

**BIOLOGICAL EVALUATION
FOR
REGIONAL FORESTER'S SENSITIVE PLANT SPECIES
AND SPECIES WITH VIABILITY EVALUATIONS**

**INVASIVE SPECIES MANAGEMENT
SHAWNEE NATIONAL FOREST**

August 16, 2010

I. Introduction

The purpose of this Biological Evaluation is to identify the likely effects of the proposed actions and alternatives in the Invasive Species Management Project to 70 Regional Forester's Sensitive Plant Species (RFSS) and 5 Plant Species with Viability Evaluations (SVE). These species have been documented as occurring on Shawnee National Forest managed lands. This Biological Evaluation ensures that Forest Service actions do not contribute to a loss of viability or contribute to a trend toward Federal listing of any species and it provides a process and standard that ensures the RFSS and SVEs receive full consideration in the decision making process.

II. Project Alternatives Analyzed

Alternative 1 – No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. The Forest would not implement any action alternative considered. Under the no-action alternative, pulling and torching of about 100 to 150 acres of invasive species each year would continue. Inventory and mapping of invasive species infestations could also continue.

Alternative 2 – Proposed Action

The Proposed Action is to treat invasive species infestations on the Forest using an integrated combination of manual, mechanical, chemical, and prescribed fire methods. Post-treatment monitoring would occur to evaluate treatment success. The Forest Service is proposing to take a four-step approach to invasive species management.

1. Site-specific management for four species

The project interdisciplinary team reviewed the many invasive species found on the Forest and identified four priority species to be targeted Forest-wide. These species are kudzu (*Pueraria montana*), Amur honeysuckle (*Lonicera maackii*), Chinese yam (*Dioscorea oppositifolia*), and garlic mustard (*Alliaria petiolata*). For the most part, these species were chosen based on their high degree of invasiveness and/or their ability to suppress or extirpate native vegetation through their aggressive growth habits. Active management centered on these species can greatly reduce both their current and potential impact. Proposed treatments for the priority species are described in detail below.

Treatments would occur on identified Forest lands, given available time and resources. Garlic mustard is very invasive and has allelopathic properties, which suppress the native vegetation and change the soil properties to favor garlic mustard. This species would be the highest priority for treatment. Kudzu, chinese yam and amur honeysuckle would follow in order of priority. Post-treatment monitoring would occur to evaluate treatment success.

2. Management of 23 natural areas based on invasive species priorities.

On the Forest, there are 80 designated natural areas managed under the Natural Area management prescription of the 2006 Forest Plan. These areas are managed for the protection and perpetuation of their significant and exceptional features. Many of these features are ecological in nature, with unique plants and/or animals and communities. Some areas have been actively managed in the past, but most that require active management have not received it in ten years or more, leading to the general degradation of the biological diversity of the natural communities.

Management would include prescribed burning of 23 natural areas (Table 1), their associated corridors (roads/trails/ streams) and adjacent land (natural area treatment zone, see maps), which serve as invasion pathways. Firelines would utilize current man-made and natural boundaries like roads, trails, and creeks, where possible, but hand-blown and mechanical fire-lines would be used where necessary. The prescribed burning of about 12,000 acres in and around the natural areas is proposed. These areas would initially be burned to stimulate desirable native vegetation and reduce the density of invasive species. Further burns would be conducted as needed to maintain ecological integrity during and following invasive plant treatment.

Table 1. Natural Areas with Priority Invasive Species¹

Name	Ranger District	Name	Ranger District
Ava Zoological Area	Mississippi Bluffs	Keeling Hill North EA	Hidden Springs
Barker Bluff RNA ²	Hidden Springs	Kickasola Cemetery EA	Hidden Springs
Bell Smith Springs EA ³	Hidden Springs	LaRue-Pine Hills RNA/EA	Mississippi Bluffs
Bulge Hole EA	Hidden Springs	Massac Tower Springs EA	Hidden Springs
Cretaceous Hills EA	Hidden Springs	Odum Tract EA	Hidden Springs
Dean Cemetery West EA	Hidden Springs	Panther Hollow RNA	Hidden Springs
Double Branch Hole EA	Hidden Springs	Poco Cemetery East EA	Hidden Springs
Fink Sandstone Barrens EA	Hidden Springs	Poco Cemetery North EA	Hidden Springs
Fountain Bluff GA ⁴	Mississippi Bluffs	Reid’s Chapel EA	Hidden Springs
Hayes Creek/Fox Den EA	Hidden Springs	Russell Cemetery Barrens EA	Hidden Springs
Jackson Hole EA	Hidden Springs	Snow Springs EA	Hidden Springs
Keeling Hill South EA	Hidden Springs		

¹ None of the natural areas proposed for treatment are located within wilderness areas.
² Research Natural Area; ³Ecological Area; ⁴Geological Area

Herbicides would be applied to manage the invasive species either before and/or after the initial burns, depending on the invasive species present. Certain invasive species would be targeted within natural areas, though any invasive species may be treated if present. Some species, like most grasses, grow well in response to fire. These species would be targeted before the burns. Other species such as Japanese honeysuckle or multiflora rose are generally set back by fire. By

burning these species there is less vegetation present (both height and density) and subsequently, less chemical would be needed for control or eradication.

Additionally, the proposal includes the cutting and stump spraying or girdling of some native trees and shrubs to improve growing conditions for natural communities on about 300 acres of barrens, glades and seep springs. Barrens and glades are unique native plant communities that traditionally have sparse vegetation. With the exclusion of fire, some of these areas have developed native shrub and tree growth that limits the diversity of the area. Dense shrubs and trees shade out the native herbaceous plants. In many cases these native herbaceous species are the unique features that the natural areas were designated to protect. These areas tend to be drier sites and have species that are adapted to these conditions. Thinning these areas helps to restore the natural condition of these unique habitats. Similarly, seep spring areas are also being encroached upon by trees and shrubs that are dewatering rare plant communities. Treatment of native and non-native species would help restore the significant and exceptional features for which the natural areas were designated.

The highest priority natural areas for prescribed fire and herbicide treatment would be those natural areas with acid seep springs (Cretaceous Hills, Dean Cemetery West, Kickasola, Massac Tower Springs, and Snow Springs). These habitats are the most threatened by invasive species and changes to the habitat. The encroachment of aggressive native and non-native invasive species in these areas, threatens to dry up the springs and dramatically degrade the plant community. These changes are destroying the spring habitat.

Rare plant resources rely on this habitat type including Regional Forester's Sensitive species such as twining screwstem (*Bartonia paniculata*), purple five-leaf orchid (*Isotria verticillata*), Longbeak arrowhead (*Sagittaria australis*), and New York fern (*Thelypteris noveboracensis*). Additional plant species confined to this community type, including several listed as threatened or endangered by the state of Illinois, are also vulnerable to extirpation without immediate management. The infestations of Nepalese browntop and Japanese honeysuckle are the primary non-native invasives that threaten to change the ecological make-up of these unique habitats. Red maple, river birch, and tulip tree are the native trees that are most aggressively dewatering the seep springs.

Of the remaining 18 natural areas, 11 have Regional Forester's Sensitive species and numerous other rare plant resources (Double Branch Hole, LaRue-Pine Hills, Poco Cemetery East, Poco Cemetery North, Bulge Hole, Fink Sandstone Barrens, Bell Smith Springs, Hayes Creek/Fox Den, Panther Hollow, Jackson Hole, and Barker Bluff). Streams or creeks run through or are adjacent to all of these natural areas, providing a corridor for invasive plant species, especially Nepalese browntop. These natural areas would be the second priority for invasive treatments.

The remaining seven natural areas (Fountain Bluff, Ava Zoological Area, Keeling Hill North, Keeling Hill South, Odum Tract, Russell Cemetery, and Reid's Chapel) contain dry to dry-mesic barrens communities, which provide a unique assemblage of rare plant resources. These remaining natural areas would be our third priority for treatment. It should also be noted that the other 57 natural areas not included in this Environmental Assessment also contain non-native invasive species. However, in order to systematically control and eradicate non-native plant

species, it was imperative that we prioritize those natural areas that needed the most attention in order to preserve their integrity.

3. Controlling the main pathways of invasion.

Stream, road, trail and right-of-way corridors are the main invasion pathways for most invasive species. Stream corridors are a dynamic environment with flooding that exposes bare soil. Similarly, roads and trails are heavily used and have exposed soil. These areas are susceptible to the establishment and growth of invasive species.

Stream, road and trail corridors would include 100 feet on each side of a road or trail. Right-of-ways would include the managed corridor (mowed or maintained area). Herbicide treatments could extend beyond 100-foot the corridors if needed to control the infestation but would not exceed 300 feet. Infestations that are greater than the 300 feet would require additional analysis and a separate decision; however, manual or mechanical treatment could be used to suppress these populations. Invasive species within these areas would be spot treated but most of the area included in these corridors would not be affected.

Forest-wide, treatments would be prioritized based on the threats posed by each species and the potential for successful control. Only a relatively small percentage of these areas could actually be treated and the percentage needing treatment would also be relatively small. Priorities for treatment within these corridors would focus on our remaining 57 natural areas and high-use recreation areas (campgrounds, trailheads and high use equestrian trails). The River-to-River trail and the nine-day trail ride area are two examples of high-use areas that would be targeted.

4. Ability to treat new infestations of invasive species

Rapid response to new invasive plant infestations (or existing population that we currently do not have recorded) would be allowed under this proposal. Hand and mechanical treatment methods, as already utilized in the no action alternative, would be used to reduce the threat of spread of newly found invasive species populations. Herbicide treatment for newly found populations, outside of the treatment corridors discussed above, would require additional environmental analysis and a new decision.

Herbicide Treatments

The Forest is proposing to use the following herbicides to treat invasive plant species: triclopyr, clopyralid, glyphosate, sethoxydim, and/or picloram. We have chosen commonly used low-impact herbicides that should provide effective treatment. Additionally, we have chosen to use methods that are the most controllable and would have the least residual impact. All applications will be done by one of three methods:

- 1) a hand held applicator, sprayer or similar equipment,
- 2) backpack sprayer, or
- 3) boom-mounted powered spray rig (ATV, UTV, Pickup truck or tractor).

The herbicide application rates would follow recommended rates for spraying. The Forest will only use those herbicides registered by the Environmental Protection Agency for the control of the plant species and for the specific type of site and use proposed. All applicable state and federal laws will be followed. Herbicides will be applied according to label directions and monitored in accordance with Best Management Practices and with direction in the Forest

Service Manual (FSM 2080, 2150 and 2200). A Pesticide Use Proposal (FS-2100-2) and safety plan (FS-6700-7) will be completed and signed prior to any herbicide use.

All herbicide handling and applications would be conducted under the guidance of a licensed herbicide applicator. Signs will be posted to alert the public as to the location and types of treatments being done and a date would be provided when the area could be safely entered.

Alternative 3 – Non-herbicide Alternative

Under this alternative, no synthetic herbicides would be used to control invasive species. The methods proposed here would rely on aggressive manual or mechanical treatments as the first course of control similar to the no action alternative. Natural weed killers would be applied when manual and mechanical methods are ineffective. This alternative was developed in response to public concerns expressed during the scoping period. People were concerned with the unintended consequences from the use of synthetic herbicides. This alternative is designed to control some invasive species and would not eradicate many populations.

Site-specific management for four species

This alternative would concentrate on the same invasive species as the proposed action but would use manual and mechanical methods as a first line of treatment. Kudzu sites could be treated initially with prescribed fire. Then a backhoe or bulldozer would be used to remove the individual plants concentrating on the root crowns. Amur honeysuckle and garlic mustard sites would be removed by concentrating on individual plants. Amur honeysuckle would be pulled using a weed wrench or similar tool to grub out individual plants. Garlic mustard would be hand-pulled or torched. Chinese yam plants would be treated initially by continual mowing, clipping, or torching. For all four species, natural weed killers would be applied, after the initial work has reduced the vigor of populations.

Natural weed killers are simple substances that directly top-kill plants upon application. They are substances encountered naturally but in small quantities. Food-grade vinegar and clove oil are the main active ingredients in one type of natural weed killer. Citric acid is also used in some formulations. Their presence is relatively well known and normally not harmful to humans or animals. However, when applied in larger doses the results are usually obvious in a very short time. After treatment, their damaging effect is quickly dissipated. Vinegar is made of acetic acid along with other weak organic acids. Clove oil is an essential oil from the clove plant (*Syzygium aromaticum*), which is native to Indonesia and India. This mixture works by disrupting membranes and causing leakage of plant cells. The damage to plants appears rapidly (1-2 days).

A hot foam machine would be used along roads and some trails to steam invasive species. The hot foam system is comprised primarily of a diesel-powered boiler and foam generator, which deliver hot water with a foam surfactant to target weeds via a supply hose and a treatment wand. The superheated hot foam (sugar is added to achieve a higher boiling point than water) is applied to the targeted vegetation at a high temperature (200°F) and low pressure; the foam traps the steam, giving it time to "cook" or "blanch" the vegetation. This causes a cellular collapse of the treated above-ground vegetation. This system is most effective on annual species. Biennial and perennial species would most likely resprout. This control method is limited in mobility and is

best used near developed sites such as campgrounds, trailheads and along roadsides and accessible trails

Management of 23 natural areas based on invasive species priorities.

All invasive species within natural areas would be treated using the methods as described in the Environmental Assessment. We would concentrate our efforts on the same natural areas described in the proposed action. Prescribed burning of the natural areas, their associated corridors (roads, trails, streams), and adjacent land would be the first course of action. Firelines would use natural boundaries such as roads, trails, and creeks, where possible, but hand-blown and mechanical fire-lines would be used where necessary. The prescribed burning of about 12,000 acres of land in and around the natural areas is proposed. These areas would likely be burned annually for the first two years—to restore native vegetation and set back the development of invasive species—and then as needed to maintain the areas' ecological characteristics, once invasive vegetation has been controlled.

Manual and mechanical weed treatment methods would be applied to manage the invasive species before and/or after the initial burns depending on the invasive species present. All invasive species would be targeted within natural areas. Additionally, the proposal includes the cutting or girdling of some trees and shrubs to improve growing conditions for natural communities on about 300 acres of barrens and glades. Cutting or girdling of trees would also be used in seep spring areas (less than 10 acres) where encroaching trees and shrubs are dewatering these rare plant communities.

Ability to treat unknown or new infestations of invasive species

Our approach for new infestations (or currently unknown) of invasive species would be the same as the proposed action, except we would use the methods described in the Environmental Assessment and by the use of natural weed killers.

Actions common to all Action Alternatives

The following actions would be implemented for any of the proposed action alternatives. Herbicide measures listed would be followed for the use of natural weed-killers.

Prevention and Education

Prevention and education are important elements in our overall invasive species management strategy (Appendix B). Prevention of invasive species spread is recognized as a primary part of the mission of the Forest Service (USDA Forest Service 2003). The Shawnee is implementing prevention measures. Among the most widely adopted practices are washing equipment before entry to forestlands and ensuring re-vegetation of treated invasive species sites. Most sites will be allowed to revegetate naturally if adjacent vegetation is native. Education efforts include presentations to employees and the public, posting information signs and boot-brush stations at recreation areas, web-site postings, displays at offices and events, and individual contacts. The Eastern Region of the Forest Service has a website devoted to the laws, policies and guidance pertaining to the eradication and control of non-native invasive plant species (<http://www.fs.fed.us/r9/wildlife/nis>) that is available to the public.

