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Service

Hoosier
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Forest



Biological Evaluation for Houston South Restoration and Vegetation Management Environmental Assessment

Effects to Plant Regional Forester Sensitive Species (RFSS)

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I. Species Considered

The proposed project is located on the Brownstown Ranger District in Jackson County, Indiana. The project area contains approximately 23,363 acres, of which 13,533 acres (58%) is National Forest System lands (acreages derived from GIS). The majority of the project area falls in Management Area 2.8. Portions of Management Areas 2.4 and 6.4 are included for prescribed burning.

The intent of this evaluation is to ensure that decisions regarding land management are made with the benefit of recent scientific information regarding Regional Forester Sensitive Species (RFSS) and the habitats they may occupy on the Hoosier National Forest. The purpose of this biological evaluation (BE) is to document the potential effects of implementing the proposed Houston South project on these species and the habitats they may occupy on the Hoosier National Forest. The intent of this document is to ensure that these species receive consideration in the decision-making process, thereby ensuring compliance with the Endangered Species Act, National Forest Management Act, direction within Forest Service Manual Sections 2620 and 2670, and Forest Service Handbook 2609.13 (USFWS 1998, USDA FS 1991, 2005, and 1992):

The Hoosier National Forest - Regional Forester Sensitive Species list includes:

• Mammals	4 species
• Birds	6 species
• Reptiles	1 species
• Amphibians	2 species
• Fish	6 species
• Mollusks	3 species
• Terrestrial Invertebrates	47 species
• Karst Invertebrates	36 species
• Vascular plants	32 species
• Non-vascular plants	2 species

139 species

This report will evaluate the proposed projects impacts on the vascular and non-vascular plant RFSS. The mammal, bird, reptile, amphibian, fish, mollusk, terrestrial invertebrates and karst invertebrate RFSS are evaluated in a separate document (Harriss 2019). The Indiana Department of Natural Resources, Division of Nature Preserves database was consulted for records of occurrence of species relevant to this evaluation (IDNR 2018). I also walked many of the stands to look for and document plant RFSS and non-native invasive species (NNIS). In addition to this, this evaluation uses the best available science in making determinations to accompany this project-specific data.

A separate report (Coon, 2019) discusses the existing plant non-native invasive species (NNIS), their potential for spread within the project area and the potential impacts to other botanical resources in the proposed project area. It also discusses Forest Service activities to prevent and mitigate NNIS spread.

II. Purpose and Need

The Houston South Vegetation Management and Restoration Project proposed actions meet Forest Plan direction to promote tree growth, reduce insect and disease levels and move the landscape toward desired future forest conditions. There is a need 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. There is a need to provide a mosaic of forest condition dominated by hardwoods, and restore dry hardwood forest ecosystems that have not experienced periodic disturbance due to fire or other naturally occurring events for extended periods of time, and are undergoing mesophication (Nowacki and Abrams 2008). Mesophication is when mature overstory oak and hickories age and die, to be replaced by more shade tolerant trees such as maple and beech. The oak and hickory hard mast are critical food for wildlife species, and their foliage supports a wide diversity of insects that cannot feed on other species. Oak and hickory ecosystems need management activities to regenerate due to the historic suppression of fire and its resulting severe competition by the less desirable shade tolerant species (Vander Yacht, et al. 2018, Iverson et al. 2017a). This project proposes to use prescribed fire and several timber harvesting techniques to promote the regeneration and maintain the oak and hickory component of these areas (stands). Included in these activities is the removal of non-native pine plantations planted in the past. Once the pine is removed, these areas will be allowed to regenerate to native hardwoods that are characteristic of their historic conditions and provide early successional habitat for those bird, wildlife and plant species that need it. Reduction of stand density in overstocked hardwood stands will increase forest health and make the ecosystem more resilient and reduce the effects of insects, disease and climate change (Iverson, et al. 2017b; Iverson, et al. 2008).

Associated activities to the vegetation management described above include the repair of poorly maintained roads, or the relocation of poorly placed roads or trails in eroded areas, to reduce sediment deposition into streams and lakes. In addition, three AOP (aquatic organism passages) will be analyzed for replacement, to allow aquatic organisms to move both up- and downstream.

Those activities that would disturb soil or vegetation are listed in Table 1, below.

III. Area Descriptions and Surveys

I and Biological Science Technicians (Evanna Phelps, Bryan King) have surveyed the project area to look at the stands and document any Regional Forester Sensitive Species (RFSS) and the occurrence of non-native invasive species (NNIS) to the best of our ability. Surveys for botanical resources occurred between April and June of 2019. I also had notes from areas in the project area that I surveyed between June and July of 2015.

The hardwood stands are a mix of mesic and dry woods. Overstory trees include oaks, hickories, beeches, maples, buckeye, tulip poplar, cherry, sycamore, black walnut and some remnant ash. However, the ash coverage in the overstory has been reduced sharply from recent Emerald Ash borer activity, much as elms are now less common due to Dutch Elm disease. Midstories are predominantly maple and beech with the other species mixed in dependent on location on the landscape (ridge, bottomland, slope) and aspect. For instance sycamores tend to be seen in bottomlands, while oak and hickories tend to be more common on ridgetops and south-facing slopes. Understory plant diversity is rich with a large number of species, including shrubs, forbs, grasses, sedges and ferns.

The planted non-native pine stands are predominated by pine species, sometimes with midstory compositions of maple, tulip poplar and ash if overstory gaps are prominent. Ground floor diversity varies greatly within different stands; the more shaded stands have bare ground

covered with pine needle with scattered with ferns, sedges and grasses. The pine stands that are experiencing tree death and have more open overstories often have a higher diversity of floor species, but less than their hardwood neighbors. Non-native invasive species (NNIS) are more common and denser in planted pine stands as compared to their neighboring hardwood stands. This is in part attributed to the past historic disturbances that stripped these areas of vegetation. The planting of non-native pines in monocultures in these areas have likely altered the soil, light regime and native plants able to survive. These areas also provide dense winter cover for birds that have eaten invasive plant fruits and then deposit them to the forest floor while resting in the pine.

IV. Scope of the Analysis

After reviewing comments received during public comment periods, the interdisciplinary team determined there were no issues that would drive the creation of an additional alternative. Therefore, no additional Alternatives are analyzed besides the proposed Action Alternative (A) and the No Action Alternative (B).

For botanical resources, the scope of the analysis will be the spatial proposed boundary of the project for **direct** and **indirect** consequences. Treatment of midstory and overstory trees with cutting and herbicide are proposed to occur in the areas slated for prescribed burning. So, the principal acres used to evaluate **direct** and **indirect** consequences to botanical resources is the disturbance acres of 18,344 acres, listed in Table 1, which double counts the acres where timber harvest and prescribed fire overlap. For **cumulative** consequences for botanical resources, a buffer of approximately 1000 feet around the proposed project boundary will be considered as well.

Implementation of the timber activities would take about 12 years to implement, and the prescribed burns would occur over a 20 year period. Therefore, this analysis is using a 20 year time frame for evaluation of cumulative impacts.

Alternative A – Proposed Action

Table 1 contains a list of proposed activities and their size for the proposed Action and No Action Alternatives.

Table 1. Projected Disturbance (in acres) by Alternative.

TREATMENT	ALTERNATIVE A	ALTERNATIVE B
Harvest types:		
Pine Clearcut	401 acres	0
Pine Thinning	78 acres	0
Hardwood Shelterwood	703 acres	0
Hardwood Thinning	2,327 acres	0
Hardwood Selection	462 acres	0
Crop Tree release	170 acres	0

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Midstory removal	234 acres	0
TSI with herbicide^	1,973 acres	0
Total Harvest and Timber Treatments area (not including TSI) ^	4,376 acres	0
Road Construction and Re-Construction	31.73 acres/ 16.36 miles	0
Road Decommissioning	(2.7 miles)	0
Log Landings and Skid Trails (acres)	417 acres	0
Total Road Construction/Re-Construction, Landings and Skid Trail (acres)	449 acres	0
Prescribed Burn (federal and non-federal acres)*	Up to 13,500 acres	0
Constructed Fireline	Up to 15.2 acres (20.9 miles)	0
3 Aquatic Organism Passages	4 acres	0
Total Disturbance area	18,344 acres*	0

^TSI = Timber stand improvement. This will occur as part of pine clearcut, midstory removal, crop tree release, shelter wood and a portion of selection treatments. Thus it is NOT additive acres, and is not included (double counted) in the TOTAL Harvest Timber Treatments. The treatments will be in the same spatial areas, but different temporally. Results will be the same: opening canopies so more light can reach the forest floor.

