USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Houston South Vegetation Management and Restoration Project

Draft Supplemental Environmental Assessment

Brownstown Ranger District, Hoosier National Forest

Jackson and Lawrence Counties **October 2023**

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Introduction

This Supplemental Environmental Assessment (Supplemental EA) was prepared to evaluate new information that was brought forward since the original decision was issued on the Houston South Vegetation Management and Restoration Project in 2020, and to provide further analysis on the potential impacts to Monroe Lake. The Houston South Final Environmental Assessment of 2019 (and all references and specialist reports incorporated into it), which this document supplements, remains valid and the information contained within it will be considered in making a decision on the actions proposed.

Background

The U.S. Forest Service proposes to treat vegetation and conduct related management activities to improve forest health and sustainability of the oak-hickory ecosystems while also improving fish and wildlife habitat. The Houston South Vegetation Management and Restoration project would move the Forest toward its desired future condition as identified in the 2006 Hoosier National Forest Land and Resource Management Plan (Forest Plan). These actions are proposed to be implemented on the Brownstown Ranger District of the Hoosier National Forest.

The 2006 Forest Plan (USDA FS 2006a), with the accompanying Final Environmental Impact Statement (FEIS) and Record of Decision (USDA FS 2006b and USDA FS 2006c), as well as all subject matter expert professional reports are hereby incorporated into this Supplemental EA.

Project Location

The majority of the project area is in the northwest corner of Jackson County on the Brownstown Ranger District of the Hoosier National Forest (Figure 1). A small portion overlaps into the northeast corner of Lawrence County. No activities are proposed in Monroe County. All proposed harvests would occur on National Forest System (NFS) lands. Prescribed fire could be applied on adjoining U.S. Army Corps of Engineers land and privately owned lands if the landowners express interest and are willing to enter into an agreement. Proposed improvements at road-stream crossings to facilitate aquatic organism passage would be implemented on county roads and possibly near private land on the downstream side of one crossing with prior approval.

The legal descriptions for the project area include:

- T7N, R2E, all or portions of Sections 14-16, 21-28 and 33-36
- T7N, R3E, all or portions of Sections 22-23, 26-30, and 31-36
- T6N, R3W, all or portions of Sections 2-6, 7-11, and 14-18
- T6N, R2E, all or portions of Sections 1-4, 10-12, and 13

For specific locations of proposed actions, please refer to the maps on our website at: https://www.fs.usda.gov/project/?project=64831.

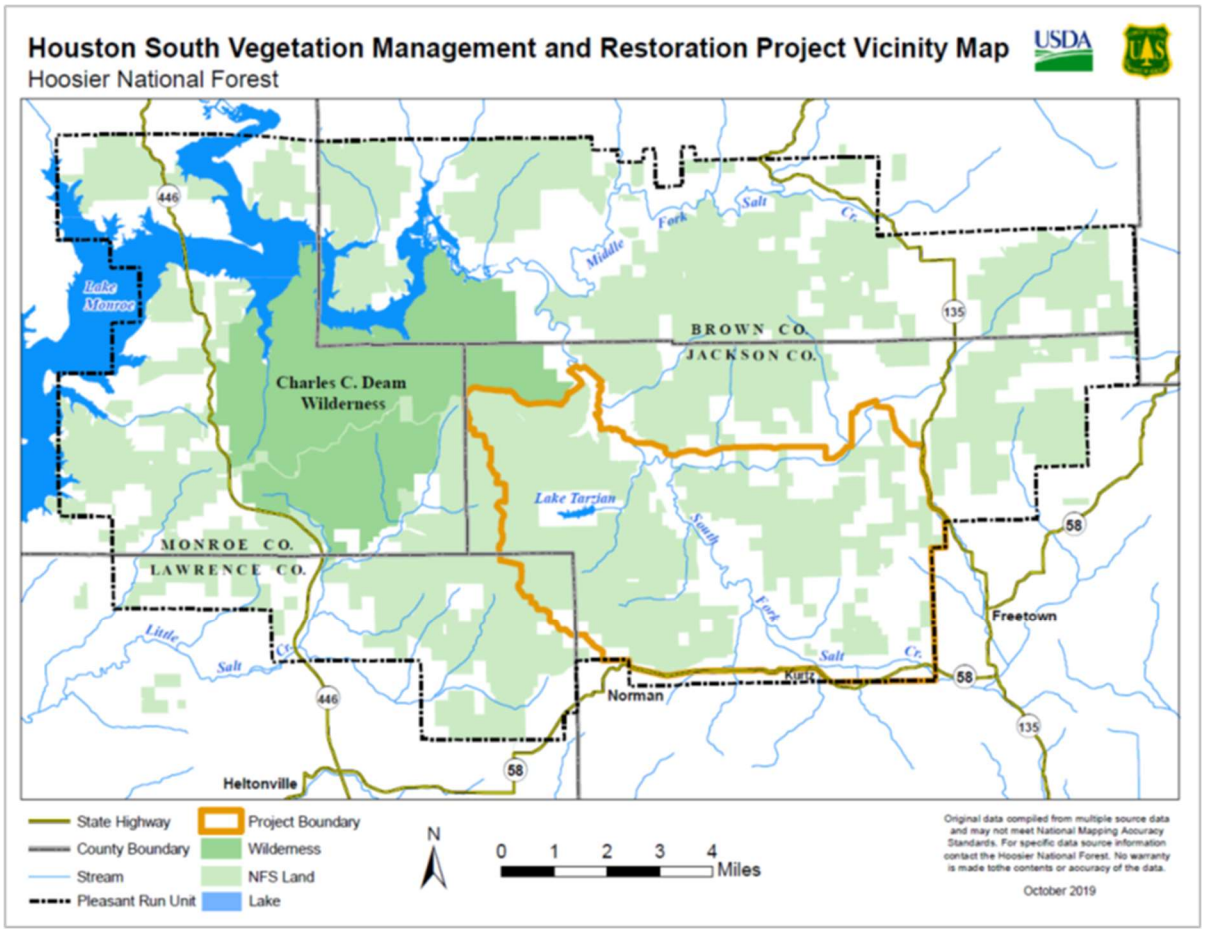

Figure 1. Vicinity map. Note that project management actions are not proposed for all the areas within the project boundary. For detailed maps of project activities within this area see: https://www.fs.usda.gov/project/?project=64831.

Need for the Proposal

The Houston South Vegetation Management and Restoration Project (Houston South Project) proposed action is based on and would fulfill Forest Plan direction associated with the goal of maintaining and restoring sustainable ecosystems. The need for the project is determined by comparing the current conditions to the desired conditions in the Forest Plan, and proposing activities that would move the area toward a more sustainable ecosystem.

Current Conditions

The project area is currently dominated by mature forest. Stand data in the proposed silvicultural treatment area shows no stands in the 0 to 9-year age class, therefore the desired amount of early successional forest habitat described in the Forest Plan (4-12 percent) is not being met. Many stands are dominated by mixed-oak and oak-hickory canopies, but competitive oak regeneration does not exist across a majority of the project area. Understories and mid-stories in these stands typically consist of shade-tolerant

species such as American beech and sugar maple, leaving very few areas where oak or hickory species can compete to be a part of a future stand. This trend is typical in contemporary forests where fire and management activities have been excluded for multiple decades.

A lack of fire is causing oak-hickory seedlings to be suppressed by a shade-tolerant mid-story. Reintroducing fire would promote regeneration and maintenance of mast producing oak and hickory in suitable areas.

The Forest Plan tells us "Without ecological restoration in the form of silvicultural treatments, oak systems will continue to decline (in terms of species richness and ecological function), converting from oak to mesophytic forests within a generation. Native wildlife species dependent on trees producing large-seeded acorns and nuts may be imperiled. To maintain the oak component, silvicultural systems need to be matched to the site characteristics combining harvest systems with regeneration treatments such as prescribed burning" (USDA FS 2006a).

Pines were planted in the 1940's to the 1970's to aid in erosion control on sites that had been cleared of their native trees. White pine and shortleaf pine were in surplus at many nurseries in the region. Planting them on abandoned agricultural ground was the best way to quickly prevent erosion which was occurring at an accelerated rate. Pines are not native to the Hoosier National Forest. As the nonnative pine stands mature, the canopy grows closer together and reduces the amount of sunlight reaching the forest floor. The ground beneath the stands, in many places, has little (if any) other plants growing to provide cover or food sources for wildlife. These pines are not better at controlling erosion than native species but were planted because they are able to grow quickly on degraded sites and were widely available as seedlings during the reforestation era.

There are 479 acres of pine in the proposed silvicultural treatment area that is not native to the Hoosier National Forest. Pine plantations provide less suitable habitat and less biodiversity than native forests for birds, insects, herpetofauna, and a range of mammals including bats (USDA FS 2006b).

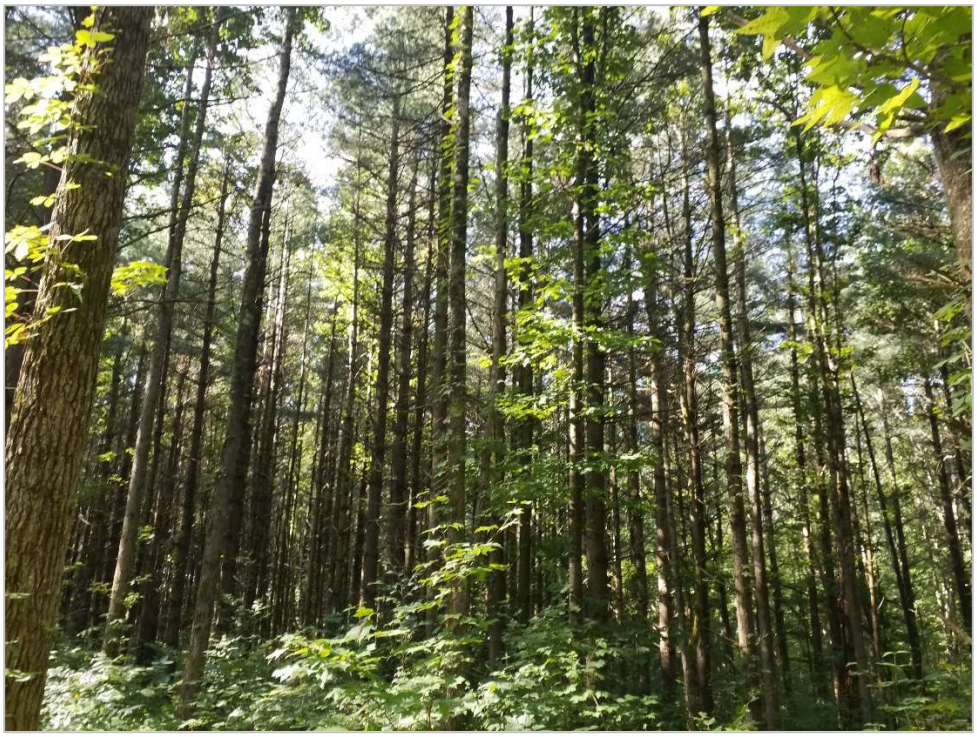

Figure 2: Overstocked non-native pine in the project area

Both the Houston South Restoration Project and the Hoosier National Forest fall within the Central Hardwood Region (CHR) as described by Johnson et al. (2009). The project area is typical of the CHR in both forest type and age class with the exception of the non-native pine plantations. Existing conditions for the project area are listed in Table 1.

Much of the project area is characterized by mature hardwood stands. Stands over 80 years old are typical, covering 60 percent of NFS lands in the project area (Figure 3). Many of these stands consist of mature chestnut oak, white oak, and black oak as dominant canopy components. Oak trees in the project area are considered over mature when they are at an age where they have reduced productivity and begin to naturally senesce and become more susceptible to mortality from pests and pathogens.

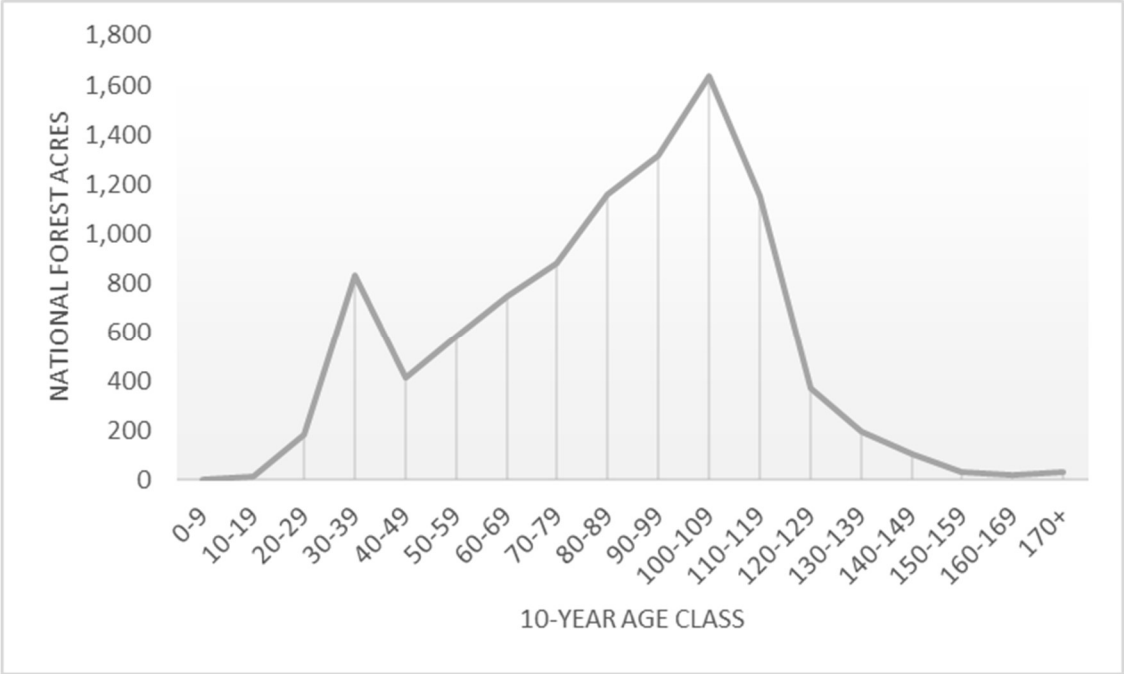

Figure 3: Hardwood age classes in Management Area 2.8 of the Houston South Project (August 2023)

Table 1: Summary of forest type by age class on NFS land (acres) in the Project Area, Management Area 2.8 (2023)

AGE CLASS	FOREST TYPE							
	Elm-Ash-Sycamore	Maple-Beech	Mixed Pine	Oak-Hickory	Oak-Pine	Shortleaf-Virginia Pine	White Pine	Grand Total
0-9	-	-	-	-	-	-	-	0
10-19	-	-	-	16	-	-	8	24
20-29	39	109	-	32	-	-	-	180
30-39	69	426	-	334	-	3	5	836
40-49	66	82	-	228	36	7	61	480
50-59	12	272	5	279	14	103	103	789
60-69	21	219	-	439	66	30	66	840
70-79	-	431	-	407	42	4	30	914
80-89	-	223	-	923	13	-	-	1,159
90-99	-	195	-	1,111	9	-	-	1,315
100-109	-	122	-	1,511	-	-	-	1,633
110-119	-	55	-	1,094	-	-	-	1,149
120-129	-	146	-	226	-	-	-	373
130-139	-	-	-	193	-	-	-	193
140+	-	-	-	184	-	-	-	184
Grand Total	**207**	**2,280**	**5**	**6,978**	**180**	**148**	**272**	**10,071**

For several millennia, oaks have been the predominant species on upland sites throughout much of the Central Hardwood Region (Abrams 2005). According to contemporary estimates, oak forest types comprise 51percent of all forest lands in the east (Spetich et al. 2002), with the upland oak-hickory forest type covering over 100 million acres in the region (Sander et al. 1983). The oak-hickory forest type currently dominates canopies in the Houston South Project area, covering 69 percent of all forested NFS land within the project boundary. Despite their widespread canopy dominance, the inability of oak reproduction to compete with large shade-tolerant advance reproduction and aggressive pioneer species has created concern about the sustainability of oak ecosystems (Lorimer 1993; Dey 2002; Brose et al. 2012).

Desired Conditions and Management Direction

The predominant Management Area (MA) in the Houston South Project is MA 2.8, which encompasses 18,956 acres (both NFS and non-NFS lands) or 81 percent of the project area (Appendix C). The desired conditions include maintaining 4 to 12 percent of the area in young forest habitat and a diversity of age class and forest structure. The Forest Plan states, “The Forest manages the area primarily for plant and animal habitat diversity, and timber harvest is an appropriate tool for use in this area” (USDA FS 2006a). Portions of MAs 2.4, and 6.4 are included for prescribed burning, recognizing linkages between natural communities regardless of Management Areas and allowing the advantages of natural features as boundaries.

The diversity of age class and forest structure shows the forest in the project area is aging, with nearly 77 percent of NFS forest stands over the age of 60 years and a lack of early successional (0-9 years) forest habitat (Table 1). The actions proposed promote additional early successional habitat, which is currently lacking, while the majority of the forest continues to age.