Our invasive species prevention and education program includes our participation in the River to River Cooperative Weed Management Area partnership. This is a group effort between 12 federal and state agencies, organizations and universities whose goal is to coordinate efforts and programs for addressing the threat of invasive plants in southern Illinois. The Weed Management Area was formally established in 2006 and addresses invasive plant species through collaborative projects and activities focused in the following areas:

- Education/Public Awareness
- Early Detection and Rapid Response
- Prevention
- Control and Management
- Research

III. Rare Plant Resources Analysis

The following information in Table 2 includes the 75 Regional Forester’s sensitive plant species and/or Species with Viability Evaluations. Species descriptions, habitat and location information, were obtained from NatureServe (2008, 2010), Plants Database (2008, 2010), and available data and literature (found in Literature Cited and Reviewed at the end of this document).

Table 2. Regional Forester’s Sensitive Plant Species (RFSS) on the Forest known to occur or have been documented as historically occurring within the 10 counties of southern Illinois where there are lands managed by the Shawnee National Forest. Species with Viability Assessments (SVE) are also listed in this analysis. An asterisk (*) denotes the assumption that the species is extirpated in that county. A double asterisk () next to the scientific name indicates that the name follows Mohlenbrock (2002), otherwise nomenclature follows the PLANTS database (2010). A = Alexander, G = Gallatin, H = Hardin, Ja = Jackson, Jo = Johnson, M = Massac, P = Pope, S = Saline, U = Union, and W = Williamson.**

A	G	H	Ja	Jo	M	P	S	U	W	Scientific Name	Common Name
	X	X	X	X	*	X				1. <i>Actaea rubifolia</i>	Appalachian bugbane
X						X	X			2. <i>Amorpha nitens</i>	Shining false indigo
			X				X	X		3. <i>Asplenium bradleyi</i>	Bradley's spleenwort
*			*					X		4. <i>Asplenium resiliens</i>	Black-stem spleenwort
						X				5. <i>Bartonia paniculata</i>	Twining screwstem
			X							6. <i>Berberis canadensis</i>	American barberry
						X				7. <i>Buchnera americana</i>	American bluehearts
						X				8. <i>Calamagrostis porteri</i> ssp. <i>insperata</i>	Porter’s reedgrass
	*	X		*		X	X			9. <i>Carex communis</i>	Fibrous-root sedge
	*			X		X		X		10. <i>Carex decomposita</i>	Cypress-knee sedge
			X	X	X			X		11. <i>Carex gigantea</i>	Giant sedge
*		*	*	*	*	*	*	*		12. <i>Carex lupuliformis</i>	False hop sedge
		X								13. <i>Carex oxylepis</i> var. <i>pubescens</i>	Sharpscale sedge
X				X	X	X	X	X		14. <i>Carex socialis</i>	Low woodland sedge

A	G	H	Ja	Jo	M	P	S	U	W	Scientific Name	Common Name
		X			X	X				15. <i>Chamaelirium luteum</i>	Fairywand
*	*		X	X	*	*		*		16. <i>Chelone obliqua</i> var. <i>speciosa</i>	Red turtlehead
	X	X	X	X		X	X			17. <i>Cirsium carolinianum</i>	Soft thistle
X	*									18. <i>Cladrastis kentuckea</i>	Kentucky yellowwood
			X							19. <i>Cynosciadium digitatum</i>	Finger dogshade
X			X	X	X	X		X	X	20. <i>Cypripedium parviflorum</i> var. <i>pubescens</i>	Greater yellow lady's slipper
				X		X				21. <i>Dennstaedtia punctilobula</i>	Eastern hay-scented fern
				X				X		22. <i>Dichantheium jorii</i> **	Variable panic grass
		X				X		*		23. <i>Dichantheium ravenelii</i>	Ravenel's rosette grass
						X				24. <i>Dichantheium yadkinense</i> **	Yadkin's panic grass
			X	X		X	X	X	X	25. <i>Dodecatheon frenchii</i>	French's shootingstar
			X	X		X		X	X	26. <i>Dryopteris goldiana</i>	Goldie's woodfern
		X		X		X		X		27. <i>Echinacea simulata</i>	Wavyleaf purple coneflower
	X		X		X	X	X	X		28. <i>Eleocharis wolfii</i>	Wolf's spikerush
				X		X				29. <i>Eupatorium hyssopifolium</i>	Hyssop leaf thoroughwort
			X	X	X	X	X	X	X	30. <i>Festuca paradoxa</i>	Clustered fescue
X			X		X	X				31. <i>Gentiana alba</i>	Plain gentian
*										32. <i>Helianthus silphioides</i>	Rosinweed sunflower
*						X		*		33. <i>Heteranthera reniformis</i>	Kidneyleaf mudplantain
		X	*			*				34. <i>Hexalectris spicata</i>	Spiked crested coralroot
			X	X		X		X		35. <i>Hottonia inflata</i>	American featherfoil
*			X	X	*			X		36. <i>Hydrolea uniflora</i>	One-flowered false fiddleleaf
	X	X				X	X			37. <i>Hylotelephium telephioides</i>	Allegheny stonecrop
						X				38. <i>Isotria verticillata</i>	Large whorled pogonia
X		X	X	X	X	X	X	X	X	39. <i>Juglans cinerea</i>	Butternut
	X	X	X	X		X			X	40. <i>Lilium superbum</i>	Turk's-cap lily
			X							41. <i>Lonicera dioica</i> var. <i>glaucescens</i> **	Limber honeysuckle
			X			X				42. <i>Lonicera flava</i>	Yellow honeysuckle
						*				43. <i>Lysimachia fraseri</i>	Fraser's yellow loosestrife
		X		X		X	X			44. <i>Matelea obliqua</i>	Climbing milkvine
		X				X				45. <i>Oxalis illinoensis</i>	Illinois wood sorrel
X	X	X	X	X	X	X	X	X		46. <i>Panax quinquefolius</i>	American ginseng
	X	X			X	X				47. <i>Phaeophyscia leana</i>	Wreath lichen
								X		48. <i>Pinus echinata</i>	Shortleaf pine
			X	X		X	X			49. <i>Plantago cordata</i>	Heartleaf plantain

A	G	H	Ja	Jo	M	P	S	U	W	Scientific Name	Common Name
						X				50. <i>Platanthera clavellata</i>	Small green wood orchid
				X	X					51. <i>Platanthera flava</i> var. <i>flava</i>	Palegreen orchid
			*			*				52. <i>Poa alsodes</i>	Autumn bluegrass
					*	X				53. <i>Polygala incarnata</i>	Procession flower
	X		X	X		X	X	X		54. <i>Polytaenia nuttallii</i>	Nuttall's prairie parsley
								*		55. <i>Pycnanthemum albescens</i>	Whiteleaf mountainmint
*			*			*				56. <i>Pycnanthemum torrei</i>	Torrey's mountainmint
			X		X	X			X	57. <i>Rhexia mariana</i>	Maryland meadowbeauty
X			X					X		58. <i>Rhododendron prinophyllum</i>	Early azalea
				X		X				59. <i>Rhynchospora glomerata</i>	Clustered beaksedge
						X				60. <i>Rudbeckia fulgida</i> var. <i>sullivantii</i>	Sullivant's coneflower
						X		*		61. <i>Sagittaria australis</i>	Longbeak arrowhead
		X								62. <i>Sanicula smallii</i>	Small's blacksnakeroot
						*				63. <i>Schoenoplectus purshianus</i>	Weakstalk bulrush
		X								64. <i>Silene ovata</i>	Blue Ridge catchfly
		X								65. <i>Silphium pinnatifidum</i>	Tansy rosinweed
		*								66. <i>Silphium trifoliatum</i>	Whorled rosinweed
	X		X	X	*	X		X		67. <i>Stenanthium gramineum</i>	Eastern featherbells
X										68. <i>Styrax grandifolius</i>	Bigleaf snowbell
			X						X	69. <i>Synandra hispidula</i>	Guyandotte beauty
						X				70. <i>Thelypteris noveboracensis</i>	New York fern
	X	X		X		X		X		71. <i>Trichomanes boschianum</i>	Appalachian bristle fern
	*		X	X						72. <i>Trifolium reflexum</i>	Buffalo clover
		X				*				73. <i>Vaccinium stamineum</i>	Deerberry
			X					X		74. <i>Vitis rupestris</i>	Sand grape
						*				75. <i>Waldsteinia fragarioides</i>	Appalachian barren strawberry

Environmental Impacts and Cumulative Impacts of Alternatives on Regional Forester's Sensitive and Species with Viability Evaluations.

Spatial Boundary: The geographic boundary for the rare plant resources in this analysis is the proclamation boundary of the Shawnee National Forest. This boundary was selected because management actions, natural processes and various activities, which occur on the Forest, are confined to the Forest and the areas immediately adjacent to it.

Temporal Boundary: The temporal boundary for rare plant resources is estimated from the last 10 years in the past to 10 years in the reasonably foreseeable future. A past temporal boundary was selected since the majority of our knowledge of rare plant resources has only come about within the last 70 years. Ten years in the past and future is long enough to accurately gauge the management effects and short enough that any unforeseeable deleterious effects resulting could be addressed, reversed, and/or mitigated.

Past, Present and Reasonably Foreseeable Future Actions

Past, present and future actions for the project area are listed at the beginning of Chapter 3 of the Invasive Species Management Environmental Assessment. The effects of these projects are bounded in time and analyzed cumulatively with the anticipated effects of the proposed action for each resource. Reasons that the identified past, present or foreseeable future action will not have Cumulative Impacts should be based on one or more of the following:

- a) The proposed action has no direct or indirect effects relative to the issue.
- b) The identified past/present/future action has no direct/indirect effect relative to the issue.
- c) The identified past, present and future actions are removed, temporally or spatially, from the proposed action to an extent that there is no combined effect on the specific resource of issue.
- d) There is no difference in effects between the action alternatives and the No Action alternative.

Table 3 displays the past, present and reasonably foreseeable future actions that have been considered in this analysis. It is concluded that agriculture (cultivated and pastureland), wildfires, timber harvest/firewood cutting, timber stand improvement, ATV use, road maintenance, tree planting, utility right-of-way maintenance, trail construction (includes reconstruction and maintenance), non-system trails, special-use permits (telephone, electric, water, driveways), openlands management, and residential development will not contribute to Cumulative Impacts since there is no difference in the effects of the action alternatives and the No Action alternative.

In some cases, prescribed burning, recreational use, and invasive species control (private lands) may contribute to Cumulative Impacts for rare plant resources. These effects may be beneficial or may have negative impacts on rare plant resources depending on the species, its location, and the action involved. Cumulative Impacts are explained in detail under each species heading below.

Table 3. Past (last ten years), present and reasonably foreseeable future actions, with potential for Cumulative Impacts, within the Forest watersheds (includes Forest Service and private lands).	
Action	Scope of Action
Agriculture (cultivated - row-cropping)	About 526,500 acres (past, present and future).
Agriculture (pastureland)	About 59,200 acres (past, present and future).
Prescribed burning *	About 3,000 acres per year (past). About 10,000 acres (present and future).
Wildfires	About 85 acres per year (past). About 1,000 acres per year (future).
Timber harvest/firewood cutting	About 1,000 acres per year (past, present and future).
Timber stand improvement	About 800 acres per year (past, present and future).

Table 3. Past (last ten years), present and reasonably foreseeable future actions, with potential for Cumulative Impacts, within the Forest watersheds (includes Forest Service and private lands).	
Action	Scope of Action
Recreational use **	About 300,000 people visited the Forest for recreation. About 37,000 for horseback riding About 150,000 for hiking or walking About 37,000 for hunting About 16,000 for fishing About 5,000 for gathering forest products (mushrooms, berries, and others). About 600 for bicycling.
ATV use	Variable use in watersheds (past, present and future).
Road (including right of way) maintenance	About 300 miles per year (past, present and future). About 1000 acres per year (past, present and future).
Tree planting	About 500 acres per year (past, present and future).
Utility right of way maintenance	About 250 miles per year maintained with herbicide (past, present and future).
Trail construction, reconstruction and maintenance	About 75 miles maintained per year (past, present and future). About 10 miles per year constructed or reconstructed.
Non-system trails	Estimate less than 100 miles of trail (past, present and future).
Special-use permits (telephone, electric, water and driveways).	Estimate less than 20 acres per year (past, present and future).
Invasive species control (private land)	About 200 acres treatment per year (past and present). About 400 acres herbicide treatment (future).
Openlands management	Disking and planting about 200 acres (past). Disking and planting about 100 acres (future).
Residential development	About 2,000 houses per decade (past and future).
* The Forest is planning on burning about 8,000-12,000 acres per year in the future. The prescribe burns in the proposed project (about 12,000 acres) would be included in these acres.	
** Based on the 2008 National Visitor Use Monitoring Survey.	

Key to global and state ranks:

G1/S1 - Critically imperiled – because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the State. Typically 5 or fewer occurrences or very few remaining individuals (<1000).

G2/S2 - Imperiled – because of rarity or because of some factor(s) making it very vulnerable to extirpation from the Nation, State. Typically 6 to 20 occurrences or few remaining individuals (1000 to 3000)

G3/S3 - Vulnerable – either because rare and uncommon, or found only in a restricted range (even if abundant in some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3000 and 10,000 individuals.

G4/S4 - Apparently secure – uncommon but not rare and usually widespread. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.

G5/S5 - Secure – common, widespread, and abundant. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

1. *Actaea rubifolia* (Appalachian bugbane)

Actaea rubifolia is a perennial herb that occurs in portions of Virginia, Tennessee, Kentucky, Alabama, Indiana, and Illinois. It flowers from July through September. This species is limited in range and there are approximately 50 to 80 occurrences known.

Actaea rubifolia has been given a Global Heritage Status Rank of G3 by The Nature Conservancy in 2001 because of its rarity range-wide (NatureServe 2008, 2010). Threats range-wide include logging, land-use change and unregulated recreational use. It is presumed extirpated in Alabama, critically imperiled in Indiana, imperiled in Illinois, Kentucky, and Virginia, and vulnerable in Tennessee. Sightings in Pennsylvania are presumed to be exotic or introduced to the state.

Actaea rubifolia is found within Pope, Gallatin, Jackson, Johnson, and Hardin counties. A report exists for Massac County on private property but the population may be extirpated because of cattle grazing; the threat is not so much of this species being eaten as it is in the trampling associated with grazing. At least 24 populations are located in southern Illinois and include locations within Thacker Hollow, north of Camp Cadiz, Grindstaff Hollow, near Cedar Lake, Ferne Clyffe State Park, Gyp Williams Hollow Ecological Area, Bell Smith Springs Ecological Area, Burke Branch Research Natural Area, War Bluff, Lusk Creek Canyon Ecological Area, Lusk Creek Canyon Zoological Area, Lusk Creek Canyon Wilderness Area, Jackson Hollow Ecological Area, north of the Jackson Hollow Ecological Area, Cove Hollow, and Jackson Falls Recreation Area. In these areas it is found in rich woods and is considered rare.

The Grindstaff Hollow population, which was discovered by Robert H. Mohlenbrock on July 27, 1954 and was relocated in 1992 by Elizabeth Longo Shimp and Lawrence Stritch. Over 3000 plants were estimated but the population was threatened and being trampled because of a user-developed horse trail on a steep rocky slope. This population was not relocated in 1999 and was thought to be extirpated (Miller 1999), however, a botanical survey near the Grindstaff Hollow area by Adam O'Connor on October 13, 2009 revealed a user-developed horse trail through 3 metapopulations with approximately 300 plants total. The primary threat to this species in southern Illinois has been unregulated equestrian use, and more recently, illegal equestrian use in closed natural areas. In at least two cases, the threat is illegal all-terrain-vehicle use in closed natural areas.

