential to occur within or near the potentially affected proposed project area, and which could be effected by the implementation of the proposed project.

Regional Forested Sensitive Animal Species

Bald eagle (Haliaeetus leucocephalus)*:* A field assessment of habitat conditions present within the project area indicates that suitable bald eagle roosting or foraging habitat is absent from the project activity area (i.e. pine stands), and no winter roost or summer nesting records are known to be present within or near the project area. Bald eagles are not likely to be using the project activity area.

Eastern timber rattlesnake (Crotalus horridus*):* The historic range of the timber rattlesnake in Illinois was quite broad and included forests of the Ozark Hills, the Mississippi Border, the Southern Division, the Western Division, and the Jo Daviess Hills. Populations apparently occurred throughout the Shawnee Hills. Illinois Natural Heritage EOR's exist for this species in Pope County. Suitable habitat is typically described as rocky hillside bluffs for den sites and woodland forests for summer habitat (Brandon et al. 1994; Brown 1993). Brandon et al. (1994) described three distinct habitats where timber rattlesnakes may be encountered during the year were listed, (rocky den sites, summer ranges, and transient areas) within their activity ranges, and pointed out that habitat may vary with age and sex of the individual. Den sites seem to be of three types: fissures in rocky ledges, talus or rock slides, and fallen rock partly covered by soil. During summer months, timber rattlesnakes are commonly found in or near brush piles, upland forest or even in cultivated fields, and near rocky areas. Gravid females tend to use open rocky sites close to dens where they bask and feed.

The majority of the project activity area is considered to represent marginally suitable to unsuitable rattlesnake denning habitat (dense canopied yellow pine with sparse ground cover vegetation, mature upland hardwoods with sparse ground cover vegetation, absence of rocky karst habitat, etc.), with an extremely low likelihood of timber rattlesnakes being present within the proposed project activity area. There is no known suitable denning habitat present within the project activity area, thus no suitable timber rattlesnake denning sites should be impacted/altered from proposed hardwood restoration activities. It is also unlikely that timber rattlesnakes would be present in adjacent forested areas since the majority of the area immediately surrounding the proposed project area consists of open non-forested agricultural area. The project activity area was surveyed to determine the possible presence of suitable rattlesnake denning sites or denning habitat, and none were found.

Quality foraging habitat is absent from the project area, and the parcel of SNF land where the project is proposed to occur is geographically isolated from suitable habitats by the presence of non-forested agricultural land. It is highly unlikely that timber rattlesnakes would be present within the project area during project implementation.

Little brown myotis (Myotis lucifugus): The pine areas proposed for hardwood restoration activity represents low quality summer roosting or foraging habitat. The adjacent upland hardwood areas, which are not proposed for timber treatments, represents suitable summer foraging and roosting habitat. Even though small to medium sized pine snags are present, the somewhat dense

canopy conditions that prevail throughout the pine areas reduces the quality of summer habitat, and reduces the likelihood that little brown myotis would be using the pine stands proposed for hardwood restoration for summer maternity habitat.

Two nights of mist net surveys were conducted in pine areas in the project area in August 2 and 6, 2013. One male little brown myotis was captured in two nights of netting. Consequently, this analysis considers the little brown myotis a species likely to be present within the project area, and will be considered in the effects/impacts analysis.

Tri-colored bat (Perimyotis subflavus):Tri-colored bats utilize a variety of forested and non-forested habitats for summer roosting and foraging, including conifer stands. Given the types of forest vegetation present within the project area, it is likely that tri-colored bats utilize at least the hardwood areas within the Ramsey Branch Project Area. Two nights of summer mist net surveys conducted within the pine areas, or in nets set across Ramsey Branch, failed to capture any tri-colored bats. It is less likely that tri-colored bats utilize the densely spaced pine areas, and more likely that they are present within mature hardwood forested habitats lying outside of the proposed project area. For this analysis, it will be assumed that tri-colored bats may be present within pine areas during summer months.

Eastern woodrat (Neotoma floridana): The eastern woodrat historically occurred throughout many suitable rocky habitats in southern Illinois. The species was virtually eliminated from all but the area located in the La Rue Pine Hills area. However, from about 2005-2010, the Illinois Department of Natural Resources embarked on a re-introduction program where woodrats from other states were released into suitable habitats in southern Illinois, one of which included the Lusk Creek Wilderness Area. Today, woodrats are present at several cliffline habitat areas within the Lusk Creek Wilderness Area, and appear to be thriving. While no karst habitat is present within the proposed project activity area, woodrats have been documented thriving quite well removed from rocky habitats, and gravitating to open grassy weedy fields. While none of this type of habitat is presently available within the project activity area, woodrats are known to be present less than several miles from the project area. It is likely that woodrats may move into the project area post treatment.

Illinois-State Listed Animals

Only two animals listed by the Illinois Department of Natural Resources as either endangered or threatened, are likely to occur within or near the proposed project. They include the golden mouse (*Ochrotomys nuttalli*) and the least brook lamprey *(Lampetra aepyptera*). Suitable golden mouse habitat is somewhat absent from the project area, but is present on adjacent agricultural lands under private ownership. These areas currently provide thickets of Japanese honeysuckle, blackberry, greenbrier, and other grasses, forbs, and legumes. The Illinois Natural Heritage Element Occurrence Record database shows numerous locality records for the golden mouse in Pope County. A 2009 locality record exists for golden mouse within or very near to the project activity area.

Scattered pockets of suitable golden-mouse habitat, consisting of Japanese honeysuckle thickets, are present along the edges of FSR 1751. The vast majority of pine areas proposed for restoration are generally considered to represent low quality golden mouse habitat. For this analysis, it will be assumed that the golden mouse may be present within pine areas.

Least brook lamprey are known to occur in Hardin, Johnson, Pope, and Williamson Counties. The SNF conducted least brook lamprey surveys from 2005-2009 to determine the presence or absence of the least brook lamprey. The species has been found present within Lusk Creek, as well as in Big Creek and Grand Pierre Creek. Occurrence records are present less than two (2) miles to the northeast in Lusk Creek upstream of the proposed project activity area; about 1-1.5 miles to the east-northeast downstream of the proposed project activity area; and, about 2-3 miles downstream about southeast

of the project area in Lusk Creek. Maps showing known locations of least brook lamprey are located in the project files.

Management Indicator Species (MIS):

MIS were identified during the forest-planning process for the 2006 Forest Plan in accordance with planning regulations. As part of the 2006 Forest Plan revision process, and after consultation with, and input provided by, the Illinois Department of Conservation, the Forest MIS list was developed, resulting in five species. The MIS in the 2006 Forest Plan include: the northern bobwhite quail, yellow-breasted chat, worm-eating warbler, scarlet tanager, and wood thrush. These five MIS were selected to: (1) provide greater focus to monitor the effects of Forest Plan implementation on wildlife species associated with openlands and early successional habitats, and mature deciduous woodlands; and, 2) to avoid the use of MIS that are considered to be habitat generalists.

A description of the habitat requirements, potential threats, and a discussion of population trends for all five wildlife MIS is listed in the "Appendices-Final EIS for the Land and Resource Management Plan", Appendix F-pages 109-116, and is incorporated by reference within this analysis document. Population trend information for MIS has been addressed on pages 145-147, in the Final EIS for the Forest Plan, and is incorporated by reference within this analysis document. Population trend information for all five MIS has also been addressed in the following discussion for each MIS.

Even though pine plantations are not known to support a high diversity and abundance of Neo-tropical migratory birds, the pine areas proposed for treatment supports a somewhat diverse number of bird species. In order to have an index of the avian diversity present within the proposed activity area, meandering random points were surveyed in the pine areas in June 2013. A total of 25 species of birds were recorded during the June 28, 2013 survey. Data sheets for the June survey are located in the project record. The only MIS bird species documented during this bird survey included yellow-breasted chat. This bird was found present in hardwood areas outside of the pine areas proposed for thinning.

Northern bobwhite quail, yellow-breasted chat, wood thrush, worm-eating warbler, and scarlet tanager are either known or suspected to occur within the project area; suitable habitat is present that could support any of these species, and/or suitable habitat may be created by implementation of the project.

Animal Species with Identified Viability Concerns (as listed in the 2006 Forest Plan)

In addition to USFWS listed-proposed-candidate, Regional Forester's Sensitive, and Illinois-State Listed animal species, the Forest Plan also lists the following animal species (Appendix H – Strategies and Guidelines for Conservation of Biological Diversity, pages 295-297) as species with recognized population viability concerns: American woodcock, gray treefrog, northern bobwhite quail, red-headed woodpecker, river otter, spring cavefish, wood thrush, worm-eating warbler, and yellow-breasted chat. The northern bobwhite quail, wood thrush, worm-eating warbler, and yellow-breasted chat are also classified as Forest MIS, and potential impacts to these species will be addressed in the sections pertaining to MIS. For this document, the following species with identified viability concerns will be evaluated: American woodcock, gray treefrog, red-headed woodpecker, and river otter. The spring cavefish does not occur or near the proposed activity area for this project and will not be addressed in this effects document.

Suitable habitat is currently present, or suitable habitat is likely to be created by implementation of Alternative Two, for the *American Woodcock (Scolopax minor), gray Treefrog (Hyla chrysoscelis), and red-headed Woodpecker (Melanerpes erythrocephalus)*. No suitable habitat is present on or near the proposed project activity area for *river otter (Lutra canadensis)*. A detailed description of habitat

requirements, as well as an assessment of existing habitat within the project activity area for Forest Viability Species is found in the Terrestrial and Aquatic Animals Working Paper.

Other Wildlife Issues

Potential effects to migratory birds; potential effects to biological diversity; and potential effects of project implementation on habitat fragmentation.

The Forest provides habitat for approximately 500 vertebrate animal species. A few of these species could occur within or in close proximity to the proposed project activity area.

It is likely that a wide suite of bird species will utilize the habitats present within the project area during spring and fall migration as temporary stopping-over habitats. This includes many species that have more northern breeding ranges but are not known to nest in Illinois. For this analysis, a discussion of effects to avian species will be restricted to those avian species that are likely to utilize habitats within the project area as breeding habitat.

The historical land-use pattern within the immediate vicinity of the Ramsey Branch Project is one of substantially high sustained human disturbance levels, large blocks of open row-crop agriculture or pasture and relatively small and narrow fragmented patches or strips of mature forest. Historical land-use levels and patterns suggest somewhat intensive use by humans of operable lands in southern Illinois over the past 100-150 years which has left a somewhat extensively fragmented landscape in many areas. Looking at areas that were once cleared agricultural lands, it is apparent that blocks of forested habitat were undoubtedly less abundant prior to acquisition by the Forest Service. The vast majority of what currently exists as yellow pine forest on the Shawnee National Forest had been cleared of forest and farmed prior to US Forest Service acquisition. It is important to recognize that this long-standing heavy human use has shaped the current landscape patterns surrounding and within the Ramsey Branch Project area, as well as the terrestrial and aquatic animal resources present.

A detailed analysis and discussion of landscape patterns, habitat fragmentation, and habitat connectivity is presented in the Terrestrial and Aquatics Animals Working Paper.