Management direction includes removal of the non-native pine to restore stands to native hardwood species (USDA 2006). The best method to achieve this goal is total removal of the pine via harvest, which allows us to grow new, healthy hardwood seedlings. These treatments also allow an opportunity to create early successional forest habitat that is rare on the contemporary landscape.

Purpose for Action

The purpose for this project is to meet Forest Plan direction to promote tree growth, reduce insect and disease levels and move the landscape toward desired conditions. It is also to increase the resiliency and structure of forested areas (stands) by restoring the composition, structure, pattern, and ecological processes necessary to make these ecosystems sustainable.

Need for Action

Within the project area, there is a need to provide a mosaic of forest conditions dominated by hardwoods and restore dry hardwood forest ecosystems that have not experienced periodic disturbance similar to fire or other naturally occurring events.

As maturing oaks and hickories age and die, they are being replaced by trees such as maple and beech. The hard-mast and insects provided by oak-hickory species provides crucial food sources for a wide array of wildlife. Without management to limit competition, oak-hickory regeneration will continue to decline and allow demographic shifts to more mesophytic forested stands in the project area.

There is a need to reduce the amount of pine in the project area to provide more suitable habitat to a wider array of wildlife species.

The Forest Plan states the desired condition of this area is to maintain 4 to 12 percent of the area in young forest habitat. By removing some areas of the pine plantations, the amount of forested habitat that is between 0 and 9 years of age would increase. This creates important early successional habitat for a wide variety of songbirds, as well as ruffed grouse and American woodcock, both of which are Regional Forester Sensitive Species. To provide for diversity in wildlife species, a range of habitats should occur across the landscape. Many wildlife species do not find browsing and other foraging habitat in mature and maturing forests. Instead, they find the fruits, seeds, insects, and other food items they seek mostly in early successional habitat.

Figure 4: Regenerating young forest, 3 years post-harvest

Figure 4 is an image of early successional forest habitat created as part of the Uniontown South Project on the Tell City Ranger District.

Within the project area, there is a need to reduce the density of the trees, thereby improving forest health. Promoting healthy forest conditions and improving stand structure within the project area would improve the overall health of vegetation, creating an ecosystem more resilient to the effects of insects, disease, and climate change.

There is also a need to repair poorly maintained roads and eroded areas to reduce sediment deposition into streams and lakes in the project area. Some roads and trails need to be better located to reduce sedimentation and increase viability of aquatic organisms. Additionally, there is a need to improve stream flow for aquatic organism passages in the project area.

On December 4, 2014, the Forest Leadership Team decided, with input from specialists from different resource areas, that the Houston South area would be the next area to focus management activities to further support the implementation of the Forest Plan and to improve forest health. The Forest Plan, with extensive input from the public, designated this area as management area 2.8. The desired condition of this management area is a diversity of plant and animal habitat. Active forest management is an appropriate tool in this area. Since the 2006 Forest Plan was implemented, active forest management including timber harvest and other vegetation management activities has focused on the southern end of the forest over the course of four different project areas, two of which were in management area 2.8. The Forest Leadership team decided it was appropriate for the next active forest management proposal to be in the Houston South area.

Public Involvement and Tribal Consultation

On September 6, 2018, Hoosier National Forest staff presented and discussed the early stages of the Houston South Vegetation Management and Restoration Project proposal at a public meeting in Bedford Indiana. Forest Supervisor Michael Chaveas delivered a presentation that included the proposal and took questions at a public meeting at the Monroe County Public Library on October 25, 2018.

On November 26, 2018, the scoping letter (USDA FS 2018a) was posted on our website, 218 hardcopy letters were mailed, and 84 emails were sent containing the scoping letter. Press releases were sent to multiple newspapers and published, announcing the proposed project. Questions and comments were received from 93 respondents. All comment letters are in the project record at the Hoosier National Forest Supervisor's Office in Bedford, Indiana.

The Forest also published project information in the Schedule of Proposed Actions (SOPA), which lists project and contact information. The Hoosier's SOPA can be found at http://www.fs.fed.us/sopa/forest-level.php?110912.

The project was first introduced to tribal partners in a conference call presentation on October 19, 2015. The project was then presented formally in a consultation letter to the State Historic Preservation Officer on November 4, 2015, requesting concurrence on the findings of the first archaeological report of investigations for the project. On November 16, 2018, invitations to consult on the project were sent to the six federally recognized tribes that consider southern Indiana their ancestral homelands. These included the Absentee Shawnee Tribe of Indians of Oklahoma, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Miami Tribe of Oklahoma, Peoria Tribe of Indians of

Oklahoma, and the Shawnee Tribe. The Absentee Shawnee Tribe of Oklahoma, Miami Tribe of Oklahoma, and Shawnee Tribe all sent formal responses which expressed no objections to the project, while each requested notification in the event human remains or other cultural or archeological resources are discovered during implementation.

On July 24, 2019, a draft EA was sent to all individuals who showed interest on the project during the initial scoping period and the draft EA was posted to the project website. The official 30-day comment period began on July 27, 2019 when the *Hoosier Times* published the legal notice. Following this, the Hoosier National Forest held two public outreach events centered around the proposed project; one on August 5, 2019 at Brownstown Central High School in Brownstown, Indiana and one on August 7, 2019 at the Monroe County Public Library in Bloomington, Indiana.

The Forest Supervisor also attended multiple Monroe County Commissioners meetings (Dec. 2018 – during the scoping period, May 2019, and Aug. 2019), as well as Jackson County Commission meetings offering updates on the process and inviting any questions.

A total of 90 comments were received during the 30-day official comment period, all of which were addressed in the draft EA. After reviewing these comments, some changes were made to alleviate concerns and clarify proposed actions. Examples include harvest methods in the proposed action were further defined, amount of trail that could be affected by silvicultural treatments was further explained, additional information on soil types and soil ratings in relation to erosion risks and mitigation, and additional design measures were added to Appendix A.

The project was subject to the pre-decisional administrative review process (36 CFR 218) and a final EA and draft Decision Notice/Finding of No Significant Impact (DN/FONSI) were released on November 5, 2019. Eleven objections were received, and after administrative review and response by the Reviewing Office, the District Ranger signed the final DN/FONSI on February 14, 2020.

Legal Challenge and Court Decision

On May 13, 2020, a Plaintiff group including the Monroe County Board of Commissioners, Monroe County Environmental Commission, Dr. Paul David Simcox, Indiana Forest Alliance, and Hoosier Environmental Council filed a complaint against the U.S. Forest Service in the United States District Court, Southern District of Indiana. The Plaintiffs claimed that the Project violated the National Environmental Policy Act – NEPA, the National Forest Management Act – NFMA, and the Administrative Procedures Act – APA. Additionally, the Plaintiffs amended their complaint on August 21, 2020, stating that the project's impact to the federally listed Indiana bat and the northern long-eared bat would violate the Endangered Species Act (ESA).

On March 30, 2022, the United States District Court, Southern District of Indiana, New Albany Division ruled in favor of the U.S. Forest Service regarding violations to the NFMA, APA, and ESA. However, the District Court ruled in favor of the Plaintiffs

stating that the U.S. Forest Service violated the NEPA by "failing to fully evaluate the environmental effects to Lake Monroe."

Following this decision, the U.S. Forest Service has engaged in additional analysis to determine what impact, if any, this project would have to Lake Monroe. The results of this analysis are included in this Supplemental Environmental Assessment.

Proposed Action and Alternatives

Proposed Action

The Forest Service proposes to conduct approximately 1,104 acres of even-aged management, 2,405 acres of thinning in both pine stands and hardwoods, and 462 acres of selection harvest in hardwood stands. Approximately 234 acres are proposed for midstory removal treatments. Midstory removal treatments remove trees in the mid-story without breaking the canopy. This produces light conditions below the canopy that allows oak seedlings to develop without increasing the competition from shade-intolerant species. Approximately 170 acres are proposed for crop tree release, which is a treatment designed to free young trees from competing vegetation. Maps can be viewed at our website at https://www.fs.usda.gov/project/?project=64831 for specific locations of proposed actions.

Table 2 lists the proposed activities and their associated acreages. These figures are approximate and represent the maximum areas that would be treated.

Table 2: Proposed activities in the project area

Proposed Activity	~ Unit of Measure
Clearcut (Pine)	401 acres
Shelterwood	703 acres
Thinning (Pine)	78 acres
Thinning (Hardwood)	2,327 acres
Selection	462 acres
Midstory Removal	234 acres
Crop Tree Release	170 acres
Total silvicultural treatments	**4,375 acres**
Herbicide Spot Treatment	1,970 acres (allowed within)
Prescribed Fire	13,500 acres
New Road Construction	3.2 miles
Temporary Road Construction	8.3 miles
Road Reconstruction	4.9 miles
Road Decommission	2.7 miles
Aquatic Organism Passages	3 structures

Clearcut – 401 acres
Clearcut harvests are regeneration cutting methods in even-aged forest stand management. This treatment is assigned to non-native pine plantations. Per the Forest Plan, clearcut harvests are used when they are the optimum harvest method to achieve stated management objectives such as conversion of non-native pine to native hardwoods and providing habitat for early successional forest species. For this treatment, with the exception of trees that are left to benefit wildlife, all trees in an area would be harvested at one time.

Shelterwood - 703 acres
Shelterwood harvests are regeneration cutting methods in even-aged management. Shelterwood harvests are defined as the cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated microenvironment (Helms 1998). The goal of the shelterwood system in this project is to establish and foster advance oak and hickory seedlings to ensure oak ecosystems are perpetuated on the landscape following the final overstory removal. Shelterwood systems can be completed in either two or three stages.

Hardwood and Pine Thinning - 2,327 and 78 acres, respectively
This treatment is assigned to overstocked hardwood and pine stands. Thinning is considered an intermediate treatment aimed at reducing stand densities to improve growth, enhance forest health, and recover potential mortality (Helms 1998). Thinning is considered an appropriate treatment for stands without adequate regeneration in place prior to harvest. In general, thinning prescriptions would reduce stand densities by approximately one-third.

Selection (Group and Single-tree) - 462 acres
Selection harvests are a form of uneven-aged management. Single-tree selection seeks to remove individual trees from all size classes more or less uniformly throughout the stand. The objective of this treatment is to promote growth of the remaining trees and provide space for regeneration (Helms 1998). It also promotes age class diversity by removing large, senescing trees to create individual tree gaps capable of recruiting younger midstory trees to the upper canopy. This technique often favors shade-tolerant trees and is prescribed on mesic sites. Approximately one-third of the density would be removed from the stand.

Group Selection is a system in which trees are removed and new age classes are established in small groups (Helms 1998). Individual groups may not be larger than 3 acres (USDA FS 2006a). Single-tree selection would be implemented between group selection harvest areas. Groups are determined at the time of sale layout by evaluating ground and other site-specific conditions.

Midstory Removal - 234 Acres
Midstory removal is assigned to stands where oak-hickory species dominate canopies but little to no oak-hickory regeneration is apparent. This treatment involves, with the

exception of trees left for wildlife, removal of all midstory stems to enhance light conditions below the upper canopy. This is not a commercial treatment.

Crop Tree Release - 170 Acres
Crop tree release is a widely applicable technique used to enhance the performance of individual trees (Miller et al. 2007). It is an intermediate silvicultural treatment intended to provide increased growing space to selected trees through the removal of crown competition from adjacent trees. This is not a commercial treatment.

Selective herbicide applications are proposed for site preparation and stand improvement activities on 1,970 acres. Herbicide would be applied specifically to the trunks and stumps of targeted woody vegetation resulting in a relatively small area of application with little to no herbicide contacting the soil.

Prescribed fire is proposed to create habitat conditions that are conducive to oak and hickory regeneration and reduce fuels created through timber harvest. Depending on adjacent landowner participation, approximately 9,700 to 13,500 acres of prescribed burning is proposed. Prescribed burning would only take place on private land with the approval of the landowner through a formal agreement and after all appropriate surveys have been completed.

Not all available acreage would be burned during any given year. The burn acreage would be split up into smaller units in areas with or without timber harvest across the project area. Annual acres burned for this project would average approximately 1,500 acres. These treatments would be repeated periodically to reach and then maintain the desired condition. Burning under a suitable prescription would return the vegetation to a vigorous condition that would benefit wildlife and promote oak and hickory regeneration.

The boundaries for these treatments would largely take advantage of topography and other natural or man-made features such as roads and trails. Fire lines that are necessary to control fire on the landscape would be constructed using non-soil disturbing tools such as leaf blowers and chainsaws. These tools allow crews to remove fuels from the forest floor and above, reducing the chances that a fire would be carried outside of the desired burn location. While creation of fire lines in this manner changes habitat in the short-term, they tend to return to their previous state more quickly than when constructing fire lines down to bare mineral soil.

To access the areas proposed for treatment, approximately 3.2 miles of new road construction would be added to the current road system along with 8.3 miles of temporary road, for a total of 11.5 miles of road construction, as well as road reconstruction on approximately 4.9 miles of existing routes. All standards and guidelines prescribed in the Forest Plan related to this type of work would be followed. Proposed lengths of roads are estimates.

When practical, existing roads would be rehabilitated to reduce erosion, correct drainage problems, and reduce illegal access from all-terrain vehicles. Approximately 2.7 miles of roads that are no longer needed would be removed from the system through

decommissioning, leaving a net of 0.5 miles of road added to the road system. Installation of vernal pools at some decommissioned road sites could occur to prevent illegal off-road vehicles use while benefiting wildlife.

There is an opportunity to replace two undersized culverts and one undersized concrete structure with appropriately sized structures that would better allow for aquatic organism passage (AOP) and allow natural material transfer that is currently stored unnaturally upstream. Removal and replacement of these crossings is needed because the structures do not allow for upstream passage of native fish species or other aquatic organisms. Proper sized crossings also restore a more natural flow regime with less impedance. Natural flow regimes promote less excessive bank erosion and help mitigate channel incision.

If implemented, the AOPs would be constructed on Tower Ridge Road at Combs Branch, County Road 825 North at Callahan Branch, and County Road 980 West at a tributary to Tipton Creek. The AOPs are proposed to help improve approximately 14 miles of upstream habitat. The three proposed AOPs are located within the South Fork Salt Creek Watershed, a watershed that ultimately drains into the Monroe Lake Reservoir which is located approximately 5.1 miles downstream of the Houston South Project boundary.

The project proposes to use sections of trails during the timber harvests, potentially affecting portions of Hickory Ridge Trail system and the Fork Ridge Trail. During project implementation, we would close certain sections of these trails for safety. We would stage project implementation appropriately to minimize impacts on trail users.

There are known cultural resources in the project area. To avoid inadvertent disturbance of these areas, 20 to 30-meter buffer zones would be established to protect potentially significant cultural resource sites. Any cultural resource sites that require protection from fire would require both indirect and direct methods of protection. Examples include placing protective fire shelters over vulnerable features or using leaf blowers to reduce fuels adjacent to protected resources.

It is expected that project implementation would begin in 2024 and would take place in stages over time, taking at least 10-15 years to complete. The work would be completed using contracts as well as Forest Service employees.

Design Measures included in the Proposed Actions

As part of project development, the ID team developed design measures (or implementation requirements). Appendix A contains design measures that would be required if the decision maker decides to implement the action alternative. The Environmental Effects section describes the effects of implementing the alternatives with design measures included.

No Action Alternative

The No Action Alternative is the continuation of the current level of management and use. There would be no project-related treatment with this alternative. Under the No

Action Alternative, the existing conditions would continue. The No Action Alternative provides a baseline to compare the environmental effects of the action alternative.

Supplemental Environmental Analysis: Monroe Lake and New Information

This supplemental EA is being prepared in response to the court ruling to describe potential effects to Monroe Lake, and to consider new information that has arisen since the original EA was completed, in order to provide the responsible official sufficient information to determine whether a Finding of No Significant Impact may be issued or whether an environmental impact statement may be warranted.

Monroe Lake

In March 2022, the United States District Court ruled that the Forest Service violated the National Environmental Policy Act (NEPA) in its final EA decision by "failing to fully evaluate the environmental effects to Lake Monroe." Therefore, additional information has been compiled in this Supplemental EA for the Houston South Vegetation Management and Restoration Project in response to the Court's ruling and request for additional information, analysis, and context. Effects to Monroe Lake are discussed further on pages 37-51.

Federally Threatened Species

Changes regarding federally threatened species have been made since the final EA was submitted in 2019. Effective March 31, 2023, the U.S. Fish and Wildlife Service (USFWS) uplisted the northern long-eared bat from federally threatened to federally endangered under the Endangered Species Act (ESA). The little brown bat is scheduled for a discretionary status review by the USFWS whose results "may be to propose listing, make a species a candidate for listing, provide notice of a not warranted candidate assessment, or other action as appropriate" (USFWS 2022a). After a review of the best available scientific and commercial information, USFWS found that listing tricolored bat is warranted and have proposed to list it as an endangered species (USFWS 2022b). Federally listed species are discussed further on pages 51-53.