*Prescribed burns will overlap with timber activities spatially in many areas, these acres are counted again (double counted) here since they will not overlap temporally and will have some different impacts to the areas than timber activities. The acreage of prescribed burns shows the acreage for initial burns, and assumes the same impacts for later re-burning of the same areas.

Proposed timber treatments that will require roads, log landings and skid trails include: pine clearcuts, pine thinning, hardwood shelterwood, hardwood thinning and hardwood selection. All of these cutting techniques will create varying sizes of gaps in the overstory canopies of these stands. Removal of cut trees will create soil disturbance due to the use of heavy machinery to cut and skid trees to log landings and haul roads. Skid trails are areas where equipment moves back and forth to remove trees, or where trees are drug along the ground, to be stock piled at log landings. Haul roads connect these log landings to existing county and township roads, and can be up to 16 feet in width. Haul roads are the roads that are designated as either re-construction or new construction in Table 1.

All of the roads designated for reconstruction and some for new construction have old, existing road beds that were used in the past. Some of the new road construction will occur in areas where no previous roads have existed. Road decommissioning will involve taking roads off the Forest's Road layer and may require brushing or the placement of barrier posts to prohibit future use by vehicles. These decommissioned roads can still be used by visitors as areas to hike and recreate.

Houston South Biological Evaluation for RFSS (Plants)

Crop tree release, midstory removal and timber stand improvement (TSI) will not require roads, skid trails or log landings. These activities will have little impact on existing soils and understory vegetation since work will be done by personnel on foot with chainsaws and herbicide backpacks or hand sprayers. These cutting and herbicide applications would reduce overstory and midstory densities to allow light to the forest floor and increase oak and hickory seedlings opportunities to advance into the mid- and upper canopies. Trees cut in these treatments will be left to naturally decompose in place. Girdled trees will be left standing for habitat use until they fall over naturally. Use of herbicides for these timber stand improvement activities will involve selective, spot spraying to avoid affecting non-target vegetation; no broadcast spraying is proposed. All herbicides proposed for use in this project are EPA approved, non-restricted herbicides and would be applied following the policies and regulations set forth by the Office of the Indiana State Chemist (OISC). Treatments would be done primarily with glyphosate, triclopyr, and imazapyr herbicide formulas which are labeled for use on woody vegetation. Design criteria (Table 6) (from Swaim 2019), emphasize proper use of herbicides to protect non-target vegetation and prevent the contact of herbicides with water sources ensuring that wildlife would not come into contact with treated water sources. Likewise, the design criteria ensure that herbicide applicators wear the appropriate personal protective equipment to reduce exposure and risk.

Prescribed burns would be used to create disturbance to discourage fire sensitive tree species (maple and beech) from establishing at a level to compete with oak and hickory regeneration. The Project shows non-federal lands as part of the proposed 13,500 acres. Private landowners will be approached and asked if they would like their lands included, if so they will sign a Wyden agreement. If no, additional lines will be made to avoid private lands. The more agreements with private landowners will decrease the amount of new fireline needed for implementation. Existing roads, trails and natural boundaries (streams) are used for fire lines (calculated to be up to 66 miles, or 48 acres) whenever possible to reduce impacts to soil and vegetation resources. Where fire lines need to be created, they are predominately made with chainsaws, brushhogs, mowers and leaf blowers. A bulldozer will be needed for approximately 159 feet of construction within the proposed 20.9 miles of new fireline. Fire lines are primarily used for foot travel and UTV equipment to implement prescribed fires. After use, created fire lines are allowed to naturally revegetate until needed again in several years to reburn the areas.

The aquatic organism passages (AOPs) will remove existing structures in the streams that are preventing organisms to move freely both up- and downstream; they would be replaced with new structures that provide for free movement of organisms in both directions. Impacts for these projects will cause soil and vegetation disturbance in the immediate area, disturbing a little less than 4 acres total for the three proposed AOPs.

Implementation of this project could be up to 12 years to achieve the timber harvest and treatments, and up to 20 years to achieve the prescribed burning objectives (includes repeated burns on the same areas over time).

Alternative B – No Action

Under the No Action alternative there would be no timber harvesting, prescribed burning or any of the associated activities listed in Table 1.

V. Environmental Consequences (Effects) by Alternative

Regional Forester Sensitive Species (RFSS)

There are currently 34 plant RFSS (vascular and nonvascular) for the Hoosier National Forest. These sensitive species have known occurrences on the Forest and inhabit a diverse array of habitat.

RFSS, on the Hoosier National Forest, occur in 10 community types and habitats, plus those wide-ranging species that use diverse habitats. The 10 community types are: dry forests, mesic forests, barrens, openlands, cliffs, caves and karst, wetlands, ponds and lakes, streams and larger river habitat.

The proposed project area is in the Brown County Hills subsection on the Brownstown Ranger District and includes dry forests, mesic forests, openlands, wetlands, ponds and lakes, and streams. It does not contain barrens, cliffs, caves and karst and larger river habitat. Therefore, the proposed project would not be detrimental to the continued viability of populations of sensitive species associated with barrens, large rivers, cliffs or caves and karsts. Because project activities would not affect these habitat communities, there likewise would be no direct, indirect or cumulative effects (Table 8) to RFSS associated with these habitat types. Therefore, these species will receive no additional consideration as part of this analysis.

The composition of Ecological Land Types and Ecological Land Type Phases for the proposed project area is documented in Table 2. Those species solely known to occur with the Crawford Upland Subsection (Tell City Ranger District and Patoka unit of the Brownstown Ranger District) will not be analyzed in this analysis since they are not documented to occur in or around the proposed project area or in the Brown County Hills Subsection (Attachment 1).

Table 2: Ecological Land Types (ELTs) and associated Ecological Land Type Phases (ELTPs) of the Brown County Hills Subsection (Van Kley, et al. 1995) within the proposed Houston South project.

ELT #	ELT Name	ELTP #	ELTP Name	Predominate canopy species/associates	Potential Habitat Type	%
1	Ridge	10	<i>Quercus prinus-alba/Vaccinium</i> , Dry Ridges	Chestnut oak, white oak, black oak & pignut hickory	Dry Forest, Open lands	2.8%
		11	<i>Quercus alba-Acer saccharum/Parthenocissus</i> , Dry-Mesic Ridges	White oak, black oak & pignut hickory	Dry Forest, Open lands	0.2%
		12	<i>Fagus-Acer saccharum/Arisaema</i> , Mesic Ridges	Sugar maple, northern red oak, black oak, white oak & yellow-poplar	Dry Forest, Mesic Forest, Open Lands	8.5%
2	Slope	20	<i>Quercus prinus-Quercus alba/Carex picta-Vaccinium</i> , Dry Slopes	Chestnut oak, white oak, black oak, pignut hickory	Barrens, Dry Forest, Open land	28.0%
		21	<i>Quercus alba-Acer saccharum/Parthenocissus</i>	White oak, black oak, pignut	Dry Forest, Mesic Forest, Open	0.3%

Houston South Biological Evaluation for RFSS (Plants)

			<i>ssus</i> , Dry-Mesic Slopes	hickory & chestnut oak	Lands	
		22	<i>Fagus-Acer saccharum/Arisaema</i> , Mesic Slopes	Sugar maple, white oak, northern red oak, American beech & pignut hickory	Mesic Forest, Open lands	28.2%
4	Bottomlands	40	<i>Fagus-Acer saccharum/Arisaema</i> , Mesic Bottomlands	Sugar maple & American beech	Mesic Forest, Open lands, Wetlands	2.1%
		41	<i>Platanus/Asarum</i> , Wet-Mesic Bottomlands	Sugar maple, American sycamore, American elm & American beech	Mesic Forest, Open lands, Wetlands	4.7%
		42	<i>Acer saccharum/Asarum-Boehmeria</i> , Bottomlands	Sugar maple, red maple, American beech, northern red oak & yellow-poplar	Mesic Forest, Open lands, Wetlands	16.1%
		43	<i>Acer saccharinum/Boehmeria</i> , Bottomlands	Silver maple, boxelder, green ash & American sycamore	Mesic Forest, Open lands, Wetlands	8.4%
5	Water	50			Rivers	< 1%
Total						100%

Tables 3 and 4 display RFSS species with known occurrences or potential habitat within the project area. An effects summary can be found on Table 8. Attachment 1 shows distribution, habitat, ecological landtype phase information, and occurrence of all plant RFSS on the Hoosier National Forest.

Table 3. Known Populations of Regional Forester Sensitive Species (RFSS) within the proposed Houston South project area.