Compliance with the Migratory Bird Treaty Act and Executive Order 13186

Executive Order 13186 signed on January 10, 2001, among other things, directed all Federal Agencies to "*take certain actions to further implement the Act" (i.e. Migratory Bird Treaty Act). For purposes of this project, the applicable sections of EO13186 are Sec.3.(e) that each agency shall "to the extent permitted by law… and in harmony with agency missions: (1) …avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions*;" and "(6) *ensure that environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.*"

The Forest has taken, and continues to take, many planning and administrative actions, at both the Forest level and the project-level, to conserve populations and to restore/improve habitats of migratory birds across the Forest. The Forest has taken numerous actions to attempt to comply with the intent of Executive Order 13186, and to the extent practicable to work with the USFWS to conserve populations of migratory birds. The Forest consulted with the US Fish and Wildlife Service on the proposed management of migratory birds (planning record) and received no indication that proposed Forest Plan actions do not work to meet the intent of the Migratory Bird Treaty Act (MBTA) or the intent of Executive Order 13186. The Forest has historically been a leader in Illinois and the Midwest

in management to benefit and conserve many species of migratory birds on the Forest. The 2006 Forest Plan expands the amount of area on the Forest on which management will be emphasized to reduce forest fragmentation and improve forest diversity for migratory birds, especially those that need un-fragmented interior forest conditions. This expansion represents an 89 percent increase in habitat, or 99,400 acres managed with emphasis for migratory bird species that are primarily forest-interior species. Areas were designated in the 2006 Forest Plan, through management prescription direction, to be managed to provide habitat to support viable populations of wildlife species associated with forest interior habitat conditions. The 2006 Forest Plan also emphasizes management for both resident and migratory grassland birds with the inclusion of the Large Openlands management prescription and its direction and guidelines.

Standards and guidelines (both at the Forest level and the management prescription level) have been developed in the 2006 Forest Plan to minimize potential direct and indirect adverse effects, and to implement actions to enhance habitat and populations of resident and migratory birds.

The single action alternative proposed and evaluated for this proposed hardwood restoration project fully incorporates the standards and guidelines outlined in the 2006 Forest Plan to reduce the potential for adverse impacts to migratory birds from implementation of land management actions. The single action alternative incorporates Forest Plan standards to provide habitat, in both the short-term and long-term, for animal species that rely on snags and tree cavities, and for habitat for animal species that rely on larger blocks of forested habitat. The proposed action was developed to restore native mixed upland hardwood forest types by the removal of non-native pine trees from areas previously planted with yellow pine trees. The proposed alternative also strives to comply with the purpose and scope of the 2009 Migratory Bird Memorandum of Understanding (MOU) between the US Department of Agriculture-Forest Service and the US Fish and Wildlife Service to promote the conservation of migratory birds.

U.S. Fish and Wildlife Service Migratory Birds of Conservation Concern

In 2009, the U.S. Department of Agriculture-Forest Service (USFS) and the U.S. Fish and Wildlife Service (USFWS) signed the "*Memorandum of Understanding (MOU) Between the U.S. Department of Agriculture-Forest Service and the U.S. Fish and Wildlife Service To Promote the Conservation of Migratory Birds" for the purpose of "strengthening migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds*". As part of this MOU, the USFS agreed to evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors. Species of Management Concern (SPC) are identified as those species listed in the USFWS publication "Birds of Conservation Concern 2002". Within this USFWS document specific bird species of conservation concern were identified for each "bird conservation region" (BCR). The Shawnee National Forest is located in BCR 24-Central Hardwood Region (CHR).

Of the 15 species that could occur on the Forest (summer or winter), two are designated as MIS for the Forest (wood thrush and worm-eating warbler), three are designated as Region Nine RFSS (cerulean warbler, Swainson's warbler, and Henslow's sparrow), and one is designated as a species of viability concern in the Forest Plan (red-headed woodpecker). The likelihood of occurrence and potential effects to these six species from implementation of the proposed action alternative has already been covered in this document.

Two migratory birds species from this list are likely to be present on the proposed project activity area (i.e. pine areas), which includes the Bewick's wren (*Thryomanes bewickii*) and whip-poor-will (*Caprimulgus vociferous*).

A more detailed assessment of habitat suitability for migratory birds of conservation concern is presented in the Terrestrial and Aquatic Animals Working Paper.

Direct and Indirect Effects of the Alternatives

This analysis of potential effects to terrestrial and aquatic animal species was conducted using the "best available science." The following effects analysis assumes that the design criteria (Table 1) will be fully implemented, to the degree practicable, under the action alternatives. A more detailed discussion of potential direct, indirect or cumulative effects/impacts can be found in the Terrestrial and Aquatic Animal Working Paper.

Alternative 1

From a terrestrial animal habitat perspective, in its present condition, the quality of terrestrial or aquatic habitat would remain poor, due to many factors, that include the monoculture condition, densely-spaced trees, dense dominant tree canopy, lack of stand diversity (i.e. absence of hardwoods), lack of downed woody debris, the lack of larger sized snags or cavity trees, the absence of a diverse herbaceous groundcover, and the absence of suitable roost trees being exposed to enough day-time solar radiation. Consequently, the likelihood of this habitat condition persisting into the near future is high. As such, implementation of Alternative One would be expected to perpetuate the existing low quality habitat conditions. Overtime, as natural weather actions (i.e. micro-bursts, insect infestations, ice damage, etc.) begin to exert themselves, various sized openings would be expected to increase in abundance within pine areas. The resulting openings that would be created would most likely result in minor improvements in habitat quality. The somewhat small openings would allow for the establishment of some herbaceous ground cover, expose some suitable roost trees to more day-time solar radiation,, and a minor improvement in the amount of downed woody debris associated with the openings. Given the somewhat shaded conditions that would be expected to prevail in these openings, it is likely that the openings would be pioneered by woody species that thrive in a partial shaded environment, such as red maple, sugar maple, sweet gum, ash, yellow poplar, hornbeam, and blackgum. Species that require more sunlight, such as the oaks and hickories, would not be expected to increase in most of these openings, and as such, improvements in the amount of hardmast is not expected to increase.

The perpetuation of these habitat conditions would have differing effects to different vertebrate and invertebrate species, which will be briefly discussed within this effects analysis.

No improvements in aquatic habitat would be expected to take place through the implementation of Alternative One. Concurrently, no additional sediment would be expected to be introduced into Ramsey Branch from the use of the ford across Ramsey Branch by motorized vehicle traffic. However, anecdotal observations of aquatic habitat conditions after a sizable rainfall event within Ramsey Branch pre-project implementation indicate a sizable amount of sediment material being introduced to Ramsey Branch from upstream of the project area. This condition would persist into the future.

Federal Listed-Candidate-Proposed Animals

Aquatic animal species: Implementation of Alternative One is expected to have no direct or indirect adverse effects to any federal listed-candidate-proposed animal species.

Indiana bat and Northern long-eared bat: Implementation of Alternative One would be expected to perpetuate the existing low quality bat foraging and roosting habitat conditions. Pine monoculture stands, such as the pine areas proposed for thinning in the Ramsey Branch Project, are considered by bat researches to represent very poor quality bat foraging and roosting habitat. As such, the likelihood of any federal listed-candidate-proposed bat species using the pine areas would remain low. As natural weather events begin to exert themselves on the pine areas, only minor improvements in habitat quality would be expected to occur. These actions potentially could be the most beneficial to the northern long-

eared bat since this bat species has been reported by researchers to be more adapted to forage in forested environments having higher vegetative clutter.

However, implementation of Alternative One would preclude any potential adverse direct or indirect effects taking place to Indiana bats or northern long-eared bats that could have resulted from the cutting, felling, or skidding of trees. No change in indirect effects from burning are anticipated to take place, since the pine areas would continue to be prescribe burned, as authorized through a previous NEPA decision.

The pine areas proposed for thinning do not provide suitable habitat for any other federal listed-candidate-proposed animal species. As such, none would be expected to be present within pine areas proposed for thinning. No other direct or indirect effects are anticipated to take place to any other federal listed-candidate-proposed animal species.

Regional Forester's Sensitive Animals

Little brown bat and tri-colored bat: The same potential direct or indirect effects previously discussed for Indiana bat and northern long-eared bat are expected to occur to the little brown bat and tri-colored bat from the implementation of Alternative One. Alternative One perpetuates the somewhat poor roosting and foraging habitat conditions.

Eastern woodrat*:* Implementation of Alternative One would be expected to perpetuate the unsuitable to very low quality habitat for eastern woodrat, with no improvements in habitat suitability. As such, the likelihood of woodrats using the pine areas would remain extremely low.

Illinois State-Listed Animals

A detailed analysis of potential effects/impacts to Illinois State Listed Animals from the implementation of Alternative One is presented in the Terrestrial and Aquatics Animals Working Paper. The analysis concluded that implementation of Alternative One is not expected to have any direct, indirect, or cumulative adverse effects/impacts to any Illinois State Listed animals.

Management Indicator Species (MIS)

A detailed analysis of potential effects/impacts to Shawnee Forest MIS is presented in the Terrestrial and Aquatics Animals Working Paper. The analysis concluded that implementation of Alternative One is not expected to have any direct, indirect, or cumulative adverse effects/impacts to any MIS's.

Forest Viability Animal Species

A detailed analysis of potential effects/impacts to Forest Viability Animals from the implementation of Alternative One is presented in the Terrestrial and Aquatics Animals Working Paper. The analysis concluded that implementation of Alternative One is not expected to have any direct, indirect, or cumulative adverse effects/impacts to any Illinois State Listed animals.

USFWS Bird Species of Conservation Concern

A detailed analysis of potential effects/impacts to *Bird Species of Conservation Concern* from the implementation of Alternative One is presented in the Terrestrial and Aquatics Animals Working Paper. The analysis concluded that implementation of Alternative One is not expected to have any direct, indirect, or cumulative adverse effects/impacts to any USFWS birds species of conservation concern.

Other Issues (Fragmentation, Nest Parasitism, Nest Predation, Migratory Bird Treaty Act)

Implementation of Alternative One is expected to maintain the existing fragmented landscape condition within and adjacent to the project activity area. The project area will continue to be somewhat isolated from larger blocks of mature hardwood forest, or from other larger patches of early successional habitat. This condition is expected to remain unchanged as long as activities on adjacent private lands continue to be allocated to pasturage or agricultural row crops. Nothing is expected to take place on larger blocks of mature forest located on Forest Service lands located within 3 or 5 mile radii of the project activity area.

Alternative 2

Federal Listed-Candidate-Proposed Animals

Aquatic animal species: Implementation of Alternative Two is not expected to have any direct or indirect effects to any federal listed-candidate-proposed animal species.

Indiana bat and northern long-eared bat*:* Implementation of the proposed pine thinning and hardwood restoration activities have the remote possibility of resulting in both direct and indirect effects to Indiana bats and northern long-eared bats. Some of these effects could be detrimental or beneficial. Activities associated with the proposed action that have the potential to cause direct, indirect, or cumulative effects to Indiana and northern long-eared bats include: a) activities that remove trees during thinning/tree harvesting operations that may result in direct effects to roosting bats; b) activities that remove trees during thinning operations that may result in indirect effects in changes to habitat; c) activities that remove trees during burning operations that may result in direct effects; d) and, activities associated with burning that may result in indirect effects due to changes in habitat. These effects may cause direct harm or injury, may improve or decrease the quality of habitat, may reduce or increase the availability of roost sites, may change the species composition and abundance of insect prey species, and/or may cause increases in elevated disturbances caused by the operation of mechanized equipment that cause elevated noise levels. Some of these actions may cause relatively localized and short-term effects (both positive and negative), while others may result in relatively longer-term effects (both positive and negative).