Secretary's Memorandum on Climate Resilience and Carbon Stewardship of America's National Forests and Grasslands (Secretary's Memorandum 1077-004)

Two actions regarding climate resilience and carbon stewardship have occurred since the submission of the final EA in 2019. On June 23, 2022, a memorandum by Agriculture Secretary Vilsack (USDA 2022) directed the Forest Service to inventory and protect mature and old-growth forests to aid in climate resilience and carbon stewardship. In a

press release on April 20, 2023, the USDA stated, "the U.S. Department of Agriculture (USDA) and Department of the Interior (DOI) announced actions to foster forest conservation, enhance forest resilience to climate change, and inform policymaking on ensuring healthy forest on federally managed lands administered by the USDA Forest Service and the Bureau of Land Management (BLM)" (USDA 2023).

Part of this action was the development of the Mature and Old-Growth Forests: Definition, Identification, and Initial Inventory on Lands Managed by the Forest Service and BLM (Mature and Old Growth Report). The report (USDA FS 2023) provided a definition of mature and old-growth forests, established an inventory of these forests which included over 100 million acres of forest land managed by the U.S. Forest Service and BLM across the country, and showcased the distribution of these forests.

The Mature and Old Growth report also provides guidance on how this information can direct current and future management at the National Forest level. While the report does not alter existing Land Management Plans it provides the framework for an adaptive management process with the most recent science, local partnerships, and social science which will improve the U.S. Forest Service and BLM's knowledge regarding mature and old-growth forests (USDA FS 2023, page 23).

Although much of the project area is characterized by mature hardwood stands in silvicultural terms, it is not considered old growth forest. Rather, the entire project area is defined as low mature/low old growth (Forest Service Climate Risk Viewer (arcgis.com)).

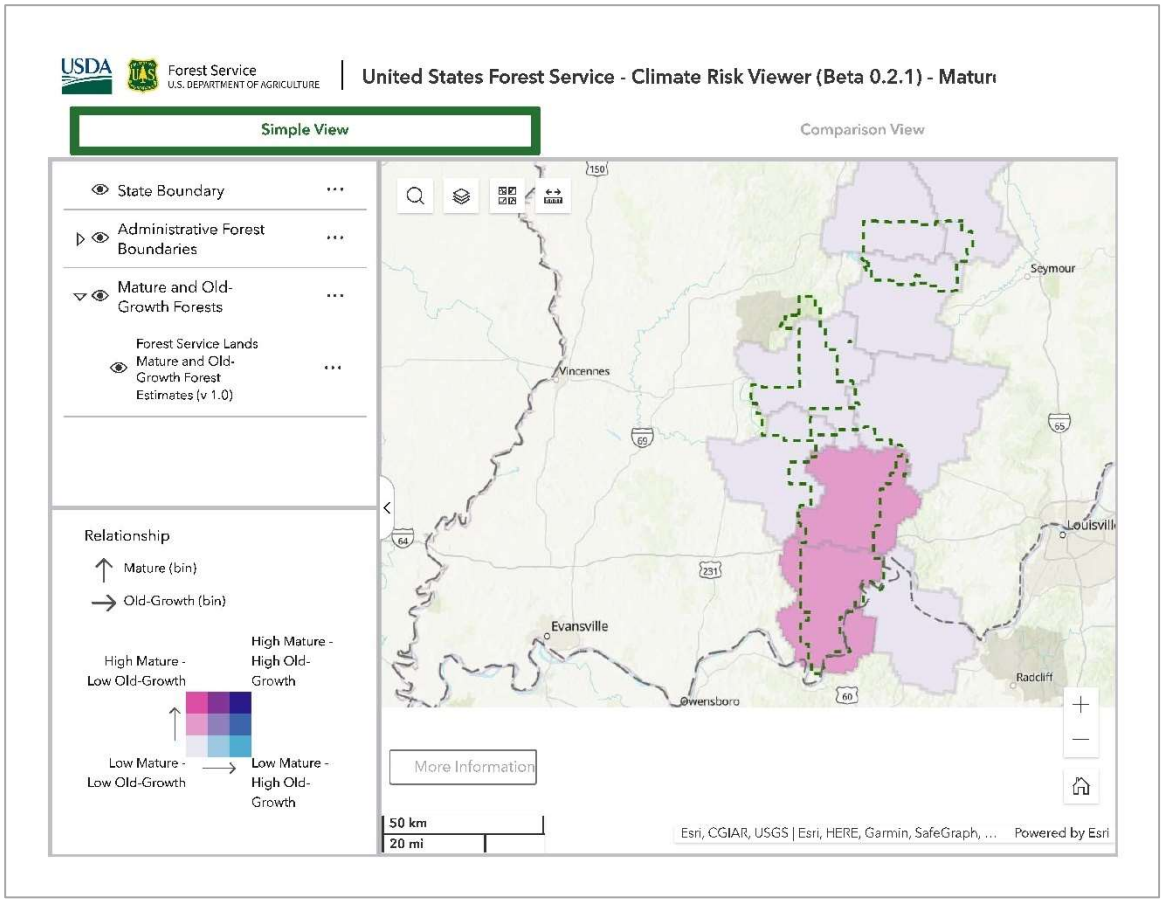

Figure 5: United States Forest Service - Climate Risk Viewer - Mature and Old-Growth

Mature forests are represented by white, light pink, and pink colors; old-growth forests are represented by white, light blue, and blue colors. The matrix created by these colors allows users to see areas of dominant mature forests, old-growth forests, and both types in the map (Forest Service Climate Risk Viewer).

Forests in the project area do not meet Old Growth characteristics as defined in the Mature and Old Growth Report (USDA FS 2023).

2022 National Prescribed Fire Program Review

As a result of a wildfire incident that occurred in New Mexico in 2022, Randy Moore, Forest Service Chief, ceased all Forest Service prescribed burning for 90 days to conduct the National Prescribed Fire Program Review on May 20, 2022. All Forest Service units were mandated to review the report generated from the National Prescribed Fire Program Review before any prescribed fire activities could resume on National Forest System land. The review included seven action items which are mandatory for a prescribed burn (see below). The Hoosier National Forest fire management staff have altered their process to follow each of the below guidelines, which included making noticeable changes to the burn plan template used for planning prescribed fire activities.

1. The Chief will designate a specific Forest Service point of contact at the national level to oversee and report on the implementation of these recommendations and on the progress made in carrying out other recommendations and considerations raised in this review report.

2. After the pause has been lifted, units will not resume their prescribed burning programs until forest supervisors go over the findings and recommendations in the review report with all employees involved in prescribed fire activities. Forest supervisors will certify that this has been done.[1]

3. Nationwide, approving agency administrators will be present on the unit for all high-complexity burns; unit line officers (or a line officer from another unit familiar with the burn unit) will be on unit for 30-40% of moderate complexity burns.

4. Prior to implementing a prescribed fire, each Forest Service unit will review all prescribed fire plans and associated complexity analyses to ensure they reflect current conditions. Prescribed fire plans will be implemented only after receiving an updated approval by a technical reviewer and being certified by the appropriate agency administrator that they accurately reflect current conditions.

5. Ignition authorization briefings will be standardized to ensure consistent communication and collective mutual understanding on key points.

6. Instead of providing a window of authorized time for a planned prescribed fire, agency administrators will authorize ignitions only for the Operational Period (24 hours) for the day of the burn.

7. Prior to ignition onsite, the burn boss will document whether all elements within the agency administrator's authorization are still valid based on site conditions. The burn boss will also assess human factors, including the pressures, fatigue, and experience of the prescribed fire implementers.

Implementing these actions from the Review is expected to minimize the risk of a wildfire from an escaped prescribed burn.

In order to achieve the desired objectives for each burn, individual burn plans are developed. These plans identify very specific weather parameters (wind speed and direction, smoke dispersal, temperature, and relative humidity) and site conditions that are required for a prescribed burn to be successful. Historically, in the Houston South project area, these conditions only occur twelve to thirteen days a year, primarily the first three weeks of April. After that timeframe, it becomes unlikely that the needed parameters will occur because the trees will be leafed out shading the fuels on the ground.

[1] Date certified for the Hoosier National Forest was November 18, 2022

Forest Health

Since the release of the final EA in 2019, forest health monitoring by the Indiana Department of Natural Resources and the State, Private, and Tribal Forestry branch of the U.S. Forest Service have documented new evidence of oak decline on approximately 10 percent of the forested land within the Houston South Project area (Figure 6). Oak decline is caused by an interaction between environmental stresses and fungal pests, and new research suggests it can be exacerbated by increased competition for resources that occurs in overly dense forest stands (Dow 2023). Reducing the density of the trees in the infested areas would increase the vigor of the remaining trees allowing them to continue to provide the ecological benefits such as food and cover for wildlife and improved water quality into the future.

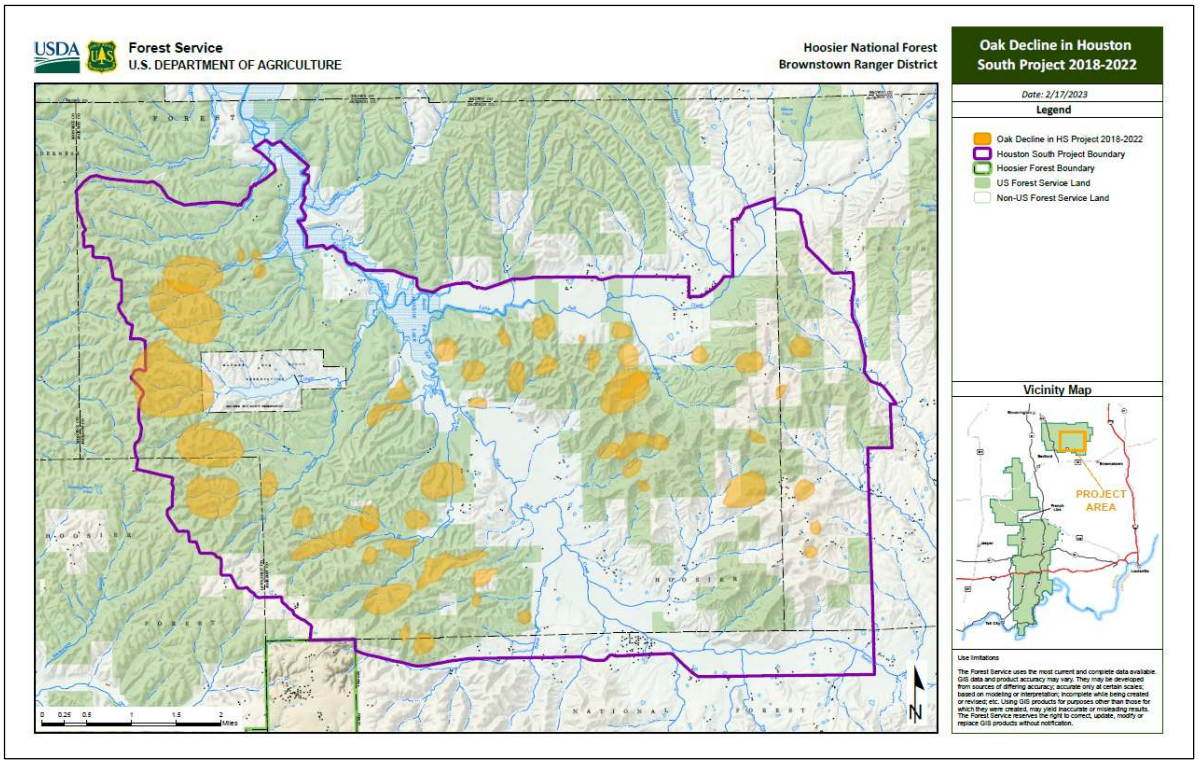

Figure 6: Location of oak decline within the Project area

Environmental Effects

Summarized Effects from the 2019 Final EA

The 2019 Final EA along with additional project information can be found at: https://www.fs.usda.gov/project/hoosier/?project=55119

Summary of the Effects Related to Relevant Issues

Hoosier National Forest staff identified 12 issues as part of the Houston South Vegetation Management and Restoration Project. For each issue, the following items were identified: indicators to evaluate the issue, the analysis area, the direct and indirect effects of the proposed action and of no action, and the cumulative effects.

- **Issue 1**: Prescribed burning could have negative effects on water quality, soils, and air quality; could cause loss of herbaceous layer, invasive plant introduction, soil acidification, nutrient runoff, greenhouse gas release, and carbon release.
    - **Indicators**: particulate matter (PM 2.5), erosion and sediment rates, increasing the spread of non-native invasive species (NNIS), greenhouse gas (GHGs) emissions, increased carbon release, and the number of miles disturbed from creating fire lines.
    - **Analysis area:** The analysis area to determine the direct and indirect effects was the Houston South Vegetation and Restoration Project boundary. The analysis area to determine the cumulative effects differed for different indicators but included a 1000-foot buffer around the project boundary, the South Fork Salt Creek Watershed, the Brownstown Ranger District, the Hoosier National Forest, and the global atmosphere. The temporal consideration for the cumulative effects is 20 years, which is the timeframe needed to complete all prescribed burns associated with the Houston South Vegetation and Restoration Project.
    - **Direct and indirect effects of the proposed action:** Post-burn monitoring shows that prescribed burns on the Hoosier National Forest are generally low intensity with no effects to soil and water resources, nutrients, or organic matter. Additionally, post-burn monitoring has found no differences in some soil characteristics between burned and unburned areas. However, these burns are viable for restoring vegetation structure and composition. If burning occurs near a riparian area, the intensity of the burn is expected to be minimal as moist areas do not burn as easily or as thoroughly, which allows vegetation to persist and maintain their filtering abilities.
        - The techniques used to create fire line (e.g., using a mower, leaf blower, and/or a chainsaw) only create short-term losses of habitat,

but this habitat recovers quickly. Only 159 feet of fire-lines would be created using heavy equipment, but all best management practices (BMPs) and standards and guidelines as outlined in the 2006 Forest Plan would be followed to avoid negative effects.

- All prescribed burns completed by the U.S. Forest Service must follow all federal, state, and local laws regarding air quality. While these are followed, local changes in fuel availability or wind may result in nuisance conditions that can cause respiratory discomfort. However, these conditions are short-lived (less than 24 hours).
- The influence of prescribed fire on NNIS is mixed, as prescribed fire can create favorable conditions for NNIS, as well as increasing nutrient availability for both NNIS and native species. When possible, the Hoosier National Forest would follow up with treatment of NNIS and all equipment would be inspected and cleaned to decrease NNIS spread.
- Any effects on carbon or GHGs would be short-lived and minor. In fact, prescribed burns increase plant growth which can increase long-term carbon uptake and storage.

- **Direct and indirect effects of no action:** Without prescribed burns, forest succession would continue contributing to the loss of fire dependent oak/hickory ecosystems. There would be no direct effects on air quality, but it could indirectly effect air quality due to the build-up of fuels that could produce long-term smoke in the event of a wildfire. The rate of spread for NNIS would continue but would be less under no action.
- **Cumulative effects:** Multiple prescribed fires on a single day could be possible, thus effective communication to prevent merging of smoke from multiple burns is necessary. Pre-planning and smoke management are required efforts and would result in no significant cumulative effects. The cumulative effect of prescribed burning on NNIS would be the continued invasion and spread of NNIS, which will occur regardless due to human activities within the surrounding the Houston South project area. The cumulative effect of prescribed burning on carbon and GHGs emission would be negligible.

- **Issues 2-4** (evaluated together): 2) Concern that trails used for hauling timber could cause erosion, 3) Concern that timber harvest could cause soil erosion during and after harvest, 4) Concern that timber harvest and road construction could cause sedimentation and nutrient loading in the watersheds of Monroe Lake.

- **Indicators:** Miles of trails used for harvest (Issue 2), percent of project area affected by soil disturbance (Issues 3 and 4), and miles of new road construction (Issue 4).

- **Analysis Area:** The analysis area to determine the direct effects was the Houston South Vegetation and Restoration Project boundary. The analysis area for indirect and cumulative impacts is the South Fork Salt Creek watershed. The timeframe of consideration is 12-15 years, as that is the time needed to complete the silvicultural treatments.

- **Direct and indirect effects of the proposed action:** The direct effects from the proposed action include soil decomposition and localized erosion and sedimentation. "Localized" infers that qualitative and quantitative measurable impacts do not progress beyond the project boundary. Previously used logging roads would be re-purposed to reduce the need for new road construction, which would reduce the effects to soil and watersheds. Additionally, rehabilitating old roads would mitigate past and on-going soil erosion. A total of 16.4 miles of road work is proposed, including: culvert installations, natural material fords, drainage dip construction, clearing corridors, aggregate placement, and earthwork. Short term (i.e., reversed in 2 years or less) effects would include sedimentation of drainages and movement of materials downhill, but control methods (including the BMPs listed in Appendix B) would reduce or eliminate this and prevent sedimentation to water bodies. Compaction, loss of water infiltration, and loss of overall long-term soil productivity are to be expected with road construction. To minimize impacts to streams, only ephemeral or intermittent streams would be crossed, and all streams would be crossed at right angles. All appropriate maintenance would occur, and only appropriate materials would be used. Only ~10% of the project area would be potentially disturbed (as defined by the Forest Service soil disturbance monitoring) by proposed actions.