Species	Habitat Type	Project Area location
Butternut (<i>Juglans cinerea</i>)	M	Many scattered across both districts
American ginseng (<i>Panax quinquefolius</i>)	M	Many scattered across both districts

Habitat (plants): M=Mesic Forests

Table 4. Regional Forester Sensitive Species (RFSS) near the proposed Houston South project area and/or with Potential Habitat within the project area.

Species	Habitat Type	Notes
Trailing arbutus (<i>Epigaea repens</i>)	D	Only 3 populations from the Pleasant Run Unit
Large yellow lady's-slipper (<i>Cypripedium pubescens</i>)	M	12 populations scattered across the Forest

Houston South Biological Evaluation for RFSS (Plants)

Illinois woodsorrel (<i>Oxalis illinoensis</i>)	M	Many populations scattered across both districts
Yellow nodding ladies' - tresses (<i>Spiranthes ochroleuca</i>)	O	Only one population know of in the Pleasant Run Unit

Habitat (plants): M=Mesic Forests; D=Dry Forests; O=Open Lands.

Species Discussion

The principal discussion concerning direct effects involves the two RFSS plants with known populations within the proposed project areas (Table 3) and the four RFSS with potential habitat in or around the project area (Table 4). We would anticipate similar effects, and apply equal protection measures, for any new RFSS plant populations discovered in the future in the proposed activity areas. I have grouped the RFSS according to the habitat categories where their known populations exist and/or where new populations are most likely to be found in the proposed project area.

Mesic Forest Communities contain large trees that dominate the forest creating a canopy closure of greater than 80 percent. Oaks are typical of south and west facing slopes. Beech and sugar maple are more frequent on north and east aspects, and in ravine bottoms. Forest composition may vary with the type and depth of bedrock. Sensitive species inhabiting mesic forests include:

Large yellow lady's-slipper (*Cypripedium pubescens* = *C. parviflorum* var. *pubescens*) is a perennial herb flowering in late spring. It occurs nearly throughout the range of northeastern United States in mesic woods (Gleason and Cronquist 1991). The species exists in 41 of the contiguous United States and Alaska (Dolan 2002a). Other reported habitat includes damp woods, wet meadows, open glades, or roadside meadows in limestone areas (Dolan 2002a). Typical habitat in Indiana is often on east and west-facing slopes in mesic or dry-mesic forests (Homoya 1993). This orchid typically occurs in Indiana in neutral to calcareous soils and less commonly in acidic soils (Danderson 2004a). The species occurs across the Forest within both the Highland Rim and Shawnee Hills Ecoregion sections. It exists in 12 widely scattered populations throughout the Hoosier National Forest in small numbers. There are documented occurrences in Crawford, Jackson, Monroe, and Perry counties. The most recent new discovery of this species in 2017 was in Crawford County in an area that is burned routinely to maintain barrens habitat.

The species can tolerate disturbance and often occurs in areas with selective tree harvest and fire (Homoya 1993). Danderson (2004a) reported that the lack of fire has apparently led to a decline in some populations and fall burning may benefit the species. It further states that other botanists believe active collection of the species may surpass habitat loss as the primary threat to the plants. Selective and careful application of herbicides in locales away from *Cypripedium pubescens* could improve the habitat quality for this mesic forest species (USDA FS 2006b, pp. 3-146 to 3-159).

Butternut (*Juglans cinerea*), also called white walnut, is a mesic forest tree that occurs in floodplain and stream terrace forests. Gleason and Cronquist (1991) regard rich, moist soil as habitat for the species. The butternut tree ranges from Minnesota to South Carolina, Georgia, and Arkansas (Gleason and Cronquist 1991). On the Hoosier, the species occurs in bottomland forests (Olson *et al.* 1990, 1991). The tree favors natural stream levees within the Lost River unit of the Hoosier (Scott *et al.* 1996). Butternut occurs across the Forest within both the

Highland Rim and Shawnee Hills Ecoregion sections. There are over 20 known sites for this species on Hoosier National Forest in Brown, Crawford, Jackson, Monroe, Orange, and Perry counties. Butternut canker (*Sirococcus clavigignenti-juglandacearum*) is a threat to the survival of the plant and has created a decline in butternut numbers and reproduction throughout its native range. More open conditions that can reduce microclimate humidity can make the butternut less susceptible to the disease (Schultz 2003). Butternuts found that are canker free and actively reproductive, are important to the future of this species since they could contain genetics that have resistance to the canker. Such individuals could be used to breed resistant individuals and bring the species back from its current decline. There were two new locations of butternut located within the Houston South project area, they are along a stream and not within any of the proposed timber treatment areas, but they are within a proposed burn unit.

If an individual is found during overstory/midstory thinning or construction of fireline, Forest personnel would take appropriate protection measures to avoid harming the tree during operations, if it is still alive (Table 5). A botanist or silviculturist would inspect the individual tree for signs of butternut canker and determine if genetic material should be collected. Since individuals primarily occur in mesic conditions near streams, the moist conditions would reduce the probability of a prescribed fire with a hot enough intensity to alter habitat negatively or impact an individual. This tree is a shade intolerant species, so prescribed burning could some benefit by creating small gaps or openings in the understory.

Illinois wood-sorrel (*Oxalis illinoensis*) is a perennial herb found in moist forests, especially on calcareous substrates, which restricts its distribution (Dolan 2002b). Other reported habitat for the species is in mesic upland forests at the base of slopes near flat bottomland (3DE Group/BHE Environmental 1998). Geographic distribution of the Illinois wood-sorrel is limited to Illinois, Indiana, and Kentucky (Heikens 2003b). Indiana populations typically occupy slopes in mesic forests on floodplains, but occasionally they occur in dry-mesic forests. The substrate is calcareous, but within a predominately acidic landscape (Heikens 2003). Illinois wood-sorrel usually occurs with some calcareous bedrock in moist forests (Hedge *et al.* 2002). Most populations of this species exist in the Shawnee Hills. It was identified at 16 areas on the Tell City Ranger District (Olson *et al.* 1990, 3DE Group/BHE Environmental 1998, Hedge *et al.* 2002), and at two sites on the Pleasant Run Unit (Olson *et al.* 1991). Eighteen of the 26 populations in Indiana occur on NFS lands on the Hoosier National Forest in 2002 (Hedge *et al.* 2002). Since 2002, Forest rare plant surveyors have found several new populations for a total of 26 occurrences on the Hoosier National Forest. This species was not found in the project area surveys, but has suitable habitat in the area and could be present.

Botanists on the SVE Panels (2004) believe that maintenance of small canopy gaps is important for continued species viability, so canopy/midstory reduction that involves single-tree or small group cutting may have minimal indirect effects and possible benefits depending on the scale of disturbance and the proximity to the plants. At most of the sites where populations or subpopulations exist there are hundreds of individual plants, so while project activities could negatively affect some individual plants, the viability of the overall population is not likely at risk with proper application of the avoidance and minimization measures (Table 5).

Illinois wood sorrel is the second most abundant plant RFSS on the Forest. The biggest threat to this species would be inadvertent spray with herbicide targeted at unwanted woody species. Herbicide application in areas of any new founds populations will not occur, in order to protect the species and its habitat. Careful implementation of the design criteria (Table 6) and project

mitigations (Table 5) for overstory/midstory thinning, prescribed burning, and herbicide applications would result in little or no direct effects to any unknown populations.

American ginseng (*Panax quinquefolius*) is a perennial herb found in rich, moist forests with populations declining since European settlement (Dolan 2002c). Typical habitat for the species primarily occurs in mature stands dominated by *Acer saccharum*, *Quercus alba* or *Q. rubra* in typically cool, moist sites (Anderson *et al.* 1993). The species is most common in Appalachia and the Ozark regions with its current range from Minnesota to South Dakota, then south to Oklahoma and Georgia (Dolan 2002c). In southern Illinois, populations commonly occurred on mid or low slopes and stream terraces. The species occurs across the Forest within both the Highland Rim and Shawnee Hills Ecoregion sections. Populations on the Tell City Ranger District occur in mesic upland forests (3DE Group/BHE Environmental 1998). Deam (1940) reports ginseng as formerly frequent to common in Indiana. This species occurs widely throughout the Forest, with about 90 known sites, consisting primarily in scattered small populations. This species does occur with the proposed project area, both historically and with new found locations found during project surveys. A total of 7 locations of this species is documented within the proposed project area and there are likely more undocumented locations as well.