At least 18 of the 24 populations in southern Illinois are currently unprotected on Forest managed lands, 6 being protected within natural areas. These populations will continue to be negatively impacted by equestrian use and ATV use unless trails continue to be designated and horses are restricted to these trails. There are at least 6 populations on private land, one is protected at Ferne Clyffe State Park, 3 appear to have no immediate threats, 1 has an unauthorized user-developed equestrian/ATV trail through the population at the railroad right-of-

way, and the last population lost portions of its population from a logging event in 1994. This species is globally rare but found locally abundant in a few of its populations on the Forest. Continued negative impacts to unprotected populations will likely cause a trend to federal listing or loss of species viability.

Environmental Impacts:

Alternative 1 should have no direct and indirect short-term impacts on *Actaea rubifolia*, however, there may be some negative indirect impacts in the long-term for this species where it occurs outside of natural areas and lands that are not being prescribed burned. This would be because prescribed fire would not be permitted in Alternative 1 for the purpose of TES species or habitat enhancement unless covered under another analysis. There would also be some negative indirect impacts in the long-term without the use of herbicide. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Actaea rubifolia* through fire management and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. Observations on the Forest have been documented that this moderately shade-requiring species requires some sunlight reaching the forest floor. Populations thrive best when there are openings in the canopy. Prescribed fire helps in opening portions of the canopy. If the surrounding forest becomes densely shaded, negative impacts can be expected in the long-term.

Alternative 3 is expected to have negative direct and indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative direct and indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Actaea rubifolia* populations within their habitats. In particular, Japanese honeysuckle and Chinese Yam (*Dioscorea batatas*) may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will certainly contribute to positive indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species.

In the past, adjacent fire-dependent communities contributed to some burning of this species' habitat on the Forest. Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. The rich woods on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually

with great intensity, yet these populations perpetuated and endured the harsh conditions. Areas harboring *Actaea rubifolia* were no exception. This species has hard, knotted, long-lived rhizomes and it inhabits rich, mesic microsites where fire severity and frequency may be lower than adjacent communities. There is no doubt that this species resprouts from its rhizomes following fires.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Actaea rubifolia* outside of natural areas or within Wilderness Areas may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Chinese Yam, Poison ivy, and/or Nepalese browntop. Surrounding areas adjacent to this species' habitat will continue to become encroached with invasive exotic species, thus encouraging competition for light, nutrients, and habitat. This would also likely occur with Alternative 3 when non-chemical means does not prove to control invasive species as chemical treatments would.

Although fire will benefit this species in Alternative 3, more aggressive management will be required to save the rare community type and habitat that this species requires. Rich talus slopes can be easily disrupted by hydrological disturbances, which will eventually cause the sites to become dehydrated (as is currently being witnessed at Grindstaff Hollow). The use of integrated pest management will benefit this species by eliminating the competition from other more aggressive species. Prescribed fires may also add nutrients back to the microhabitat, which should help stimulate populations.

Alternatives 1-3 restrict prescribed fire in Wilderness Areas. *Actaea rubifolia* is not known to require fire but the surrounding vegetation adjacent to its habitat may become so densely shaded in the long-term as to keep this species from receiving the sunlight that it does require. This rare species is one that may have a trend towards federal listing because of the past and current negative impacts that it receives from recreational use and habitat degradation.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Actaea rubifolia* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Actaea rubifolia* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning

and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

2. *Amorpha nitens* (Shining false indigo)

Amorpha nitens is a branching, leguminous shrub. It is a very rare species that has been documented from approximately 21 to 80 occurrences in Oklahoma, Arkansas, Louisiana, Alabama, Tennessee, Georgia, Kentucky, and Illinois. This species reaches its northern range limit in the thickets and streambanks of southern Illinois. It occurs in a variety of habitats within its range including dry rocky upland barrens-like habitat and prairies (Taft 2004a).

According to NatureServe (2008, 2010) primary threats to *Amorpha nitens* include the destruction of habitat through agricultural conversion, grazing, and hydrological perturbations (such as dam construction). Other threats are exotic species such as *Lonicera japonica* and *Rhamnus cathartica*. The Nature Conservancy assigned *Amorpha nitens* the Global Ranking of G3 in 1995 and has been determined it to be critically imperiled in Illinois, Alabama, and Georgia, and vulnerable in Kentucky. It is possibly extirpated from Louisiana. It is currently not ranked or is under review in South Carolina, Tennessee, Arkansas, and Oklahoma.

In Illinois, *Amorpha nitens* is historically known from Alexander, Pope, Pulaski, and Saline counties. The Pulaski location has not been relocated since 1968. The Pope and Saline locations occur on National Forest managed lands. One is along the Grand Pierre Creek (2 metapopulations on private land and a metapopulation on National Forest managed land) and the other within Cave Hill Research Natural Area, in the Saline River floodplain. Historic populations were documented by E.J. Palmer in 1919 as occurring along the Ohio River banks but these have not been relocated. The Alexander County population was recently discovered by Steve Hill (collections #31788 and #31819) and reported to originally consist of four colonies totaling about 22 plants. Since this discovery, highway construction appears to have destroyed about half of the population (Taft 2004a).

Environmental Impacts:

Alternative 1 should have no direct and indirect short-term impacts on *Amorpha nitens*, however, there may be some negative indirect impacts in the long-term for this species where it occurs outside of natural areas and lands that are not being prescribed burned. This would be because prescribed fire would not be permitted in Alternative 1 for the purpose of TES species or habitat enhancement unless covered under another analysis. This species is known from Cave Hill Research Natural Area (RNA) and at Grand Pierre Creek; Cave Hill is proposed for fire management in a separate Environmental Assessment (CE for Prescribed burning of Cave Hill, Dennison Hollow, and Stoneface Research Natural Areas and Simpson Township Barrens Ecological Area and Adjacent Forest Communities, 2009 in progress) but not in this assessment. There would also be some negative indirect impacts in the long-term without the use of herbicide. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Amorpha nitens* through integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. Observations on the Forest have been documented that this moderately shade-requiring species requires some sunlight reaching the forest floor. Populations thrive best when there are openings in the canopy. Grand Pierre Creek and the surrounding environs are not currently being considered for fire management. Herbicide would likely be used at the two known sites since both occur along roadways and waterways. If this were the case, precautions would be taken to protect *Amorpha nitens* from any adverse impacts from the application of herbicides. This species is easily identifiable and will be avoided during spraying.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Amorpha nitens* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle (*Lonicera maackii*) and Chinese yam may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will certainly contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts although the cumulative impacts would also take into consideration the proposed natural area burns in a separate document. Fire may have some direct effects in the short term if the root crown is in an erosive area or if adventitious buds are directly burned in a fire (John Taft, personal communication with Elizabeth Shimp on August 25, 2004). The two locations on the Forest are in areas where very little fuel is available except, perhaps, following a period in the late fall/early winter when an accumulation of leaf litter may surround the plant. These locations are also densely shaded and plants appear to be more spindley than bushy. Literature on the effects of fire on *Amorpha nitens* is generally lacking, however, the resprouting habit observed for *Amorpha nitens* and its affiliation with light gaps, barrens-like habitat and prairies suggests that this is a species that may have tolerance to fire (Taft 2004a).

These plants have vigorous resprouting abilities when the tops are cut or when plants appear to be otherwise dead. Studies by Dr. John Taft (personal communication with Elizabeth Shimp on August 25, 2004) demonstrate that there is at least an 85% germination rate with seeds regardless if seeds are scarified or not. This means that fire is not necessary to induce germination. Dr. Taft also noted that although this species grows with native species in shaded conditions, it has a tendency to grow towards more ambient sunlight and away from neighboring species such as bladdernut and shrubby St. John's wort.

There may also be some negative indirect cumulative impacts for Alternatives 1 and 3 in the long term since there are no plans to use herbicides. These effects may come from exotic species

encroachment, such as Japanese honeysuckle, which may cause a reduction in health and vigor of *Amorpha nitens* populations on the Forest. Prescribed fire will help reduce or control that negative impact at Cave Hill RNA but no fires are planned for Grand Pierre Creek.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Amorpha nitens* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through roads where this species occurs. Since there should be no negative impacts to *Amorpha nitens* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

3. *Asplenium bradleyi* (Bradley's spleenwort)

Asplenium bradleyi is an evergreen, perennial fern found within the eastern and midwestern United States excluding New England and the states north of Illinois. It was historically documented from 19 states. It reaches its northern range limit in southern Illinois where it is very rare and occurs primarily on sandstone cliffs and chert outcrops.

Primary threats to *Asplenium bradleyi* in southern Illinois include drought conditions and over collecting. Drought conditions are associated by the destruction of habitat throughout much of the species' range. Examples of activities leading to drought conditions range-wide include strip mining activities, logging, rock climbing, and adjacent road and trail use. The Global Ranking by The Nature Conservancy changed from G3 to G4 in 1993 (NatureServe 2008, 2010). This species is presumed extirpated in New York, Maryland, and West Virginia; vulnerable in Georgia and Kentucky; imperiled in North Carolina, Virginia, Tennessee, Alabama, and Ohio; and critically imperiled in Illinois, Indiana, Pennsylvania, New Jersey, and South Carolina. It is not ranked or is under review by Missouri, Arkansas, and Louisiana. Through the risk analysis, this species was retained on the RFSS list by the Shawnee National Forest to aid in its protection.

Asplenium bradleyi has been found within Saline, Jackson, and Union counties. It was first discovered in Illinois in Randolph County at Piney Creek, west of West Point by Robert H. Mohlenbrock in 1954. On March 6, 1955 he discovered another population (collection #4988) along the Jackson County extension of the creek (Mohlenbrock, 1955). It is known to occur on the Forest within the LaRue-Pine Hills/Otter Pond (shaded, cherty slope) and Cave Hill Research Natural Areas, Panther Den Wilderness Area, and Garden of the Gods Ecological Area. Each of these sites has only a few plants per population. The Garden of the Gods population was last documented in 1980 as being scattered on the eastern cliff faces and overhangs.

Environmental Impacts:

Alternative 1 should have no direct and indirect short-term impacts on *Asplenium bradleyi*, however, there may be some negative indirect impacts in the long-term for this species where it occurs outside of natural areas and lands that are not being prescribed burned. This would be because prescribed fire in adjacent areas would not be permitted in Alternative 1 for the purpose of TES species or habitat enhancement unless covered under another analysis. There would also be some negative indirect impacts in the long-term without the use of herbicide. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat. These effects may come from the aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Asplenium bradleyi* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species, as well as excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Asplenium bradleyi* through integrated pest management at the LaRue-Pine Hills location. This species is readily identifiable and can be easily avoided during the use of herbicides. Herbicide would not likely be used at one of the sites since it does not occur near a trail, road or waterway corridor. If these locations are sprayed with herbicide, precautions would be taken to protect *Asplenium bradleyi* from any adverse impacts.

LaRue-Pine Hills/Otter Pond Research Natural Area is part of the proposed project area. The Panther Den Wilderness Area is not considered in this project. A trail runs near the Garden of the Gods Ecological Area site so it would be included in this project. This species is known from Cave Hill Research Natural Area but this location within the natural area is not proposed for herbicide use. Cave Hill is proposed for fire management in a separate Environmental Assessment (CE Prescribed burning of Cave Hill, Dennison Hollow, and Stoneface Research Natural Areas and Simpson Township Barrens Ecological Area and Adjacent Forest Communities, 2009 in progress) but not in this assessment. Herbicide use would be considered if in the future *Pueraria montana* (kudzu), *Lonicera maackii* (bush honeysuckle), *Dioscorea oppositifolia* (Chinese yam), or *Alliaria petiolata* (garlic mustard) are found at Cave Hill RNA. If this were the case, precautions would be taken to protect *Asplenium bradleyi* from any adverse impacts from the application of herbicides. At Garden of the Gods EA, *Alliaria petiolata* will be herbicided at specific sites but *Asplenium bradleyi* does not occur near these sites.

Alternative 3 is expected to have negative direct and indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative direct and indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Asplenium bradleyi* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive woody encroachment in the understory. Prescribed fire in adjacent areas will certainly contribute to positive indirect short-term and long-term impacts to these populations by stimulating native

species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Fire management and herbicide use are expected to have positive indirect short-term and long-term impacts for Alternative 2 but fire may have some direct short-term and long-term negative effects in Alternatives 2 and 3 if the surrounding forest or that forest on the bluffs results in drying and erosion at LaRue Pine Hills RNA; on the otherhand, positive impacts may result from the burned forest adding nutrients to its microhabitat (Hill 2003a). The effects of fire are not well studied on this species but the Cave Hill RNA population has persisted, without apparent fluctuation in numbers, following previous prescribed fires. With the current information available, fire appears to be neither beneficial nor detrimental to the populations on the Forest other than it does allow the species to compete better when aggressive invasives are controlled. Fire is not proposed for the Garden of the Gods EA population.

Other populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires occurred especially on the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (a result of the suppression of wildfires which was directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet the *Asplenium bradleyi* populations perpetuated and endured the harsh conditions.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. At LaRue-Pine Hills RNA, for Alternative 1 in the long-term, populations of *Asplenium bradleyi* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper. In Alternative 2, prescribed fire and herbicides may benefit the species by eliminating the competition from the other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat.

There may also be some negative direct and indirect cumulative impacts for all alternatives in the long term for all *Asplenium bradleyi* locations outside of LaRue-Pine Hills RNA since there are no current plans to use herbicides in the future except for 4 primary species. These effects may come from exotic species encroachment, such as Japanese honeysuckle, which may cause a reduction in health and vigor of *Asplenium bradleyi* populations on the Forest. Prescribed fire will help reduce or control that negative impact at LaRue-Pine Hills RNA but no fires are planned for the other sites except for Cave Hill RNA (analysis in progress).

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Asplenium bradleyi* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Asplenium bradleyi* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

4. *Asplenium resiliens* (Black-stem spleenwort)

Asplenium resiliens is a wiry evergreen fern (spleenwort) that occurs in south-central and eastern United States. It reaches its northwestern margin of its range in southern Illinois where it is now only known to still be extant at one location on a limestone ledge.

According to Herkert and Ebinger (2002) the primary threat to *Asplenium resiliens* in Illinois is over-collection. The Nature Conservancy assigned this species the Global Ranking of G5 in 1984 but it is unranked or under review in 11 states; presumed extirpated in Louisiana; possibly extirpated in Ohio; critically imperiled in Nevada, Utah, Colorado, Illinois, Indiana, Mississippi, South Carolina, Pennsylvania, and Maryland; imperiled in Kansas and North Carolina; vulnerable in West Virginia; and apparently secure in Kentucky and Virginia (NatureServe 2008).

In Illinois, *Asplenium resiliens* is historically known from Alexander, Jackson, and Union counties. Records for these locations are scanty but information leads one to believe that the two Alexander locations have not been relocated for over 30 years, the Jackson County location at Devil's Bake Oven (another collection is noted as Grand Tower, however, the location is described for Devil's Bake Oven as being an exposure of Grand Tower Limestone and Lingle Formation), on thin soils of the limestone cliff, may still be present but has not been observed for over 10 years (private), and the Union County locations at LaRue-Pine Hills/Otter Pond Research Natural Area (2 possible stations, shaded limestone cliff) have not been seen since 1987. A collection by Robert H. Mohlenbrock was documented as being discovered December 26, 1954 (collection #4948) at Grassy Knob (Mohlenbrock 1956). If these populations are still present, they are, in fact, susceptible to over-collecting. It is also possible that these populations may already have been collected to extirpation. Further searches for these populations are needed and collections should be prohibited where restrictions are not yet enforced.