Actions associated with the proposed project that have the potential to result in direct effects to Indiana and northern long-eared bats include: the removal of suitable roost trees (either intended or unintended) caused by the felling of trees, the operation of mechanized equipment, and the removal of suitable roost trees from burning activities.

Given that standing live trees will be harvested during the summer maternity season, the potential exists for timber felling/harvesting operations, and the operation of mechanized heavy timber equipment conducted during the summer maternity season to have a direct effect to individual Indiana and northern long-eared bats and/or summer maternity colonies that might be present within suitable roost trees within treated pine areas. As evidenced by the snag inventory that was conducted in June 2013, snags greater than 9" dbh are present, but uncommon throughout portions of the pine areas proposed for treatment. Additionally, all of the standing dead pine snags are located within a somewhat dense forest canopy. Tree density is also exceedingly high. All of these factors lessen the likelihood that Indiana bats may be using the pine areas proposed for timber thinning. Additionally, all standing snags >9 inches dbh will protected during the implementation of hardwood restoration activities. No standing snags greater than 5"dbh will be intentionally felled during hardwood restoration activities. If at any time any snags greater than 9"dbh will need to be felled for creation of temporary skid trails, or log landing areas, they will be removed either outside of the summer maternity season (outside of the period from April 1-September 30); or, if needed to be conducted

during the summer maternity period, evening exit counts will be conducted to assure non-occupancy by summer roosting bats. Any snags that are considered to be non-occupied by summer roosting bats will be felled within 48 hours from time exit surveys were conducted.

While these mitigation measures should effectively preclude the likelihood of an Indiana or northern long-eared bat maternity roost tree being intentionally or inadvertently felled during the summer maternity period, the risk remains a bachelor male or non-reproductive female bats may be roosting within a smaller diameter snag (5-9"dbh) and directly "harmed" by a tree being inadvertently knocked over by the operation of heavy equipment, a tree being felled that falls into a snag, or by mechanized equipment when skidding downed trees. Smaller diameter hardwood and pine snags are present in varying degrees throughout the pine stands proposed for thinning. Snags in the 5-8" dbh class exist, scattered throughout portions of the pine stands. These snags have a higher potential of being occupied by solitary roosting bachelor male Indiana or northern long-eared bats. They are generally considered too small in diameter to be used as maternity roost trees.

A collection of factors combine to substantially reduce the likelihood of Indiana or northern long-eared bats using suitable snags or for summer foraging within pine areas proposed for timber thinning, which include: a) the poor quality of the habitat provided by the pine areas (too high of canopy density, densely spaced trees, too high of vegetative clutter; b) the failure to capture any Indiana or northern long-eared bats during two nights of summer mist net surveys; c) the relatively small size of the parcel of land where the proposed activity area is located; d) the geographic isolation of the tract from other larger more suitable habitats; e) and the distance of the proposed project activity area from any known Indiana or northern long-eared bat maternity roosts or hibernacula. Consequently, it is considered highly unlikely that solitary male Indiana or northern long-eared bats would be using some of the smaller diameter hardwood and pine snags (5-9" dbh).

Numerous mitigation measures have been included in the "*Design Criteria*" (Table 2) which have been incorporated into the Proposed Action that should collectively work together to minimize, to the extent practicable, the likelihood of direct adverse effects to Indiana or to northern long-eared bats resulting in the direct taking of Indiana or northern long-eared bats during the summer maternity period (April 1-September 30). The "*Design Criteria*" fully incorporate the "*terms and conditions*" provided in the December 2005 USFWS BO, and all SNF Forest Plan "standards and guidelines" developed to avoid adverse effects to Indiana bats.

Hardwood restoration activities will be carried out in full compliance to the extent practicable with the "*terms and conditions*" provided to the Forest by the USFWS in their December 3, 2005 BO on the 2006 Shawnee National Forest LRMP. Compliance with snag and cavity tree Forest Plan standards and guidelines will provide for the retention/protection of existing snags/cavity trees, and for the creation of future snags/cavity trees, for the immediate time period and into the near future.

Actions associated with the proposed project that have the potential to result in indirect effects (beneficial and negative) to Indiana or northern long-eared bats include: a) the removal of suitable live and dead roost trees with a possible reduction in the number of suitable roost trees; and b) a change in habitat conditions resulting from the implementation of prescribed burning operations.

The removal of standing live pine trees will result in fewer number of pine trees remaining post-treatment. This could reduce the number of trees that could provide suitable summer roost trees into the future. However, over time, while prescribed burning is not part of the proposed action, the use of periodic prescribed burning would be expected to create additional dead trees, thus resulting in a projected no net change in the availability of suitable roost trees. In fact, some recent studies have suggested that prescribed burning results in a greater number of snags available in a stand that is periodically burned.

In the long-term, as desirable hardwood trees (especially Class 1 roost trees) become established and make up a larger proportion of the dominant canopy, the resulting mature mixed pine and hardwood stand should become higher quality summer roosting habitat into the future. Stands are projected to become more productive and better quality bat habitat as the restored areas become older. It would seem likely that over time the residual pine trees will incur some natural mortality and provide suitable summer roost trees. Timber harvesting operations will inadvertently result in damage to a certain number of residual live trees (both hardwood and pine) in thinned stands. These trees will progressively die, increasing the number of snags/potential roost trees in treated areas.

No burning is proposed as part of the proposed action in the 53 acre project area. However, burning has taken place throughout the 80 acre Forest Service parcel under a previous NEPA decision. As such, burning represents a potential cumulative effect.

Conducting prescribed burning in suitable summer Indiana or northern long-eared bat habitat has the risk of affecting individual bats by: 1) killing roosting bats present in standing snags during burning operations; 2) reducing the availability of summer roost trees by burning up snags; 3) creating additional summer roost trees resulting from the killing of live trees from fire; 4) disturbance to winter roosting bats through the introduction of smoke into winter hibernacula sites; and, 5) reducing the availability of insect prey species by reducing the distribution and abundance of downed/standing dead trees. Burning thinned pine areas during the non-summer maternity period (December through late March) will virtually eliminate the potential risk of direct mortality occurring to bats roosting in snags within burned areas, since Indiana and northern long-eared bats would be absent from areas being burned. The later in the winter that burning is conducted the greater the chance that individual Indiana bats may be disturbed/impacted by burning, since adult females quite often depart winter hibernacula in early to mid-April in search of maternity roost sites. However, burning earlier in the winter hibernation period increases the likelihood of smoke emissions disturbing winter roosting bats. This is virtually unlikely to occur in the Ramsey Branch Project Area since the nearest known Indiana bat or northern long-eared bat hibernacula is well over five miles away. At this distance, smoke dispersion should be such that in the event any smoke would travel in the direction of the hibernacula, smoke concentrations would be miniscule. Prescribed burning operations should pose virtually no risk to winter roosting bats.

Prescribed burning may burn up some standing snags, depending upon specific burning conditions. Prescribed burning operations will undoubtedly result in additional mortality to residual live pine trees, as well as some smaller diameter hardwood trees, which should further increase the availability of summer roost trees within the project area. It is highly likely that any snags consumed by burning conducted at Ramsey Branch will be more than offset by the creation of additional snags resulting from burning and/or damage from the operation of logging equipment and thinning operations, and will ultimately result in an improvement in roosting habitat conditions for cavity-roosting bats.

This analysis concludes that Indiana and northern long-eared bats are unlikely to be present within the pine stands proposed for hardwood restoration, for the reasons previously stated in the terrestrial and aquatic animal working paper, and within this EA document. While the potential exists for some minor direct effects occurring to individual bats, the likelihood and scope of this occurring is mitigated to the extent practicable by the implementation of mitigation measures previously discussed in this effects analysis. While implementation of hardwood restoration activities has a remote possibility of having direct adverse effects to individual bachelor male Indiana or northern long-eared bats, the implementation of Alternative Two should not result in any adverse effects to Indiana bats or northern long-eared bats, and will not jeopardize these species.

The Forest informally consulted with the Marion Illinois Sub-Office for the US Fish and Wildlife Service on the proposed Ramsey Branch Project. On August 8, 2013, the Forest received an email from Matthew Mangan, Fish and Wildlife Biologist , stating: "*Based on the habitat at the site and the*

survey results, the Service agrees that a NLAA (Not Likely to Adversely Affect) determination for the proposed project would be appropriate."

Refer to the "Terrestrial and Aquatics Animals Working Paper" for a more detailed discussion of potential effects to Indiana or northern long-eared bats.

Regional Forester's Sensitive Animals

Little brown bat: The potential direct, indirect and cumulative adverse effects previously described for the Indiana and northern long-eared bat are applicable to the analysis of effects to the little brown myotis, since the three species have been reported using very similar types of habitat for summer roosting and foraging. However, the most current scientific literature also strongly suggests that while little brown myotis have been reported using similar types of habitat to that used by Indiana bats (Bergeson, S. M. 2012; Broders and Forbes. 2004; Kalcounis and Brigham.1995), the species has been reported using a greater variety of summer roost sites.

Based upon the best current scientific information, it is believed that the full implementation of the "*Design Criteria*", which fully incorporates the "*terms and conditions*" in the December 2005 USFWS BO, as well as the applicable SNF Forest Plan "standards and guideline", will provide a high degree of reliability in avoiding direct and indirect adverse effects to little brown myotis. The potential remains that implementation of timber thinning operations, with associated activities (development of temporary skid trails, log landings, noise associated disturbance, etc.). However, there remains the potential to cause direct harm to individual bachelor male bats that may be using suitable roost trees during the summer months. Because of the time of year that timber thinning will like to take place, it is possible that individual bats could be harmed, especially if those activities are undertaken prior to July 15, or prior to October 1st. The likelihood of this action taking place is elevated since one adult male little brown bat was captured during two nights of summer mist net surveys conducted in June 2013 in the proposed project activity area. However, it is more likely that this male little brown bat came from a bachelor male roost site from hardwood areas in the vicinity.

It is also conceivable that this single adult male little brown bat may have been using some of the standing dead pine snags within the proposed activity area. However, the likelihood of this happening is extremely low given the highly fragmented nature of the landscape surrounding the project activity area, the low quality of the pine areas being proposed for treatment, the dense spacing of trees, and the substantially high canopy densities.

Additionally, should any individual bats be adversely impacted, the level of effects are not expected to rise to the level that jeopardizes the existence of the species. Implementation of Alternative Two may adversely impact an individual little brown bat, most likely being a bachelor male or non-reproductive female. However, should any individual bats be adversely impacted, the level of impacts are not expected to rise to the level that will contribute to a loss of species viability, nor jeopardizes the existence of the species.

Tri-colored Bat*:* Because tri-colored bats do not colonize summer roosts, instead utilizing clumps of live leaf foliage within the tree canopy, implementation of the "terms and conditions" issued by the USFWS in their December 2005 BO will have minimal benefits in reducing any potential adverse impacts to summer roosting tri-colored bats that might be present within pine areas during timber thinning/harvesting activities. Consequently, the cutting/removal of trees during the summer season has a likelihood of causing direct mortality to non-volant young-of the-year, as well as adult female bats. Virtually all of the mature forest across the SNF represents suitable tri-colored bat habitat, and as such, the availability of summer roosting and foraging habitat is not limited in scope or quality.