American ginseng is the most abundant plant RFSS on the Forest. Kauffman (2006) reported that botanists on national forests believe root harvesting has the greatest impact on ginseng populations. Researchers have few documented findings on the effects of fire on *Panax quinquefolius*, but in mesic hardwood forests, the result is typically a low-intensity, low-severity fire during the dormant season, where individual plants usually remain the following year after the burn (Kauffman 2006). He further explains that *Panax quinquefolius* grows where plant communities have at least 50 percent shade and optimum levels are 70-80 percent. The Forest would protect known plant populations from any physical impacts due to fireline or road construction activities. Because the species is vulnerable to reductions in canopy closure, the proposed overstory/midstory thinning could have the greatest potential for indirect effects to the species. However, Kauffman (2006) stated botanists suspect that either thinning or single-tree removal may favor ginseng by increasing incidental light to the forest floor. Likewise, since plants tend to occur in mesic forest habitat near streams or near small moist, rocky outcroppings, they are not likely to occur in timber harvest areas where tree removal would be targeted. Sufficient amounts of unaffected habitat will exist nearby and between the proposed timber implementation areas for this species.

Open Land Communities occur naturally and through early successional manipulation, on the Hoosier National Forest. These areas have minimal tree cover and instead are populated predominately by grasses and forbs. These communities can occur in dry, ridge top locations or bottomlands, so species compositions can vary widely within this community type.

Yellow nodding ladies'- tresses (*Spiranthes ochroleuca*) is a perennial orchid known from only Bartholomew and Brown counties in Indiana (IDNR 2018). It prefers well-drained, acidic substrates and grows in full sun in eroded gullies of long abandoned old fields, powerline cuts through dry upland forests, and bladed shoulders of road rights-of-way (Homoya 1993). The one known location of this species on the Hoosier National Forest occurs in Brown County, in a maintained wildlife opening that experiences high summer temperatures and drought. The known location of this plant is outside the proposed project area, however, potential habitat for this species may occur within the project area.

Dry Forest Communities contain trees that dominate the forest creating a canopy closure of greater than 80 percent, and may be rocky. Oaks are typical of south and west facing upper slopes, and on ridgetops. Forest composition may vary with the type and depth of bedrock. This community often grades imperceptibly into mesic forests or barrens. Sensitive species inhabiting dry forests include:

Trailing arbutus (*Epigaea repens*) is a creeping, evergreen shrub that grows on shaded, acidic, dry slopes adjacent to sandstone outcrops (Olson, et al. 1991). Within the Hoosier National Forest, known sites of this species are associated with a canopy of chestnut and black oak (*Quercus prinus*, *Q. velutina*), at the break of the upper slope in dry forests. Closure of canopy and understory is the primary threat to this species (Olson 2003, per.comm.). In southern Indiana this species has only been reported from Monroe and Morgan counties (IDNR 2018), and has no known occurrences within the proposed project area. However, potential habitat for this species may occur within the proposed project area.

Species Specific Direct and Indirect Effects

Action Alternative: Of the 2 known **butternuts** in the project area, both are outside of proposed timber activities, but are inside proposed burn areas. For the **American ginseng**, one population is outside both the proposed timber or burning areas. The remaining 6 are either in a timber treatment stand and/or a proposed burn area. However, some of these individuals are within stream corridors that will be protected from any timber activity due to Forest Plan (USDA FS 2006a) standards and guidelines. For these two species, **butternut** and **American ginseng**, there are likely more undocumented individuals of these species within the project area.

The remaining four species (**Large yellow lady's slipper, Illinois wood-sorrel, yellow nodding ladies'-tresses, trailing arbutus**) are not historically known from within the project area and were not found during project surveys. They are still analyzed because they may occur in the proposed project areas, and/or have potential habitat that is altered.

Direct effects, for all 6 species, would be the loss of individuals during road and log landing construction, skidding, fireline construction or herbicide overspray. Known occurrences of plant RFSS will be protected from timber activities, fireline construction and herbicide applications (Table 5). The mesic forest species are highly unlikely to co-occur with where road and log landings will be constructed on ridgetops. However, direct impacts to unknown RFSS could occur during timber skidding activities.

Timber herbicide applications will be made with selective applications (cut-stump, basal bark, hack-n-squirt, or foliar of seedlings) to individual trees, no broadcasting of herbicide will occur. Therefore, the likelihood of overspray onto unknown individual RFSS, while possible, is minimal. In addition, personnel applying herbicides will abide by the Design Criteria (Table 6). This also will reduce potential impacts to unknown populations of RFSS.

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. Indirect effects from timber activities would be the alteration of habitat to that of more open canopies, resulting in more light to the forest

floor. For openland species this will be beneficial. For the dry forest species, this will likely also create beneficial habitat by reducing the canopy cover of shade tolerant species (beech and maple) and promoting oak and hickory regeneration in this plant communities. For the mesic forest species, all of these can exist in a continuum of different canopy densities. **Large yellow lady’s slipper** and **butternuts** will likely benefit from the increased light and reduced humidity conditions created, respectively. **American ginseng** and **Illinois wood-sorrel** are the two most abundant RFSS on the Forest and while they may be impacted initially, are able to survive and persist in a disturbed landscape.

Burning activities will occur predominantly when plants are dormant and is unlikely to have direct impacts. If growing season burns do occur, the intensity during green-up will likely be low and thus only top-kill individuals leaving their roots to resprout the next year. Indirect effects to these species would be an alteration of habitat to more open midstories. For **butternuts**, a reduction in understory and midstory canopies (e.g. shrubs) could reduce humidity and reduce impacts of butternut canker. **American ginseng** has been found in areas of past burns and seems to be tolerant of the disturbance. Likewise, **Large yellow lady’s slipper** has been found in areas previously burned and adjacent to permanent roads, the species seems to need the disturbance created by these activities to increase light to the forest floor. **Illinois wood-sorrel** has also been found in previously burned areas, and seems to be tolerant of the disturbance. **Yellow nodding ladies’-tresses** and **trailing arbutus** are most threatened by canopy closure and the loss of oak canopy, respectively. Thus, prescribed burns that reduce midstory and select for oaks over shade tolerant species should be beneficial to these species.

An additional indirect effect of the proposed activities for this project is non-native invasive species (NNIS) and their potential for spread. Multiple species of NNIS occur throughout the project areas and have the potential to alter habitat potential for these RFSS as disturbance activities increase their opportunity for spread. See the Issue report (Coon 2019) for a discussion of NNIS. With the occurrence of timber and fire activities in the area, the Forest will be treating NNIS in the area, pre- and post-harvest and burn under the Nonnative Invasive Species Plant Control Program Analysis (USDA FS 2009) to help prevent and mitigate NNIS establishment and spread.

If any new populations of these six RFSS are found they will be documented and protected from any direct impacts (Table 5).

Avoidance and Minimization Measures

Table 5: Avoidance and Mitigation Measures Recommended for plant RFSS protection.

MITIGATION MEASURES	REASON RECOMMENDED
Include equipment cleaning clause in all timber contracts.	To reduce the likelihood of introducing new NNIS to the area
Clean all equipment to be used for burn implementation (prescribed burn equipment, fireline creation) <i>prior</i> to entry onto the Hoosier Forest.	To reduce the likelihood of introducing any additional non-native invasive species (NNIS) to the area.
Reseed disturbed areas created at log landings. Consider reseeding disturbed areas along firelines, as needed. Use either the Hoosier National Forest seed mix (Attachment 2) or consult with Forest Botanist on species composition of seed mix.	Provide native seed to compete with and reduce NNIS germination and establishment. Protect native plant resources in the area.

Houston South Biological Evaluation for RFSS (Plants)

Protect known populations of American ginseng from impacts during timber logging activities and fireline construction.	Prevent direct impacts to RFSS: American ginseng
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.	Prevent direct impacts to RFSS: butternut
Report any newly found populations of RFSS to the Forest Botanist and protect them from direct impacts during timber logging activities and fireline construction.	Prevent direct impacts to any new RFSS populations found during implementation.

Design Criteria

Table 6: Recommended Design Features for Herbicide Application

The Forest would take a multi-step approach to reduce the effect of herbicides on non-target vegetation:
1. When using chemical methods, choose a method that, when applied directly, targets the undesirable plants with little over-spray (e.g. cut-stump, basal bark, hack-n-squirt),
2. Apply herbicide when adjacent native plants are dormant (early spring or late fall),
3. 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.
4. 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.
5. Herbicide applicators* will follow label directions and not exceed any mixing or application rates.
6. In addition, temporarily close treatment areas when warranted (e.g. heavily used trails near treatments).
*All applicators will be either an Indiana state licensed applicator, or supervised by one, according to OISC (Office of Indiana State Chemist) regulations.

Species Specific Determinations

The following determinations are made with the assumption that all Avoidance and Minimization measures (Table 5) and herbicide application Design Criteria (Table 6) would be followed during project implementation.