Environmental Impacts:

Alternative 1 should have no direct and indirect short-term impacts on *Asplenium resiliens*, however, there may be some negative indirect impacts in the long-term for this species where it occurs outside of natural areas and lands that are not being prescribed burned. This would be because prescribed fire in adjacent areas would not be permitted in Alternative 1 for the purpose of TES species or habitat enhancement unless covered under another analysis. There would also be some negative direct and indirect impacts in the long-term without the use of herbicide. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat. These effects may come from the aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Asplenium resiliens* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species, as well as excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Asplenium bradleyi* through integrated pest management at the LaRue-Pine Hills location. This species is readily identifiable and can be easily avoided during the use of herbicides. Herbicide would not likely be used at the other sites since they do not occur near a trail, road or waterway corridor. If these locations are sprayed with herbicide, precautions would be taken to protect *Asplenium resiliens* from any adverse impacts.

Fire management in Alternatives 2 and 3 may also have some direct short-term and long-term negative impacts if the surrounding forest or that forest on the bluffs results in drying and erosion (Hill 2003b); on the other hand, positive effects may result from the burned forest adding nutrients to its microhabitat. In Alternative 3, the use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

As seen with *Asplenium bradleyi*, the effects of fire are not well studied on this species but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. At this point in time, fire appears to be neither beneficial nor detrimental to the populations on the Forest, although further studies would be desirable.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In Alternative 1, in the long-term, populations of *Asplenium resiliens* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Asplenium resiliens* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and plant collecting where this species occurs. Since there should be no negative impacts to *Asplenium resiliens* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

5. *Bartonia paniculata* (Twining screwstem)

Bartonia paniculata is an annual or perennial herb of wet peat bogs and sands, and occurs in the southeastern United States and north along the Atlantic Coast. Its northern interior range limit is in the acid seep springs of extreme southern Illinois. This species generally flowers between August and September.

Primary threats to *Bartonia paniculata* in Illinois are habitat loss (woody and shade-tolerant species encroachment), and hydrological changes. This species occurs exclusively in and adjacent to acid gravel seeps and springs within Pope County. These populations are known from Poco Cemetery North, Cretaceous Hills (mesic upland forest), Kickasola Cemetery, and Snow Springs Ecological Areas. The Snow Springs population (seep springs) was first documented in 1967 (Schwegman 1969) and the now-dehydrated area is dominated by shading Red maple and River birch. This species was last seen during 2007 by Elizabeth Longo Shimp while the natural boundaries were being posted at Snow Springs. The Cretaceous Hills population at Sphagnum Springs that was also discovered in 1967 (Schwegman 1969) and relocated on November 2, 1995 (E.Ulaszek and D. Spivey collection #3060). The Poco Cemetery North population (dry-mesic barren) was discovered October 21, 1994 (J. Shimp collection #5376). The Kickasola Barrens “New Spring” location (acid gravel seep) was last seen and collection made on September 27, 1994 (E. Ulaszek collection #2289).

The Nature Conservancy assigned this species the Global Ranking of G5 in 1984 (NatureServe 2008) but it is critically imperiled in Wisconsin, Illinois, Oklahoma, Ohio, New York, Maine,

District of Columbia, and Ontario, Canada; imperiled in Michigan, North Carolina, Delaware, and New Brunswick, Canada; vulnerable in Indiana, Pennsylvania, Maryland, Virginia, Georgia, and Georgia, and presumed stable in Kentucky and Nova Scotia. It is unranked or under review in 14 states and 1 Canadian province. It had been determined to be presumed extirpated in Illinois until it was identified in three seep areas on the Forest during the early 1990's.

Environmental Impacts:

There may be some negative direct and indirect short-term and long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Bartonia paniculata* populations within the seep springs on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle and Nepalese browntop (*Microstegium vimenium*) may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Hydrological disturbances leading to the drying out of these seep springs are a primary threat to this species; Massac Tower Springs is all but dried out and the invasive Nepalese browntop has taken over portions of the former seep spring habitat. Nepalese browntop was found in 2007 in the Snow Springs seep and much of it was hand-pulled although seedlings re-emerged the same season. A large population of Nepalese browntop found within the Kickasola barrens is migrating towards the seep springs and it is predicted that this aggressive invasive could possibly lead to the demise of this seep spring community. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit *Bartonia paniculata* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Bartonia paniculata* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. Preference would be to use herbicides early in the season during the spring or early summer to avoid emergence of *Bartonia paniculata*. Observations on the Forest have been documented that this species requires some sunlight reaching the seep springs on the forest floor. Populations thrive best when there are openings in the canopy.

Alternative 3 is expected to have negative direct and indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. Eventual exotic species encroachment may cause a reduction in health and vigor of *Bartonia paniculata* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected

to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. Prescribed fires have also benefited this species in other areas such as the Coastal Plain Marshes in Michigan (Kost and Penskar 2000). Seep springs in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs on the Forest are habitat to several native fire-adapted species. Following prescribed fire in 1992 in Kickasola Cemetery Barrens, a population of 20 *Bartonia paniculata* flourished in the seep during 1993.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Bartonia paniculata* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by controlling and/or eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the rare community type and habitat that this species requires. Hydrological disturbances will eventually cause the seeps to dry up (as is currently being witnessed at Massac Tower Springs) and the demise of this species in Illinois will be inevitable.

Prescribed fire and non-chemical means of removing exotic species from the seep springs in Alternative 3 may slightly benefit this species, however, the repetitive nature of these applications, and the low success rate expected, may mean that not all sites may be treated. These seep spring areas must be aggressively managed to remove the invasive species that threaten this rare community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Bartonia paniculata* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking, equestrian use, and other uses where this species occurs. Since there should be no negative impacts to *Bartonia paniculata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative

impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

6. *Berberis canadensis* (American barberry)

Berberis canadensis is an erect shrub that occurs in southeastern United States, and ranges northwest to Illinois. The Fountain Bluff population, the only population known in southern Illinois, was first discovered in 1973, last observed in 1987 but not relocated during searches in 1988 and 2002 (John Schwegman personal communication in Hill 2003c). Up until January 2, 2009, it was thought that this species occurred on the Shawnee National Forest but it is actually on private property along the Mississippi River. Since this project does not propose any management on this private property, there is no need to analyze this species.

7. *Buchnera americana* (American bluehearts)

In Illinois, *Buchnera americana* is a species of prairies and fields. It is known primarily in west central Illinois but with additional occurrences found in one extreme northern county and one in a southern county (Pope). It is historically known from 13 Illinois counties although most collections were made during the 1970's and earlier (Danderson 2004a). In Illinois, this species has been seen in flower from mid-June through September.

According to NatureServe (2008, 2010), the primary threat to *Buchnera americana* is habitat loss. The loss of prairie fires has led to successional changes where the sites convert to woodlands and become shaded. Without the natural regime of fires, open prairie areas will continue to close in and may lead to the demise of this species. The Nature Conservancy assigned this species the Global Ranking of G5? in 1994 and has historical occurrences listed for 25 states and Ontario but it is presumed extirpated or possibly extirpated from 7 states and the District of Columbia. It has been determined to be critically imperiled in Indiana, Virginia, Georgia, and Ontario, Canada; imperiled in Ohio and Texas; and vulnerable in Illinois, Kentucky, and Tennessee. This species has been extirpated from the periphery of its range but it appears stable elsewhere.

In southern Illinois, *Buchnera americana* is very rare (e-mail communication from John Schwegman to Beth Shimp April 5, 2001). It is a prairie/barrens annual-perennial and is restricted to the barrens communities of south Pope County. John Schwegman has monitored this species for several years and has determined that it is mostly an annual but has the capability to become a parasite on composite species, and if it does, it becomes a perennial. It is known from Cretaceous Hills Ecological Area on Forest Service managed lands (Azotus Field) and from the adjacent Cretaceous Hills Nature Preserve managed by the State of Illinois. According to John Schwegman, like so many annuals of the prairie, this species disappears without fire. The fact that it has not been seen in Azotus Field for over 20 years does not mean that it is still not in the seed bank. In order for this species' seeds to germinate, a light requirement must be met. In addition, the longer the photoperiods of light is exposed to *Buchnera americana* seeds, the higher the percentage rate of germinating seeds (Danderson 2004a).

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Buchnera americana* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit *Buchnera americana* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well, or even express itself in its native habitat, in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Buchnera americana* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. Observations on the Forest have been documented that this species requires open sunlight reaching the forest floor. Populations thrive best when there are large openings in the canopy.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Buchnera americana* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. Stephen Widowski and Lawrence Stritch observed this species in 1988 at Cretaceous Hills Ecological Area following prescribed fires within Azotus Field and within the State managed nature preserve. Azotus Field was first burned as part of wildlife management, but was later prescribed burned for its natural area attributes. Observations included the sightings of a least two clusters of individuals on each of the publicly managed lands (personal communication between Stephen Widowski and Elizabeth Longo Shimp on August 31, 2004). Prescribed fires have also benefited this species in other areas such as Strait Creek Prairie Bluffs in southern Ohio. A small population of *Buchnera americana* was the primary reason for The Nature Conservancy to purchase this tract of land in 1984 and following aggressive fire management,

the population numbered in the thousands (The Nature Conservancy 2002). Fire had reclaimed the Indian grass-little bluestem community after it had been previously overgrown with red cedar.

Impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Buchnera americana* populations within the Cretaceous Hills, but may lead to the extirpation of the species in southern Illinois. Many of the south Pope County barrens are already becoming invaded by aggressive native and exotic woody species. The rare barrens community types, such as these, which are associated with acidic seep springs, will succumb to successional species if intensive management is not implemented. Open sunny barrens benefit *Buchnera americana* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Buchnera americana* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species requires.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Buchnera americana* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Buchnera americana* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from

prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

8. *Calamagrostis porteri* ssp. *insperata* (Porter's reedgrass)

Calamagrostis porteri ssp. *insperata* is a perennial grass that has a very limited distribution in the central United States. Its range extends from southern Ohio, southwest to Kentucky, Illinois, Missouri and Arkansas. Its habitat includes dry rocky woods usually with a northern slope, on dry limestone cliffs and sandstone outcrops. This species rarely flowers in Illinois; flowering time is from June through September.

Threats to this species include canopy closure as a result of natural forest succession or succession due to fire suppression, clear-cutting, grazing, soil compaction, recreational use of habitat, and loss of habitat to primarily agriculture (Hill, 2003d, NatureServe 2004). It was assigned a G4T3 Global Ranking by The Nature Conservancy in 1996. It is only known from 7 states and is presumed extirpated from Arkansas, critically imperiled in Illinois, Indiana, and Kentucky; imperiled in Ohio, and vulnerable in Missouri. It is not ranked or under review in Tennessee (NatureServe 2010). Approximately 80 occurrences are known throughout this species' range.

Calamagrostis porteri ssp. *insperata* is found at 6 locations within 3 natural areas in Pope County of southern Illinois. It is known to occur within Lusk Creek Canyon, Hayes Creek/Fox Den Creek, and Bell Smith Springs Ecological Areas. The first population was discovered October 11, 1991 at Bell Smith Springs by Bill Summers of the Missouri Botanic Garden (collection #4774). The population was scattered along a north-east facing sandstone bluff top. The first population at Lusk Creek Canyon was discovered by John Schwegman August 27, 1992 on a northeast-facing wooded bluff top. Approximately 200 plants were found at that time. With further searches, Todd Bittner discovered the second and third populations at Bell Smith Springs on October 8, 1993 (collection #347 and #349) and the second population at Lusk Creek Canyon on October 18, 1993 (#350). The Hayes Creek/Fox Den Creek site was later discovered by Eric Ulaszek and Elizabeth Longo Shimp on July 21, 1995 (collection #2700). The Hayes Creek population is the smallest in number of plants and area that it inhabits.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Calamagrostis porteri* ssp. *insperata* populations within the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny woodlands benefit *Calamagrostis porteri* ssp. *insperata* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Calamagrostis porteri* ssp. *insperata* through prescribed burning and integrated pest management at Hayes Creek/Fox Den Creek and Bell Smith Springs Ecological Areas, however, Lusk Creek Canyon is not included in the prescribed burning in this project and, therefore, may experience long-term negative impacts. This species is readily identifiable and can be easily avoided during the use of herbicides. Observations on the Forest have been documented that this species requires open sunlight reaching the forest floor. Populations thrive best when there are large openings in the canopy.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Calamagrostis porteri* ssp. *insperata* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire would contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species, however, this project does not include prescribed burning at Lusk Creek Canyon.

Negative impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Calamagrostis porteri* ssp. *insperata* populations within the the natural areas. Open sunny barrens benefit *Calamagrostis porteri* ssp. *insperata* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal. In Alternative 3 the use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Research has shown that habitat changes leading to closed canopies are detrimental to the vegetative performance of this species (Bittner and Gibson 1998, Bittner 1995). It has also shown that disturbance caused by trampling from hiking trails also poses threats to the populations (Bittner 1993). The three largest populations have hiking trails running through them; two of them are at Bell Smith Springs and the third is at Lusk Creek Canyon. However, these same trails are providing canopy gaps, which increase light to the forest floor, benefiting the populations with increased photosynthesis opportunities. The small population at Hayes Creek/Fox Den Creek is small and is increasingly becoming shaded out by the overstory trees and understory shrubs. The populations at all sites are currently under low light levels and succession is progressively closing the canopy. It is highly probable that these populations inhabited a greater area but have succumbed to over-shading and have become restricted to the bluff edges and the gentle slopes adjacent to the bluff edges. The bluff edges provide a confined and vulnerable refuge for the remaining tillers in the populations.

Dr. David Gibson from Southern Illinois University at Carbondale has been studying the effects of selective tree and shrub removal and girdling larger trees at one of the population sites at Bell Smith Springs Ecological Area. More direct and ambient light was permitted to hit the forest floor. Tillers, which were depauperate in stature, had been transplanted to greenhouses where they were provided with optimal conditions including full sunlight. Within one growing season the tillers became vigorous, robust and flowered. These same plants failed to flower the following season. During the summer of 2003, an area was cleared at Bell Smith Springs for the research study. By the summer of 2004, the area exposed to additional sunlight produced a much more robust population with flowering individuals (e-mail and photos from Dr. David Gibson to Elizabeth Shimp on June 29, 2004). Since that time, no tree or shrub removal has occurred and the area has succumbed to aggressive woody encroachment. The species has responded by lack of vigor and few to no flowering plants.