Should any individual bats be present within trees harvested during the summer months, it is likely that individual bats could be killed/harmed, or at least forced to vacate roost trees. However, the scope of this adverse impact is believed to be minimal at best, should be confined to a few individual bats, and should not represent a threat to the continued population viability across the SNF or cause a population trend toward federal listing.

***Eastern woodrat**:* Since the pine areas proposed for thinning do not presently constitute suitable habitat, implementation of Alternative Two is not likely to cause any direct or indirect adverse effects/impacts. However, given that woodrats have been recently re-introduced into the Lusk Creek area, and the propensity of the species for early serial habitats, it is likely that the project area may become suitable habitat post-implementation, and subsequently beoccupied by woodrats. Implementation of Alternative Two may have beneficial short-termand long-term effects. The ultimate conversion to mature mixed upland hardwoods and pines should have long-term beneficial effects/impacts since woodrats rely on hardmast as an important seasonal food source.

Illinois State-Listed Animals

***Golden mouse**:* Implementation of Alternative Two is expected to have beneficial short-term effects through the creation of suitable habitat.

***Least brook lamprey**:* Compliance with Illinois Best Management Practices, and Forest Plan standards and guidelines should effectively mitigate the possibility of any adverse downstream impacts to aquatic habitat in Lusk Creek. Consequently, no direct or indirect adverse impacts are anticipated from the implementation of Alternative Two.

Management Indicator Species (MIS)

***Yellow-breasted chat**:* Implementation of Alternative Two is not expected to have any adverse direct or indirect impacts. Alternative Two is expected to have short-beneficial indirect impacts by the creation of suitable habitat post-treatment.

Wood thrush: Implementation of Alternative Two is not expected to have any adverse direct or indirect impacts. Habitat suitability is expected to decrease in the short-term, but increase in the long-term as pine areas transition to mature mixed upland hardwood and pine.

Worm-eating warbler: Implementation of Alternative Two is not expected to have any adverse direct or indirect impacts. Habitat suitability is expected to decrease in the short-term, but increase in the long-term as pine areas transition to mature mixed upland hardwood and pine.

***Scarlet tanager**:* Implementation of Alternative Two has the potential to cause direct impacts to individual birds due to the harvesting of mature trees during the nesting season. However, the scope of the impacts should be restricted to the immediate project area, be of a short-term nature, and should not have any adverse impacts to the viability of the species across the Forest. Habitat suitability is expected to decrease in the short-term, but increase in the long-term as pine areas transition to mature mixed upland hardwood and pine.

***Northern bobwhite quail**:* Implementation of Alternative Two is expected to have no adverse direct impacts, since pine areas presently constitute marginal to unsuitable habitat. However, implementation of pine thinning is expected to have beneficial short-term indirect impacts due to the creation of early seral habitat.

Forest Viability Animal Species

***American woodcock**:* Implementation of Alternative Two is expected to have no direct or indirect adverse impacts, since the pine areas presently constitute marginal to unsuitable habitat. However, Alternative Two is expected to have beneficial indirect impacts by the creation of early seral habitat in the short-term, and by the creation of mature mixed upland hardwood forest in the long-term.

***Gray treefrog**:* Implementation of Alternative Two is not expected to have any adverse direct or indirect impacts.

***Red-headed woodpecker**:* Implementation of Alternative Two is not expected to have any adverse direct or indirect adverse impacts. However, reducing the density of standing trees, and the use of prescribed fire, is expected to have both short-term and long-term beneficial impacts through the creation of suitable habitat.

USFWS Birds Species of Conservation Concern

***Bewick's wren and whip-poor will**:* Implementation of Alternative Two is not expected to have any adverse direct or indirect adverse impacts. Thinning is expected to have beneficial short-term impacts to Bewick's wren through the creation of early seral habitat; and, long-term beneficial impacts to whip-poor-will through the creation of mature mixed upland hardwood forest.

Other Issues (Fragmentation, Nest Parasitism, Nest Predation, Migratory Bird Treaty Act)

Implementation of Alternative Two is not likely to result in any appreciable changes in nest parasitism rates, nest predation rates, forest fragmentation, or adverse impacts to habitat connectivity since the project area is located in a highly fragmented environment. Thinning is expected to have no appreciable impacts on the degree of habitat fragmentation due to the small size, and somewhat isolated nature of the Forest Service parcel within which the project activity area is located.

The following table provides a summary of the projected direct, indirect, and cumulative effects/impacts to potentially affected terrestrial and aquatic animals from the implementation of either Alternative One or Alternative Two for the Ramsey Branch Project.

Listing of Direct, Indirect, or Cumulative Effects/Impacts by Alternative.

Species	Classification	Alternative One: Effects/Impacts Determination	Alternative Two: Effects/Impacts Determination
Indiana bat	Federal-Endangered	No direct, indirect or cumulative effects	May Affect-Not Likely to Adversely Affect; beneficial long-term effects
Northern long-eared bat	Federal-Proposed for listing	No direct, indirect or cumulative effects	May Affect-Not Likely to Adversely Affect
Gray bat	Federal-Endangered	No direct, indirect or cumulative effects	No Effect
Other federally-listed/proposed/candidate terrestrial/aquatic animal species		No direct, indirect or cumulative effects	No direct, indirect or cumulative effects
Bald eagle	R9-RFSS	No direct, indirect, or cumulative adverse impacts	No direct, indirect or cumulative impacts
Eastern timber rattlesnake	R9-RFSS	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts
Little brown myotis	R9-RFSS	No direct, indirect, or cumulative adverse impacts	May impact individuals-no risk to viability-will not cause trend toward federal listing; beneficial long-term impacts

Tri-colored bat	R9-RFSS	No direct, indirect, or cumulative adverse impacts	May impact individuals-no risk to viability-will not cause trend toward federal listing; beneficial long-term impacts
Eastern woodrat	R9-RFSS	No direct, indirect, or cumulative adverse impacts	Beneficial short-term and long-term impacts
Golden mouse	Illinois State-Listed	No direct, indirect, or cumulative adverse impacts	May impact individuals-no risk to viability-will not cause trend toward federal listing
Least brook lamprey	Illinois State-Listed	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts
Northern bobwhite quail	MIS	No direct, indirect, or cumulative adverse impacts	Beneficial short-term impacts
Wood thrush	MIS	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts; beneficial long-term impacts
Worm-eating warbler	MIS	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts; beneficial long-term indirect impacts
Yellow-breasted chat	MIS	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts; beneficial short-term indirect impacts
Scarlet tanager	MIS	No direct, indirect, or cumulative adverse impacts	May impact individuals but no adverse impacts on viability or trend toward federal listing; beneficial long-term indirect impacts
American woodcock	Forest Viability Species	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts; beneficial short-term indirect impacts
Gray treefrog	Forest Viability Species	No direct, indirect, or cumulative adverse impacts	May impact individuals but no adverse impacts on viability or trend toward federal listing; beneficial long-term indirect impacts
Red-headed woodpecker	Forest Viability Species	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts; beneficial long-term indirect impacts
River otter	Forest Viability Species	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts
Bewick's wren	USFWS bird species of conservation concern	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts; beneficial short-term indirect impacts
Whip-poor-will	USFWS bird species of conservation concern	No direct, indirect, or cumulative adverse impacts	No direct, indirect, or cumulative adverse impacts; beneficial long-term indirect impacts

Terrestrial and Aquatic Animal Resources

A reasonable attempt was made to conduct a comprehensive summary of all past, present, and reasonably foreseeable future activities that could affect federally-listed animals, regional forester sensitive animals, Illinois State-Listed animals, Shawnee National Forest Wildlife MIS, and Neo-tropical migratory birds within a five mile radius surrounding the Ramsey Branch Hardwood Restoration Project boundary. While it extremely difficult to anticipate activities that may take place

on private lands, past activities have been used to make estimates on activities likely to take place into the near future. A more detailed discussion of potential affects is included under each wildlife species group discussion in the Terrestrial and Aquatic Animals Working Paper.

Federal Threatened and Endangered Species

Indiana bat and northern long-eared bat: The Indiana bat and northern long-eared bat are the only federally-listed or proposed terrestrial or aquatic animal species likely to be present and/or potentially affected by the proposed hardwood restoration project. Potential summer roosting and foraging habitat has been, and will continue, to be altered by activities that take place on non-Forest Service lands. Activities that have the potential to adversely affect Indiana bat and northern long-eared bat populations and habitat include, but are not restricted to, timber harvesting, prescribed burning, clearing of forested areas for commercial or residential uses, clearing of vehicle/equipment access roads, cutting of standing live trees for firewood, felling of standing snags during summer months; and, the application of herbicides/pesticides.

No pesticides are being used on national forest lands within the analysis area. The Shawnee National Forest is currently in the process of completing the environmental documentation to permit the application of selected, approved, and environmentally safe herbicides for the control of non-native invasive plant species, and in research natural areas and natural areas. However, none of the herbicides being evaluated are known to have any adverse effects to any federally-listed-proposed-candidate, regional forester sensitive, Illinois state-listed, or MIS animal species known or likely to occur within the Ramsey Branch project area. It is not possible to determine the amount of pesticides being applied on non-Forest Service lands. However, excluding the use of herbicides being applied to private lands, the degree to which these activities have, are, or will occur is thought to be somewhat small.

A very low amount of mature hardwood forest has been harvested on non-Forest Service lands in the past five years, and this level is expected to remain the same into the near future. However, it would be feasible that additional landowners might be inclined to harvest their forest tracts due to a change in economic conditions.

Most residential and/or commercial development has taken place on lands previously farmed, either row crop agriculture or pastureland. Based on the most recent level of private construction that has taken place, residential growth is not expected to change substantially in the next 10 years in Pope County.

None of these activities, in conjunction with what has, is, or may occur on National Forest lands, should constitute a cumulative adverse affect to Indiana bat or northern long-eared bat populations or habitat (refer to previous discussion of potential effects).

Table 6 provides a cumulative listing of vegetative management activities that have been approved on national forest lands for the past five years. These acres contribute toward the acres of "*take*" issued by the USFWS in their December 2005 BO.

Table 6. Incidental take of Indiana bats (forested acres affected) for the Ramsey Branch Hardwood Restoration Project and its contribution to the cumulative total for the Shawnee National Forest (as outlined on page 87 of the USFWS Programmatic Biological Opinion of December 3, 2005).

Project	Timber	Timber Stand	Wetland	Minerals	Total

	Harvest and Timber Management	Improvement	Management	Management	Forest Acres Affected
Ramsey Branch Hardwood Restoration Project	53 acres	53	0	0	106
Harris Branch Hardwood Restoration Project	200 acres	0	0	0	200
East Side Openlands Prescribe Burn Expansion	1692	0	0	0	1692
Big Muddy River Habitat Improvement	91	5600	200	0	5891
Prescribed Fire for Implementation of Wildlife Habitat Improvement Project and/or Urban Interface Fuel Conditions	0	3700	0	0	3700
Cumulative Total	2036	9353	200	0	11589

Implementation of Alternative Two, in the short-term, should improve the likelihood that Indiana bats and northern long-eared bats may utilize the project area for summer roosting and foraging by increasing the exposure of snags to solar radiation, decreasing the degree of vegetative clutter, and converting poor quality summer roosting and foraging habitat to highly suitable roosting and foraging habitat in the long-term. There should be no cumulative adverse short-term effects to either the Indiana bat or the northern long-eared bat. In the long-term, implementation of Alternative Two should have beneficial long-term effects by gradually transforming mature monoculture pine stands that are marginally suitable roosting and foraging habitat, to highly suitable mature mixed pine and hardwood roosting and foraging habitat. Implementation of Alternative Two should have no cumulative adverse effects to Indiana bat and northern long-eared bat populations on the Shawnee National Forest (refer to previous discussion of potential effects).