For RFSS plants inhabiting dry forests and openlands, or those that occur in mesic forests and can take some canopy and midstory reduction, the proposed project activities could provide a substantial benefit to the potential habitat of these sensitive plants by reducing woody encroachment and maintaining periodic fire disturbance. They would likely benefit from prescribed burning and creation of small openings in the canopy through overstory and midstory thinning. The *Forest Plan* final environmental impact statement (FEIS) describes several assumptions regarding habitat requirements of these dry forest species, including additional focal SVE plants selected as indicators of other habitat communities (USDA FS 2006b, pp. 3-146 to 3-159). All of the woody encroachment removal and burning would cause short term effects to unoccupied habitat, but over the long term would restore the forest closer to historical conditions degraded by woody encroachment of shade tolerant trees and a lack of fire.

Houston South Biological Evaluation for RFSS (Plants)

Herbicide treatment of encroaching woody trees would reduce resprouting potential, moving the area closer to the desired future condition which could then be maintained with prescribed burning. Accidental drift or overspray of herbicides could directly impact any nearby RFSS. However, much of the cutting and herbicide applications will occur during the RFSS's dormant seasons. If herbicide spraying is done during growing season, the Design Criteria (Table 6) should reduce impacts to a point that they are negligible.

Alternative A: Overstory and midstory opening during timber activities and prescribed burns could directly, or indirectly, affect some individuals of the 6 RFSS that either are known to or could occur in the Houston South project area (**American ginseng, butternut, Illinois wood-sorrel, large yellow lady's slipper, yellow nodding ladies'-tresses and trailing arbutus**), and thus the determination for these species is the proposed project **may impact individuals and their habitat, but is not likely to trend them toward federal listing or reduce population viability**. For the remaining 28 plant RFSS, since they are either not known from the proposed project area or do not have potential habitat, implementation of this project would have **No Impact**. See Table 8 for a summary of these determinations.

Alternative B: The no Action alternative would have none of the activities listed in Table 1, and thus no direct impacts to any RFSS within the project area. Indirectly, those RFSS of dry forests would continue to have shade tolerant tree species overtake their communities that could see population, or habitat potential, decline overtime as their habitat changes to a more mesic forest with dense overstory canopies. The openland species would still have open habitat due to wildlife opening maintenance activities (see cumulative effects). Mesic forest species would be likely to continue to prosper. Thus the No Action alternative would have a **may impact on individuals and their habitat, but is not likely to trend them toward federal listing or a loss in viability for trailing arbutus**. This alternative would have **no impact on individuals and habitat of yellow nodding ladies'-tresses, American ginseng, Illinois wood-sorrel, butternut and yellow lady's slipper**. For the remaining 28 plant RFSS, since they are either not known from the proposed project area or do not have potential habitat, implementation of this project would have **No Impact**. See Table 8 for a summary of these determinations.

VI. Cumulative Effects

Table 6 lists the other activities known to occur on the Hoosier National Forest and surrounding non-federal lands in the past, present and foreseeable future. This section will analyze whether these activities have the potential to change the determination made for the RFSS in the Direct and Indirect Effects section above.

Houston South Biological Evaluation for RFSS (Plants)

Table 7. Past, Present and Reasonably Foreseeable Future Action Within or Around the Proposed Houston South Project Area.

	ACTION	PAST	PRESENT	FUTURE	Description
1.	Natural gas and power right-of-way maintenance	x	x	x	Mowing, brushing, herbicide applications, NNIS spread
2.	State and County Road maintenance	x	x	x	Mowing, brushing, herbicide, de-icing solutions, NNIS spread
3.	Privately owned pasture and crop land	x	x	x	Herbicide applications, mowing, plowing, discing, NNIS spread
4.	ATV riding on private lands and illegal ATV on federal lands.	x	x	x	Soil rutting, erosion, NNIS spread
5.	Private timber operations	x	x	x	Tree removal, road/skid/landing construction
6.	Private land and lawn maintenance	x	x	x	Mowing, herbicide, planting of NNIS
7.	Maintenance of Forest Service roads	x	x	x	Ditch cleaning, grading, graveling on "open to Public" roads
8.	USFS Pleasant Run Road decommissioning		x	x	Decommission 13 roads and 52 road segments
9.	USFS Buffalo Pike timber sale	x			43 acres single tree OR group tree selection harvest
10.	Hiking, horseback & bike riding	x	x	x	Along designated USFS and private trails
11.	USFS Trail Reroutes	x		x	Trail reroutes, close/obliterate old trail, re-contour
12.	Maintenance of established USFS trails	x	x	x	Mowing, brushing, grading, gravel placement
13.	Upland game and mushroom hunting	x	x	x	Throughout area
14.	Maintenance of Forest wildlife openings	x	x	x	Mowing, brushing, cutting, prescribed burning
15.	USFS Hominy Mortar Wetlands	x			Created shallow water wetlands
16.	USFS Ephemeral Wetlands	x			Created seasonal wetlands
17.	USFS Lake and Pond Habitat Improvement	x	x	x	Cutting and dropping trees into lakes and ponds
18.	Non-native Invasive Species (NNIS) treatments. USFS and private lands	x	x	x	Manual, Mechanical and/or Herbicide control methods
19.	USFS Jackson County AOPs (2)		x		Aquatic organism passage reconstruction

Houston South Biological Evaluation for RFSS (Plants)

	ACTION	PAST	PRESENT	FUTURE	Description
20.	USFS Maumee Prescribed Burn	x			1,650 acre Rx burn
21.	USFS Tornado Blowdown	x			1,759 acre prescribed burn
22.	USFS Fork Ridge Restoration	x	x	x	Prescribed burning of 820 acres

The implementation of the proposed Action Alternative will be over a twelve year period for timber activities and up to 20 years for prescribed fire activities. As such, it is important to realize that the activities described in Table 1 will not occur in a concentrated time frame and therefore, the direct and indirect impacts will be spaced out both spatially and temporally.

Historical factors postulated to contribute to the decline of the native species, such as RFSS, is the conversion of forest habitat to non-forest uses. Large areas in and around the Hoosier National Forest have been converted from native ecosystems to those characterized by both native and non-native plant monocultures. In addition to row crops, this would include pine plantations and areas dominated by the non-native invasive, pasture grasses: tall fescue (*Festuca arundinacea*) and smooth brome (*Bromus inermis*).

Past activities on private land which have probably affected the native species in the vicinity of the action area include conversion of natural forest communities to agricultural or residential uses and high-grading timber harvests. Present or reasonably foreseeable future activities on private land that may affect these species 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. Private lands near the proposed action area would continue to be a mixture of forest, non-native open pastures, crop fields and residential areas. Those area converted from forest often represent a complete loss of habitat for most plant RFSS and native woodland species.

Past activities on National Forest System lands that may have impacted the plant RFSS are timber harvests, trail reroutes, and prescribed burning. The Buffalo Pike timber was implemented with similar mitigations to this proposed project and has had NNIS treatments for several years post-harvest. The harvest did not change the forest type; it was a restoration project similar to this proposed project. USFS trail reroutes are often done to move trails from areas where historic use (e.g. old road in riparian corridor) combined with current use are detrimental to natural resources; they are instead placed in more resilient locations on the landscape. Past burns were to manage tornado blow down after effects and safety concerns, maintain wildlife openings and promote oak-hickory regeneration. All of these projects were surveyed for RFSS and analyzed prior to implementation.

Past, ongoing and reasonably foreseeable future activities on National Forest System lands within the Affected Area that may affect RFSS include management of early successional habitats and routine maintenance of recreational trails. Without periodic mowing, brushing or burning, naturally occurring changes in vegetation would result in replacement of early successional habitats with forest habitats and loss of associated animal species (e.g. Henslow's sparrow, bobwhite quail, ruffed grouse). Likewise, trails would become unusable for public recreationists if vegetation is not prevented from encroaching on the trails. Other activities on trails include water bar maintenance and placement of rock or other materials to maintain trail surfaces and reduce erosion. Prescribed burning activities that are ongoing are to maintain

wildlife openings and/or improve oak/hickory regeneration on the landscape. These activities were all surveyed and analyzed for RFSS prior to implementation.

One of the biggest concerns, cumulatively for plant RFSS, is the introduction or spread of non-native invasive species (NNIS). Historical land-use in the area (farming, livestock grazing, homesites, roads, etc) had already introduced some NNIS prior to some federal purchases of the properties. Some NNIS were historically encouraged by state and federal agencies to plant for wildlife (autumn olive, multiflora rose, Chinese lespedeza), others were planted for horticultural interest (Japanese honeysuckle, multiflora rose, Japanese barberry, callery pear), or timber production (princess tree, tree-of-heaven), and some were introduced accidentally (Japanese stiltgrass). Today, public use for game and mushroom hunting, hiking, horse and bike riding, and other activities also has the possibility of introducing NNIS through propagule transport on shoes, livestock and equipment. Wildlife opening management, timbering activities, prescribed burning and trail maintenance/relocation activities also cause soil and vegetation disturbance that can increase the capability for NNIS to establish and spread. NNIS introductions and spread also occurs on non-federal lands where disturbance occurs to soil and vegetation (Table 7), some examples include: right-of-way mowing (roads, powerlines, gaslines), agriculture, recreation activities, and timber harvesting.