    - Of the 48 soil types in the Houston South project area, 6 are identified as "soils of concern" from soil interpretations related to use of ground-based equipment, excerpted from NRCS. These soils require additional consideration and mitigation. However, risks for these soils would be mitigated through placing log landings and skid trails on flat or low slope areas, using water bars and woody debris to minimize erosion, installing proper drainages, following up with proper rehabilitation techniques, and conducting all activities when conditions are dry and limiting or restricting work when conditions may promote erosion (e.g., after rain events when soils would be more prone to impacts). Contracts would restrict the type of equipment to be used and when/where equipment can

access forest stands. Frequent inspections and monitoring would occur to ensure all guidelines are being followed.

- The proposed action would implement the multiple management requirements of the Hoosier National Forest - Forest Plan that address soil disturbance and water quality risks that are used to reduce impacts. BMPs have been found to be 96.5% effective on federal lands even when terrain is steep. BMPs have a long history of reducing impacts from timber harvests, and watersheds surrounded by actively managed forests are higher quality than those surrounded by agricultural and other non-forested lands. BMPs are also effective at reducing the impacts caused by log landings, logging roads, and skid trails, which have the most potential for disturbing soil. Stream management zones and riparian buffers would be used in riparian areas and are effective at reducing the risk of timber harvests to sensitive riparian species. Water quality would not be affected by timber harvest in the Houston South Project area because Forest Plan standards and guidelines, BMPs, and mitigation practices are followed. Consistent and repeated monitoring would occur to ensure all BMPs are effective including comparing future conditions to current conditions.

- The creation of new aquatic organism passages would disturb ~4 acres but would ultimately reduce erosion from the natural flow regime. Additional watershed restoration techniques are used to prevent erosion that would only have minimal disturbance to the entire watershed. New aquatic organism passage structures are specifically designed to address current flow restrictions of undersized culverts. Upgraded structures allow for increased flow volumes, reducing pressurized flows that can contribute to erosion and sediment movement downstream.

- **Direct and indirect effects of no action:** Without management, current runoff and erosion patterns would continue and decrease water quality and aquatic habitat over time as no actions to rehabilitate currently degraded roads and trails would occur. Additionally, without the new aquatic organism passages, stream erosion and sedimentation would also occur and likely worsen.

- **Cumulative effects:** Ongoing and past activities on private land include timber harvesting, grazing, agriculture activities, and other minor residential disturbances, all of which can impair soil and water quality. Although encouraged, best management practices may not have been applied commonly on private lands to adopt soil and water conservation practices.

- **Issue 5**: Concern that closing trails during periods of timber management could have negative impacts to recreationists.
    - **Indicators:** Miles of affected trail in or adjacent to areas proposed for treatment and duration of trail closures.
    - **Analysis Area:** The analysis area to determine direct, indirect, and cumulative effects is the Houston South Vegetation and Restoration Project boundary. The timeframe of consideration is 12-15 years for silvicultural activities.
    - **Direct and indirect effects of the proposed action:** The proposed actions would have both positive and negative effects. Trail users could be affected by ~14.5 miles of intermittent trail closures during timber sales.
        - There are ~8.7 miles of system roads that coincide with trails within the project area. Any road reconstruction or construction that occurs on an existing designated trail would be rehabilitated per design measures and returned to its original condition (or improved condition) upon road use expiration. It may be determined that the location of the temporary road is a more sustainable location than the nearby existing trail location, thus trails may be relocated to where the road would be constructed. Trails impacted by log skidding would be returned to their preexisting state.
        - Trail re-routes in the Hickory Ridge trail system may occur on trails that are in riparian areas or in poor locations. Additionally, a short spur trail would be added as a connector trail from a small parking area to Hickory Ridge Trail 15. One permanent trail closure would occur due to poor trail condition and low use. Overall trail mileage would not increase or decrease by more than two miles within the project area.
        - Recreation impacts would be considered in the scheduling of sale units. Treatment units would be staggered, and adjoining units would not be impacted at the same time. Treatments may occur in one area, and then followed by another area within the project boundary but not directly next to the previously treated unit. The least amount of trail closure needed to ensure safety and project success would be applied, but only during active sales and active prescribed burning.
        - Although silvicultural treatments and prescribed burns would negatively affect trail use and other recreational activities in the project area, the long-term benefit of restoring early successional

habitat and the regeneration of oak and hickory trees substantiates the need for short term impacts to recreation. Similar recreation opportunities compared to those being interrupted exist at nearby locations.

- **Direct and indirect effects of no action:** No direct effects to users on trail systems within the project area would occur. Although a lack of forest management may increase the number of trail closures to remove wind-blown trees on trails and a lack of timber management would not lead to increased habitat diversity over time which some trail users seek.

- **Cumulative effects:** No additional cumulative effects to recreation resources are anticipated as there are no other past, present, or future recreation actions predicted to contribute aggregated effects.

- **Issue 6**: Concern that prescribed burning could have negative impacts on recreational opportunities.

  - **Indicators:** Miles of affected trail in or adjacent to areas proposed for treatment and miles of roads in or adjacent to areas proposed for treatment.

  - **Analysis Area:** The analysis area to determine direct, indirect, and cumulative effects is the Houston South Vegetation and Restoration Project boundary. The timeframe of consideration is up to 20 years for prescribed burning activities.

  - **Direct and indirect effects of the proposed action:** ~29.5 miles of trails are in the project area that may be used for prescribed fire lines and access. 1.2 miles of publicly available roads are within the project area. Trails within a burn unit would be closed during the burn and all closures would be temporary in nature (approximately five days). Burns would be scheduled by units, and the entire project area would not be impacted at the same time, but instead spread out over several years. Similar recreation opportunities compared to those being interrupted exist at nearby locations.

  - **Direct and indirect effects of no action:** No direct effects to users on trail systems within the project area would occur. A lack of prescribed fire would not lead to increased habitat diversity which some trail users seek.

  - **Cumulative effects:** No additional cumulative effects to recreation resources are anticipated as there are no other past, present, or future recreation actions predicted to contribute aggregated effects.

- **Issue 7**: Concern that proposed harvest treatments and prescribed fire treatments could degrade the visual quality along trail corridors.

- **Indicators:** Visual Quality Objectives.
- **Analysis Area:** The analysis area to determine direct, indirect, and cumulative effects is the Houston South Vegetation and Restoration Project boundary. The timeframe of consideration is up to 20 years.
- **Direct and indirect effects of the proposed action:** The proposed actions would have both positive and negative effects. Although timber harvests would result in a more visually open landscape, treatment types would differ, thus offering a greater diversity of sites and a greater diversity of viewable wildlife. Harvested stands would begin appearing natural after several years.
  - Prescribed burning would result in smoke being visible during burns and shortly after burns and burn scars may be visible on trees along trails systems within the project area. However, prescribed fire should increase visual quality by maintaining an open understory within forests, increasing wildflowers, and maintaining open spaces.
  - All debris resulting from vegetative management and prescribed fire use would be treated to maintain the visual foreground along frequently traveled roads, trails, and streams to meet visual quality objectives defined in the Forest Plan.
- **Direct and indirect effects of no action:** No direct effects to users on trail systems within the project area would occur. A lack of forest management may increase the number of trail closures to remove wind-blown trees on trails. A lack of timber management and prescribed fire would not lead to increased habitat diversity which some trail users seek.
- **Cumulative effects:** No additional cumulative effects to recreation resources are anticipated as there are no other past, present, or future recreation actions predicted to contribute aggregated effects.

- **Issue 8**: Concern that vegetation management and the use of herbicide treatment could have negative effects to the [South Fork] Salt Creek watershed.[2]
  - **Indicators:** Chemical contaminants from herbicides.
  - **Analysis Area:** The analysis area to determine direct and indirect effects is the Houston South Vegetation and Restoration Project boundary. The scale to evaluate cumulative effects is the South Fork Salt Creek watershed. South Fork Salt Creek drains into Monroe Lake, and thus any

[2] Concerns raised by the public included negative effects of herbicides to Monroe Lake. By including the entire South Fork Salt Creek watershed in the issue statement, effects to all streams within the watershed that drain into Monroe Lake were analyzed.

effects to the Lake would be most effectively identified at this scale, in the watershed where all project activities would occur. The timeframe of consideration is 12-15 years because silvicultural treatments would be complete by this period.

- **Direct and indirect effects of the proposed action:** Selective herbicide treatments are proposed on 1,970 acres including 401 acres in clearcuts, 238 acres in shelterwood areas, 462 acres in selection cuts, 234 acres in midstory removal areas, and 170 acres in crop tree release areas. Herbicide would be applied specifically and only to the trunks and stumps of targeted woody vegetation resulting in a relatively small area of application with little to no herbicide contacting the soil. The average number of stems per acre to be treated in this project are lower than the number that could be treated without exceeding the maximum use rate of the herbicide.
  - Herbicides used are specific to plants and do not harm animals or humans, and do not bioaccumulate. These herbicides biodegrade quickly after application, thus do not remain reactive in the soil, or readily transported via runoff. Proposed herbicides for this project would include a subset of those identified for use under previous decisions in which a Finding of No Significant Impact (FONSI) was prepared (USDA FS 2009, USDA FS 2018b).

- **Direct and indirect effects of no action:** No action would result in no direct or indirect effects related to herbicide use from implementing silvicultural treatments.

- **Cumulative effects:** Since NNIS are also being treated within the project area, precautions would be taken to ensure application rates do not exceed those recommended on the manufacturers' labels, therefore there are no cumulative effects from overlapping herbicide applications. Privately owned agricultural lands likely use herbicide multiple times per year. However, these applications are not considered for cumulative effects given that it is unlikely that herbicides applied on the Hoosier National Forest would translocate sufficiently to combine with them.

- **Issue 9**: Concern that prescribed burning could harm or displace wildlife. Additionally, Hoosier National Forest staff evaluated the proposed impacts to plant species on the Regional Forester Sensitive Species (RFSS) list.

  - **Indicators**: Habitat condition and the stability of RFSS plants.

  - **Analysis Area**: The analysis area to determine direct and indirect effects is the Brown County Hills Subsection. The analysis scale for cumulative

effects includes a 5-mile buffer. The timeframe of consideration is 20 years because prescribed fire treatments would be complete by this period.

- The analysis area to evaluate the direct and indirect effects on plant RFSS are the action areas consisting of the proposed project activities. The area for cumulative effects is a 1000 ft buffer around the project area. The timeframe for analysis is 20 years which is the period needed to complete all activities.

- **Direct and indirect effects of the proposed action**: Effects of prescribed fire on animals are generally short-lived. The lasting effects of keeping oak in the ecosystem, through prescribed fire, outweigh the short-term negative effects. Oak forests provide habitat for insects and birds that other forest types do not.
  - Effects to wildlife RFSS
    - There are currently 141 wildlife RFSS for the Hoosier National Forest that must be taken into consideration for the proposed actions. Overall, there should be no trend toward federal listing or extirpation for any RFSS.
    - No cliff/karst, barrens, or large rivers exist within the project area. There are no known occurrences of RFSS fish, amphibians, or mollusks occur in the project area. Therefore, the proposed actions would not harm RFSS associated with those habitats.
    - Mammals – There would be no effect to Allegheny woodrats, as they do not occur in the project area. Three bat species likely inhabit forests and are assumed to occur in the project area. While the proposed action could impact these bats species, burning would primarily take place during seasons that would have minimal impact on bats. No trees would be removed for fire lines during bat active seasons. Additionally prescribed burning could benefit bats.
    - Birds – Surveys of birds in the project area identified 84 bird species including those on the RFSS list and those listed as State endangered or as species of concern for Indiana. Prescribed burning should have no effect on habitat availability for Henslow's sparrow. Ruffed grouse were last spotted in the Forest in 2016. This species may be extirpated from Indiana without promotion of early successional forests; thus, the species would benefit from the proposed actions. Cerulean warblers were not detected in 2017 surveys. The proposed action could affect this species, if present, but because of their mobility and availability of adjacent habitat, the proposed project should not have adverse effects to the viability of their populations locally or in Indiana. Loggerhead shrikes and barn owls are

not presumed to be on the forest as the forest does not provide their preferred habitats; thus, no effect is expected. However, the proposed action would increase habitat availability for them. American woodcock was found in 2016 surveys of the project area. The proposed action would increase habitat availability and thus the species would benefit.

- Reptiles – Timber rattlesnakes likely exist in the project area. Prescribed burning may impact this species, but ample refugia habitat exist in the surrounding area. Prescribed burning during the dormancy season should have no effect, while burning during the late growing season could have negative effects.
- Terrestrial invertebrates - The West Virginiana white could be negatively affected during growing season burns. However ample refugia exists. Prescribed burning would increase plant diversity thus benefitting this species. The monarch butterfly requires open habitats, and thus would benefit from the proposed actions.

▪ Effects to plant RFSS

- There are 34 plant RFSS. Two species, butternut and American ginseng are known to be in the project area. Butternut is outside of proposed timber harvest areas, but within the prescribed fire area, and ginseng is within both the timber and prescribed burning areas. There are four other RFSS that may be within the project area: trailing arbutus, large yellow lady's-slipper, Illinois woodsorrel, and yellow nodding ladies'- tresses, but they have not been found.
- Direct effects for all six species could be the loss of individuals during road and log landing construction, skidding, fire line construction or herbicide overspray. Known occurrences of RFSS would be protected. Species occurring in mesic or wet habitats would be protected as proposed actions are for dryer areas. Possible indirect effects may occur to these six RFSS in the form of lost or altered areas of suitable habitat within the proposed activity areas. Burning activities would occur predominantly when plants are dormant, thus direct impacts are unlikely. Prescribed burns that reduce midstory and select for oaks over shade tolerant species should be beneficial to these species.

o **Direct and indirect effects of no action:** No negative effects would occur to wildlife RFSS, but no positive effects of habitat creation would occur either. Similarly, no direct impacts would occur to plant RFSS, however

increased shade and competition could indirectly negatively influence these species.

- **Cumulative effects:**
  - Effects on wildlife RFSS
    - Current rates of habitat conversion on non-Forest Service land will likely continue. Currently approved Hoosier National Forest projects will continue but have been found to have no negative impacts. No cumulative effects are expected.
  - Effects on plant RFSS
    - Present or reasonably foreseeable future activities on private land that may affect RFSS include construction or use of roads, agricultural use of riparian areas, high-grading timber harvests, and activities associated with residential development in rural or forested areas. Past activities on National Forest System lands that may have impacted the plant RFSS are timber harvests, trail reroutes, and prescribed burning. Ongoing and reasonably foreseeable future activities on National Forest System lands within the project activities area that may affect RFSS include management of early successional habitats and routine maintenance of recreational trails.
      - The biggest threat for plant RFSS is the invasion of NNIS, which can be facilitated via public use of the forest and with wildlife opening management, timbering activities, prescribed burning and trail maintenance/relocation. Generally, seed from most NNIS plants within the cumulative effects area remains viable in the soil from two to seven years.

- **Issue 10**: Concern that project activities could increase the potential spread of plant NNIS (Nonnative Invasive Species).

  - **Indicators:** Miles/acres disturbed for road, skid trail, fireline, and log landing construction and acres of harvest.

  - **Analysis Area:** The analysis area to determine direct and indirect effects is the action area consisting of the proposed project activities. The area for determining cumulative impacts is the Houston South Vegetation Management and Restoration Project area plus a 1000 ft buffer. The temporal consideration for cumulative effects is 24 years.

  - **Direct and indirect effects of the proposed action:** Current NNIS infestations are currently found within and surrounding the project area. These infestations are more severe in heavily disturbed areas and in old

fields and wildlife openings. Current and future NNIS surveys would focus on areas which would be disturbed with project actions as well as identifying high priority NNIS. Non-native pine stands are often more infested with NNIS compared to native hardwood stands and clearcutting pine stands would likely increase the spread of NNIS initially.

- The proposed action could facilitate the spread of NNIS to new locations. However, the project design measures should result in a low to moderate risk of new introductions of NNIS. NNIS plant control treatments within the project areas would help reduce the spread of NNIS.
- Timber harvests act as a disturbance which can facilitate NNIS spread. Shade intolerant NNIS species would decline overtime as the forest canopy closes. The two invasive plants with occurrences in the project area that inhabit shaded conditions and pose the greatest threat to natural ecosystems are Japanese stiltgrass and garlic mustard. Post harvest NNIS treatments would focus on new timber roads, skid trails and fire lines. Garlic mustard and Japanese stiltgrass are abundant in areas where AOPs are proposed and thus treatment would prioritize these areas for 5 years to prevent spread. Site-specific surveys reveal that stiltgrass occurs more often and in greater abundance in pine stands than in hardwood stands. The species spreads primarily by movement of seeds and plant fragments; thus roadwork, harvest, and fire line activities have the potential to contribute to the expansion of these populations. Pine clearcutting would increase light and create drier conditions that may reduce productivity and decrease some existing stilt grass populations that occur within units, but at the same time contribute to spreading the species by equipment. The spread of tree-of-heaven would vary but treatments of this species prior to harvests or prescribed burn would be a high priority.
- The highest potential for establishment and spread of NNIS are newly disturbed areas. Land adjacent to the roadways where clearing would occur provides the most likely site for possible NNIS colonization or spread. Actions such as ditch work or culvert maintenance and replacement and AOP construction would also contribute to spreading NNIS. The project proposes to close and decommission all temporary roads thereby reducing possible spread of invasive plants in the future. Hoosier National Forest staff would attempt to control NNIS spread through revegetation efforts and the use of pre and post herbicide treatments.