White Nose Syndrome (WNS)

When considering the cumulative effects to Indiana bats and northern long-eared bats from the implementation of the proposed project, and what is taking place to many bat populations throughout the Northeast and East from exposure to WNS, the implementation of the proposed project is not expected to result in any cumulative adverse effects to either Indiana bats or northern long-eared bats. The implementation of the proposed hardwood restoration project is not expected to directly "harm"

or “take” any individual bats of these two species. Consequently, implementation of the project is not expected to have any adverse cumulative effects.

WNS was confirmed present in Illinois in January-February of 2013. As of the time of the preparation of this effects analysis document, WNS has been found present in three caves in southern Illinois, including Pope, Hardin, and Saline Counties. It is likely that WNS will be confirmed at a site in Alexander County. It is likely that WNS is already present in other caves or mines throughout Illinois, but not at detectable numbers. At this point in time, the high degree of winter mortality to bats reported for states in the Northeast has failed to take place in the Midwest, or in states such as Tennessee or Kentucky. Some bat researchers have postulated that the overall mortality rates to cave-roosting bats may be substantially less for states in the Southeast, as well as the more southerly latitudes for Illinois, Indiana, Missouri, Tennessee and Kentucky, since winters generally are much warmer, extremely cold periods are traditionally much shorter in duration and severity, and bats can easily exit winter torpor to drink and to feed during warmer winter days. Only time will tell what bat mortality rates will take place in southern Illinois.

WNS is projected to continue its movement westward in spite of the best “confine and control” measures implemented by state and federal agencies. Cave closures, and strict adherence to the most current USFWS Decontamination Protocol has appeared to have not been fully successful in slowing the spread of the fungus assumed is responsible for the deleterious effects to bats from contact with the fungus. A decision to implement, or to not implement, the Ramsey Branch Hardwood Restoration Project will have no bearing on the outcome of the spread of WNS westward, and the projected bat mortality. The Shawnee NF is doing all that is feasible and practicable to assist in the slowing the spread of WNS into other caves and mines in Illinois, as well as the spread of WNS. Additionally, the implementation of this proposed project will have virtually no effect on any hibernacula in southern Illinois known to be used as either winter or summer roosting sites.

Since no Indiana bats or northern long-eared bats were captured during surveys, the affected area represents such a small area, the quality of the pine forest being proposed for restoration constitutes such poor quality habitat, and both species are unlikely to be present utilizing the pine areas for summer roosting, implementation of the proposed hardwood restoration project is not expected to result in any adverse cumulative effects to either bat species.

Region Nine Sensitive Species

The little brown myotis, tri-colored bat, and eastern woodrat are the only Region Nine sensitive wildlife species thought to have the potential to occur, or to be impacted, within the Ramsey Branch Project Area, or within the cumulative effects analysis area. Some activities that may be taking place on non-Forest Service lands have the potential to affect populations of both bat species. These include: timber harvesting, clearing of forested areas for residential or commercial development, new road construction, pesticide application, and prescribed burning. It is anticipated that the current level of these activities will continue on into the near future. Implementation of Alternative Two should improve habitat quality for both bat species in the short-term and the long-term, in a similar manner previously discussed for cumulative effects to Indiana bat and northern long-eared bat. Implementation of Alternative Two is not expected to result in any adverse cumulative effects to either bat species (refer to previous discussion of potential affects). Implementation of Alternatives One or Two are not expected to result in any cumulative adverse impacts to the eastern woodrat. Implementation of Alternative Two has the potential to have beneficial impacts by creating additional suitable habitat for woodrats within the project area.

A discussion of the potential cumulative effects/impacts to Illinois State Listed animals, Forest MIS Animals, Forest Viability Animals, USFWS Bird Species of Conservation Concern, and other animal issues can be found in the Terrestrial and Aquatic Animals Working Paper. The analysis concluded

that implementation of Alternative Two is not expected to result in any adverse cumulative effects/impacts.

Rare Plant Resources

This section describes the rare plant resource concerns with the project area, including: (1) Affected Environment, (2) Design Criteria developed to protect and preserve the rare plant resources and (3) a discussion of the potential environmental effects of each of the proposed alternatives. Rare plant resources include those listed as Federal threatened or endangered (F-T&E), Regional Forester's Sensitive Species (RFSS), State of Illinois threatened or endangered (IL-T&E), and Species with Viability Evaluations (SVE) also known as Species with Viability Concerns (SVC). "The Regional Forester's Sensitive Plant species biological Evaluation" and the "Environmental Analysis for State of Illinois Threatened and Endangered Plant Species with Viability Evaluations" can be found in the project record.

Affected Environment – Rare Plant Resources

The primary rare plant resource issue in this analysis is the protection of rare plant resources and the assurance that F-T&E, RFSS, IL-T&E, and SVE plant resources will not be negatively affected by project implementation. Because all earth-disturbing activities will be confined to the project area, the area under consideration is the project area itself. Since project activities are confined to the project area and other rare plant resources outside of the project boundary are not affected by this proposed project or a no-action alternative, it is reasonable to limit the analysis to the project area boundary.

The project area was visited several times by the Forest's botanist and others who were skilled in botanical identification between 2004 and 2013. In addition, two vegetation monitoring plots were established in 2004; one was placed in the pines and a second one was placed in a successional hardwood stand. The plots were established to monitor the vegetation changes influenced by prescribed fire. These plots will also be used to monitor changes resulting from other project implementations or natural occurrences, such as timber harvest, extreme weather disturbances, and vegetation succession.

Design Criteria – Rare Plant Resources

The design criteria developed for the analysis of the project area includes the protection and monitoring of any known locations of rare plant resources and the protection of any rare plant resources found prior to, or during, project implementation. The 2006 Forest Plan provides direction in its standards and guidelines that will ensure the perpetuation of rare plant resources on the Forest as well as within the proposed project area (FW26.2, 26.3, 26.5, 26.6, and Appendix H; pages 42-43 and 285-298).

Effects of the Alternatives – Rare Plant Resources

Alternative 1

There will be no direct, indirect or cumulative effects on rare plant resources as a result of the implementation of this alternative because no hardwood restoration activities would occur and, therefore, earth-disturbing activities would not take place.

Alternative 2

There be no direct or indirect effects on rare plant resources as a result of the implementation of the action alternative. One location of a RFSS, *Panax quinquefolius* (American Ginseng) is known at the project area. This species appeared following a prescribed burn and has persisted at this location. This site will be protected through the avoidance of any ground disturbing activity. If any other sites are discovered prior to or during project implementation, the appropriate standards and guidelines will be followed to protect the new site(s).

The analysis of cumulative-effects takes into account all known past, present proposed and reasonably foreseeable future actions that would likely affect the project area. Since there are no expected direct or indirect adverse effects to rare plant resources as a result of the actions proposed in either of the alternatives, there would be no resulting cumulative effects.

Non-Native Invasive Plant Species (NNIS)

This section describes the non-native invasive plant species (NNIS) concerns with the project area, including: (1) Affected Environment, (2) Design Criteria developed to control the spread of NNIS and (3) a discussion of the potential environmental effects of each of the proposed alternatives. A general discussion on NNIS is found in the project record entitled "Non-native Invasive Plant Species". The Supplemental Information Report (SIR): Microstegium vimineum (Nepalase Browntop) within the 'Harris Branch restoration of Hardwoods in a Pine Stand Project Area' and its presence on the Shawnee National Forest was prepared in 2012 and its contents give a good description of how the Nepalese browntop grass is aggressive in its invasive nature across the Forest. This document can be found in the Project Record.

Affected Environment – NNIS and Undesirable Native Species

The primary NNIS plant resource issue in this segment is the possibility that the thinning of the pine overstory will increase the density of non-desirable understory plants (native and non-native) that will compete with the hardwood seedlings and saplings. The indicator identified for monitoring these effects is the changes in the numbers and frequency of native and non-native plant species including shortleaf pine. Because all earth-disturbing activities will be confined to the project area, the area under consideration is the project area itself. Since project activities are confined to the project area and other NNIS and undesirable native species outside of the project boundary are not affected by this proposed project or a no-action alternative, it is reasonable to limit the analysis to the project area boundary.

The project area was visited several times by the Forest's botanist and others who were skilled in botanical identification between 2004 and 2013. In addition, two vegetation monitoring plots were established in 2004; one was placed in the pines and a second one was placed in a successional hardwood stand. The plots were established to monitor the vegetation changes influenced by prescribed fire. These plots will also be used to monitor changes resulting from other project implementations or natural occurrences, such as timber harvest, extreme weather disturbances, and vegetation succession.

Non-native invasive plant species (NNIS) are well documented as having impacts on native plant communities and wildlife habitat. NNIS were recorded in and around the project area. NNIS vary in the rate of invasion and spread. Humans, animals, wind and water are effective at facilitating the spread of NNIS. Human clothing and footwear are known vectors for spreading NNIS. Equipment and vehicles may also spread NNIS from one site to another. The most aggressive NNIS within the project area are Japanese honeysuckle and Nepalese browntop. These species rapidly out-compete native species. Table 7 presents a list of non-native species commonly found in the project area.

Species with rapid establishment and growth rates correlate directly with the greatest potential to impact native plant communities and change ecological processes for those communities (www.invasivespecies.gov). In the project area some aggressive non-native plant species are autumn olive (*Elaeagnus umbellata*), Japanese honeysuckle (*Lonicera japonica*), Nepalese browntop (*Microstegium vimineum*) and multiflora rose (*Rosa multiflora*).

Those with more moderate rates include burning bush (*Euonymus atropurpurea*), large fescue (*Festuca arundinacea*), and beefsteak plant (*Perilla frutescens*). Some species, although identified as

NNIS, have become naturalized to southern Illinois. These species apparently do not have rapid growth and spread rates and pose less (in a relative sense) of a threat to native ecosystems. Some of these species are Queen Anne's lace (*Daucus carota*) and yarrow (*Achillea millefolium*).

Some species are native to the United States, but are not native to southern Illinois (with the exception of Union County) or have escaped plantings. These include the planted shortleaf pine (*Pinus echinata*) and other planted pine species.

Pine plantations have been a continuous source of NNIS following the planting of non-native pines and soil and other site disturbances associated with it. Currently, hand-pulling, cutting and propane torching are methods used for control of NNIS on the Forest. However, due to budget constraints these activities are focused in natural areas, wilderness areas and areas with garlic mustard (*Alliaria petiolata*).

Past prescribed burns have been extremely beneficial to the native species within several of the ecological areas as well as to other forested areas. Fire is one of best management tools for enhancing native populations and habitat especially within the barrens and glade areas. In many cases, this tool allows the more conservative native species to have a competitive edge over the more aggressive exotics and weedy natives.

Table 7. Some non-native species encountered during floristic surveys and site visits (2004-2013).