Generally, for most NNIS plants within the cumulative effects area, their seed remains viable in the soil from two to seven years. For some species, their seed may lie dormant and remain viable for up to 15 or 20 years. Project Design Measures (equipment cleaning) help reduce the introduction of new NNIS during project implementation. However, NNIS will continue to spread within the project area (in spite of implementing mitigations and control measures) and in surrounding non-federal properties. Managing this spread will require long-term monitoring and early detection rapid response, by natural resource staff, for a decade or two in the project area. Management of NNIS will be done, both pre- and post-implementation under the Non-native Invasive Species Plant Control Program Analysis (USDA FS 2009).

The compaction from skidding and log landing will result in compacted soils that restrict re-establishment of native vegetation. Without the re-establishment of native vegetation, there is a higher likelihood of NNIS being able to establish. However, the Hoosier National Forest is currently working with Forest Research staff and specialists from other southern tier National Forests in the region to develop protocols for post treatment of these impacted areas to establish native plant species that will benefit pollinators and other wildlife species, while competing with NNIS. The first meeting of this collaborative is scheduled for July 2019. Initial efforts by the Hoosier National Forest have been variable, but with continued collaboration, data collection and monitoring, we hope to increase our successful revegetation of these impacted areas.

While all of the above mentioned activities could have impacts to RFSS and/or their habitat, most of them have been ongoing for decades and have not driven any of the analyzed RFSS to a loss of viability or federal listing. Increased activity by the Forest Service to treat NNIS within the area (Coon 2019, USDA FS 2009) will reduce introduction and spread potential. Meanwhile, an increased interest of private landowners in controlling of NNIS (SICIM 2019) through local Cooperative Invasive Species Management Areas (CISMAs), will help reduce uncontrolled NNIS spread on private lands and rights-of-ways. Just in 2018, the Jackson County CISMA co-sponsored a workshop on controlling NNIS along rights-of-ways for road maintenance personnel. This group is also raising the awareness of NNIS and their impacts to private landowners in the area.

So, while the project cumulative effects **May Impact** the six RFSS analyzed for the proposed project, the cumulative effects would not cause a **loss of viability that would push any of the species to federal listing**. Therefore, the overall determination for the 6 RFSS analyzed remains the same after adding the consideration of cumulative effects (Table 8).

VII. Consistency with the Forest Plan

All alternatives are consistent with the *Forest Plan* (USDA FS 2006a) and analysis regarding RFSS in the *Forest Plan* Final Environmental Impact Statement (USDA FS 2006b). The proposal is also consistent with the Appendix C, Endangered and Threatened; Sensitive; and management Indicator Species in the *Forest Plan* (USDA FS 2006c).

VIII. Consistency with Laws, Regulations, and Handbooks

The National Forest Management Act (NFMA) regulations of 36CFR 219.19 specify that fish and wildlife habitat will be managed to maintain viable populations of existing native and desired non-native species. This requirement is further defined in Forest Service Manual 2672, which establishes a “Sensitive” category to include animal and plant species in addition to indicator species whose viability is a concern to the Forest Service. The objective is to ensure these Regional Forester Sensitive Species (RFSS) do not become threatened and endangered as a result of Forest Service actions.

Houston South Biological Evaluation for RFSS (Plants)

Table 8. Summary of Proposed and No Action Alternatives effects to Regional Forester Sensitive Species (plants)

Regional Forester Sensitive Species	Habitat Type	Habitat Present?	Species Present?	Habitat Potentially Affected?	Species Potentially Affected?	Effects Determination Proposed / No Action
Vascular Plants						
Blue monkshood <i>Aconitum uncinatum</i>	M	NO	NO	NO	NO	NI/NI
Bluehearts <i>Buchnera americana</i>	B	NO	NO	NO	NO	NI/NI
Porter's reedgrass <i>Calamagrostis porteri</i> ssp. <i>porteri</i>	D, M	NO	NO	NO	NO	NI/NI
Greater (large) yellow lady's-slipper <i>Cypripedium parviflorum</i> var. <i>pubescens</i> (= <i>C. pubescens</i>)	M	Yes	*	Yes	Yes	MI/ NI
Eastern trailing ticktrefoil <i>Desmodium humifusum</i>	D	NO	NO	NO	NO	NI/NI
Cypress panicgrass <i>Dichanthelium dichotomum</i> var. <i>dichotomum</i> (= <i>Panicum yadkinense</i>)	M	NO	NO	NO	NO	NI/NI
French's shootingstar <i>Dodecatheon frenchii</i>	C	NO	NO	NO	NO	NI/NI
Trailing arbutus <i>Epigaea repens</i>	D	Yes	*	Yes	Yes	MI/ MI
White thoroughwort <i>Eupatorium album</i>	D, B	NO	NO	NO	NO	NI/ NI
Cluster fescue <i>Festuca paradoxa</i>	B	NO	NO	NO	NO	NI/NI
Yellow gentian <i>Gentiana alba</i>	B, D	NO	NO	NO	NO	NI/NI
Butternut <i>Juglans cinerea</i>	M	Yes	Yes	Yes	Yes	MI/ NI
Canada lily <i>Lilium canadense</i>	D	NO	NO	NO	NO	NI/ NI
Umbrella magnolia <i>Magnolia tripetala</i>	M	No	No	No	NO	NI/NI
Limestone adder's tongue <i>Ophioglossum engelmannii</i>	B	No	No	No	NO	NI/NI
Illinois woodsorrel <i>Oxalis illinoensis</i>	M	Yes	*	Yes	Yes	MI/ NI
Allegheny-spurge <i>Pachysandra procumbens</i>	D	NO	NO	NO	NO	NI/ NI
American ginseng <i>Panax quinquefolius</i>	M	Yes	Yes	Yes	Yes	MI/ NI

Houston South Biological Evaluation for RFSS (Plants)

Regional Forester Sensitive Species	Habitat Type	Habitat Present?	Species Present?	Habitat Potentially Affected?	Species Potentially Affected?	Effects Determination Proposed / No Action
Largeleaf phlox <i>Phlox amplifolia</i>	M	NO	NO	NO	NO	NI/NI
Small green woodland orchid <i>Platanthera clavellata</i>	P, W	NO	NO	NO	NO	NI/NI
Prairie parsley <i>Polytaenia nuttallii</i>	D, B	NO	NO	NO	NO	NI/NI
Small's sanicle <i>Sanicula smallii</i>	D, M	NO	NO	NO	NO	NI/NI
Rock skullcap <i>Scutellaria saxatilis</i>	M	NO	NO	NO	NO	NI/NI
Yellow nodding ladies'-tresses <i>Spiranthes ochroleuca</i>	O, (M)	Yes	*	Yes	Yes	MI/ NI
Eastern featherbells <i>Stenanthium gramineum</i>	M	NO	NO	NO	NO	NI/ NI
Bristle fern <i>Trichomanes boschianum</i>	C	NO	NO	NO	NO	NI/ NI
Weft fern <i>Trichomanes intricatum</i>	C	NO	NO	NO	NO	NI/ NI
Buffalo clover <i>Trifolium reflexum</i>	D, B	NO	NO	NO	NO	NI/NI
Southern woodland violet <i>Viola hirsutula</i>	D, M	NO	NO	NO	NO	NI/NI
Appalachian vittaria <i>Vittaria appalachiana</i>	C	NO	NO	NO	NO	NI/ NI
Barren strawberry <i>Waldsteinia fragarioides</i>	D	NO	NO	NO	NO	NI/NI
Netted chainfern <i>Woodwardia areolata</i>	C	NO	NO	NO	NO	NI/NI
Nonvascular Plants						
Pink dot lichen <i>Dibaeis absoluta (= Baeomyces absolutus)</i>	C	NO	NO	NO	NO	NI/ NI
Norway Bryoxiphium (sword) moss <i>Bryoxiphium norvegicum</i>	C	NO	NO	NO	NO	NI/ NI

Rev 5 January 2018 CRC

Regional Forester Sensitive Species Effects Determinations:

- NI** = No impact.
- BI** = Beneficial impact.
- MI** = May impact individuals or habitat, but not likely to cause trend toward federal listing or reduce viability of a population or species.
- LI** = Likely to impact individuals or habitat with the consequence that the action may contribute towards federal listing or result in reduced viability of a population or species.
- *** = No documented occurrence of the species, but presumed present due to nearby sightings and suitable habitat.
- Unk** = Unknown. Potential habitat occurs within the project area, some observations on the ranger district but no known occurrences nearby.