        - The primary objective regarding NNIS plants is to avoid introducing new infestations and to slow the spread of existing populations. Prevention measures include equipment cleaning prior to implementation, avoiding increased disturbance near existing populations (particularly for designating log landings), using gravel to cover small bands of NNIS to prevent their spread by equipment, and to revegetate areas with native species. A portion of funds from the timber sales would be used to treat invasives within the stands and coordination between timber and botany staff would determine the areas of highest need for treatment.

    - **Direct and indirect effects of no action:** Active NNIS plant colonization and establishment as influenced by ongoing activities within the project area would continue at current rates. With no action, NNIS would continue to spread and increase and could displace valuable wildlife habitat, threaten biodiversity, and potentially affect rare plant communities or individual rare plant populations. The rate of spread, however, under the no action alternative would be less because of no increase in ground disturbance.

    - **Cumulative effects:** NNIS plants occur throughout the cumulative effects area on NFS lands, as well as adjacent private ownership. For many species, establishment of these populations occurred prior to the existence of the Hoosier National Forest. The cumulative effect of implementing the action alternative combined with ongoing human and natural disturbances is the continuing spread of these species. Interest in treating NNIS on private lands is increasing. Land use decisions made by adjacent landowners may affect the spread of invasive plants as much as activities carried out by the Hoosier. Continued implementation of the Nonnative Invasive Species Plant Control Program in selected portions of the project area where most needed will occur in response to ground disturbing activities. Future projects which involve ground disturbance would increase the risk of spreading NNIS.

- **Issue 11**: Concern that vegetation manipulation or timber harvest, coupled with climate change could negatively impact the local environment.

    - **Indicators:** Project activities contributing to GHGs (greenhouse gases) and climate change.

    - **Analysis Area:** The analysis area is the global environment. The timeline is 20 years as all project activities would be completed then.

    - **Direct and indirect effects of the proposed action:** The Houston South Project would make an extremely small contribution to overall emissions.

It is difficult and highly uncertain to ascertain the indirect effects of emissions from single or multiple projects of this size on global climate. The proposed action would increase forest resistance to insects, disease, wildfire, age related declines in productivity, or a combination of factors that can reduce carbon storage and alter ecosystem functions. Remaining trees and newly established trees typically have higher rates of growth and carbon storage. According to the Intergovernmental Panel on Climate Change reducing stand density, one of the goals of the project, is consistent with adaptation practices to increase resilience of forests to climate-related environmental changes. Thus, the proposed actions would meet objectives for both adapting to climate change and mitigating GHG emissions.

- The wood and fiber removed from the forest in this proposed action would be transferred to the wood products sector for a variety of uses. The Intergovernmental Panel on Climate Change recognizes wood and fiber as a renewable resource that can provide lasting climate-related mitigation benefits that can increase over time with active management.

- **Direct and indirect effects of no action:** No action would result in stand density not being reduced which could lead to a decrease in the resilience of forests to climate-related environmental changes.

- **Cumulative effects:** Because the direct and indirect effects would be negligible, the proposed action's contribution to cumulative effects on global GHGs and climate change would also be negligible.

- **Issue 12**: Harvesting timber could decrease the rate of carbon sequestration.

  - **Indicators:** Change in carbon sequestration rates.

  - **Analysis Area:** The analysis area for carbon sequestration rates includes forested lands within the Hoosier National Forest because this is where the proposed actions may affect carbon stocks. The timeframe for the analysis is 20 years because all project activities should be completed by then.

  - **Direct and indirect effects of the proposed action:** Negative impacts on carbon stocks caused by disturbances and climate conditions have been modest and exceeded by forest growth. Following natural disturbances or harvests, forests regrow, resulting in the uptake and storage of carbon from the atmosphere. Over the long term, forests regrow and often accumulate the same amount of carbon that was emitted from disturbance or mortality.

Although harvest transfers carbon out of the forest ecosystem, most of that carbon is stored in wood products.

- The effect of the proposed timber harvest focuses on aboveground carbon stocks which comprises about 45% of the ecosystem carbon stocks on the Hoosier National Forest. However, not all trees would be removed so the entire 45% would not leave the site. The effect of the proposed prescribed fire focuses on the understory and forest floor, which together comprise about 9% of the Forest-wide ecosystem carbon stocks. Timber harvesting generally results in a negligible amount of carbon loss from the mineral soils, which contain about 33% of the ecosystem carbon. The carbon loss from proposed actions to the understory and forest floor would be negligible given it is not stable or long-lived and would be replaced within months to a few years. Furthermore, any initial carbon emissions from the proposed actions would be balanced and possibly eliminated because the remaining trees and newly established trees typically have higher rates of growth and carbon storage.

- **Direct and indirect effects of no action:** No action would result in naturally dying trees that would emit carbon to the atmosphere, which may or may not be offset by forest growth.

- **Cumulative effects:** Because carbon would be removed from the atmosphere with time as the forest regrows, any potential cumulative effects would be minimal or mitigated.

Summary of the Effects on Threatened and Endangered Species and Cultural Resources

1. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

    a. **Analysis Area:** The analysis area to determine direct and indirect effects is the Brown County Hills Subsection. The analysis scale for cumulative effects includes a 5-mile buffer. The timeframe of consideration is 20 years because prescribed fire treatments would be complete by this period.

    b. **Direct and Indirect Effects of the Proposed Action:** Within the vicinity of the proposed project, there are no known records of the eastern fanshell, rough pigtoe, or sheepnose mussel. Therefore, there would be no direct, indirect, or cumulative effects to these species from implementing this project.

i. There are no records of caves being used by gray bats within the Hoosier National Forest and no known caves within the project boundary. Project activities may affect summer habitat, foraging habitat, and travel corridors but it is not likely to adversely affect this species.

ii. There are occurrences of Indiana bat within the action area, but the nearest known hibernacula is 16 miles from the project area. Thus, proposed actions should not affect hibernacula or swarming/staging behavior of Indiana bats. Timber harvests would have short term negative consequences via the removal of roost trees, but long-term positive effects via improved foraging and roosting habitat. Indiana bats are well adapted to changes in their habitat and all actions would follow a design to lessen impacts.

iii. There are no known occurrences or hibernacula for northern long-eared bats within the project area. Negative impacts resulting from proposed activities would not exacerbate the effects of white-nose syndrome. Project activities should not affect winter hibernacula of the northern long-eared bat directly or indirectly. The proposed actions could affect swarming/staging behavior of the northern long-eared bat. Timber operation effects are believed to be short-term with long-term benefits.

c. **Cumulative effects:** Present or reasonably foreseeable future activities, which may have an impact on these species, include the construction or use of roads, continued agricultural use, timber harvest and activities associated with residential development. The past, present, or foreseeable Forest Service activities that could potentially cause cumulative impacts in conjunction with the proposed action are the continuation of early successional management, wetland maintenance, the Buffalo Pike Project, potential trail reroutes, Pleasant Run Road Decommissioning, Lake and Pond Habitat Improvement, Jackson County AOPs, Fork Ridge Restoration and NNIS herbicide applications. Most of these activities are considered not likely to adversely affect the Indiana bat and have a beneficial effect on local bat species. No cumulative effects are expected for federally listed species.

2. The degree to which the action may adversely affect cultural resources.

a. **Direct and Indirect Effects of the Proposed Action:** With proper design, there would be no direct or indirect effect to culturally significant sites as all such sites would be avoided during implementation.

b. **Cumulative effects:** There would be no cumulative effects of the proposed action to culturally significant sites.

New Information for Monroe Lake

Affected Environment

Monroe Reservoir (Monroe Lake or Lake Monroe) is a 10,750-acre reservoir constructed and operated by the Louisville District of the U.S. Army Corps of Engineers. The reservoir was created in 1964 by damming Salt Creek. Its primary purpose is flood control, but it also serves as a primary municipal water supply source. Additionally, Monroe Lake is heavily used for recreation including boating, swimming, fishing, and hunting (Sullivan 2002).

Four watersheds drain into Monroe Lake: South Fork Salt Creek, Middle Fork Salt Creek, North Fork Salt Creek, and Lake Monroe-Salt Creek (U.S. Geological Survey 2013; Figure 7). The U.S. Forest Service manages approximately 19 percent of the land base within Monroe Lake's watersheds, while private lands comprise of about 57 percent of the land, the State of Indiana manages approximatley16 percent of the land, and the U.S. Army Corps of Engineers manage about 8 percent of the land. Proposed silvicultural treatment acreage comprises 1.6 percent of the total watershed area. The Houston South Vegetation Management and Restoration Project area falls exclusively within the South Fork Salt Creek watershed, a watershed that ultimately drains into Monroe Lake.

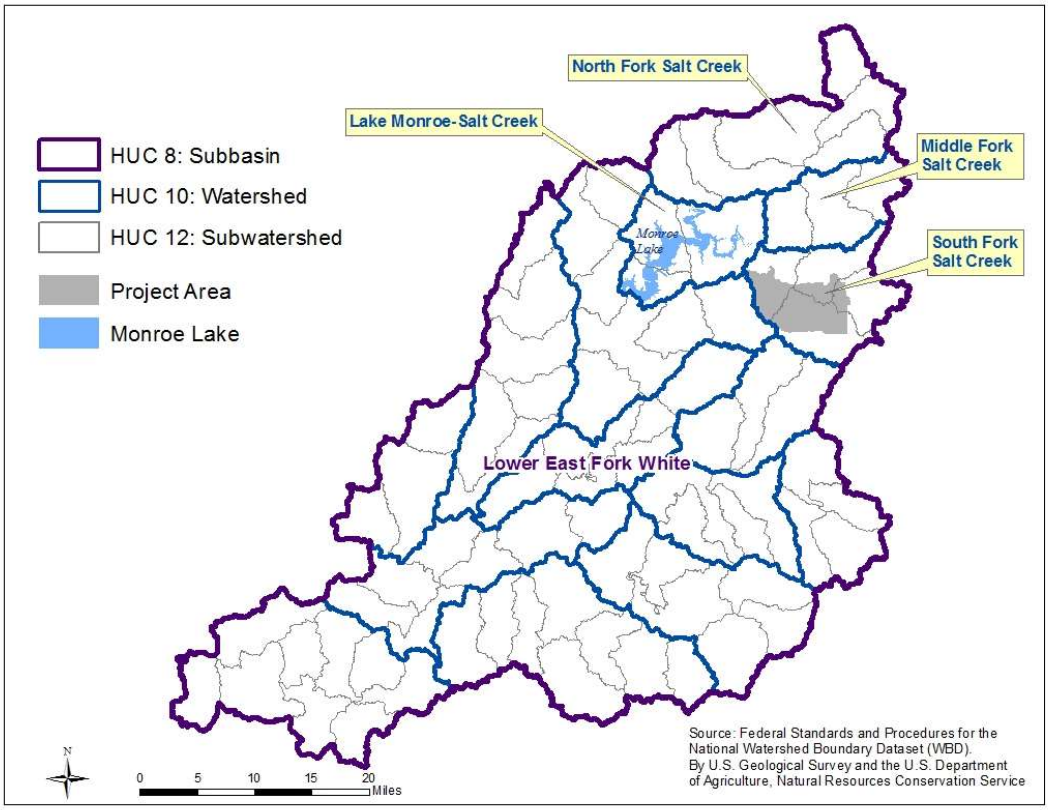

Figure 7: Subbasin, Watersheds, and Subwatersheds

The Lake Monroe Watershed Management Plan (Sullivan 2022) states, "Over 82% of the watershed is forested. While intact forest is excellent at protecting water quality, forest management activities such as timber harvests have the potential to generate sediment that can impact nearby streams. Branches and logs dumped in streams can create log jams that exacerbate streambank erosion. These impacts can be minimized if best management practices are used, ideally with a forest management plan put in place prior to project implementation." Additionally, the plan states "The key to protecting and improving water quality in the lake is to keep pollutants such as sediment, fertilizer, animal manure, and septic system leakage from reaching the streams that flow into Lake Monroe. A key strategy will be increasing the use of best management practices on agricultural, forested, residential, and urban land in the watershed."

The Lake Monroe Watershed Management Plan (Sullivan 2022) identified multiple water quality issues that are not caused by forest management, including: nutrient overloading from agriculture and septic practices causing blue-green algae blooms, E. coli bacteria from failing septic systems, sedimentation caused from agriculture, and construction. Additionally, it highlighted that a history of forest management without the uses of BMPs has also caused current water quality issues. However, the Hoosier National Forest has only conducted two forestry projects within the watersheds of Monroe Lake since 1988, a group of salvage harvests after a 1988 tornado, and the Buffalo Pike project in 2018, which included a 52-acre selection harvest that occurred 8.5 miles from Monroe Lake.

Harmful algal blooms (HABs) can occur in Monroe Lake, although forest management activities that follow Forest Plan guidance and appropriate BMPs have little to no correlation with HABs. According to the U.S. Army Corps of Engineers Louisville District Water Quality Program Management Plan (ACE 2018), HABs can be caused by ample sunlight, warm temperatures, low-water or low-flow conditions, and excessive amounts of nutrients such as nitrogen and phosphorus. While many commentors for the Houston South Project raised concern about HABs due to the project, the Lake Monroe Watershed Management Plan (Sullivan 2022) concluded that the high percentage of agricultural land surrounding South Fork Salt Creek has resulted in elevated levels of nitrogen and phosphorus within Monroe Lake, which are currently the main contributors to HABs.

Aside from the water quality issues mentioned above, the Lake Monroe Watershed Management Plan (Sullivan 2022) identified water quality issues resulting from sedimentation, high levels of phosphorus, lakeshore erosion, turbidity, over-recreation, urbanization of the watershed, algal blooms, and the lack of a comprehensive watershed management plan. The plan states, "Significant erosion is visible along several stretches of Lake Monroe's shoreline, particularly when water levels are low. Though it is difficult to quantify, shoreline erosion may be a significant source of sediment in the lake (Figure 10 - 12). Shoreline erosion is exacerbated by fluctuations in water level due to management of the reservoir for flood control. When water levels are elevated for an extended period of time, the soil becomes saturated and can slough off in large chunks." The plan also noted that sedimentation is exacerbated by streambank erosion, inadequate

riparian buffers, heavy livestock usage and their access to streams, farmed wetland areas, crop tillage, boat resuspension of sediment, and poorly designed driveways and stream crossings.

Figure 8: Photo of Monroe Lake Shoreline Erosion

Figure 9: Monroe Lake Shoreline Erosion

Figure 10: Bare Roots Show the Extent of Monroe Lake Shoreline Erosion

The streams within the project area are impaired due to E. Coli and low dissolved oxygen levels, however, timber harvesting would not compound these issues. Though these streams are impaired, forest management is allowable in these areas if the following conditions are met: no harvests within the 100-year floodplain, the use of riparian buffers around all headwater streams, and erosion control BMPs to confine sediment within the project area.

Proposed Action

Effects to Monroe Lake

Direct and Indirect Effects

The Hoosier National Forest, Forest Plan Final Environmental Impact Statement (FEIS) states, "Lake Monroe and Patoka Lake (U.S. Army Corps of Engineer reservoirs) provide municipal water for several southern Indiana communities. As such, the public is vitally concerned with maintaining the quality of water in the watersheds of these lakes" (USDA FS 2006b p. 3-230). Therefore, it is important to disclose information to the public that might improve engagement and understanding of the Forest Service work. The FEIS determined, "Any of the alternatives would have little to no effect on these reservoirs and their watersheds. Guidance included for vegetation management and other Forest management would mitigate any potential soil movement and sedimentation to the background level" (USDA FS 2006b p. 3-230). The FEIS further explains, "In combination with the practices (past and ongoing, as well as reasonably foreseeable future ones) on other lands, the actions permitted by the alternatives would not impair the water quality of the lakes."

Timber harvest activities would be properly planned and implemented to avoid detrimental soil disturbances; see the Soil and Water Design Measures in Appendix A. The Hoosier National Forest operates under the guidance of the Forest Plan that contains many standards and guidelines pertaining to maintaining and restoring watershed health. Implementation of the Forest Plan would mitigate potential negative effects to watershed health from the proposed actions. The Forest Plan FEIS states that any of the alternatives of the FEIS would not affect the water quality disproportionately compared to the percentage of the watershed in NFS ownership. Neither productivity of forest soil nor water quality will be substantially negatively affected during or after timber harvests that follow Forest Plan standards and guidelines (USDA FS 2006b).