Open sunny woodlands and the associated bluffs benefit *Calamagrostis porteri* ssp. *insperata* and other prairie and barrens species. This fire-adapted grass will likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other plants. Population enhancement cannot be achieved without selective tree and shrub removal and will be greatly facilitated with maintenance by prescribed fire and herbicide applications.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. Alternative 1 will have negative indirect impacts in the long-term to populations of *Calamagrostis porteri* ssp. *insperata*, which may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations and open up the canopy for more light to the forest floor. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species inhabits.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal. Prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species and opening up the canopy for more direct and ambient sunlight. The lack of any management actions will eventually lead to the demise of these populations. They are currently confined to

small areas on the Forest whereas it is highly probable that these populations once occupied a greater area and were most likely more widespread.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Calamagrostis porteri* ssp. *insperata* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Calamagrostis porteri* ssp. *insperata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. Developed recreational site may have negative impacts to this species in all alternatives because of the combination developed recreation site/natural area designation at Bell Smith Springs. To a lesser degree, the trail leading to the State managed Indian Kitchen at Lusk Creek Canyon, may also have negative impacts to the species. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

9. *Carex communis* (fibrous-root sedge)

Carex communis is a tufted perennial sedge that occurs in the eastern United States, less Louisiana and Florida, and adjacent Canada. In Missouri this species tends to be found on rich, north-facing wooded slopes (Yatskievych 1999). In Indiana it was listed as common in dry woods of all types, particularly on rocky slopes (Deam 1940). This species has been found at only a few scattered localities in Illinois, primarily in open rocky woods. It generally flowers from May through July.

The primary threat to this species appears to be the loss of native habitat. It is critically imperiled in Illinois, Mississippi and New Foundland, Canada; and vulnerable in Iowa and North Carolina. It is known from 22 states where it is not ranked or is currently under review, and apparently secure or secure in 6 states and Ontario and Quebec. The Global Ranking by The Nature Conservancy was determined to be G5 in 1986 (NatureServe 2010).

In southern Illinois *Carex communis* is found within Pope, Saline, and Hardin counties. Unverified reports have been made for Gallatin and Johnson counties. It is known from Garden of the Gods, Bell Smith Springs, and Gibbons Creek Ecological Areas. It was also found in 2001 outside of the boundaries of Garden of the Gods Ecological Area where a user-developed equestrian trail had been created. It was discovered in Gibbons Creek Ecological Area by Mark Basinger during 2004 while establishing a pre-burn vegetation plot. The Bell Smith Springs population has not been relocated since 1984 (streambank).

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Carex communis* populations within the Forest. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny woodlands benefit *Carex communis* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Carex communis* through prescribed burning and integrated pest management at Bell Smith Springs Ecological Area. However, Garden of the Gods and Gibbons Creek Ecological Areas are not part of this project proposal for prescribed burning, however, the Garden of the Gods location is along a hiker/equestrian trail and could be treated for invasive species. This species is not readily identifiable and a knowledgeable botanist would need to identify this species in order for it to be avoided during the use of herbicides. Observations on the Forest have been documented that this species requires open sunlight reaching the forest floor. Populations thrive best when there are large openings in the canopy.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Carex communis* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire would contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species, however, this project does not include Garden of the Gods and Gibbons Creek Ecological Areas. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Habitat changes leading to closed canopies are detrimental to the vegetative performance of species that rely on some direct sunlight. This species appears to perform better in open woodlands in southern Illinois rather than closed canopy forest. An open woodland exists at Garden of the Gods as well as Gibbons Creek Ecological Area. It has also been documented as being trampled by horses on a user-developed trail outside of Garden of the Gods Ecological

Area. It is highly probable that the population at Bell Smith Springs may be suppressed or has succumbed to over-shading from the enclosing canopy.

Open sunny woodlands and barrens benefit *Carex communis* and barrens species. This fire-adapted sedge will likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other plants. Population enhancement at Bell Smith Springs may be achieved with additional selective tree and shrub removal.

Carex communis is a species that is dispersed by ants. A study conducted in Quebec, Canada concluded that leaf litter had a negative effect on germination and establishment of this species (Vellend, Lechowicz and Waterway 2000). The physical barrier to emergence is thought to be the main inhibiting effect on seedling establishment although reduced light levels were also suggested as contributors.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Alternative 1 will have negative indirect impacts in the long-term to populations of *Carex communis*, which may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations and open up the canopy for more light to the forest floor. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species inhabits.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal. Prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species and opening up the canopy for more direct and ambient sunlight. The lack of any management actions may eventually lead to the demise of these populations. They are currently confined to small areas on the Forest whereas it is highly probable that these populations once occupied a greater area and were most likely more widespread.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive

species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Carex communis* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Carex communis* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. Developed recreational sites may have slight negative impacts to this species in all alternatives because of the combination developed recreation site/natural area designation at Bell Smith Springs and Garden of the Gods Ecological Areas. The three existing populations are currently confined to three small areas on the Forest whereas it is highly probable that these populations once occupied a greater area and were most likely more widespread. A seed bank is likely available at Bell Smith Springs but the over-shading and accumulated leaf litter may be inhibiting this species from re-establishing itself. Continued use and creations of user-developed trails through populations are also detrimental to individual plants, populations and habitat outside of the Garden of the Gods Ecological Area. Spurs and dispersed use in this area could lead to the demise of this species at this particular location. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

10. *Carex decomposita* (Cypress-knee sedge)

Carex decomposita is a perennial cespitose sedge with thick, woody rhizomes. It is a species of swamps, often on floating logs or buttressed tree bases, ranging from New York to Michigan and south to Florida and Texas. This species reaches its northwestern range limit in the cypress swamps of southern Illinois.

The primary threat to this species is loss of native habitat (habitat conversion and drainage). The spotty distribution, specific habitat requirements, and continued habitat destruction are leading to an accelerated decline of this species. It is historically known from 22 states but is listed as presumed extirpated in Michigan and possibly extirpated in New York, and the District of Columbia. It is critically imperiled in Illinois, Ohio, Delaware, Maryland, Alabama, and Texas; imperiled in Indiana, Kentucky, Tennessee, Virginia, North Carolina, South Carolina, Georgia, and Arkansas; and vulnerable in Missouri, Louisiana, and Mississippi. It is possibly extirpated in New York and the District of Columbia, and extirpated in Michigan. It is not ranked or is currently under review in Florida and Oklahoma. The Nature Conservancy assigned the Global Ranking of G3 in 1997 (NatureServe 2008, 2010).

In southern Illinois it is found in Johnson, Pope, Pulaski, and Union counties. A Gallatin County population on private property was destroyed several years ago by logging activities (Herkert 1991). It is unclear where the Pulaski population is but with several swampy areas in the county, the probability of its existence is very good. The Johnson County population is located at Deer Pond, which is privately owned. On the Forest, this species is known from Grantsburg Swamp

Ecological Area and along the lower road at LaRue-Pine Hills/Otter Pond Research Natural Area from Winters Pond to Otter Pond. It grows in the swamps, often on cypress knees, stumps, and downed logs. Range-wide there is a spotty distribution of this species and that is also the case locally. In southern Illinois it occurs in isolated patches within the swamps. Opportunities for seed dispersal are limited with reduced numbers of protected swamps and permanent wetlands. This species requires high-quality conditions without hydrologic alterations, such as water drainage, or chemical pollutants.

Environmental Impacts:

There should be no impacts from Alternative 1, however, if there are impacts it would be negative indirect long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Carex decomposita* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open sunny swamps benefit *Carex decomposita*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps could help in the ability for this species to compete with other species better.

Alternative 2 is expected to have any direct impacts on this species in the swamp habitat. If there are impacts, they would be positive indirect short-term and long-term impacts on *Carex decomposita* through prescribed burning and integrated pest management on adjacent land at LaRue-Pine Hills/Otter Pond Research Natural Area. However, Grantsburg Swamp Ecological Area is not part of this project proposal for prescribed burning, nor will herbicides be applied unless one of the 4 main species is identified as a threat. Care must be taken with prescribed burns in not allowing the swamp to burn hot; damage to the thick, woody rhizomes could damage or kill individual clumps. Generally, swamps do not carry hot fires, if they burn at all. This species is readily identifiable and can be easily avoided during the use of herbicides. It is critical that this species does not come in contact with herbicides as it is extremely sensitive to chemicals and could be severely damaged or killed during applications. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps within the forest. Populations thrive best when there are large openings in the canopy, such as along the roadway at LaRue-Pine Hills RNA.

Alternative 3 is not expected to have any impacts on this species. If there were impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Carex decomposita* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Another consideration is the continual spread of Garlic Mustard along the roadway

at LaRue-Pine Hills despite hand-pulling methods and propane-torching. Prescribed fire, as long as it does not burn hot through the swamp (if fire even reaches the swamp), would contribute to positive indirect short-term and long-term impacts to these populations by stimulating surrounding native species and helping reduce the competition of invasive species, however, this project does not include Grantsburg Swamp Ecological Area. Although not expected, there could be negative indirect long-term effects that may result from Alternative 3 if aggressive exotic plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species. A point of interest at LaRue-Pine Hills/Otter Pond might be that the *Carex decomposita* seems to currently inhabit, especially, the areas along the roadsides within the swamp. This possibly could be a result of larger gaps within the swamp canopy allowing more sunlight to reach the swamp surface.

Hydrological disturbances leading to the drying out of swamps are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever if care is not taken in perpetuating these areas. Open sunny areas within the LaRue and Grantsburg swamps benefit *Carex decomposita* and must be monitored for the long-term. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

Carex decomposita is sensitive to cropland chemical runoff and requires clean spring water to survive. The spring water within the swamps of southern Illinois may also be responsible for this species' northern range limit. The spring water temperature may help support this species whereas other wetland areas and potential habitat further north may exceed temperature requirements of this species (NatureServe 2004 - personal communication with John

Schwegman). If pesticides are required for an aggressive control/eradication of exotic species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Carex decomposita* populations within the area.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. Alternative 1 should result in no impacts to this species. If there are impacts, they would be negative impacts in the long-term to populations of *Carex decomposita*, which may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, amur honeysuckle, or Nepalese browntop.

Prescribed fire (not hot through the swamps) and herbicide use in adjacent areas in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate populations and open up the canopy for more light to the swampy forest floor. Although fire will benefit this species, if applied wisely, more aggressive management, such as careful herbicide use, may be required to manage the swamp community type and habitat that this species occupies.

Prescribed fire on adjacent land and non-chemical means of removing exotic species from the swamp communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These swamp communities must be aggressively managed to remove the invasive species that may threaten this community type.

Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal. Prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species and opening up the canopy for more direct and ambient sunlight. The lack of any management actions may eventually lead to the demise of these populations. They are currently confined to small areas on the Forest whereas it is highly probable that these populations once occupied a greater area and were most likely more widespread.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the swamp communities in which *Carex decomposita* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and driving where this species occurs at LaRue-Pine Hills. Recreational use at Grantsburg Swamp is limited, however, a roadway along the southern boundary is a continuous vector for invasive species. Since there should be no negative impacts to *Carex decomposita*

resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. Developed recreational sites may have slight negative impacts to this species in all alternatives because of the developed recreation sites at LaRue-Pine Hills. The two existing Forest populations are currently confined to small areas whereas it is highly probable that these populations once occupied a greater area and were most likely more widespread.

Although fire on adjacent land may benefit this species, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps to dry up and the demise of this species in Illinois could result. In particular at the LaRue-Pine Hills/Otter Pond swamp road, there is a danger that the continued graveling of the road could eventually disrupt the natural springs and alter the hydrology along the road. This may already be occurring although research is lacking in this area. This is the location that the *Carex decomposita* was once found most frequently. The gravel is dumped and spread here since heavy rains and flooding wash the gravel into the adjoining swamp and springs. If the species is negatively impacted at this location, there will be negative Cumulative Impacts to the species in southern Illinois. These Cumulative Impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

11. *Carex gigantea* (Giant Sedge)

Carex gigantea is a perennial cespitose sedge that can also be found growing singly, from fibrous roots with long connected rhizomes. It is a species of swamps and wet woods primarily on the coastal plain from Delaware south to Florida, east to Texas and north in the Mississippi Embayment to southern Illinois and Indiana. Its northern range limit is southern Illinois, where it is known from wet woods and swamps.

The primary threat to this species is loss of native habitat (habitat conversion and drainage). The spotty distribution, specific habitat requirements, and continued habitat destruction are leading to an accelerated decline of this species. It is historically known from 18 states and but is listed as critically imperiled in Illinois, Indiana, Arkansas, and Missouri, imperiled in Kentucky, and vulnerable in Maryland and Delaware. It is apparently secure in Virginia and North Carolina, and secure in Mississippi. The 8 states of Oklahoma, Texas, Louisiana, Tennessee, Alabama, South Carolina, Georgia, and Florida currently do not have a rank or it is under review. The Nature Conservancy assigned this species the Global Ranking of G4 in 1984 (NatureServe 2010).

In southern Illinois it is historically known from Jackson, Johnson, Massac, Pulaski, and Union counties. On the Forest, this species is known from Grantsburg Swamp Ecological Area in a bottomland hardwood forest (Mark Basinger and John Rundle July 5, 1994; collection #8709 and #8725) and at LaRue-Pine Hills/Otter Pond Research Natural Area north of Otter Pond in a wet woods near the swamp (last observed November 28, 1967). A population discovered at Sielbeck Woods (private) in Massac County by Mike Homoya in 1976 was relocated and vouchered by

John Schwegman August 1, 1997 and again observed September 6, 2001 by Mark Guetersloh. The Pulaski County site at Post Creek Cutoff (private) was discovered on June 23, 1992 by John Taft. Documentation for the Jackson County occurrence was lacking at the time of this writing. Opportunities for seed dispersal are limited with reduced numbers of protected bottomland hardwoods, swamps and permanent wetlands. This species requires high-quality conditions without hydrologic alterations, such as water drainage, or chemical pollutants.

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, it may be some negative indirect long-term impacts resulting aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Carex gigantea* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open sunny swamps benefit *Carex gigantea*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps could help in the ability for this species to compete with other species better.

Alternative 2 is not expected to have any impacts on this species. If there are impacts, Alternative 2 may have positive indirect long-term impacts on *Carex gigantea* through prescribed burning and integrated pest management at LaRue-Pine Hills/Otter Pond Research Natural Area, however, Grantsburg Swamp Ecological Area is not part of this project proposal for prescribed burning, nor will herbicides be applied unless one of the 4 main species is identified as a threat. This species is readily identifiable and can be easily avoided during the use of herbicides. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps within the forest. Populations thrive best when there are large openings in the canopy, such as along the roadway at LaRue-Pine Hills RNA.

Alternative 3 is also not expected to have impacts to this species. If there are impacts, they would likely be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Carex gigantea* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Another consideration is the continual spread of Garlic Mustard along the roadway at LaRue-Pine Hills despite hand-pulling methods and propane-torching. Prescribed fire would contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species, however, this project does not include Grantsburg Swamp Ecological Area. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial

invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species. At LaRue-Pine Hills/Otter Pond *Carex gigantea* inhabits the wet woods between the swamplands. At Grantsburg Swamp, it occurs in the bottomland forest adjacent to the swamp. Both areas are permanently wet-soiled.

Hydrological disturbances leading to the drying out of swamps and the adjacent wetlands and bottomland hardwoods are a primary threat to this species; the majority of former swamplands and wetlands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps and wetlands have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever if care is not taken in perpetuating these areas. Moderately open canopy areas within and adjacent to the LaRue and Grantsburg swamps benefit *Carex gigantea* and must be monitored for the longterm. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is most likely sensitive to cropland chemical runoff and requires unpolluted wetlands to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamps and adjacent wetlands and bottomland hardwoods, then exceptional care should be taken not to directly or indirectly impact the *Carex gigantea* populations within the area.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. Although fire on adjacent land may benefit this species, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps and associated wetlands and wet woods to dry up and the demise of this species in Illinois could result. In particular, at the LaRue-Pine Hills/Otter Pond location, there is a danger that the hydrology of the wet woods

could be greatly altered with a dense invasion of woody shade-tolerant species. Over the last few decades, the composition of the forest in this area has changed and non-native aggressive species have encroached in this species' native habitat. Disturbances caused from the former Southern Illinois University Field Station may have also contributed to possible hydrological changes in this area.