Houston South Biological Evaluation for RFSS (Plants)

Regional Forester Sensitive Species Habitat Associations:

C = Cliffs
M = Mesic forests
D = Dry forests
B = Barrens

O = Open lands
P = Ponds, lakes, waterholes
W = Wetlands
S = Streams and rivers

Cliffs - Cliffs are areas characterized by their vertical exposures of resistant bedrock, and may have associated overhangs. The upper portion of cliffs is often within the dry forest community while the lower part is in mesic forest.

Mesic Forests - Typically dominated by large trees that create a canopy closure of greater than 80 percent. Soils drain well, and may be rocky. Their aspect and elevation largely determine which species dominate. Oaks are typical of south and west facing slopes. Beech and sugar maple are more frequent on north and east aspects and in ravine bottoms. Forest composition may vary with the type and depth of bedrock.

Dry Forests - Dominated by trees which that a canopy closure of greater than 80 percent. Soils are rocky and typically excessively drained. Oaks are typical of south and west facing upper slopes and on ridgetops. Forest composition may vary with the type and depth of bedrock.

Barrens - Communities having tree canopy cover of 20 to 60 percent usually of post oak (*Quercus stellata*) and a ground cover dominated by prairie grasses, especially Indian grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), and big bluestem (*Andropogon gerardii*). Typically, prairie forbs also occur in this rare plant community. They have thin soils over limestone or occasionally sandstone bedrock. The barrens exist as isolated communities within the matrix of dry forests.

Open Lands Sensitive plant species inhabit open, grassy habitats, often on eroded sites. The dominant species at these sites consist of either native plants or non-native species, and often-varying combinations of both.

Ponds - This habitat designation pertains largely to fish species stocked in either man-made or natural ponds, but these areas also provide habitat for some sensitive plants that inhabit wet soils along pond margins.

Wetlands - Are flooded areas or have hydric soils, and have a cover of vegetation consisting of either woody (swamp) or herbaceous (marsh). The vegetation can be quite variable depending on frequency and duration of flooding. These areas may be either natural or artificial.

Streams - Habitat consists of lands along both streams and rivers. Some species may occur in adjacent riparian woodlands.

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Houston South Biological Evaluation for RFSS (Plants)

ATTACHMENT 1

Regional Forester Sensitive Species	Geographic Distribution	Forest Distribution	Ecological Subregions Section/Subsection	Community Type and Habitat	Ecological Landtype Phases (ELTPs)
Vascular Plants					
Blue monkshood <i>Aconitum uncinatum</i>	Ranges through the Appalachians and the Allegheny Plateau	Very rare, five pops exist in one watershed. (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Mesic Forest Communities: perennial herb typically associated with moist, rocky forests. It flowers from August to October.	ELTP 13, 24, 25, 26, 40, 41
Bluehearts <i>Buchnera americana</i>	Eastern USA, from New York west to Kansas and Texas, south to Georgia	Very rare, only three populations (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Barrens Communities: perennial herb found in sandy soils of upland forests and prairies. It flowers from July to September.	ELTP 10, 20, 21, 22
Porter's reedgrass <i>Calamagrostis porteri</i> spp. <i>porteri</i>	Appalachian mountains from New York south to Alabama and a few populations in eastern Kentucky	Very rare, only two populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: a perennial grass inhabiting north-facing slopes above large cliffs on the Forest. The sites consist of dry-mesic upland forest dominated by oak and hickory. Typically sterile, and flowering is extremely rare.	ELTP 22, 23
Greater (large) yellow lady's-slipper <i>Cypripedium parviflorum</i> var. <i>pubescens</i> (= <i>C. pubescens</i>)	Ranges across much of the eastern North America	Rare, twelve widely distributed pops across the Forest	Interior Low Plateau-Transition Hills/Brown County Hills - Shawnee Hills/Crawford Upland and Escarpment	Mesic Forest Communities: perennial herb found typically in rich, moist forests. It flowers from late April to July.	ELTP 12, 13, 22, 23, 24, 25, 26, 40, 41
Eastern trailing ticktrefoil <i>Desmodium humifusum</i>	Atlantic Coastal Plain, and in Missouri and Indiana	Extremely rare, only one population (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: a trailing vine-like perennial herb found in somewhat sandy, dry forests. It flowers from July to August.	ELTP 10, 11, 12, 20, 21, 22, 23
Cypress panicgrass <i>Dichanthelium dichotomum</i> var. <i>dichotomum</i> (= <i>Panicum yadkinense</i>)	Wide-spread across the eastern United States	Extremely rare, only one population (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Mesic Forest Communities: a perennial grass of moist or wet forests, often associated with calcareous soils. It flowers from June to July.	ELTP 13, 24, 25, 26, 40, 41
French's shootingstar <i>Dodecatheon frenchii</i>	Limited range, primarily in the Shawnee Hills section of the Interior Low Plateaus	Rare, locally distributed populations in unique habitat (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Cliff Communities: perennial herb inhabiting deep shade under overhanging sandstone bluffs, typically within mesic hardwood forests. It flowers from April to May.	ELTP 30
Trailing arbutus <i>Epigaea repens</i>	Southern Canada south, especially in Appalachia and the Allegheny Plateau	Very rare, only three populations (Pleasant Run Unit)	Interior Low Plateau-Transition Hills/Brown County Hills	Dry Forest Communities: creeping evergreen shrub found on acidic forest soils. It flowers from April to July.	ELTP 10, 11, 20, 21
White thoroughwort <i>Eupatorium album</i>	Ranges mostly in the Coastal Plain and mountainous parts of the eastern United States	Very rare, sparsely distributed in five populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland and Escarpment	Dry Forest Communities: perennial herb that grows in open forests. It flowers in mid-summer, typically in June.	ELTP 10, 11, 12, 20, 21, 22, 23
Cluster fescue <i>Festuca paradoxa</i>	Maryland to Minnesota, south to Georgia and east Texas	Extremely rare, only one population (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Barrens Communities: a grass found in open woods and prairies. It flowers May to July.	ELTP 10, 20, 21, 22

Houston South Biological Evaluation for RFSS (Plants)

Regional Forester Sensitive Species	Geographic Distribution	Forest Distribution	Ecological Subregions Section/Subsection	Community Type and Habitat	Ecological Landtype Phases (ELTPs)
Yellow gentian <i>Gentiana alba</i>	Minnesota east to Ontario, south to Missouri, Kentucky and Virginia	Very rare, four populations (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Barrens Communities: perennial herb found in open woods and prairies. It flowers from August to October.	ELTP 10, 20, 21, 22
Butternut <i>Juglans cinerea</i>	Across much of eastern United States	Rare, sparsely distributed across the Forest	Interior Low Plateau-Transition Hills/Brown County Hills - Shawnee Hills/Crawford Upland and Escarpment	Mesic Forest Communities: a mesic forest tree typically found in floodplain and stream terrace forests. It flowers from April to June.	ELTP 12, 13, 22, 23, 24, 25, 26, 40, 41
Canada lily <i>Lilium canadense</i>	Eastern Canada, south in the Appalachians to Alabama	Very rare, four populations (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: perennial herb found in dry, rocky woods and in moist meadows. It flowers typically in July.	ELTP 10, 11, 12, 20, 21, 22, 23
Umbrella magnolia <i>Magnolia tripetala</i>	Ranges from Indiana to New England, then south to Florida, and west to Oklahoma	Rare, eight populations in a small-localized area (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Mesic Forest Communities: a mesic forest tree typically found in rich forests within deep, moist secluded ravines. Native populations known only from Crawford County. It flowers in May.	ELTP 13, 23, 24, 25, 40
Limestone adder's tongue <i>Ophioglossum engelmannii</i>	Missouri east to Virginia, southwest to Arizona and Mexico, then to Florida	Very rare, sparsely distributed in five populations (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Barrens Communities: a small fern found in dry, open areas in bedrock or on calcareous soils. It flowers from May to July.	ELTP 10, 20, 21, 22
Illinois woodsorrel <i>Oxalis illinoensis</i>	Southeastern Illinois and southern Indiana, and south to central Tennessee	Rare, sparsely distributed. (Pleasant Run, Tell City Units)	Interior Low Plateau-Transition Hills/Brown County Hills - Shawnee Hills/Crawford Upland	Mesic Forest Communities: a perennial herb found in moist forests, especially on calcareous substrates. It typically flowers in May.	ELTP 12, 13, 22, 23, 24, 25, 26, 40, 41
Allegheny-spurge <i>Pachysandra procumbens</i>	Cumberland Plateau, the Tennessee River valley, and Mississippi	Very rare, three sites on forest. (private land-Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: a low-growing subshrub of rich woodlands. It flowers from April to May.	ELTP 10, 11, 12, 20, 21, 22, 23
American ginseng <i>Panax quinquefolius</i>	Ranges throughout much of the eastern United States	Rare, sparsely distributed in small populations across the Forest	Interior Low Plateau-Transition Hills/Brown County Hills - Shawnee Hills/Crawford Upland and Escarpment	Mesic Forest Communities: a perennial herb found in rich, moist forests. It flowers from May to July.	ELTP 12, 13, 22, 23, 24, 25, 26, 40, 41
Largeleaf phlox <i>Phlox amplifolia</i>	Highland Rim, the southern Appalachians, and the eastern Ozarks	Very rare, six records widely scattered in two watersheds (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Mesic Forest Communities: perennial herb found in moist forests and wooded floodplains. It requires mesic sites with some opening, rather than deeply shaded sheltered ravines. It flowers from June to September.	ELTP 13, 24, 25, 26, 40, 41
Small green woodland orchid <i>Platanthera clavellata</i>	Ranges across much of eastern North America	Very rare, only two populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Ponds: a perennial herb found in moist, sandy, or gravelly borders of ponds, lakes, and sloughs. It flowers from June to September.	ELTP 40, 41, 42