With adherence to Forest Plan guidance, the use of design features and BMPs, and proper monitoring, this project would have minimal to no effects on water quality in any water body and particularly to Lake Monroe itself, which lies several miles downstream from the project sites.

The Forest Service follows BMP monitoring guidelines to protect water quality using the

National Best Management Practices for Water Quality Management on National Forest System Lands Technical Guide (USDA 2012).

The Lake Monroe Diagnostic and Feasibility Study (Jones et al. 1997) states, "As with agricultural BMPs, there are adequate silviculture BMPs available for application in Lake Monroe's watershed, but many landowners must be educated on their proper use." It also states, "The implementation of agricultural, forestry, and urban BMPs has been proven over the years to be very effective in reducing watershed erosion and runoff, and ultimately, in reducing the delivery of NPS [non-point source] pollutants to lakes."

When a system of BMPs is implemented, the loss of sediment and nutrients can be greatly reduced as a result of silvicultural activities (Wynn et al. 2000)

Aust and Blinn (2004) synthesized research of forestry BMPs on the effects to water quality and productivity over a 20-year period in the Eastern United States. The results from the large amount of research indicate that BMPs that minimize soil and litter layer disturbance, facilitate rapid regeneration and control overland flow of water do effectively minimize negative water quality effects of harvesting and site preparation.

McCoy and Sobecki (2017) found that there is a 96.5 percent effectiveness of BMPs on federal lands. The 3.5% where effectiveness failed in these studies does not mean sediment reached a stream, and in those rare cases where some sediment may reach a stream, that does not mean it would ever reach Monroe Lake given the distance such sediment would need to travel to reach the lake.

The Lake Monroe Watershed Management Plan (Sullivan 2022) highlights the effectiveness of proper BMPs at mitigating the risk of damaged soils or reducing water quality during timber harvests. On page 6, the document lists practices conservation practitioners would like to see implemented to address water quality. One of those were, "Educating forest owners about forestry best management practices before they conduct a timber harvest so they can implement conservation practices from the beginning (rather than reaching out for help after a harvest has taken place without good BMPs)."

While forest management could increase sedimentation, which can be a source of nitrogen and phosphorus accumulation (Sullivan 2022), following Forest Plan standards and guidelines along with implementing BMPs would reduce sedimentation. To reduce sedimentation resulting from project activities, the following standards and guidelines and BMPs would be followed as part of the proposed action:

- Prohibit log skidding and heavy equipment within streambeds.
- Use temporary erosion and sediment control practices (e.g., silt fence).
- Skid roads should be designated by Forest Service personnel and should not exceed a gradient of 35 percent.
- Designate log landings on site by Forest Service personnel. Locate landings on upland, well-drained, nearly level sites to minimize surface runoff and soil erosion.

A full list of standard and guidelines and required BMPs can be found in Appendix B. The Forest Service exceeds the BMPs as suggested by the Lake Monroe Watershed Plan (Sullivan 2022) including a forest management plan, training of foresters and loggers, critical area seeding, forest trails and landing improvement, riparian forested or herbaceous buffer, streambank stabilization, logjam removal, wetland creation or restoration, and improved stream crossing.

Certified timber sale administrators and harvest inspectors oversee the implementation of silvicultural activities to ensure the proper implementation of Forest Plan guidance, BMPs, and project design. Harvest inspectors identify potential erosion risks and mitigate them before they become an issue by laying slash over bare ground, adding silt fencing, adding water bars, and adding seed and mulch to disturbed areas. Other resource professionals such as wildlife biologists, recreation specialists, botanists, and soil scientists regularly work in these areas and report any concerns they may encounter.

In addition to water quality BMP monitoring, turbidity would be monitored at the Kurtz, Maumee, Callahan, and Negro sites (Figure 8) throughout the lifespan of the Houston South Project. Increased turbidity is caused by excess levels of clay, silt, inorganic and organic matter, algae, and dissolved colored organic compounds in waterways. Baseline turbidity readings have been collected in association with discharges since stage (water levels) cannot be directly associated with turbidity due to backwater effects (i.e., pooling of accumulated water in a stream channel indicating high flow stages but low discharges) on South Fork Salt Creek from Monroe Lake. Baseline information shows pre-harvest and pre-burn turbidity conditions are driven by natural erosion, private land use, and seasonal plant and algae growth. The Kurtz site would be used to monitor water quality entering the project area and the Maumee site would monitor the quality exiting the project area. Additionally, the Callahan and Negro sites allow the Forest Service to monitor water quality in main tributaries within a timber operations area. If turbidity is found to increase relative to the pre-treatment levels during project activities, further investigation and remediation would occur to ensure proper BMP usage.

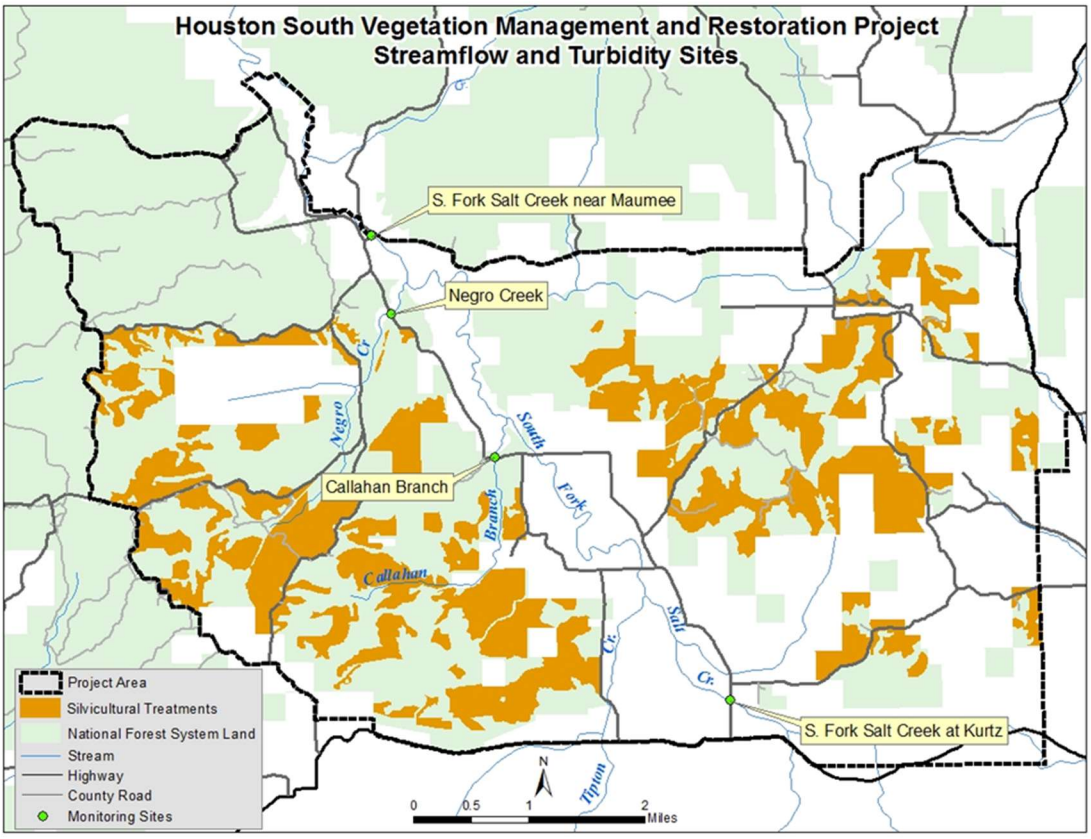

Figure 11: Houston South Streamflow and Turbidity Monitoring Sites

All prescribed fires conducted as part of the project would be low intensity, especially in riparian areas, and analysis has shown that lower intensity burns only remove the top layer of organic material, allowing soil-stabilizing vegetation to recover within six months of the prescribed burn (Rigg and Larson 2007). Monitoring on the Hoosier National Forest has found revegetation to occur in as little as two months (Figure 9). Monitoring has also shown that prescribed fires do not increase erosion. Additionally, while prescribed fire does turn some organic matter into ash, this ash does not leave the site (Menke 2023). Furthermore, the prescribed burns in the project would not kill overstory trees or otherwise affect the ability of the stand to sequester carbon in mature trees.

A study by Elliot and Vose (2005) to investigate effects of prescribed burning on soil solution chemistry and stream water quality suggest that low intensity, low severity prescribed burns could be used to restore vegetation structure and composition in mixed pine-hardwood ecosystems without negatively impacting water quality.

Figure 12: Photo of Fork Ridge Burn Unit on the Brownstown Ranger District, Two Months After a Prescribed Burn

Herbicide use for stand improvement and site preparation activities typically requires a single application to attain the desired effects. Herbicide would be applied specifically to the trunks and stumps of targeted woody vegetation. This treatment results in a relatively small area of application compared to a broadcast spray where an entire area is treated. It also results in little to no herbicide contacting the soil. The maximum amount of herbicide used in a given treatment would remain well below the maximum forestry use rate per year as identified on the manufacturer's label. For example, when using Arsenal® (imazapyr) for stem injection treatments (hack and squirt), the maximum use rate for forestry treatments is 96 ounces/acre/year. Assuming three-inch-wide hacks and an average tree diameter at breast height of six inches, 705 stems per acre could be treated with a concentrate treatment, or 9,600 stems per acre could be treated with a dilute treatment.

Several measures would be taken to mitigate accidental contamination when using herbicide for timber stand improvement treatments. First, buffers would be placed around all streams and water sources. Second, herbicide would only be used on ridge tops and upper-mid slopes, and not within floodplains. Third, herbicide would not be applied when precipitation is expected. Fourth, all herbicide treatments would be selective, by placing herbicide directly on the cambial tissues, and not by foliar or broadcast spraying. Fifth, all herbicide applicators would be licensed by the Office of Indiana State Chemist or under the direct supervision of licensed applicator. Lastly, the Forest Service would only use EPA approved non-restricted herbicides. All of these measures greatly reduce the potential for herbicides to reach soils and further reduced the potential for herbicides to reach streams and other surface waters (dissolved or suspended by soil) to a negligible level.

Numerous studies have demonstrated that approved herbicides can be safely applied in forests. Forestry herbicides inhibit biochemical pathways that are specific to plants, are

very low in animal toxicity and do not bioaccumulate. Research has shown that herbicides used in forestry biodegrade relatively fast after application and that leaving untreated buffer zones around water sources insures that they will be protected. (Kochenderfer et al. 2012).

Hoosier National Forest staff would take action to restore any impacts that do occur from silvicultural activities. For example, in conjunction with the U.S. Forest Service Northern Research Station, a study was created to determine the best methods to rehabilitate log landings. The study evaluates using biochar, which can de-compact soil to improve infiltration, soil porosity, and water holding capacity, all of which can mitigate surface water run-off and erosion. Additionally, the project utilizes native plant species to provide richer, more sustained resources for pollinators and to reduce the spread of NNIS. Native plants also have deep root systems, which de-compact soil, increasing its porosity and water infiltration. In addition, in 2019, our monitoring of the Buffalo Pike harvest found that the main skid trail had not revegetated properly. As a solution, Forest staff blanketed the skid trail with topsoil and reseeded the area, resulting in the establishment of native plant species. All of these tools would be available during implementation of the proposed action.

The Houston South Vegetation Management and Restoration Project area does not occur directly along the shore of Monroe Lake (Figure 1) and there is a significant distance before any influence from the project such as non-point source pollution (sediment/soil) could arrive in Monroe Lake. The nearest forestry action from this project is approximately 10 stream miles from the shore of the lake. All potential effects to water quality in the South Fork Salt Creek watershed, which eventually flows into Monroe Lake were addressed in the Houston South Vegetation Management and Restoration Project EA (and summarized above). Total proposed prescribed fire treatments are 4.9 percent and proposed silvicultural treatments make up 1.6 percent of the combined watersheds that collectively drain to Monroe Lake. These treatments would be implemented gradually, over a span of 10 years or more, with vegetation recovery occurring between each treatment. Therefore, on average, silvicultural treatments would impact less than 0.16 percent of the combined Lake Monroe watersheds in any given year. Following the Forest Plan standards and guidelines, the proper design criteria, and the proper implementation of BMPs, the Houston South Vegetation Management and Restoration Project would not add additional impairments to Monroe Lake via erosion (Menke 2023). Thus, the proposed action would have no effect to Monroe Lake.

The proposed project includes the replacement of three Aquatic Organism Passages (AOPs). While these replacements would benefit fish and other aquatic specie by connecting currently dissected stream habitats, they also repair undersized culverts which cannot properly handle high volumes of water during heavy rain events and therefore increase erosion in their current state, challenges which are also likely to worsen under the predicted greater rainfall events forecast in a changing climate. The Forest Service efforts to design and fund improved stream crossings would provide important infrastructure improvements to the Jackson County transportation system.

The project proposes to rehabilitate or relocate several sections of eroding trails and repair or decommission several miles of eroding roads. These activities, along with fixing three undersized stream crossings from diverted eroding flows, would have long term benefits to water quality.

No Action

The no action alternative would pose risks to the water quality of Lake Monroe. Current runoff and erosion patterns would be expected to remain the same, decreasing water quality and available aquatic habitat over time.

Roads, trails, and undersized culverts in the project area are currently contributing sediment to the South Fork of Salt Creek watershed. With no action, repairs as proposed in the Houston South project would not occur.

No action would result in continued degradation of 7.6 miles of roads within Monroe Lake's watersheds, that the proposed action would either repair or decommission. These roads are currently decreasing water quality through increased erosion and sedimentation in the watershed. These are legacy roads that still exist in the watershed, many of them decades old, pre-dating the creation of the National Forest and have either not been maintained over time or were poorly located to begin with (or both) and are having a negative impact on water quality currently due to the increased erosion they are causing.

Approximately 26 miles of the Hickory Ridge trail system and the 3.5 miles of the Fork Ridge trail are within the project area. No action would result in many parts of these trails not being re-located from riparian or other poor areas, where they are currently degraded and leading to increased erosion (Figure 13) Several trails are entrenched, headcut, and have become a surface water drainage (Figure 14). Houston South project activities would provide long-term improvements to the trail systems.

Figure 13: Hickory Ridge Trail #11

Figure 14: Hickory Ridge Trail #3

The three road stream crossing improvements that are proposed to widen channel flows through stream crossings would not be constructed. The improvements would have not

only increased the availability and connectivity of habitat for fish species but also repaired undersized culverts. Undersized culverts cannot properly handle high volumes of water flow during heavy rain events and therefore increase erosion in their current state, issues which are also likely to worsen under the predicted increase in rainfall events that are predicted in a changing climate. Thus, under no action, efforts to design and fund infrastructure improvements to the Jackson County, IN, transportation system would not occur.

The restoration of head-cut streams in the project area, which could reduce sedimentation of streams, would not occur.

With no action, decline in oak/hickory regeneration would continue, resulting in replacement by trees such as beech and maple. Studies have found that nitrate concentrations in stream water through forests vary by the watershed's tree species composition (Lovett et al. 2004a). Lovett et al. (2004b) found that stands dominated by sugar maple led to high rates of nitrate release to stream water, while red oak have lower release rates. Nitrates are agents which can cause algal blooms in water bodies. Aside from the benefits oak species provide to wildlife, they may play an important role in protecting water quality as compared to the maple species that are replacing them.

No action would result in the forest having increased vulnerability to climate change, insects, and disease, which is likely to lead to large scale forest degradation and die off which could have increasing impacts to watershed health.

Additionally, recent research has shown that in the absence of management, forest stands in the central states region will continue to age and, due to tree senescence outpacing growth, become net carbon emitters (Hoover and Smith 2023).

Cumulative Effects

Over 82% of the watersheds of Lake Monroe are forested, and farming is generally limited to the wide valleys of Lake Monroe's three main tributaries, the North Fork, Middle Fork, and South Fork Salt Creek. According to the Lake Monroe Diagnostic and Feasibility Study (Jones et al. 1997) agriculture, which occurs across ~1,153 acres in the floodplain of the South Fork Salt Creek has the "potential for being the most significant source of NPS [Non-Point Source] pollution in Lake Monroe's watershed." These floodplains are frequently flooded and easily eroded and degraded with flooded debris (Figure 16). Flooding also causes property damage, increased stream bank erosion, and lateral stream movement; flooding under climate change projections is predicted to be more frequent and more severe. Conversely, the Houston South Vegetation Management and Restoration Project, which proposes no timber harvests in the floodplain, would improve ecosystem health.

No reasonably foreseeable future Forest Service activities are proposed within the cumulative effects geographical boundary.