The use of prescribed fire on adjacent land, integrated pest management, and tree and shrub removal will benefit this species by helping maintain the hydrology of the Research Natural Area and by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat that will help stimulate the populations. Recreational use at the Swamp road may contribute to the continued influx of invasive species along the roadway. Special care should be taken to eliminate these species when they first show up so as to preserve the rare swamp communities and their edge species. These Cumulative Impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the swamp communities in which *Carex gigantea* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Carex gigantea* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

12. *Carex lupuliformis* (false hop sedge)

Carex lupuliformis is a cespitose or singularly growing perennial sedge. It is uncommon in eastern North America, west to southwestern Quebec, Wisconsin and Louisiana. It is found scattered throughout Illinois and occurs in wet woods, wooded swamps, marshes, meadows, and roadside ditches.

Being a wetland species, *Carex lupuliformis* is threatened by the destruction of its native habitat. Damming of rivers, ditching, channeling, floodplain cultivation, and spring flood cycle interruptions are major threats of this species throughout its range. Other threats have been documented as being habitat destruction and ATV use. The G4 Global Ranking for this species was assigned by The Nature Conservancy in 2000 and is listed as having widespread declines throughout its range. It is possibly extirpated in Iowa, critically imperiled in Quebec and Ontario, Canada, Wisconsin, Pennsylvania, New Jersey, North Carolina, Arkansas, and Texas. It

is also listed as imperiled in Michigan, Indiana, Ohio, New York, Vermont, Connecticut, West Virginia, Virginia, Delaware, Maryland, and Tennessee, and vulnerable in Illinois and Connecticut. It is apparently secure in Kentucky and Mississippi. It is not ranked or is under review in 7 states (NatureServe 2010).

Carex lupuliformis is listed as historically occurring in Alexander, Pope, Johnson, Jackson, Massac, Pulaski, Saline, Hardin, and Union counties. This species is not as common as once thought to be in Illinois because original specimens have been previously misidentified and found to actually be *Carex gigantea* or *Carex lupulina*. There is a possibility that some of the above county records may be misidentifications that have perpetuated over the years. This species is not listed as threatened or endangered in the State of Illinois, which makes tracking collections and records more difficult. Although this species is not listed in Illinois, there have not been any sightings or collections made on the Shawnee National Forest or southern Illinois counties in over 40 years. Records from the Illinois Natural History Survey collections (specimen list provided to Elizabeth Longo Shimp by e-mail on December 17, 2004 from Loy R. Phillippe) indicate that the following specimens are available at the herbarium: Alexander (Evers #30438, 20 June 1951, east of Miller City, lake shore; Evers #32872, 19 September 1951, southeast of Olive Branch, bottomland ditch), Pope (Evers #23561, 10 June 1950, east of Dixon Springs, marsh), Pulaski (Evers #19997, 25 August 1949, south of Ullin, marsh land), and Union counties (Henry #2203, 22 July 1966, LaRue Swamp, wet ground).

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, they may be negative long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Carex lupuliformis* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open sunny swamps benefit *Carex lupuliformis*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps could help in the ability for this species to compete with other species better.

Alternative 2 is also expected to have no impacts to this species. If there are impacts, they would be positive indirect short-term and long-term impacts on *Carex lupuliformis* through prescribed burning and integrated pest management at LaRue-Pine Hills/Otter Pond Research Natural Area, however, Grantsburg Swamp Ecological Area is not part of this project proposal for prescribed burning, nor will herbicides be applied unless one of the 4 main species is identified as a threat. This species is not readily identifiable but can be easily avoided during the use of herbicides if anything that looks like *Carex gigantea* or *Carex lupulina* is not sprayed. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps within the forest. Populations thrive best when there are large openings in the canopy, such as along the roadway at LaRue-Pine Hills RNA.

Alternative 3 is also expected to have no impacts to this species. If there are impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Carex lupuliformis* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Another consideration is the continual spread of Garlic Mustard along the roadway at LaRue-Pine Hills despite hand-pulling methods and propane-torching. Prescribed fire would contribute to positive indirect short-term and long-term impacts to these populations by stimulating surrounding native species and helping reduce the competition of invasive species, however, this project does not include Grantsburg Swamp Ecological Area. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps and wetlands in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps and wetlands on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. The finding of this species at LaRue-Pine Hills in 1966 demonstrates this species resistance to fires. Fires swept across the swamps and wetlands adding nutrients and reducing competition from more aggressive wetland species. *Carex lupuliformis* does better when more sunlight reaches the populations. Range-wide this species responds well to open canopies within its wet habitat.

Hydrological disturbances leading to the drying out of swamps and wetlands are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have been destroyed or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever care is not taken in perpetuating these areas. Open sunny areas within the swamps and wetlands benefit *Carex lupuliformis* and must be monitored for the longterm. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is likely sensitive to cropland chemical runoff and requires clean spring water in the wetlands to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Carex lupuliformis* or species with similar appearances within the area.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit *Carex lupuliformis*, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps and wetlands to dry up and a more evident decline of this species in Illinois could result.

The use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by helping maintain the hydrology of the Research Natural Area and by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat that will help stimulate the populations. Recreational use at the Swamp road may contribute to the continued influx of invasive species along the roadway. Special care should be taken to eliminate these species when they first show up so as to preserve the rare swamp communities and their edge species.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the swamp communities in which *Carex lupuliformis* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Carex lupuliformis* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

13. *Carex oxylepis* var. *pubescens* (Sharpscale sedge)

Carex oxylepis var. *pubescens* is a rare perennial sedge that occurs in dry-mesic to mesic woods and is confined to 4 states. The northern range limit of this species is in southern Illinois where it is known from one county. It was first found in 1993 in southern Illinois and although there have been several sightings, none have been found outside of Hardin County.

Threats to this species include canopy closure as a result of natural forest succession and fire suppression, and loss of habitat from clear-cutting, grazing, soil compaction, and recreational

use. It was assigned a G5?T3 Global Ranking by The Nature Conservancy in 1999. *Carex oxylepis* var. *pubescens* was recently only known from Arkansas and Tennessee. It was later documented as occurring in Mississippi. It is critically imperiled in Tennessee, and listed as vulnerable in Arkansas and Mississippi (NatureServe 2010).

Carex oxylepis var. *pubescens* was first found in Illinois on May 27, 1993 along a stream in dry-mesic woods within Panther Hollow Research Natural Area, Hardin County (Jody Shimp collection #4310). It was found again in Panther Hollow on July 1, 1994 within a disturbed, dry-mesic woods adjacent to a pine plantation (Jody Shimp collection #5271, 5272, and 5273). Shimp also found the species along user-developed ATV trails near Camp Cadiz on April 28 and May 10, 1995 (collections #5407 and #5996, respectively). These were found in second growth early successional forests. On June 12, 1995, Eric Ulaszek and Mark Basinger found this species in a dry-mesic upland forest above a sandstone cliff about a mile from Battery Rock (collection #2502) and again on June 13, 1995 (no collection made) in a dry-mesic forest along the River-to-River trail near Battery Rock. Mark Basinger made the latest collections on July 8, 1998 within a dry-mesic upland forest and a pine plantation on a ridge along the Ohio River south of Sturgeon Hill (collections #11371 and #11372, respectively). In Illinois, this species appears to prefer open, dry-mesic rocky woods, especially where light gaps are present. Little to no information is available regarding the ecology of this species and its requirements. Observations indicate that the only closed canopy woods it was found in were along trails within pine plantations where more ambient light was available. Further searches for this species should continue in order to determine its extent in the state.

Environmental Impacts:

Alternative 1 is expected to have negative direct and indirect short-term and long-term effects on *Carex oxylepis* var. *pubescens* with the lack of herbicide use. Nepalese browntop is invading the trailsides where this species is currently known from and will eventually outcompete this species. Closed canopies may be detrimental to the vegetative performance of this species, which is why it may be appearing more frequently along trails. These same trails that provide a gap in the canopy providing more ambient light, are also supporting a corridor for exotic species, which may contribute to additional competition for its habitat. The populations are currently under low light levels and succession is progressively closing the canopy. It is highly probable that these populations inhabited a greater area but have succumbed to over-shading and have become restricted to these gap openings.

Open sunny woodlands benefit *Carex oxylepis* var. *pubescens* and other upland species. This sedge is very likely fire-adapted as is it's close relative, *Carex oxylepis*. Populations would most likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other competing plants. However, prescribed fire is not planned for areas that have this species. Although Alternative 2 will have no impacts regarding prescribed fire, it will have positive direct and indirect short-term and long-term impacts resulting from the use of herbicides. Selective spraying will help control encroaching invasive species that threaten the few locations that this species inhabits.

Alternative 3 may have negative indirect long-term impacts by the lack of herbicides. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to be re-treated. All of the trails that this species occurs on will not be suitable for a truck to transport the hot foam to so this method will not be able to be used.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Fire will likely benefit this species, as well as more aggressive management such as selective tree and shrub removal and re-routing of current designated and user-developed trails. Prescribed fire, integrated pest management, and tree and shrub removal would benefit this species by eliminating the competition from other more aggressive species and opening up the canopy for more direct and ambient sunlight. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate suppressed populations, however, prescribed fire is not planned for any of the locations that this species is found in. It is highly probable that these populations once occupied a greater area and were most likely more widespread.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Carex oxylepis* var. *pubescens* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Carex oxylepis* var. *pubescens* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

14. *Carex socialis* (Low woodland sedge)

Carex socialis is a perennial, colonial sedge of floodplain forests from South Carolina and Georgia west to Texas and north in the Mississippi Embayment to southern Illinois and Indiana. Mohlenbrock and Schwegman (1969) first described this species in Illinois from specimens collected along the Ohio River in Massac County. At the northern margin of its range in southern Illinois, it is found in wet woods and floodplains.

According to NatureServe (2004) the primary threats to *Carex socialis* are clear-cutting and wetland drainage. Encroachment by exotic species such as Japanese honeysuckle and kudzu may pose an additional threat in disturbed areas.

In Illinois, it has been found in Johnson, Massac, Pope, Pulaski, Saline, and Union counties. On the Shawnee National Forest it is found in the floodplain forests at LaRue-Pine Hills/Otter Pond Research Natural Area in Union County, Grantsburg Swamp and Schwegman's Ecological Areas in Johnson County, within a flatwoods along Bay Creek and along Grand Pierre Creek in Pope County, on state property at Heron Pond and Goose Pond near the Cache River in Johnson County, on the privately owned Halesia Nature Preserve in Massac County near the Ohio River, and within a private flatwoods in Saline County near Harrisburg.

The Nature Conservancy assigned *Carex socialis* the Global Ranking of G4 in 1998 and has determined it to be vulnerable in Illinois and Kentucky, and imperiled in Missouri, Tennessee and Indiana. It is critically imperiled in Alabama, Georgia, South Carolina, and North Carolina, and apparently secure in Arkansas and Mississippi. It is not ranked or is under review in Oklahoma (NatureServe 2010). It is noted as being locally common at some locations in the Coastal Plain and lower Mississippi Valley (Homoya and Rayner 1987).

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, they may be negative long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Carex socialis* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open sunny swamps benefit *Carex socialis*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps could help in the ability for this species to compete with other species better.

Alternative 2 is also expected to have no impacts to this species. If there are impacts, they would be positive indirect short-term and long-term impacts on *Carex lupuliformis* through prescribed burning and integrated pest management at LaRue-Pine Hills/Otter Pond Research Natural Area, however, Grantsburg Swamp Ecological Area is not part of this project proposal for prescribed burning, nor will herbicides be applied unless one of the 4 main species is identified as a threat. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps within the forest. Populations thrive best when there are large openings in the canopy, such as along the roadway at LaRue-Pine Hills RNA.

Alternative 3 is also expected to have no impacts to this species. If there are impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of

Carex socialis populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Another consideration is the continual spread of Garlic Mustard along the roadway at LaRue-Pine Hills despite hand-pulling methods and propane-torching. Prescribed fire would contribute to positive indirect short-term and long-term impacts to these populations by stimulating surrounding native species and helping reduce the competition of invasive species, however, this project does not include Grantsburg Swamp Ecological Area. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps and wetlands in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps and wetlands on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluff tops. Fires swept across the swamps and wetlands adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps, wetlands and flatwoods are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever care is not taken in perpetuating these areas. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is likely sensitive to cropland chemical runoff and requires clean spring water in the wetlands to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Carex socialis* populations within the area.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit this species, more aggressive management may be required to save the

rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps, wetlands and flatwoods to dry up and a more evident decline of this species in Illinois could result.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Carex socialis* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Carex socialis* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

15. *Chamaelirium luteum* (Fairywand)

Chamaelirium luteum is a dioecious, perennial lily with a basal rosette of spatulate leaves. It is found infrequently in meadows, thickets, rich woods, mesic forests and bogs from Massachusetts south to Florida, west to Ohio, southern Indiana and Illinois, Arkansas, and Louisiana. It is disjunct in southern Ontario, Canada. This species reaches its northwestern range limit in extreme southeastern Illinois.

Threats to this species include root and seed collection for medicinal purposes, canopy closure as a result of natural forest succession and fire suppression, and loss of habitat from clear-cutting and shelterwood cutting. It was assigned a G5 Global Ranking by The Nature Conservancy in 2001. *Chamaelirium luteum* is known from 23 states, the District of Columbia and Ontario, Canada. It is presumed extirpated in Ontario, critically imperiled in Illinois, Indiana, New York, Massachusetts, Connecticut, and Delaware, imperiled in Louisiana, and vulnerable in Arkansas, Maryland, and New Jersey. It is apparently secure in Kentucky and secure in West Virginia and North Carolina. It is also listed as an introduced (exotic) species in Michigan and not ranked, or under review, in 9 states and the District of Columbia.

In southern Illinois it is found in low wooded hillsides in Hardin, Massac, and Pope counties. On the Forest it is found along Burke Branch in mesic floodplain forest at Burke Branch Research Natural Area, in the little seep springs in the Cretaceous Hills Ecological Area (also in mesic upland forest), along the sandy banks of of a dried stream at Massac Tower Springs Ecological Area, just outside of the protected barrens areas in southern Pope County in a dry-mesic open woods on a south facing slope, near the Ohio River, and outside of the Kaskaskia Woods Ecological Area in a ravine.

Environmental Impacts:

Alternative 1 is expected to have negative direct and indirect short-term and long-term effects on *Chamaelirium luteum* with the lack of herbicide use. Nepalese browntop is invading the sites where this species is currently known from and will eventually outcompete this species. Closed canopies may be detrimental to the vegetative performance of this species, which is why it may be appearing more frequently along trails. Some trails that provide a gap in the canopy providing more ambient light, are also supporting a corridor for exotic species, which may contribute to additional competition for its habitat. The populations are currently under low light levels and succession is progressively closing the canopy. It is highly probable that these populations inhabited a greater area but have succumbed to over-shading and have become restricted to these gap openings.

Open sunny woodlands benefit *Chamaelirium luteum* and other upland species. Populations would most likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other competing plants. However, prescribed fire is not planned for areas that have this species. Although Alternative 2 will have no impacts regarding prescribed fire, it will have positive direct and indirect short-term and long-term impacts resulting from the use of herbicides. Selective spraying will help control encroaching invasive species that threaten the few locations that this species inhabits.