Houston South Biological Evaluation for RFSS (Plants)

Regional Forester Sensitive Species	Geographic Distribution	Forest Distribution	Ecological Subregions Section/Subsection	Community Type and Habitat	Ecological Landtype Phases (ELTPs)
Prairie parsley <i>Polytaenia nuttallii</i>	Primarily the Midwestern prairies (Michigan, Wisconsin to Nebraska)	Extremely rare, only one population (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: perennial herb of open woods and prairies. The one site on the forest occurs in barrens. It flowers from May to June.	ELTP 10, 11, 12, 20, 21, 22, 23
Small's sanicle <i>Sanicula smallii</i>	Occurs mostly in the SE from Texas to Florida and Virginia. Outlying pops in Illinois and Indiana.	Very rare, only three populations (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Mesic and Dry Forest Communities: occurs primarily in rich woods of dry-mesic upland forests. Indiana populations found in Crawford, Harrison, and Perry counties. It flowers in May and June.	ELTP 10, 11, 12, 13, 20, 21, 22, 23, 24, 25, 26
Rock skullcap <i>Scutellaria saxatilis</i>	Occurs primarily in the Allegheny Plateau and the Appalachians	Very rare, only two populations (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Mesic Forest Communities: a perennial, reclining herb inhabiting moist, rocky forests along streams and the shade of cliffs. It flowers from May to July.	ELTP 13, 24, 25, 26, 40, 41
Yellow nodding ladies'-tresses <i>Spiranthes ochroleuca</i>	Ontario to New Brunswick, then south to North Carolina and west to Kentucky	Extremely rare, only one population (Pleasant Run Unit)	Interior Low Plateau-Transition Hills/Brown County Hills	Open Land Communities: orchid inhabiting a small wildlife opening on the Forest on mesic to dry-mesic slopes. Occurs in open grassy habitat with little bluestem grasses. It flowers in October.	ELTP 12, 21, 22
Eastern featherbells <i>Stenanthium gramineum</i>	Ranges from Pennsylvania and Missouri south to Florida and Arkansas	Very rare, only two populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Mesic Forest Communities: a perennial herb found in moist woodlands, especially in areas of calcareous soils. It flowers from June to September.	ELTP 13, 24, 25, 26, 40, 41
Bristle fern <i>Trichomanes boschianum</i>	Primarily found from the Interior Low Plateau to the Central Appalachians	Very rare, only two populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Cliff Communities: inhabits moist, shaded sandstone cliff overhangs. It produces spores from June to September.	ELTP 30
Weft fern <i>Trichomanes intricatum</i>	Mostly occurs in the Appalachians from Alabama to the NE USA with outlying populations in Illinois and Indiana.	Very rare, only two populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Cliff Communities: a fern gametophyte found on moist, shaded sandstone cliff overhangs. This species typically occurs with mosses and liverworts.	ELTP 30
Buffalo clover <i>Trifolium reflexum</i>	Ranges from the southern Great Plains to most of the eastern USA except for New England	Extremely rare, only one population (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: perennial herb of open woods and prairies, typically in areas of disturbance. The one site on the forest occurs in barrens. It flowers from May to July.	ELTP 10, 11, 12, 20, 21, 22, 23
Southern woodland violet <i>Viola hirsutula</i>	Ranges from New York to Georgia, then west to Alabama and north to Kentucky and Indiana	Extremely rare, only two populations at one small-localized area (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: perennial herb of open woods. Indiana populations occur in dry to dry-mesic upland forests. Both populations located in Perry County. It flowers from late April to early May.	ELTP 11, 12, 22
Appalachian vittaria <i>Vittaria appalachiana</i>	Located mostly in the southern Appalachians, and in southern Indiana	Rare, thirteen widely scattered populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Cliff Communities: a fern gametophyte found on moist, shaded sandstone cliff overhangs. This species typically occurs with mosses and liverworts.	ELTP 30

Houston South Biological Evaluation for RFSS (Plants)

Regional Forester Sensitive Species	Geographic Distribution	Forest Distribution	Ecological Subregions Section/Subsection	Community Type and Habitat	Ecological Landtype Phases (ELTPs)
Barren strawberry <i>Waldsteinia fragarioides</i>	Much of eastern USA, south to the Coastal Plain	Extremely rare, only one population (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Dry Forest Communities: a trailing, herbaceous plant inhabiting openings and sandstone bluffs on north aspects in dry forests. It flowers from April to June.	ELTP 10, 11, 12, 20, 21, 22, 23
Netted chainfern <i>Woodwardia areolata</i>	Ranges from the Maritime Provinces, and the Ohio River valley south	Very rare, only six scattered populations in localized area (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Cliff Communities: a fern found in moist, acidic habitats, associated with sandstone outcrops on the Hoosier. It produces spores form July to October.	ELTP 30
Non-Vascular Plants					
Pink dot lichen <i>Dibaeis absoluta</i> (= <i>Baeomyces absolutus</i>)	Few scattered locations in North America	Rare, only three populations (Tell City Unit)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Cliff Communities: lichen typically found on shaded, sandstone cliffs.	ELTP 30
Norway Bryoxiphium (sword) moss <i>Bryoxiphium norvegicum</i>	Few scattered locations in the Midwest, Southeast, and Washington	Rare, twelve widely scattered populations (Lost River, Tell City Units)	Interior Low Plateau-Shawnee Hills/Crawford Upland	Cliff Communities: moss typically found on shaded, sandstone cliffs or outcroppings.	ELTP 30

ATTACHMENT 2

**Hoosier National Forest
Approved Seed Mixture**

(March 15, 2007 by Kirk Larson/Past Botanist and Zachary Riggs/Past Soil Scientist)

For use at all locations and seasons

Apply throughout the season when soil moisture conditions are adequate for germination. Winter wheat and spring oat are nonnative annual agricultural (nurse) crop species, but they are non-persistent and a fast-growing, short lived plants that provides quick soil stabilization to keep invasive weeds from invading without competing with native grasses/wildflowers. Mix the winter wheat or spring oats seed with the selected native seed species according to the rates displayed below.

<u>Species</u>	<u>per acre</u>
Winter wheat (<i>Triticum aestivum</i>)	40 lbs/acre
(Or) Spring oats (<i>Avena Sativa</i>)	40 lbs/acre
Switch grass (<i>Panicum virgatum</i>)	4 lbs/acre
Virginia wild rye (<i>Elymus virginicus</i>)	4 lbs/acre
Partridge pea (<i>Cassia fasciculata</i>)	1 lbs/acre
(Or) Illinois bundle flower (<i>Desmanthus illinoensis</i>) TELL CITY RD ONLY	1 lbs/acre

This seed mix is for use in general applications across the Hoosier where ground disturbances have created conditions with the potential for soil erosion and the possible spread of nearby nonnative invasive species. Typically, areas requiring seeding may include roadsides, log landings, and firelines on steeper slopes.

Where necessary use a light covering of weed-free straw, if available, to help prevent the introduction of invasive weed seed. If weed-free straw is not available or it is visually questionable (lots of seed visible), then it is much better to not use any at all. DO NOT use hay.