Tree Species	**Herbaceous Plants**	**Herbaceous Plants**
Elaeagnus umbellata.	*Achillea millefolium*	**Monocots**
Shrub and Vine Species	*Daucus carota*	*Festuca arundinacea*
Euonymus atropurpurea	*Perilla frutescens*	*Microstegium vimineum*
Lonicera japonica	*Pinus echinata*	
Rosa multiflora	*Prunella vulgaris*	

Design Criteria and Monitoring – NNIS

The design criteria developed for the analysis of the project area includes the slowing of spread and monitoring of NNIS prior to, or during, project implementation. Table 2 displays the design criteria that will be used to help achieve the desired results. These criteria are also being used in the Harris Branch Hardwood Restoration in a Pine Stand Project. Table 1 displays the monitoring activities that will be used to ensure that the NNIS spread is not exaggerated by the implementation of the project. This same monitoring schedule is also being used for the Harris Branch Hardwood Restoration in a Pine Stand Project.

Effects of the Alternatives – NNIS

Alternative 1

Alternative 1, the no-action alternative, would not have direct impacts on the existing native vegetation because there would be no actions that would enhance native species or discourage the proliferation of non-native invasive species (NNIS). However, this alternative would have negative indirect impacts to native vegetation over the long term (within 10 to 50 years). NNIS would continue to invade and spread within the already disturbed pine plantation. No efforts would be made to reduce the spread of NNIS or to encourage the health and vigor of native plant species. An increase in both the numbers and abundance of NNIS over the next 10-50 years would be anticipated under the no-action alternative. This alternative is the least favored for the reduction of NNIS and promotion of native plant species. Two plots at the Harris Branch Restoration site have demonstrated that Nepalese Browntop (*Microstegium vimineum*) will continue to spread throughout the pine stands regardless if pine thinning occurs or not. Also see SIR for *Microstegium vimineum* for Harris Branch Restoration of Hardwoods in a Pine Stand.

Alternative 2
Alternative 2 would have direct positive impacts on the native vegetation. The commercial harvest would remove 40-60 percent of the non-native pine overstory that serves as a seed source for establishing young pine. An indirect effect of removing the pine would be that more sunlight would reach the forest floor encouraging the native shade-intolerant oaks and hickories to grow more competitively with other species. In addition, site preparation to reduce shade-tolerant trees, woody non-native invasive species and other tree species in the understory would further increase the amount of sunlight to existing oak and hickory seedlings and saplings.

The continued prescribed fire in both alternatives would stimulate and favor native vegetation and would help reduce the spread of NNIS. Prescribed fires are typically moderate-intensity fires lit during periods of high soil moisture. These types of fires have positive effects on native plant resources, increasing native diversity and helping reduce NNIS, with the exception of some grass species, such as Nepalese browntop. Native vegetation should increase in health and vigor with the reduction of the pine needle and duff layer on the ground. Native ground flora from the seed bank should be able to be expressed, in the absence of the thick suppressing mulch, that is currently present. Spring ephemerals and newly established seedlings will have root systems that will aid in the control of potential erosion by securing the soil during times of heavy rainfall.

Fire gives native plant species a competitive edge, with the exception of some exotic grasses. It reduces the spread of species, such as Japanese honeysuckle, although it does not completely eliminate it. Some exotic grasses and seeds from shortleaf pine cones may be stimulated by the prescribed fires, but they would have more native species to compete with and site preparation work would focus on removing the woody species such as pine. Most of the other NNIS will typically wane in the presence of prescribed fire. Temporary and minimal impacts on native vegetation would occur where some would be damaged or killed by timber harvest operations or prescribed fire. This impact would be short-term as natives become better established within the project area.

A lesser abundance of NNIS over the next 10-50 years is anticipated under this alternative compared to the no-action alternative. The number of NNIS species may or may not increase over the next 10-50 years because fire will not eliminate all NNIS species in both alternatives. Alternative 2 would provide the best conditions for the reduction of NNIS and promotion of native plant communities by encouraging more oak and hickory establishment.

Cumulative Effects - NNIS
The cumulative effects analysis on NNIS focuses on the subset of actions that have affected or could potentially affect these resources. Past, present and future reasonable actions are displayed at the beginning of chapter 3.

Alternative 1 would not change the current management situation. We do not anticipate an increase in any of the potential past, present, or reasonably foreseeable future actions. Over the next 10-50 years this alternative would result in the continued spread of NNIS. These negative effects when viewed in light of the activities currently occurring and those reasonably foreseeable are expected to result in a no cumulative effects. Roads are inevitable conduits for NNIS travel within the project area and adjacent areas. Not only would NNIS continue to spread within the project area, but would also continue to spread to adjacent areas as road use continues. NNIS would continue to increase in number of species and abundance and these increases would translate into an increase in the NNIS in adjacent areas of the Forest.

The action alternative would benefit the project area by reducing the abundance of NNIS. Alternative 2 includes commercial pine thinning, and site preparation, which offers the best reduction of NNIS within the project area. There should be no negative cumulative impacts on native vegetation in the

project area, when considering the above past, present, and reasonably foreseeable future actions. The effects of the action are localized and will not noticeably affect areas beyond the project area.

Soil and Water Resources

Affected Environment - Soil and Water Resources

The project area is located on a ridge in the headwaters of Ramsey Creek in the Little Lusk Creek/Lusk Creek watershed (31,801 acres). The sale area is within the Eastern Broadleaf Forest Province, the Interior Low Plateau, Shawnee Hills Section. Within the Shawnee Hills Section, the project area is located in the East Shallow Loess Land Type Association of the Lesser Shawnee Hills Subsection in the Forest Service National Hierarchical Framework of Ecological Units (Fralish et al, 2002).

Water Quality - The Illinois Environmental Protection Agency (IEPA) rates the water quality in many streams across the state. Ratings include "full support," "partial support" and "nonsupport or not assessed." "Full support" indicates water quality is presently adequate to maintain designated uses. "Partial support" indicates water quality has been impaired, but only to a minor degree. Ramsey Branch was not assessed by the IEPA in 2014. This assessment was based on land use information, location of known point pollution sources and professional judgment. The intermittent and ephemeral stream segments that drain the project area and join Ramsey Branch have not been assessed by the IEPA.

Riparian Features - The Forest Plan provides standards and guidelines for filter strips in riparian corridors that would be applied to the project. Widths are based on stream type (perennial, intermittent, ephemeral) and slope with greater slope provided a greater filter strip. Forest Plan guidelines provide a minimum 50-foot wide riparian filter strip on either side of intermittent streams with adjacent land-slopes of 10% or less (Forest Plan, Table 5.2). Ephemeral streams are provided 25-foot filter strips along each side of the stream. The guidelines would be followed in most circumstances but could require flexibility to site-specific factors. The riparian filter strips are not part of the suitable timber base; however, mechanical disturbances may occur within the filter strip if the bare limit exposure limits (10 percent of every 150 foot linear segment, Forest Plan Page 40-41) are not exceeded (USDA Forest Service, 2006).

Wetlands and Floodplains - Floodplain soils in the project area are adjacent to streams and are typically productive areas that are frequently flooded. Floodplain soils in the project area were mapped by the NRCS and more information is available in the project file (USDA NRCS, 2008). No jurisdictional wetlands are located in the project area.

Soils - The soils in the project area are primarily silt-loam textured soils. Many of these soils developed in a layer of loess, or silt-sized particles transported by wind. In some places, this loess layer is thin and the soils developed in both loess and the underlying sandstone or shale bedrock. Many of the bottomland and floodplain soils were developed in alluvial, or water-transported, material. The USDA Natural Resources Conservation Service (NRCS 2008) mapped the soils in the project area. More information about the soils in the project area and the management limitations of these soils is available in the Project Record (USDA NRCS 2008; USDA NRCS,).

The NRCS mapped many of the soil units on the shoulder slopes and side slopes in the project area as moderately eroded (USDA NRCS 2008). This means that it is evident from the soil profile that these soils have been excessively eroded under past management. These have been stable for many years, however, and are developing new topsoil horizons. The project area, which is a pine stand, was probably once an old field. Before the pines were planted, the ridges in the project area were likely in agricultural production.

Effects of the Alternatives – Soil and Water Resources

The following effects analysis assumes that the Design Criteria (Table 2) will be implemented. The Inter-disciplinary team identified the potential negative impact of soil erosion and compaction on soil productivity and water quality as a result of the harvest and thinning as a key issue for the analysis. The indicators used (tons per acre per year of soil displaces) to track changes among the alternatives relate to the amount of soil displaced and the amount of bare ground.

Key Issue: The soil erosion and compaction resulting from harvest activities will have a adverse effect on soil productivity and water quality.

- The amount of soil displaced (tons/acre/year).
- Sediment load in the watershed (project area %).
- Percentage of bare ground.

Soil erosion and compaction are the two primary effects of soil disturbance. Because soil is eroded off the surface horizon, erosion results in a loss of nutrients for forest productivity . It also results in a loss of biodiversity of thousands of species of soil organisms numbering in the millions of total organisms which are lost to the site where the erosion takes place (Pierzynski, Sims, Vance 2000). In addition, erosion also results in a loss of carbon which was sequestered in the surface horizon. The primary measure of soil erosion is expressed in tons/acre/year (t/a/y). Each soil mapping unit has a T value (or soil loss tolerance value given in tons/acre/year (NRCS 2008). Every soil mapping unit is assigned a T value and these are found in the project record. Soil erosion loss exceeding this value is considered detrimental to the productive capacity of the soil. The maximum T value for many soil mapping units is five t/a/y.

Soil compaction restricts or prohibits tree growth and water infiltration. The primary areas of compaction on this project are expected to occur on skid trails and roads. Erosion and compaction which occur within 100 feet from intermittent and perennial streams can also result in sedimentation of these streams.

Alternative 1 – Soil and Water Resources

No new management activities would take place. Therefore, no management-related changes in productivity of the land would occur. Soils would be impacted by regular maintenance and use of roads as well as planned and ongoing natural resource management activities. In the absence of wildfire, current runoff and erosion pattern would be maintained. An upland erosion rate of less than one ton per acre per year is predicted by the Forest Service Watershed 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. Actual soil organic matter may increase, with an accompanying increase in microorganisms and fungi. Since there is no harvest, no carbon would be removed from the forest. Dead and dying trees would decay, with carbon released to the atmosphere.

No ecological restoration or vegetation management would occur under this alternative although prescribed fire would continue to be implemented. There would be no direct or indirect effects on soil or water from timber harvest or associated activities. Soil quality and productivity would be increased in the long-term as organic matter decomposes and converts to the A horizon. 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 other alternatives. Implementation of this alternative is not anticipated to result in measurable changes on water quality.

Alternative 2: Proposed Action – Soil and Water Resources

Activities associated with the proposed pine thinning include the use of existing roads and the construction and use of skid trails, log landings and stream crossings. These activities have the potential to expose soil and cause soil compaction. Exposed soil has the potential to erode at a faster rate than normal geologic rates. Soil particles can be loosened and transported in overland flow. Most of the eroded soil, about 90-98 percent, is trapped in vegetation and deposited downslope, but some enters adjacent streams and can decrease water quality and the amount of quality aquatic habitat (USDA Forest Service, 2000). Loss of substantial amounts of nutrient-rich topsoil can also decrease soil site productivity, or the long-term ability of the land to grow healthy trees.