Alternative 3 may have negative indirect long-term impacts by the lack of herbicides. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to be re-treated. All of the trails that this species occurs on will not be suitable for a truck to transport the hot foam to so this method will not be able to be used.

Hydrological disturbances leading to the drying out of these seep springs may also be a threat to this species; Massac Tower Springs is all but dried out and the invasive *Eulalia* has taken over portions of the former seep spring habitat. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs and open woodlands benefit *Chamaelirium luteum* and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternative 3, in the long-term, populations of *Chamaelirium luteum* may become overshadowed, suppressed or out-competed by Japanese honeysuckle, Poison ivy, or Nepalese browntop. Although fire will benefit this species, more aggressive management will be required to save the rare community type and habitat that this species requires. Hydrological disturbances will eventually cause the seeps to dry up (as is currently being witnessed at Massac Tower Springs) and the demise of this species in seep springs will be inevitable.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Chamaelirium luteum* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Chamaelirium luteum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

16. *Chelone obliqua* var. *speciosa* (Red turtlehead)

Chelone obliqua var. *speciosa* is a branching perennial in the figwort (snapdragon) family. It is a rare species of alluvial woods, swamps, low woods, and wet meadows, and ranges from Minnesota and Michigan south to Arkansas and Kentucky. There are accounts of historical populations of this species scattered throughout 25 counties in Illinois but only 12 are considered to be extant (Phillippe, 2004a). This species flowers from August through September and bears fruit September through October (Ambrose *et al.* 2002).

According to NatureServe (2004) primary threats to *Chelone obliqua* var. *speciosa* include the physical destruction of habitat and artificial changes in hydrology. Succession may also threaten this species as it does not do well with competition from robust shrubs and vines under a closed canopy. It is found scattered throughout Illinois and has been reported from eight of the southernmost counties. Records from the Illinois Natural History Survey collections (specimen list provided to Elizabeth Longo Shimp by e-mail on December 17, 2004 from Loy R. Phillippe) and Iverson *et al.* (1999) indicate that the following specimens are available at the herbarium: Alexander (last seen 1931), Gallatin (last seen 1960), Hardin (last seen 1988), Jackson (last seen 1989), Johnson (separate locations 1931, 1931/1978, 1960, 1969, 1990/1992, Massac (1951), Pulaski (1931) and Union (1960) counties. The only extant populations on the Shawnee National Forest may be the Johnson County collections of 1990/1992 at Grantsburg Swamp Ecological Area.

The Nature Conservancy assigned this species a Global Ranking of G4T3 in 1994 and has determined it to be vulnerable in Illinois, Indiana, and Kentucky, critically imperiled in Iowa and Michigan, and possibly extirpated in Arkansas. It is not ranked or is under review in Missouri and Minnesota. Southern Illinois, southern Indiana and western Kentucky are considered to be strongholds for this species, however, trends are not well known and populations are likely declining across its range due to loss of habitat (Ambrose *et al.* 1994). Management activities

including selective thinning, maintenance of a dynamic hydrological cycle and periodic disturbances may be necessary to protect suitable habitats (Ambrose *et al.* 1994).

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, they may be negative long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Chelone obliqua* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open sunny swamps benefit *Chelone obliqua*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps could help in the ability for this species to compete with other species better.

Alternative 2 is also expected to have no impacts to this species. If there are impacts, they would be positive indirect short-term and long-term impacts on *Chelone obliqua* through prescribed burning and integrated pest management, however, Grantsburg Swamp Ecological Area is not part of this project proposal for prescribed burning, nor will herbicides be applied unless one of the 4 main species is identified as a threat. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps within the forest.

Alternative 3 is also expected to have no impacts to this species. If there are impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Chelone obliqua* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire would contribute to positive indirect short-term and long-term impacts to these populations by stimulating surrounding native species and helping reduce the competition of invasive species, however, this project does not include Grantsburg Swamp Ecological Area. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps, wetlands and flatwoods in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps, wetlands and flatwoods on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive

wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and blufftops. Fires swept across the swamps and wetlands adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps, wetlands and flatwoods are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever if care is not taken in perpetuating these areas. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is likely sensitive to cropland chemical runoff and requires clean spring water in the wetlands to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Chelone obliqua* populations within the area.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit *Chelone obliqua*, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps, wetlands and flatwoods to dry up and a more evident decline of this species in Illinois could result.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Chelone obliqua* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Chelone obliqua* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning

and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

17. *Cirsium carolinianum* (Soft thistle)

Cirsium carolinianum is a fibrous-rooted biennial herb growing 0.5 to 1.5 meters tall with a range of southeastern United States. It is a species of dry acidic woodlands and reaches its northern range limit in extreme southern Illinois. Most of the populations in Illinois are in the Shawnee National Forest and appear increase in numbers in the areas that are prescribe burned. Here it is a species of open dry-mesic upland woods and it is associated with barrens areas and rocky woods.

The Nature Conservancy assigned this species the Global Ranking of G5 in 2003. Its Conservation Status is critically imperiled in Virginia, imperiled in Ohio, Indiana, Illinois, and North Carolina, and vulnerable in Kentucky and Georgia. It is not ranked or is currently under review in Texas, Oklahoma, Louisiana, Arkansas, Missouri, Mississippi, Alabama, Tennessee, and South Carolina (NatureServe 2010). On the Forest, this species is known from Bell Smith Springs Ecological Area in a dry upland forest.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Cirsium carolinianum* populations within the Forest. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny woodlands benefit *Cirsium carolinianum* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Cirsium carolinianum* through prescribed burning and integrated pest management.

Observations on the Forest have been documented that this species requires open sunlight reaching the forest floor. Populations thrive best when there are large openings in the canopy.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Cirsium carolinianum* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire would contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in

the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Habitat changes leading to closed canopies are detrimental to the vegetative performance of species that rely on some direct sunlight. This species appears to perform better in open woodlands in southern Illinois rather than closed canopy forest. Open sunny woodlands and barrens benefit *Cirsium carolinianum* and barrens species. This fire-adapted sedge will likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other plants.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Alternative 1 will have negative indirect impacts in the long-term to populations of *Cirsium carolinianum*, which may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations and open up the canopy for more light to the forest floor. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species inhabits.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal. Prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species and opening up the canopy for more direct and ambient sunlight. The lack of any management actions may eventually lead to the demise of these populations. They are currently confined to small areas on the Forest whereas it is highly probable that these populations once occupied a greater area and were most likely more widespread.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive

species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Cirsium carolinianum* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Cirsium carolinianum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. Developed recreational sites may have slight negative impacts to this species in all alternatives because of the combination developed recreation site/natural area designations. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

18. *Cladrastis kentuckea* (Kentucky yellowwood)

Cladrastis kentuckea (= *C. lutea*) is leguminous tree that grows up to 15 meters tall. It occurs in the southeastern United States (native to 18 states) and the Ozarks. A plant of rich woods and calcareous bluffs, this species reaches its northern range limit in southern Illinois. Unlike other species in its subfamily, *Cladrastis kentuckea* does not fix nitrogen with rhizobia.

According to NatureServe (2004) primary threats to *Cladrastis kentuckea* include certain forest management practices (allowing areas to succeed to shade-tolerant species), disease and pests. The Nature Conservancy assigned this species the Global Ranking of G4 in 1984. *Cladrastis kentuckea* is critically imperiled in Illinois, Louisiana, South Carolina, imperiled in Indiana, Oklahoma, Mississippi, and North Carolina, and vulnerable in Missouri, Kentucky, Alabama, and Georgia. This species is considered introduced (exotic) in Ontario (Canada), New York, Maine, and Massachusetts. It has been determined to be secure in Tennessee and is not ranked or is under review in 5 other states (NatureServe 2010).

In Illinois, it was reported from Gallatin County over 40 years ago but that population (a single tree) has not been relocated since. It was discovered in 1928 in Alexander County at Wolf Creek Botanical Area and on nearby private property. Abundant flowering occurs only every second or third year at Wolf Creek and this population has been identified as being infected with the fungal pathogen *Botryosphaeria dothidea*. The species population has been counted as having less than 100 individuals. Reports were made that the trees were once more numerous and that they grew large enough to be cut for timber. The trees today are generally in poor condition with many dead or dying with live basal sprouts. These observations have been documented since the early 1970's.

Environmental Impacts:

This thin-barked species is easily injured by fire as evidenced by the numerous fire scars on the bases of the larger trees. The fungal pathogen *Botryosphaeria dothidea* is responsible for all mortality noted. Moisture stress and physical injury from fire seems to contribute to disease onset and severity. The only population on the Forest consists of a few adult trees but the

majority consists of trees in generally poor condition with many dead or dying with live basal sprouts. This condition was also documented in earlier studies (Hutchison and White 1973, Schwegman 1992b).

Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. The rich woods that this species occurs in is also habitat to the Bigleaf Snowbell bush (*Styrax grandifolia*). Although the effects of fire may be detrimental to this species, populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The Wolf Creek Botanical Area in Alexander County was no exception.

None of the activities proposed in all alternatives will negatively impact this species on Forest land. Fire may be prescribed near locations that this species occurs in at Wolf Creek Botanical Area, however, measures to protect trees from damage or death will be implemented. Selective tree and shrub removal should aid in more sunlight reaching the forest floor, although this may not be necessary. The removal of threatening Japanese honeysuckle is desirable in this location. Alternative 2 should be beneficial to this species when using herbicide to control/eradicate invasive species that threaten this species' habitat. Alternative 3 may be slightly beneficial in the use of vinegar/clove oil to control annual invasives but may prove ineffective in controlling perennial invasives. The hot-foam method would not be practical to use in this area since there are no roads that the equipment could utilize near the *Cladrastis kentuckea* populations.

Cumulative Impacts:

Cumulative impacts are similar to Environmental Impacts to this species. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Cladrastis kentuckea* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Cladrastis kentuckea* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

19. *Cynosciadium digitatum* (Finger dogshade)

Cynosciadium digitatum is a perennial herb whose range is 9 states in the southern middle states. It reaches its northern range limit in southern Illinois where it occurs at Oakwood Bottoms in Jackson County in swamps, floodplain forests, and pin oak flatwoods. In botanical surveys during the early 1990's, seven populations of this species were identified near or in existing ditches, levees, or powerline right-of-ways. The largest population at Oakwood Bottoms occurs in a railroad right-of-way.

The Nature Conservancy assigned this species the Global Ranking of G4G5 in 1985. Its Conservation Status is critically imperiled in Illinois, imperiled in Missouri, and apparently secure in Mississippi. It is currently not ranked or is under review in Texas, Oklahoma, Arkansas, Louisiana, Alabama, and Tennessee (NatureServe 2010).

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, they may be negative long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Cynosciadium digitatum* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open sunny swamps and ditches benefit *Cynosciadium digitatum*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps and ditches could help in the ability for this species to compete with other species better.

Alternative 2 is also expected to have no impacts to this species. If there are impacts, they would be positive indirect short-term and long-term impacts on *Cynosciadium digitatum* through prescribed burning and integrated pest management. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps and ditch areas within the forest.

Alternative 3 is also expected to have no impacts to this species. If there are impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Cynosciadium digitatum* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire would contribute to positive indirect short-term and long-term impacts to these populations by stimulating surrounding native species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be

futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps, wetlands and flatwoods in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps, wetlands and flatwoods on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps and wetlands adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps, wetlands and flatwoods are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever if care is not taken in perpetuating these areas. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is likely sensitive to cropland chemical runoff and requires clean spring water in the wetlands to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamps or ditches, then exceptional care should be taken not to directly or indirectly impact the *Cynosciadium digitatum* populations within the area.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit *Cynosciadium digitatum*, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps, wetlands and flatwoods to dry up and a more evident decline of this species in Illinois could result.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive

species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Cynosciadium digitatum* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Cynosciadium digitatum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

20. *Cypripedium parviflorum* var. *pubescens* (Greater yellow lady's slipper)

Cypripedium parviflorum var. *pubescens* is a rhizomatous perennial orchid found in most of the United States (less 2 of the southern and 5 of the western states) and adjacent Canada. In Illinois it is found in both dry and moist open woodlands and although not common, is found scattered throughout the state.

The Nature Conservancy assigned this species the Global Heritage Status Rank of G5T5? in 2002 but all of the states it occurs in do not have their statuses ranked and available information suggests that this species is still in a decline. Although there are more than a thousand populations of this species range-wide, most are small in size. Primary threats to this species include loss of native habitat, horticultural collecting, and medicinal collecting. Most populations have fewer than 30 individuals and no known populations have more than 400 individuals. This species is currently critically imperiled in Idaho, Arizona, Delaware, Maryland, Utah, and Rhode Island, and imperiled in New Hampshire, Mississippi, Wyoming, New Mexico, and 3 Canadian provinces. It is considered as vulnerable in Illinois, Indiana, North Carolina, Alabama, South Carolina, New York, Vermont and 5 Canadian provinces. It is apparently secure in Ohio, Pennsylvania, West Virginia, Kentucky, and Virginia and secure in 2 Canadian provinces. It is currently not ranked or is under review in 19 states and 2 Canadian provinces.

In southern Illinois it is considered rare with few individuals within a population reaching the flowering stage. Populations on the Shawnee National Forest are generally less than a dozen individuals each. Known populations on the Forest have been dug up by orchid enthusiasts for their beauty only to be extirpated from their native habitats. *Cypripedium parviflorum* var. *pubescens* has been historically documented from 52 Illinois counties including Alexander, Massac, Pope, Johnson, Jackson, Williamson, and Union counties in southern Illinois. In Illinois and Indiana it is described as rare or uncommon at each of these sites (Danderson 2004c). It is known to occur on an oak-hickory wooded slope within Lusk Creek Canyon Ecological Area and in Thacker Hollow on a rich mesic ravine area and on a rocky wooded slope. It is mostly known from unprotected sites across the Forest.

Environmental Impacts:

Alternative 1 will have negative indirect long-term impacts to *Cypripedium parviflorum* var. *pubescens* in the areas that will not be prescribed burned. This species occurs in fire-adapted and fire-dependent plant communities that are being encroached by maple trees, shrubs, and exotic invasive species. This species responds well to fire and is able to compete better in its habitat in those areas that are prescribed burned. Negative long-term impacts will mostly come from woody species encroachment and invasive species encroachment. Invasive species currently impacting the habitat that this species occurs in include Nepalese browntop, amur honeysuckle, Japanese honeysuckle, multiflora rose, and an overabundance of poison ivy. With time, possibly over the next ten years, this rare species may be outcompeted by the aggressive invasive species and may become extirpated from several of their previously known locations.

Alternative 2 will have positive direct and indirect short- and long-term impacts to *Cypripedium parviflorum* var. *pubescens* from prescribed burning and the use of herbicide to control aggressive invasive species. Controlling and/or eradicating aggressive invasive species that threaten these species and their community type will greatly enhance the ability of this rare species to compete and persist. Prescribed burning is not planned for known locations of this species but will benefit this species if it does occur at these sites.