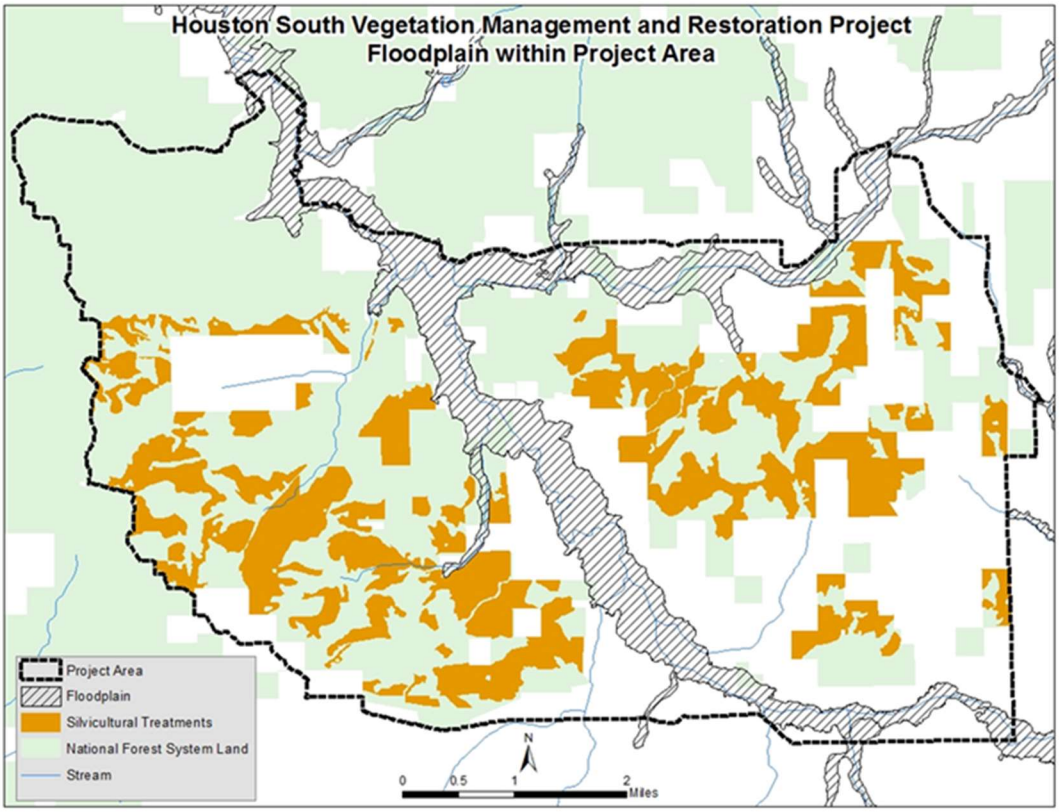

Figure 15: Locations of Proposed Silvicultural Treatments in Relation to Jurisdictional Floodplain

Figure 16: Flood debris in an agriculture field

Ongoing activities that disturb soil on private lands, such as crop cultivation, grazing, land development, and timber harvest in the absence of BMPs are expected to continue for the length of the Houston South Project and beyond. Additional new soil disturbances have been occurring on private land, including recreational use of off-road vehicles.

Urban development within the Monroe Lake watershed is affecting water quality, as an estimated 9,000 households are served by onsite septic systems. Pollutants from both agricultural fields and urban areas, such as fertilizer, animal manure, sediment, and septic system leakage are washed into Monroe Lake when it rains (Sullivan 2022).

Future actions will likely add to historic soil disturbances, resulting in more soil and water quality degradation. While private landowners have been encouraged in the past to adopt soil and water conservation practices, even if measures are employed during an activity, consistent long-term maintenance practices to control erosion and sedimentation from disturbances are less likely to have been (or be) implemented. Because of the lack of BMP regulation on private lands, soil-disturbing activities that negatively affect soil and water quality will likely persist. Additionally, this is worsened by the fact that Monroe County exempts agriculture and forestry from zoning ordinances that are meant to combat sedimentation.

According to the Lake Monroe Watershed Management Plan (Sullivan 2022), Monroe Lake is highly erodible due to the topography and soil type within the watershed. Streambank erosion accounts for ~86% of observed sedimentation. Other major sources of sedimentation include conventionally tilled cropland, livestock with access to streams, construction sites with insufficient erosion control methods, and forestry sites "***with insufficient***" (as quoted directly from the Lake Monroe Watershed Management Plan) erosion control. The Houston South Project would not have insufficient erosion control methods because Forest Service personnel and contractors would use Forest Plan standards and guidelines and design criteria, along with implementing BMPs.

With adherence to the Forest Plan, the Houston South Vegetation Management and Restoration Project would not further negatively impact Monroe Lake, but instead would improve the water quality by repairing and decommissioning degraded roads, improving, and re-routing degraded trails, and implementing AOPs to improve streamflow and streambank stability. Any direct or indirect impacts of the proposed actions would be mitigated; therefore, no cumulative effects are expected.

New Information for Threatened and Endangered Species

The spatial boundary used to evaluate direct and indirect effects is the Brown County Hills Subsection (222EM) which is the Ecological Classification System and primary habitat association that the project area falls in. Because bat species forage over longer distances, a 5-mile buffer was established for the cumulative effects geographical boundary. The temporal consideration for cumulative effects is 20 years, as prescribed fire treatments would likely be completed in this timeframe.

Proposed Action

Direct and Indirect Effects

The little brown bat and tricolored bat were analyzed in the 2019 Final EA as RFSS. These bat species are wide-ranging and could use this area for feeding, roosting, and corridors. Both bats are considered present and were located in the Hoosier National Forest during the 2010 mist-net surveys (McClanahan 2010) or during current acoustic monitoring.

Little brown and tricolored bats can be found in a cave inside the cumulative effects boundary, although in low numbers. White-nose syndrome is known to occur in these species and has heavily affected populations in Indiana. Large declines have been noted during forest hibernacula surveys and these species are now considered rare.

Project activities could negatively impact these species concerning roosting, staging/swarming, and summer habitat. However, growing season burning would be minimal and would not occur during the non-volant period (June 1 to July 31). Removal of hazard trees for fire line preparation may indirectly affect bat species by removing potential roost trees. Crews would remove trees for fire line during the bat's inactive period to avoid any direct effects. The proposed project would have short-term effects with long-term benefits for these species regarding travel corridors and foraging. Since both bat species have rare occurrences on the landscape, the availability of existing cover habitat adjacent to the project area and rarity of growing season burns, project activities should not result in reduced viability of a population or species (Harriss 2019). Design criteria, vernal pools, and existing cover habitat adjacent to the project area would benefit these species, but negative impacts could occur. Therefore, this project may have both positive and negative impacts on the little brown and tricolored bat.

On August 22, 2022, the Forest Service requested to reinitiate consultation to address changes in the take prohibitions that apply to the northern long-eared bat (NLEB) on the continued implementation of planned and ongoing projects within the Eastern and Southern Regions of the USDA Forest Service with the U.S. Fish and Wildlife Service, (Service).

The Forest Service provided a Biological Assessment, with subsequent revisions and clarifications. These actions were previously consulted on using the 2016 Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Exempted from Take Prohibitions (PBO), but whose activities have not yet been completed.

The Service listed the NLEB as a threatened species on April 2, 2015, and issued a species-specific 4(d) rule on January 14, 2016. Under the 4(d) rule, incidental take of the NLEB was not prohibited except in certain situations described in the rule. Reinitiation was requested in response to the reclassification of the NLEB as an endangered species on November 30, 2022 that resulted in a change to the take prohibitions that apply to the species, which became effective March 31, 2023.

The Service provided the Forest Service a Biological Opinion (BO) and an Incidental Take Statement (ITS) on March 31, 2023 (USFWS 2023). In the BO, the Service determined that the level of anticipated take is not likely to jeopardize the continued existence of the NLEB provided the Forest Service complies with the terms and conditions of the ITS.

No Action

A lack of action would result in no impacts to any of the bat species. However, it would also result in the continued decline of the oak-hickory ecosystem and a lack of diversity in habitat types and forest age classes, which could have negative indirect effects on bats. Additionally, the lack of climate resilience that would arrive from the proposed action could also indirectly negatively affect bats.

Cumulative Effects

With adherence to the Forest Plan and compliance with the terms and conditions of the Incidental Take Statements, no cumulative effects to federally listed bat species are expected. No reasonably foreseeable future Forest Service activities are proposed within the cumulative effects geographical boundary.

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Appendix A - Design Measures

The ID team incorporated management requirements and design measures in the project design to reduce any potential negative impacts of the project. Forest Plan standards and guidelines (USDA 2006a) and statewide best management practices (BMPs) are also required of implementers of the project (Appendix B).

Table A-1: Design Measures

SITUATION TO BE PREVENTED OR AMELIORATED	MEASURE	RESPONSIBILITY OF
Cultural Resources		
Damage to cultural resource sites	Adequate buffer zones (20 meters in width) will be established and flagged on the ground to avoid all cultural resource sites that require protection during treatment activities.	Heritage resource specialist
Damage to cultural resource sites	Adequate buffer zones (30 meters in width) will be established and marked on the ground to avoid all cemeteries	Heritage resource specialist
Damage to cultural resource sites	Cultural resource sites that require protection from fire will have a buffered fire line laid in with foam or a leaf blower. Regardless of the method, heavy downed fuels located on-site should be hand removed, if possible.	Heritage resource specialist, prescribed burn specialist
Damage to cultural resource sites	If cultural materials or human remains are discovered during project implementation, immediately cease work and notify the Heritage Resource Specialist.	All Implementers
Damage to cultural resource sites	Conduct cultural resource surveys of private lands prior to implementation of prescribed burning or ground disturbance during road construction and reconstruction.	Heritage resource specialist, prescribed burn specialist, engineering
Damage to cultural resource sites	Motorized vehicle/machine work will be limited in duration and occur in favorable weather conditions to avoid ground disturbance at protected sites.	All Implementers
Damage to cultural resource sites	Cut trees near protected sites so they fall away from site features and site boundary.	All Implementers
NNIS		
Potential spread of NNIS plants	Clean equipment before entering work areas. Include equipment cleaning clause in all timber contracts.	Contract administrator
Potential spread of NNIS plants	Clean all equipment to be used for burn implementation (Rx equipment, fire line creation) prior to entry onto the Hoosier Forest.	Prescribed burn specialist/burn boss
Potential NNIS germination and establishment	Reseed disturbed areas created at log landings. Consider reseeding disturbed areas along fire lines, as needed. Use either the Hoosier National Forest	Timber sale administrator and prescribed burn specialist/burn boss

	seed mix or consult with Forest Botanist on species composition of seed mix.	
Herbicide Application		
Effect of herbicides on non-target vegetation	Choose a method that, when applied directly, targets the undesirable plants with little over-spray (e.g. cut-stump, basal bark, hack-n-squirt).	Herbicide applicators
Effect of herbicides on non-target vegetation	Apply herbicide when adjacent native plants are dormant (early spring or late fall).	Herbicide applicators
Effect of herbicides on non-target vegetation	If application is necessary during the growing season, use selective herbicides or a selective method of application to reduce effects to the surrounding non-target vegetation.	Herbicide applicators
Effect of herbicides on non-target vegetation	Apply only formulations approved for aquatic use in or next to surface waters. Minimize the use of triclopyr (ester formulation) or surfactants used with glyphosate (terrestrial version) within ephemeral, intermittent or perennial stream corridors, or within 100 feet of lakes, ponds or wetlands.	Herbicide applicators
Effect of herbicides on non-target vegetation	Follow label directions and do not exceed any mixing or application rates. In addition, temporarily close treatment areas when warranted (e.g., heavily used trails near treatments).	Herbicide applicators
Prescribed Fire		
Excess smoke in the air locally	Before beginning ignition, ensure smoke dispersal forecasts as issued by the National Weather Service are conducive to minimizing smoke impacts.	Prescribed burn specialist/burn boss
Excess smoke in the air locally	Do not ignite fire when the area is in nonconformity or when air quality alerts have been issued for the area.	Prescribed burn specialist/burn boss
Excess smoke in the air locally	Develop burn plan parameters that moderate fire behavior.	Prescribed burn specialist/burn boss
Excess smoke around smoke-sensitive targets	Burn only when atmospheric conditions would keep smoke away from smoke-sensitive targets.	Prescribed burn specialist/burn boss
Prescribed fire escaping or damaging property	Keep fuel concentrations away from perimeters, power lines, and residences.	Prescribed burn specialist/burn boss
Soil and Water		
Erosion	Erosion control measures will be kept concurrent with operations as dictated by ground and forecasted weather conditions.	Timber sale administrator
Reduce the risk of erosion and to avoid effects to riparian areas	Skid roads and log landings are to be located to minimize soil and stream buffer disturbance; avoid or limit the number of functioning stream crossings; use existing old skid routes where desirable; and avoid the steeper and wetter areas within the units and areas of disturbance when practical. Skid trails should not exceed 35% slope. Consult with soil scientist, fisheries biologist, or botanist to approve log landing locations as needed.	Timber sale administrator

Minimize compaction, rutting, puddling, ponding, and soil movement	Operate tracked or rubber-tired equipment when soils are most resistant to compaction and rutting. Conduct equipment operation between June 1 and November 15, when soils are not saturated, unless authorized by a FS representative if suitably dry or frozen soil conditions allow.	Timber sale administrator
Minimize compaction, rutting, puddling, ponding, and soil movement	Suspend skidding/hauling during periods where soils are: saturated due to high levels of precipitation when air temperatures are above freezing; thawing during winter months after periods of being frozen; and under any other conditions that would appear to be saturated.	Timber sale administrator
Soil movement into streams	Install erosion control measures along road construction when inside filter strips.	Engineering, contractors
Subsurface flows to the surface and creating new water ways on steep hill slope; severe rutting and compaction	To protect areas where water comes to the surface and runs down a skid road, limbs and tops can be placed on the road surface to be run over by equipment to act as a cushion and disperse the weight of heavy equipment thereby preventing severe rutting and compaction.	Timber sale administrator
Minimize sediment reaching streams	Leave a 25 foot no cut filter strip along perennial streams.	Timber sale Administrator and sale prep personnel
Effects to soil and water	In riparian corridors (25 feet for ephemeral, 50 feet for intermittent, and 100 feet for perennial), operate tracked or rubber-tired equipment when soils are most resistant to compaction and rutting.	Timber sale Administrator
Recreation		
Effects to trails	Restore trail tread to its original condition as much as possible after treatment and in a timely manner. Operations including: repair to waterbars, removal of slash and debris, smoothing of ruts in trails, removal of overhead hazards, and brushing in widened trail corridors.	Engineering, recreation personnel, contract administrator
Possible negative effects on Visuals	Lop and scatter slash adjacent to the Hickory Ridge and Fork Ridge Trails for 25 feet.	Contract administrator
Transportation		
Sedimentation in drainage	Install temporary culverts for access for rights-of-way, logging and road construction	Engineering, contractors
Possible negative effects on Visuals	Chip or bury slash generated from roadwork on the trail where practicable.	Engineering, contractors
Possible negative effects to Aquatic Organism Passages	Use bridges, bottomless pipes, or fords to meet guidelines for AOP crossings on drainages.	Engineering, sale administrator
Sediment movement	Install erosion control devices, keep equipment out of drainages, except at approved crossings	Engineering, sale administrator
Wildlife		
Effects to bats	Remove hazard trees for fire line prep prior to April 15 and after September 15	Prescribed burn specialist/burn boss

Effects to bats	Remove midstory and crop tree release prior to April 15 and after September 15	Silviculturist
Effects to bats	Implement Standards and Guidelines from the Forest Plan, maximize the benefit to Indiana bats and protect the gray bat (USDA FS 2006a) pages 3-3 through 3-5)	All implementers
Effects to sensitive species	Dates of prescribed burning and fire line placement may need re-evaluated based on future sensitive species research findings. Coordinate with the wildlife biologist on current findings	Wildlife biologist
RFSS Plants		
Effects to RFSS Plants	Protect known populations of American ginseng from impacts during timber logging activities and fire line construction.	All Implementers
Effects to RFSS Plants	Do not cut or damage any butternut trees without having them evaluated for healthiness. Stop all activity around any butternuts discovered during implementation and protect trees from disturbance until they can be assessed by a Biologist/ Silviculturist for butternut canker resistance.	All Implementers
Effects to RFSS Plants	Report any newly found populations of RFSS to the Forest Botanist and protect them from direct impacts during timber logging activities and fire line construction.	All Implementers

Appendix B - Pertinent Forest Plan Guidance Associated with Soil and Water Quality and Indiana Logging Forestry Best Management Practices

Hoosier National Forest Land and Resource Management Plan (Forest Plan), Forest-wide Guidance, Soil and Water Conservation:

Stabilize areas disturbed by management activities as soon as practical, or at least within the same growing season.

Improve or maintain water quality by designing and maintaining roads in accordance with Appendix G [of Forest Plan].

Reduce compaction and rutting by prohibiting heavy equipment use when the soils are in a saturated condition, thereby reducing surface runoff, soil erosion, and loss of soil nutrients.

Give priority to stabilizing areas discharging soil into watercourses, especially those that affect the watershed of municipal or recreational reservoirs.

Guide soil protection and management for all activities according to site capabilities as identified by interpretation of soil and other ecological site factors.

Prohibit log skidding and heavy equipment within streambeds.

Skid roads should be designated by Forest Service personnel and should not exceed a gradient of 35 percent.

Construct and maintain waterbars on skid trails to slow surface runoff before it creates channels and gullies or moves excessive amounts of sediment into streams.