Shelterwood Harvest - The proposed pine thinning will have the potential to result in some soil erosion, soil compaction, sedimentation and bare soil areas. Shelterwood removal is assumed to have a 20-30 percent canopy cover upon completion of cutting activities. Erosion rates (FSWEPP modeling) were predicted in the Soil and Water Working Paper (Project Record). Highest erosion rates are modeled on the Wellston silt loam (18 – 30 percent) and lowest are on Grantsburg silt loams (2 – 5 percent and 5 – 10 percent slopes).

Soil erosion potential is low to medium for this stand scheduled for treatment (NRCS interpretations). Soil erosion would generally be greatest during the first year after harvest and revert back to pre-harvest levels two to three years after harvest and associated activities. Erosion levels are given in the Soil and Water Working Paper (Project Record). A 40 percent canopy cover was assumed for this treatment.

Soil compaction potential is medium to high in this stand (NRCS interpretations). Compaction occurs when ground-based equipment is used in the operation. Use of pre-designated skid roads, one pass over non-skid road areas, avoidance of wet soil conditions and piling slash ahead of ground based equipment can minimize compaction over the treatment areas.

Soil Productivity - Accelerated soil erosion can remove the productive topsoil more quickly than it develops. This can reduce the soil productivity of the site. Site productivity of the project area would be maintained by controlling erosion and compaction, using BMP and Forest Plan standards and guidelines. This alternative would maintain site productivity, but would likely result in more of the project area temporarily (less than five years) in a detrimental state (i.e., eroded, compacted, displaced) than Alternative 1.

Water Quality - Water quality in Ramsey Branch would be protected through the implementation of BMPs and Forest Plan standards and guidelines. The temporary increase in sedimentation is proportional to the acreage of timber harvested in relation to the size of the watershed. The project area is a small portion of the whole watershed. This suggests there will be slight, minor decrease in the water quality of adjacent streams if Alternative 2 is implemented. This would be a short-term effect (three years) and water quality would be maintained in the long-term.

Cumulative Effects - Cumulative watershed effects are the estimated additive changes in watershed disturbance (principally soil erosion and soil compaction), forest productivity and hazard of damage on soil from fire that might occur from the existing conditions, implementation of the proposed project, current activities within the analysis area and any foreseeable actions. Implementing Alternative 2 is expected to result in slightly more soil erosion, compaction and sedimentation of streams than Alternative 1 The anticipated short-term (less than five years) increase in soil erosion and sedimentation as a result of implementing Alternative 2 may cause a slight, temporary decrease in water quality in on-site and adjacent streams. The alternative would maintain soil productivity and water quality in the long term in the project area, although compaction effects could still persist. The effects of the project, considered with the effects of the past, present and reasonably foreseeable actions in the watershed would result in minimal, short-term (less than five years) increase in erosion and sedimentation to the streams. Once the project area returns to baseline, pre-disturbance levels of

erosion and sedimentation, the cumulative effect of all actions in the watershed could result in a minimal, long-term sediment load in the streams, which would negatively affect water quality to a negligible degree.

Global Climate Change

Global climate change was initially addressed in the Appendices to the Final Environmental Impact Statement for the Land and Resource Management Plan 2006, page 196. It was recognized that current modeling tools for accessing global climate change have a high level of uncertainty.

Climate change was identified as an issue and is considered in cumulative effects. *Carbon* is continually sequestered in the soil and in living biomass just as carbon is released into the atmosphere. Any carbon released into the atmosphere through prescribed burning has to be balanced with additional carbon sequestered in the forest through increased tree and plant growth generally observed after a prescribed fire.

An increase of greenhouse gases has been observed during the past few decades and many (including many scientists) recognize this. There is some debate on the role of trees in sequestering carbon to mitigate this increase. Gerould Wilhelm of the Conservation Research Institute out of Elmhurst, IL, in his article (The Realities of Carbon Dioxide: Seeing Through the Smog of Rhetoric and Politics and found on-line at: http://www.cdfinc.com/images/download/Realities_of_CO2_revised.pdf.) states in his summary: "Planting trees or setting forests aside cannot offset the oxidation of fossil fuels because fossil carbon represents stored carbon from another era. Such organic carbon is converted to CO2 in surplus amounts. Trees and vegetation of this era already are cycling carbon into the atmosphere at a rate and concentration to which contemporary life forms are adapted"

In the Forest Service guidance entitled, *Eastern Region Climate Change Considerations in Project Level NEPA Analysis,* the following points are made: "Because greenhouse gases mix readily into the global pool of greenhouse gases, it is not currently possible to ascertain the indirect effects of emissions from single or multiple sources (projects). Also, because the large majority of Forest Service projects are extremely small in the global atmospheric context, it is not presently possible to conduct quantitative analysis of actual climate change effects based on individual or multiple projects." In addition, "project level effects are swamped by other variables. Including how much greenhouse gases will change globally, the sensitivity of the earth system to a unit change, and how global temperature changes will lead to regional climate impacts. "(Eastern Region Forest Service, 2013)

"Carbon sequestration and cycling should be evaluated at landscape scales (i.e. beyond the project level) and over long time frames (i.e. multiple decades). Projects such as harvesting and prescribed burning may lead to short-term losses if carbon , but as long as those areas are allowed to regenerate as forests, they will be net carbon sinks within a relatively short period of time (about 6 – 10 years, depending on species type, site conditions, etc.)". In addition, "the use of forest products as biofuels or for long-lived wood products can help reduce fossil fuel emissions." (Eastern Region Forest Service, 2013)

Carbon sequestration would likely 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. Continued 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.

Terrestrial and Aquatic Animal Resources

A detailed summary of potential effects/impacts to terrestrial and aquatic animals reportedly attributed to climate change is presented in the Terrestrial and Aquatic Animals Working Paper.

In summary, in the context to global climate change, there will be no environmental effects or cumulative effects from actions at Ramsey Branch.

Fuels, Fire Risk, and Fire Regime Condition Class

The spatial boundary of analysis for fuel effects was the project boundary itself, since vegetation outside this area would not be affected by the project, and would therefore not have any cumulative effects with other projects. The spatial boundary for Fire Risk and Fire Regime Condition Class (FRCC) is the Little Lusk Creek (6th Code HUC) watershed, since FRCC is usually considered at the landscape level. The temporal boundary for cumulative impact analysis was chosen to be from the present time to 10 years in the future because this approximates the maximum time proposed for project activities to occur plus about 5 years to allow for the effects of those activities to become apparent.

Existing Condition

A variety of fuel conditions exist in the project area. Fuel loads are generally light. Needle litter is the primary carrying fuel over most of the project area. Snag density and loadings of coarse dead fuels (100-hr and 1000-hr time lag classes) are moderate in some places due to overcrowding and prescribed fire-induced overstory mortality. These large fuels comprise about 65-80% of the total downed woody fuel loading in the project area, which is estimated at about 10-15 tons/acre, or about normal for moderate-aged southern Illinois forests.

Fire hazard describes the potential for harm or damage from a wildland fire, chiefly governed by the interaction of fuels, weather, and topography within a given area. Fire risk is the potential for occurrence within a given area coupled with fire hazard in relation to the values at risk. Topography is flat to rolling and stands are variably dense, providing some shelter from the wind and shading from the sun. With the nearby roads and fuel type changes, there are several indirect containment opportunities. However, there are also large expanses of continuous fuels, including the Lusk Creek Wilderness. The hottest, driest, windiest days are most likely to produce a wildfire with losses, particularly when adjacent fields are cured. Fire occurrence was relatively high on Forest lands in the area in the past 30 years or so. Twenty-Nine fires were recorded in the 31800 acre Little Lusk Creek watershed in this timeframe for a total of 375.5 acres (USDA Forest Service 2012). A large fire (≥100 acres) occurred in the watershed in 1986, and more recently elsewhere in the county in 2004 (100 acres) and 2006 (130 acres). Given the location and amount if existing fire breaks, the proximity of fire response units, and the vegetation characteristics, large fires (>100 acres) are not common in the area and are not expected to become so. However, given the fuel continuity, relatively high fire occurrence history, and poor access to some parts of the area, fires of intermediate size (10-100 acres) would not be unsurprising.

Fire managers have developed a standardized terminology and a methodology to describe the health, resilience, and integrity of ecosystems, incorporating disturbance, succession, and other ecological concepts. This is called Fire Regime Condition Class (FRCC). It uses two factors to diagnose departure from reference conditions: 1) Vegetation Composition and Structure, and 2) Changes in fire regime (e.g. fire frequency, extent, and severity under natural conditions, which include aboriginal use of fire and other disturbances but not Euro-American influences). The degree of departure is known as Condition Class. Condition Class 1 (FRCC 1) means the landscape has vegetation, fuels, and

disturbance characteristic of the natural regime. Key ecosystem components are intact. More simply put, it is within the natural or historical range of variability. Condition Class 3 (FRCC 3) indicates a high degree of departure from the reference condition, including departure from vegetation-fuel composition and fire frequency/ severity or both. There is a high risk of losing one or more key ecosystem components. Condition Class 2 (FRCC 2) indicates a moderate degree of departure and a moderate risk of losing key ecosystem components, and is somewhere between FRCC 1 and 3 (Hann et al 2004). About 75% of the project area and 60% of the watershed is in Condition Class 3, with about 25% of the project area and watershed in Condition Class 2. The remainder of the watershed is in Agriculture, which is not classified, with a minor amount in the Urban (Developed) category.

Effects of the Alternatives – Fuels, Fire Risk, and Fire Regime Condition Class

Alternative 1

Under this alternative, no immediate change (direct effects) would be obvious to fuels properties or resulting fire behavior. That is not to say that the project area would not undergo some change (indirect effect) with this alternative. Two scenarios are possible in the intermediate future, depending on the advance of *Microstegium vimineum* (Nepalese browntop). With little or no advance in existing or new Nepalese browntop populations, litter and fine fuels would accumulate at normal rates, having already regained most of what was consumed during the 2006 prescribed fire. Soon litter loads and depth would stabilize as influx would be equal to decomposition. Eventually, though, mixed mesophytic hardwoods would gain more dominance, and the litter layer would be ever more compact and thinner. This would be less flammable, and fires would be smaller in extent and burn with reduced severity when they did occur. This would reinforce the trend toward mixed mesophytic dominance.

Nepalese browntop populations are expected to advance with or without project activities. A major advance in existing or new Nepalese browntop populations, however, would result in it becoming the dominant carrying fuel in a wildfire. The area would experience higher spread rates and longer flame lengths if it burned. The increased intensity would probably kill more midstory/overstory trees, which would add to the fuel load and open the canopy a bit more to sun and wind, which could increase fire behavior on subsequent fires. Also, the existing Nepalese browntop populations would respond with increased biomass and increased coverage of the project area.

The only foreseeable activity or event that would have an overlapping (cumulative) effect is prescribed burning. This was authorized with a Decision Memo in 2004 and reauthorized in 2009, and would continue regardless of the decision made for this project. A prescribed fire would consume much of the fine fuels (1 hour and 10 hour time lag fuels), and some of the leaf and needle litter. In past burns on the Forest this has ranged from 50 to 90%. In some isolated areas on the hottest burns the entire litter layer was consumed. Duff is rarely consumed, but this has also happened on a very small scale, such as under large piles of downed wood. Predictions using the First Order Fire Effects Model (Keane et al 2004) yield 0-6% bare soil exposed. By year 3 or 4 post-burn the project fuel beds would begin to appear similar to current levels. Prescribed burning would probably have a net-positive effect on Nepalese browntop, allowing it to spread more quickly through the project area, though perhaps not at the same level as after a wildfire.

Fire hazard would very slightly decrease in the "uninvaded" scenario described above due to the slight changes in the fuel bed in the next 10 years. In the "invaded" scenario, fire hazard would increase as described above. Values at risk and fire occurrence, though fairly high, are not expected to change much in 10 years however, so there would likely be no perceptible change in fire risk.

Fire occurrence may actually approach historic averages, if prescribed burning is maintained. Because of many decades of fire exclusion, however, vegetative composition and structure would still be quite departed from reference conditions. The shade tolerant species now present in the midstory and understory would slowly grow and shade out competing (oak) species. Some oak seedlings and

saplings, present because of previous thinning and prescribed burning efforts, would persist in the stand. This number is probably not enough to reach the target stand composition. FRCC percentages for the project area and watershed would not appreciably change.

Alternative 2

Implementing the proposed action would cause a major change in fuels characteristics, at least temporarily. In harvest operations the boles would be cut and skidded to landing areas and decked to await removal. The tops and branches, however, would be left on site. Once severed from the stem, these branches die and lose moisture, becoming much more flammable, especially when red needles are present. Loading would increase, particularly in the 1, 10, and 100 hour size classes. Where the tops and branch wood is continuous, this would best be described as a slash fuel model (SB2), and would experience longer flame lengths, faster rates of spread, and more profuse spotting if a fire should occur. Where it is discontinuous, this would still be characterized as a timber litter fuel model, but would be subject to scattered flare-ups when fire would reach the jackpots. The project is likely to allow any existing Nepalese browntop populations to expand. These may become the primary carrying fuel for a fire as described in Alternative 1 above.

The elevated fuel load and increased fire behavior potential would be temporary. Hazard fuel reduction treatments are a normal component of harvest operations. These can consist of piling and burning of fuels, crushing, masticating, or chipping, or prescribed burning over the project area (here considered a cumulative action), which would burn the fuels in place. Crushing, masticating, or chipping fuels rearranges them into smaller size classes, and usually places them lower to the ground where they have less air circulation around the fuel particles (reduced packing ratio and bulk density), and allows them to decompose faster. Fires that burn into mechanically treated fuels usually have lower flame lengths, lower area coverage, and lower emissions (Glitzenstein et al 2006), though frequently a higher ratio of the emissions come from smoldering combustion. FOFEM modeling shows no mineral soil exposed under these conditions. Pile burning reduces most woody fuels, and broadcast burning reduces primarily fine woody debris and litter. The first three slow a fire's spread and especially reduce its intensity, but the latter removes carrying fuels as well, rendering a site resistant to fire spread, until sufficient litter is built back up typically in about 3 years.

Fire hazard would dramatically increase in the project area temporarily due to the fuel changes described above. Since it is more open to the drying effects of sun and wind, and would develop a fuel bed with higher surface-area-to-volume ratio and vertical orientation, the project are would be more susceptible to ignition. If a fire did start, it would probably burn with more intensity and spread faster and farther than before. However, once slash disposal (fuel treatment) occurs the elevated fuel hazard would largely disappear. Even if slash treatments do not begin within 3 years, hazard would start to decrease as needles fall off and begin to decompose. In 5 years smaller branch wood would also start to break up and decompose (Loomis 1967). Fire occurrence, though fairly high, is not expected to change much in 10 years, and it is unlikely that an ignition would occur in the project area prior to the completion of fuels treatments. Further, since the project area occupies such a small part of the landscape, it is unlikely that a fire elsewhere in the watershed would reach the project area. Values at risk are also not expected to change. Given these considerations, there would likely be a very minor, temporary, increase in fire risk.

Implementing the proposed action would cause a noticeable improvement in fire regime condition class. Fire occurrence in the project area would approach that of historic return intervals if prescribed burning is maintained. Fire return intervals for the watershed as a whole would still be far reduced from historic levels, given the major reduction in patch size. Vegetative structure and composition would be improved as well. The harvest, site preparation, and subsequent burning would improve germination and growing conditions for oak and related plant species. Litter levels would be reduced, and the site would dry a little quicker because of that and increased light and wind, favoring the drought adapted oaks. The more open canopy would also increase light for these moderately shade-

intolerant species, a requirement for growth into the advanced regeneration pool. By providing for oak regeneration and creating a mixture of hardwood dominated age classes, the project would improve stand compositions towards desired conditions. By thinning the forest the project would improve structure closer to the oak-dominated woodlands and savannahs that was likely characteristic of the area in resettlement times. This would probably be described as Condition Class 2, or at least an improved Class 3. The landscape as a whole would still be considered Class 3, since this project affects such a small part of it, and other projects would not occur with sufficient size or frequency to improve it.

Heritage Resources

This section describes the heritage resource concerns with the project area, including: (1) Affected Environment, (2) Design Criteria developed to protect and preserve the heritage resources and (3) a discussion of the potential effects of each of the proposed alternatives.

Affected Environment - Heritage Resources

The primary heritage resource issue in this analysis is the preservation and protection of heritage resources and the assurance that significant heritage resources will not be affected by project implementation. Archaeological sites are located on and in the ground and are affected by any activity that disturbs the soil. Because all earth-disturbing activities will be confined to the project area, the area under consideration is the project area itself. Since project activities are confined to the project area and other heritage resources beyond the project boundary are protected by law, it is reasonable to limit the analysis to the project area boundary.

The project area was inventoried as part of larger timber–related projects in 1977. In addition, the project area was re-inventoried using the most current field methods to ensure that all sites located within the area were recorded. There are two archaeological sites recorded within the project area: one historic discard site associated with a house located on nearby private property, and one prehistoric isolated find consisting of a single chert flake. Neither site is considered to be eligible for inclusion on the National Register of Historic Places; recording their location exhausts their research potential (SHPO Concurrence 1977; 2013 SHPO Concurrence, IHPA Log #007121813).

Design Criteria - Heritage Resources

The design criteria developed for the analysis of the project area included methods developed decades ago with the passage of the National Historic Preservation Act of 1966 (NHPA) and its implementing regulations. According to Section 106 of the NHPA, "The agency official shall take the steps necessary to **identify historic properties within the area of potential effects.** The area of potential effect is defined as "….the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties…The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." [36CFR 800.16(d)].

Effects of the Alternatives – Heritage Resources

Alternative 1

There will be no direct, indirect or cumulative effects on heritage resources as a result of the implementation of this alternative because no hardwood restoration activities would occur and, therefore, earth-disturbing activities would not take place.

Alternative 2

There will be no direct effects on heritage resources as a result of the implementation of the action alternative. Only two archaeological sites were recoded within the project area, neither of which is

eligible for inclusion on the National Register of Historic Places, therefore, no potentially eligible sites will be affected by earth-disturbing activities associated with Alternative 2.

In general, project activities associated with hardwood restoration have the potential to indirectly affect heritage resources by opening up, via road improvements, areas of the forest in which cultural resources are located. Because additional travel ways are not being constructed during this project, it is expected that the sites located in or adjacent to the project area will not be more vulnerable to either intentional or unintentional damage and, therefore, there would be no indirect effects as a result of the implementation of any of the two alternatives included in this analysis.

The analysis of cumulative-effects takes into account all known past, present and reasonably foreseeable future actions that would be likely to affect the project area: vegetation management, recreation use, prescribed and wild-land fire and road maintenance. Because there are not expected to be adverse effects (direct or indirect) to the archaeological resources as a result of the actions proposed in any of the alternatives, there would be no resulting cumulative effects.

Socioeconomics

Because of the limited nature and extent of the project (53 acres), there would be no significant effect on the economic resources of Pope County. Implementation of Alternative 1 would have a slightly adverse effect or no effect on the regional economy in that no additional employment opportunities are foreseen, no matter how small. Implementation of either Alternative 2 would have a slightly beneficial economic effect through additional employment.

Disclosures

Clean Water Act – Silvicultural activities identified in the action alternatives comply with Section 319 of the Clean Water Act. The Illinois Non-point Source Management Program, which recommends using IDNR BMPs, was developed to comply with Section 319 of the Federal Clean Water Act (IEPA, 2001; IDNR, 2000). These practices, as well as Forest Plan Standards and Guidelines and soil suitability limitations, as determined by the USDA NRCS, will be used to guide the action alternatives (Project Record).

Air Quality – The air quality of the Forest meets EPA standards (USDA Forest Service 2003 Annual Monitoring Report, 2004). Implementation of any of the alternatives would result in a few thousand hours of heavy equipment use over the next 1-2 years. The amount of exhaust generated from the level of activity expected in any of the alternatives would not have a measurable effect on air quality in the Forest. There would be a short-term, adverse effect on air quality in the project area and in the watershed during periods of prescribed burning. This could result in negligible, direct and indirect effects in the long term, and an insignificant contribution to the cumulative air quality of the Forest and region.

Prime Farmland, Timberland, and Rangeland – Some prime farmland occurs in the project area. These areas are mainly on the silt-loam textured soils located on the ridge with less than 5-percent slope, and the narrow floodplain soils with less than 4-percent slope. Most of the soils in the project area are classified as prime timberland soils. There is no prime rangeland on the Forest (USDA NRCS, 1988). Site productivity would be maintained in the project area under all alternatives.

Floodplains and Wetlands – Floodplain site productivity and riparian function would be maintained in the project area under all alternatives. None of the alternatives will have an adverse

effect on the site productivity or function of the sites in the Lusk Creek watershed near the project area identified as having one or more wetland characteristics.

Adverse Consequences That Cannot Be Avoided – Slight, temporarily accelerated rates of soil erosion would occur in Alternatives 2 even though IDNR forestry BMP's guidelines, Forest Plan standards and guidelines and soil suitability limitations identified by the NRCS would be used to guide activities. There could be temporary, minor increases in turbidity in adjacent streams after storms, resulting from runoff. Temporary, minor soil compaction would occur as result of mechanized harvest and skidding equipment**.**

Irreversible or Irretrievable Commitment of Resources – None of the alternatives would have an irreversible or irretrievable commitment of resources in the project area or adjacent area if design criteria are followed.

Irreversible Effects – There are no known irreversible effects on soil and water resources from any alternative.

Irretrievable Effects – Soil erosion above natural rates is an irretrievable effect. Alternatives 2 would result in a temporary, slight increase in erosion rates above natural geologic rates, returning to pre-implementation levels in 2-3 years.

Environmental Justice – Because of the limited nature and extent of the project (53 acres), none of the alternatives would have disproportionate, direct or indirect adverse effects on any minority populations and individuals living below the poverty level

Consultation and Coordination

See project record for listing of agencies and persons contacted.

Interdisciplinary Team Members			
Name	**Contribution**	**Degree**	**Experience (Years)**
Tom Neal	Vegetation	B.S. Forestry	30
John DePuy	Soils	M.S. Forest Ecology	36
Mary McCorvie	Heritage	B.A. Anthropology	32
Elizabeth Shimp	Botany	M.S. Botany	28
Rod McClanahan	Wildlife/Aquatics	M.S. Wildlife/Forestry	37
Matthew Lechner	NEPA	M.S. Fisheries Science	25
Scott Crist	Fuels and Fire	B.S. Geography	15