Soil disturbing operations that extend over a number of operating seasons may require mulching of exposed areas to reduce surface erosion.

Designate log landings on site by Forest Service personnel. Locate landings on upland, well-drained, nearly level sites to minimize surface runoff and soil erosion.

When operations are complete, prepare landings to provide favorable site conditions for seed germination. The landings should be seeded with approved Forest Service seed mixtures and mulched to prevent erosion until vegetation becomes reestablished on the site. These actions should be taken as soon as practical after disturbance.

Logging or site preparation equipment should avoid plastic soils (soils that can be molded or shaped like clay) when the water table is within 12 inches of the surface or when soil moisture exceeds the plastic limit. Soil moisture exceeds the plastic limit if the soil can be

rolled to pencil size (approximately ¼ -inch diameter and 6 inches long) without breaking or crumbling.

Resource management activities that may affect soil or water quality must follow Logging and Forestry BMPs for Water Quality in Indiana (IDNR 1998), or most recent version, as a minimum to achieve soil and water quality objectives. When Forest Plan standards exceed Indiana BMPs or water quality standards, Forest Plan standards take precedence.

Where topsoil is less than one inch thick or where organic matter is less than 2 percent, retain logging slash in place (perform limbing at the stump).

Designate the location of roads, trails, main skid trails, and similar features that disturb soils. Stabilize disturbed sites during use and revegetate after use to control erosion.

Utilize the "Indiana Storm Water Quality Manual" (IDEM 2007) as well as "Best Management Practices for Erosion and Sedimentation Control" (USDOT 1995) for guidance on limiting sedimentation.

In disturbed areas, generally stockpile topsoil and return it to the site.

Permanent water bodies and perennial streams will consist of a 100-foot riparian corridor. This can be adjusted based on site specific analysis.

Intermittent streams will have a minimum 50-foot corridor from each stream bank and ephemeral streams will have a 25-foot minimum riparian corridor.

Waterholes or small ponds up to 0.5 acre with adjacent slopes no more than 5 percent should have a 25-foot riparian corridor. If adjacent slopes are steeper, wider corridors may be needed.

In general, roads and trails will not be constructed in riparian corridors unless no practical alternatives exist. Road and trail approaches to streams will be located to minimize erosion and sediment introduction to the stream.

Roads and trails will generally cross channels at right angles. Channel crossings will be accomplished using bridges, culverts, fords, or other appropriate crossing structures according to site specific conditions. Remove unnecessary crossings when a road or trail is decommissioned.

Limit heavy equipment crossings in riparian corridors.

Minimize cuts and placement of fills while building new roads in wetlands and riparian corridors in accordance with safety and other engineering road design criteria. Provide sufficient drainage to ensure that the absorption capacity of the riparian corridor is not exceeded.

Keep slash out of water bodies, stream channels, floodplains, and areas where it may be swept into streams, rivers, and water bodies except to meet other habitat objectives.

Soil-disturbing activities of approved practices within designated riparian corridors will require effective erosion control. Implement, as needed, erosion control measures such as straw bales in ditch lines and small drainages, berms in road embankments during construction, diversion ditches, slash and unmerchantable logs across slopes and trails, check dams in ditch lines, sediment detention basins, and sediment fences.

Indiana Logging and Forestry Best Management Practices; BMP Field Guide

Planning Forest Roads

Lay out the road and its drainage system before equipment arrives.

Use existing access routes if use will not aggravate an erosion problem.

Apply the riparian management zone BMPs to road locations.

Minimize the number of stream crossings.

Provide safe and visible access to public roads.

Avoid or minimize disturbance to areas of high-quality trees.

Coordinate with utility companies and highway departments.

Keep grades between 2% and 10% when possible.

Maintain buffers between roads and waterways and other sensitive areas.

Grades up to 15% can be used for distances up to 300’.

Break road grades frequently to divert water from road surface onto stable areas of the forest floor.

Use naturally stable sites such as ridge crests and well drained sites and contours.

Avoid gullies, seeps and other permanently wet areas.

Mark the locations of grade breaks, outslopes and diversions.

Incorporate aesthetic considerations, especially in visually sensitive areas. Visually sensitive areas may include landings next to roadways, residences and property access points.

Construct only as much road as necessary.

If possible, construct, stabilize, and seed in advance of use.

Minimize clearing.

Keep road width to the minimum necessary to operate safely.

In winter, removal of leaf cover will allow road to freeze quicker.

Keep blades off the ground when shearing and pushing debris.

Minimize earth moving activities when soils are excessively wet or excessively dry, and before oncoming storms.

Place crushed stone on highly erosive sites or when hauling during wet or muddy conditions where necessary.

Add geotextile stabilizing fabric under the crushed stone on wet sites where necessary.

When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety.

Construct roads to drain well at all times.

Install culverts or other breaks at specified intervals on steep grades, where inside ditches are required.

Drain water diverting structures and road runoff onto the undisturbed forest floor away from stream channels.

Minimize cut and fill work and keep slopes at stable angles.

Maintain an undisturbed buffer strip between forest roads and streams.

If sufficient buffer strip next to waterways is not possible, use temporary erosion and sediment control practices (e.g., silt fence).

Install erosion control measures as road sections are completed.

At culvert drain spout install sufficient energy dissipaters, such as brush or riprap, where necessary to prevent sediment delivery to the water course.

Do not place fill material into open sink holes, waterways, wetlands, floodways or other sensitive areas.

Do not leave felled or cleared material in major stream channels or where it may be washed into a channel during a flood event.

Protect the public roadbed and drainage system when accessing public roads. Install a properly sized culvert when necessary.

Install an entry gate or barricade to keep potentially damaging and unwanted traffic off the forest road.

Road and Trail Maintenance

Avoid long steep grades greater than 20%. Use steeper grades only for short distances and when large water bars or other diversions are installed and maintained.

Keep public roadways clean of mud and logging debris.

Clean dips, culverts, and crossdrains; repair ditches to prevent erosion and sediment delivery into waterways.

Clear away even minor obstructions that may have accumulated in drainage structures (especially culverts).

Smooth edges that develop on road surface if they will trap water.

Closing Forest Roads

Stabilize forest roads and smooth water channeling ruts and outside berms as soon as possible after use.

Insure that all erosion control and water management measures (e.g., water bars, drainage dips, culverts and ditches) are working.

Seed road areas prone to erosion that will not quickly re-vegetate naturally. Fertilizer and lime may be needed in some cases. All unsurfaced roads exceeding 5% in grade should be seeded.

Mulching may be necessary to reestablish ground cover on some difficult areas.

Properly placed logging slash can help break the flow of water. It must be limbed to achieve good contact with the road surface.

Forest owner should revisit the site periodically to determine if repair or maintenance is needed.

Skid Trails

Avoid long steep grades greater than 20%. Use steeper grades only for short distances and when large water bars or other diversions are installed and maintained.

Locate to allow skidding at an angle to the slope, not straight up and down a hill.

Avoid skidding through stream channels, springs, seeps, sinkholes and other wet areas.

Cross streams as near to a right angle as possible. Utilize temporary bridges or install culverts where practical.

Remove temporary crossings as soon as use is completed.

Fords may be utilized where stable conditions exist and allow crossing without excessive soil movement into the stream (sedimentation).

If necessary, install temporary crossings in small intermittent and ephemeral streams by placing logs or poles side by side in the streambed. Do so only if:

- Soil is not introduced into the stream,
- Stream flow is not blocked or diverted,
- Woody material is removed after use.

Closing Skid Trails

Smooth water channeling ruts and berms.

Install appropriately spaced water bars and other diversions as each harvest section is completed or shut down—even temporary shutdowns.

Divert water off skid trails before the trail enters a riparian management zone or crosses a stream.

Drain each diversion onto stable forest ground.

Seed skid trails prone to erosion and slow to re-grow naturally.

Mulch and fertilize seeded areas where necessary.

Return disturbed recreation trails to pre-harvest condition or better.

Install a visible traffic barrier to prevent use by off-road vehicles.

Logging debris in combination with water bars or other diversions can be placed on skid

roads for erosion control. Brush and logs need to be limbed sufficiently to allow ground

contact.

Stream Crossings

Avoid crossing streams when possible.

Cross at right angles at a point where the streambed is straight and uniform.

Minimize the use of equipment in the streambed.

Limit construction activity to periods of low or normal flow.

Minimize excavation and fill at stream crossings and other disturbances to stream banks and channels.

Use materials that are clean, non-erosive and non-toxic.

Avoid using soil as fill except when installing culverts.

Avoid altering stream flow.

Divert runoff from roads and trails leading to stream crossings into undisturbed vegetation. Avoid directing runoff directly into streams, including ephemeral streams.

Construct bridge, culvert or pole crossing at elevations higher than the road approach.

If necessary, stabilize road and trail approaches to stream crossings with aggregate or other suitable material.

Anchor one corner of bridge to prevent movement downstream.

Stabilize exposed soil as soon as practicable.

Maintain crossings in safe, functional condition.

Close temporary crossings by removing culverts, poles, portable bridges and other obstructions as soon as crossings are no longer needed.

Bridges

Bridges are effective ways to keep equipment out of flowing streams.

Utilize a bridge design that will provide safe access and minimize disturbance to the stream bank, channel, and the riparian management zone.

Use temporary or portable bridges instead of culverts to access areas where permanent structures are not needed.

Place them so as not to unduly constrict stream channels or impede flood waters.

Anchor temporary bridges on one end with a cable or other device so they do not float away during high water.

Install so they can be removed easily and promptly when they are no longer necessary.

Culverts

Use minimum size of 12 inches in diameter and large enough to pass flood flows.

Use arch culverts where it is important to retain the natural stream bottom.

Both ends should extend at least one foot beyond the edge of the fill material.

Place in line with the natural stream course.

Install at or slightly less than the natural stream slope.

Compact fill material firmly around culverts, particularly around the bottom half to prevent water from seeping around the culvert.

Cover the top of culverts with fill to a depth of one third of the pipe diameter or at least 12 inches, whichever is greater, to prevent crushing.

Hollow logs are permissible in very small channels if they can handle anticipated stream

flows but should be removed once they are no longer needed.

Keep culverts open and free of obstructions.

Use flared end culverts or rip rap where necessary to protect culvert inlet from erosion.

Fords

Avoid using fords if practicable, especially in areas of significant water quality concerns.

Select fording sites with gentle approaches, low banks, and hard and stable streambeds.

Construct to conform as closely as possible to the original streambed to minimize water flow restrictions.

Stabilize the streambed and approaches where necessary. Stabilizing material may include corduroy mats, reinforced concrete planks, crushed rock, rip-rap or rubber mats.

Avoid depositing soil in the stream during ford construction and use.

Avoid use during high water.

Pole fords should be used carefully to maintain water flow.

Pole fords are not appropriate for perennial stream crossings.

Remove pole fords immediately after use.

Riparian Management Zones (RMZs)

Make RMZs as wide as practical based on watershed characteristics.

When harvesting trees in the RMZ, minimize disturbance of the forest floor, exposure of mineral soil and degradation of stream banks, and leave adequate tree stocking to shade the stream.

Locate roads and skid trails outside RMZs except where necessary for stream crossings.

Minimize mechanical disturbance to the forest floor by using directional felling away from the water course and winching to skid trails outside an RMZ when necessary.

Do not pile slash, fill or debris within these areas.

Remove felled tops and logging debris from the channels of perennial and large intermittent streams.

Place felled tops and debris a sufficient distance away from the water course to prevent flood impediments.

Protect the forest floor to allow sediment to be filtered out before reaching the watercourse.

Rule of thumb - expose no more than 10% bare, mineral soil, well distributed throughout an RMZ.

Avoid locating equipment and material storage sites, maintenance sites and log landings within an RMZ.

Avoid operating wheeled or tracked equipment in an RMZ and watercourses except on designated roads and stream crossings.

Don’t locate roads or skid trails on pond dams.

Divert forest road and skid trail runoff onto stable areas before it enters the RMZ.

Stabilize all roads, skid trails, cuts and fills in the RMZ as soon as practicable after construction and use.

Avoid broadcast spray of pesticides or fertilizers within the RMZ.

Cut few if any trees within 15 feet of permanent watercourses.

Retain at least 50% well distributed canopy cover in the primary RMZ on perennial water courses.

Ephemeral streams

Minimize soil disturbance, crossings, and channel blockages.

Remove channel blockages and stabilize erosive areas after use.

Avoid broadcast applications of pesticides and fertilizers if water is present.

Avoid diverting runoff from skid trails and forest roads into ephemeral stream channels.

Log Landings

Keep the number and size of landings to the minimum needed to operate safely and efficiently.

Choose a site that will hold up under anticipated use by heavy equipment.

Avoid sensitive areas, such as riparian management zones, waterways, caves, springs, seeps, and open sinkholes.

Maintain an undisturbed buffer strip between log landings and sensitive areas.

Locate landings on slightly sloping ground where soil and site characteristics facilitate drainage and minimize erosion problems.

Design landings to provide safe access and visibility onto highway when next to public roads.

Consider aesthetics when planning log landings next to roadways and other visually sensitive areas.

When possible, maintain a buffer screen next to public roads and trails for aesthetic purposes.

Notify appropriate utility companies before locating landings near overhead and underground utilities.

Construction of Log Landings

Minimize soil disturbance and clear only the size of landing needed.

Clear high stumps, dead snags and other hazards.

Construct water diversions to drain water away from the landing and onto a stable area of the forest floor.

If leveling is necessary, cut and fill should not obstruct the natural drainage of the area. During construction, use temporary erosion and sediment control practices (such as silt fences) where there is significant erosion potential or where there are insufficient buffer strips next to waterways.

Use and Maintenance of Log Landings

Restrict fueling and maintenance activities to designated areas of the landing. Handle all fuels and lubricants with care to avoid spills.

Avoid use of the landing when conditions may lead to soil movement off site or when extensive rutting can occur and affect site and water quality.

Apply coarse stone or other stabilizing cover as needed in extreme conditions.

Leave log cutoffs in the woods or a designated area of the landing to minimize work hazards, improve landing efficiency and appearance.

Minimize soil compaction, rutting and logging debris on agricultural and other non-forest lands.

Keep the public roadbeds clean of mud and debris and maintain the public road drainage system.

Maintain water diversion and erosion control measures to control runoff into and from the landing.

Closing Landings

Remove all trash, containers, equipment and other contractor materials.

Leave the landing in a usable condition, free of large ruts and logging debris.

Do not block drainages with log cutoffs or other landing debris.

Cut or lop standing snags and unsightly treetops in visually sensitive areas. Visually sensitive areas may include landings next to roadways, residences and property access points.

Seed and mulch landings, where there is significant erosion or aesthetic concern. Lime and fertilizer may be needed on some landings to achieve adequate and rapid revegetation.

Install appropriate traffic barriers where needed to prevent off-road vehicle damage to recently stabilized areas and other conservation efforts.

Handling Fuels, Lubricants, and other Hazardous Materials

Report all fuel, lubricant and hazardous material spills, exceeding one pound or pint, which enter the waters of the state, including groundwater, and causes a sheen or creates damage to the water quality. Report within 2 hours to the Indiana Department of Environmental Management 24-hour hotline: 888-233-7745.

Additionally report spills: 1) near well heads, 2) operating fluids exceeding 55 gallons, 3) spills which may damage water quality, 4) spills exceeding your cleanup capabilities, and 5) any spill where there is doubt or when technical clarification or assistance is needed. Any spill not cleaned up is also reportable. (Indiana Spill Rule-327 IAC 2-6-1&2).

Clearly specify and use a designated area for fueling, material storage and maintenance. This area should be away from waterways, areas prone to runoff or sensitive areas like caves, sinkholes, springs, seeps and riparian management zones.

Use caution when fueling all equipment, even chainsaws, to avoid spills.

Equipment Breakdown and Spills

Used oils, fuels, antifreeze and other materials may be considered hazardous and must be disposed of at approved sites. Do not mix wastes. For disposal site information contact the Indiana Department of Environmental Management (IDEM) at 317-233-7745. Toll free 888-233-7745.

Place all drained lubricants, fuels, etc. in closed containers. Remove them from the site for disposal or recycling according to state and federal regulations.

Drain oil filters when hot and dispose of used filters, oil cans and grease tubes properly.

Drained metal cans and filters can be recycled as scrap metal.

Maintain all equipment to avoid leaks.

Clean up any spills that may have occurred according to state regulations. Provide receptacles, a spill kit and instructions for use in breakdown situations. As a minimum, the spill kit should include shovels, plastic sheeting (e.g. Visqueen*) for containment,

plastic container to hold spill contaminated material, 2 bags of absorbent (dry sand, oildry, kitty litter, peatmoss, ground corncobs, sawdust, and new straw are suitable

absorbing materials). The spill kit should also include an instruction packet, available from IDEM.

Spills may be temporarily handled by: a) placing contaminated materials on heavy plastic and covering to protect from rainfall; b) using absorbents to soak up spilled materials for easy removal; c) constructing a dike to prevent off site movement of material.

Appendix C – Management Area 2.8 within the Project Area.