Alternative 3 will have the same environmental impacts to *Cypripedium parviflorum* var. *pubescens* as Alternative 1 as it pertains to invasive species encroachment and Alternative 2 as it pertains to prescribed burns. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Cypripedium parviflorum* var. *pubescens* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The rich open woods on the Forest are habitat to several native fire-adapted species. Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. Populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The locations where this species exists today are no exception. According to Danderson (2004c), habitats supporting this species in a park, including limestone glades, have been treated with prescribed fire and monitoring has indicated that no adverse impacts have resulted from the use of fire.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Cypripedium parviflorum* var. *pubescens* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Cypripedium parviflorum* var. *pubescens* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

21. *Dennstaedtia punctilobula* (Eastern hay-scented fern)

Dennstaedtia punctilobula is an arching perennial fern that occurs in the eastern United States and adjacent Canada. In Illinois this species is restricted to Johnson and Pope counties, primarily within the Shawnee National Forest, on moist, north-facing sandstone ledges. These ledges vary in length from a few inches to several hundred feet and *Sphagnum* spp. is a typical associate.

The Nature Conservancy assigned this species the Global Ranking of G5 in 1984. Its Conservation Status is critically imperiled in Michigan and New Foundland, Canada, imperiled in Illinois, Missouri, and Arkansas, vulnerable in Indiana and Alabama, apparently secure in Kentucky, and secure in North Carolina, West Virginia, Virginia, Delaware, New Jersey, New York, and Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island, Canada (NatureServe 2010).

Dennstaedtia punctilobula is known from Bell Smith Springs Ecological Area (mesic north-facing rocky slope and upland forest), Double Branch Hole Ecological Area (north-facing cliff), Lusk Creek Wilderness, and Hayes Creek/Fox Den Creek Ecological Area (mesic north-facing cliffs and lower slope of forest).

Environmental Impacts:

Alternative 1 should have no direct and indirect short-term impacts on *Dennstaedtia punctilobula*. There would also be some negative indirect impacts in the long-term without the use of herbicide. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat. These effects may come from the aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Dennstaedtia punctilobula* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental

to this species, as well as excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Dennstaedtia punctilobula* through integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. If these locations are sprayed with herbicide, precautions would be taken to protect *Dennstaedtia punctilobula* from any adverse impacts.

Alternative 3 is expected to have negative direct and indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative direct and indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Dennstaedtia punctilobula* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive woody encroachment in the understory. Prescribed fire in adjacent areas will certainly contribute to positive indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Fire management and herbicide use are expected to have positive indirect short-term and long-term impacts for Alternative 2 but fire may have some direct short-term and long-term negative effects in Alternatives 2 and 3 if the surrounding forest or that forest on the bluffs results in drying and erosion; on the otherhand, positive impacts may result from the burned forest adding nutrients to its microhabitat.

Populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires occurred especially on the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (a result of the suppression of wildfires which was directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet the *Dennstaedtia punctilobula* populations perpetuated and endured the harsh conditions.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive

species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Dennstaedtia punctilobula* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Dennstaedtia punctilobula* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

22. *Dichanthelium jorii* (Variable panic grass)

Dichanthelium jorii (= *D. commutatum*) is a tufted, warm-season perennial grass with decumbent culms found in floodplain and swamp forests of the southeastern United States. This species ranges from Texas and Florida in the south to Illinois, Michigan, New York and Maine in the north. The southern Illinois populations are disjunct from its normal range by over 300 miles. Here it is a species of low swamps and floodplain forests. Some botanists consider it a synonym of a broadly defined *Dichanthelium commutatum*.

The primary threats to this species are not listed in the available literature, but due to its preference for bottomland swamps and wet habitats, its primary threat is likely the loss of wetland habitat or disruption of historic hydrologic cycles. The Nature Conservancy assigned this species a Global Ranking of G5 in 1994 and it is listed as state endangered in Illinois. Little information is available on trends for this species. Considering the few locations where *Dichanthelium jorii* has been collected and the protection afforded in those locations, it is likely that populations of this species are remaining stable.

In southern Illinois it is known from floodplain forests in Johnson and Union counties. It has been collected from the floodplain forest at LaRue-Pine Hills/Otter Pond Research Natural Area in Union County, Bell Pond inside of Grantsburg Swamp Ecological Area and the state-managed Little Black Slough/Heron Pond along the Cache River in Johnson County.

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, they may be negative long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Dichanthelium jorii* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open

sunny swamps benefit *Dichantheium jorii*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps could help in the ability for this species to compete with other species better.

Alternative 2 is also expected to have no impacts to this species. If there are impacts, they would be positive indirect short-term and long-term impacts on *Dichantheium jorii* through prescribed burning and integrated pest management, however, Grantsburg Swamp Ecological Area is not part of this project proposal for prescribed burning, nor will herbicides be applied unless one of the 4 main species is identified as a threat. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps within the forest.

Alternative 3 is also expected to have no impacts to this species. If there are impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Dichantheium jorii* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire would contribute to positive indirect short-term and long-term impacts to these populations by stimulating surrounding native species and helping reduce the competition of invasive species, however, this project does not include Grantsburg Swamp Ecological Area. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps, wetlands and flatwoods in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps, wetlands and flatwoods on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps and wetlands adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps, wetlands and flatwoods are a primary threat to this species; the majority of former swamplands in southern Illinois have

already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever if care is not taken in perpetuating these areas. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is likely sensitive to cropland chemical runoff and requires clean spring water in the wetlands to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Dichanthelium joorii* populations within the area.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit *Dichanthelium joorii*, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps, wetlands and flatwoods to dry up and a more evident decline of this species in Illinois could result.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Dichanthelium joorii* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Dichanthelium joorii* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

23. *Dichanthelium ravenelii* (Ravenel's Rosette Grass)

Dichanthelium ravenelii is a loosely tufted, warm-season, perennial bunch grass. It is known from the southeastern and central United States and along the northwestern margin of its range in extreme southern Illinois, where it is known from dry open forests on rocky ledges. One location is known from beneath a powerline. Flowers and fruits are produced from June through September.

Threats to this species include fire suppression and canopy closure in open dry upland forest habitats. It is listed as imperiled in Delaware, vulnerable in Maryland, North Carolina, and Virginia, and critically imperiled in Illinois. This species is not ranked or is under review in 13

states and the District of Columbia. The Global Rank of G5 was assigned by The Nature Conservancy in 1984.

Dichanthelium ravenelii is known in southern Illinois from Hardin, Pope, and Union counties. It is found in dry upland cherty slopes in the Ozark Hills Natural Division and open, dry, rocky upland forests over sandstone in the Shawnee Hills Natural Division. It is known from Atwood Ridge Research Natural Area (although not seen there since 1977), a site north of Lamb (found in 1988) and Dog Creek Barrens Ecological Area (found by Mark Basinger July 9, 2004 while establishing a vegetation monitoring plot for prescribed fires).

Environmental Impacts:

Alternative 1 may have some negative indirect long-term impacts to *Dichanthelium ravenelii* as it pertains to invasive species encroachment. Multiflora rose, Japanese honeysuckle, and Nepalese browntop easily invade the habitat that this species occurs in.

Alternative 2 should have beneficial direct and indirect short- and long-term impacts to this species pertaining to invasive species management through the use of herbicides. Prescribed burns will not have any impacts since the Atwood Ridge population is already being burned under a separate project. Being a grass, this species favors fire and does well following a burn.

Alternative 3 will have the same impacts to this species as Alternative 1 as it pertains to the use of herbicide and Alternative 2 as it pertains to prescribe burning. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Dichanthelium ravenelii* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

Closed canopies may be detrimental to the vegetative performance of this species, which is why it may be appearing more frequently along powerlines, user-developed trails, and within open woodlands. These same trails that provide a gap in the canopy providing more ambient light, are also supporting a corridor for exotic species, which may contribute to additional competition for its habitat. Disturbance caused by trampling from hiker/equestrian trails also poses threats to the populations. Compaction, plant destruction and soil erosion can contribute to this species decline at these locations. Unfortunately, these same trails are providing canopy gaps, which increase light to the forest floor, benefiting the populations with increased photosynthesis opportunities. The populations are currently under low light levels and succession is progressively closing the canopy. It is highly probable that these populations inhabited a greater area but have succumbed to over-shading and have become restricted to these gap openings.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Dichanthelium ravenelii* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Dichanthelium ravenelii* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

24. *Dichanthelium yadkinense* (Yadkin's panicgrass)

Dichanthelium yadkinense is a perennial grass of the southeastern United States. It is a species of moist to wet woods and is sometimes included in a broadly defined *Dichanthelium dichotomum* var. *dichotomum*. However, it is a distinct entity in southern Illinois, where it occurs in sandy soil of mesic forests and gravelly streambanks.

A Global Heritage Status Rank has not been determined for this species. Range-wide it is a species of rich or damp woods, thickets, bottomlands, and swamps. In Illinois, the primary threat for this species is user-developed hiker/equestrian trails that are created in its habitat along creeks and within creek floodplain terraces.

Dichanthelium yadkinense is found only within Pope County. It is known to occur within Lusk Creek Canyon Ecological Area, Lusk Creek Canyon Zoological Area, Lusk Creek Wilderness Area, Double Branch Hole Ecological Area, and within the Snow Springs Ecological Area (reported in 1969, seep springs). At these locations, it is a species of mesic forests, wet soil, seep springs and gravelly streambeds. In 1992, this species was thought to be extirpated from its original location at Double Branch Hole Ecological Area because of user-developed horse trails. In 1997 Mark Basinger and Elizabeth Longo Shimp separately found this species in other portions of the natural area adjacent to and near the creek. This species was first documented in Lusk Creek Wilderness along Lusk Creek Zoological Area near the Lusk Creek Ecological Area during 2000 by Mark Basinger with additional locations being found along the northern part of the creek near Lusk Creek North Ecological Area by Elizabeth Longo Shimp.

Environmental Impacts:

The majority of the populations of *Dichanthelium yadkinense* occur along the streambanks and creeks and will not be affected in the short-term by Alternative 1 but in the long-term, over the next 10 years, most may experience negative indirect effects from the continued encroachment of invasive species. In many cases, the lack of prescribed fire will also have negative indirect long-

term effects to these species. Many of these species are not located in areas that a prescribed burn would carry into, but the adjacent burned areas would have an influence on the habitat that these species occupy. Yadkin's panic grass is currently threatened by Nepalese browntop along the creeks that it inhabits. This species cannot compete with the dense matting of the Nepalese browntop.

Alternative 2 will have beneficial direct and indirect short- and long-term effects on Yadkin's panic grass at Jackson Hole EA and Snow Springs BA from the use of prescribed fire if the fire actually reaches this species in its habitat. Prescribed burns are not planned in this assessment for the other areas that this species occurs at Lusk Creek Wilderness. In regards to herbicide use, Alternative 2 will have beneficial direct and indirect short- and long-term effects resulting from the elimination or control of invasive species that compete for the same habitat for this species. Fires may not actually burn the immediate habitat that this species occurs, which is along the edges of creeks, because of little or no fuel available. The fires will burn adjacent areas that will benefit the species by opening up the canopy for more sun to reach the forest floor. In addition, if this species burns, its response will likely be positive like most grasses respond to fire.

Alternative 3 will have the same Environmental Impacts to this species as Alternative 1 as it pertains to the continued encroachment of invasive species and lack of herbicide use, and Alternative 2 and 3 as it pertains to prescribed burns. Alternative 3 will also have some direct short-term positive effects with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with the vinegar/clove oil as well as with the hot foam method.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternatives 1 and 3, in the long-term, populations of *Dichanthelium yadkinense* outside of natural areas may become over-shaded, suppressed or out-competed by other aggressive woody native species, Nepalese browntop, Chinese yam and invasive plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. Alternative 1-3 will have long-term negative impacts to this species since there will be an inability to prescribe burn the habitat for this species in the Lusk Creek Wilderness Area. Fires generally benefit grass species such as *Dichanthelium yadkinense*. The prescribed fire at Double Branch Hole EA may also add nutrients back to the microhabitat will help stimulate the suppressed populations.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Dichanthelium yadkinense*

inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Dichanthelium yadkinense* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

25. *Dodecatheon frenchii* (French's shootingstar)

Dodecatheon frenchii is a perennial herb known from Illinois, Indiana, Missouri, Kentucky, Arkansas, and Alabama. It is found in close association to sandstone ledges, overhangs and bluffs, preferring north and east-facing exposures. French's shooting-star grows in habitats which yield little competition from other plant species, often growing alone in bare soil. It is documented from a 10-mile wide belt in southern Illinois in six counties, all within the Greater Shawnee Hills Section of the Shawnee Hills Natural Division.

Primary threats to this species have been unregulated recreational use under sandstone overhangs, disturbances caused by artifact hunters, and other recreational activities such as rock climbing, ATV and equestrian use, and camping/campfires. Logging has also been considered a threat when sufficient buffer has not been afforded to populations. The Nature Conservancy assigned this species the Global Heritage Status Rank of G3 in 1990. Illinois appears to have the most occurrences and is well in southern Illinois possibly because of its endemic nature. It is listed as vulnerable in Illinois and Kentucky, imperiled in Indiana and Arkansas, and it is critically imperiled in Missouri and Alabama. It is currently not ranked or under review in Wisconsin (NatureServe 2010)

In Illinois, *Dodecatheon frenchii* is found within Pope, Johnson, Jackson, Saline, Union, and Williamson counties. It is known to occur within several areas on the Forest including Lusk Creek Canyon Ecological Area, Lusk Creek Canyon Zoological Area, Lusk Creek Canyon Wilderness Area, Jackson Hole Ecological Area (sandstone overhang, although it has not been relocated at this site for several years), Jackson Hollow Ecological Area, Jackson Falls Dispersed Recreation Area, Bulge Hole Ecological Area, Little Grand Canyon/Horseshoe Bluff Ecological Area, Garden of the Gods Ecological Area, Schwegman Ecological Area, Bell Smith Springs Ecological Area (base of bluff in mesic upland forest), and Double Branch Hole Ecological Area. This species is found beneath sandstone overhangs and along drip lines at the base of bluffs. This species has also been found in the immediate adjacent woods and associated sandstone boulders. At this time, these populations are not threatened with extirpation because of habitat loss but without protecting the forest and sandstone ledges and shelters that this species is dependent on these populations could eventually become decreased or eliminated (Hill 2002a).

Environmental Impacts:

Alternative 1 should have no direct and indirect short-term impacts on *Dodecatheon frenchii*. There would also be some negative indirect impacts in the long-term without the use of

herbicide. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat. These effects may come from the aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Dennstaedtia punctilobula* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species, as well as excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Dodecatheon frenchii* through integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. If these locations are sprayed with herbicide, precautions would be taken to protect *Dodecatheon frenchii* from any adverse impacts.

Alternative 3 is expected to have negative direct and indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative direct and indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Dodecatheon frenchii* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive woody encroachment in the understory. Prescribed fire in adjacent areas will certainly contribute to positive indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Fire management and herbicide use are expected to have positive indirect short-term and long-term impacts for Alternative 2 but fire may have some direct short-term and long-term negative effects in Alternatives 2 and 3 if the surrounding forest or that forest on the bluffs results in drying and erosion; on the otherhand, positive impacts may result from the burned forest adding nutrients to its microhabitat.

Populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires occurred especially on the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (a result of the suppression of wildfires which was directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet the *Dodecatheon frenchii* populations perpetuated and endured the harsh conditions.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Dodecatheon frenchii* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs at the base of bluffs along the drip-line. Even with the re-routing of trails, there can be some expectation that Forest users will utilize the areas for recreational uses including hiking, camping, fires, rock climbing, rappelling, and other activities that may damage individuals, populations or habitat for this species. Since there should be no negative impacts to *Dodecatheon frenchii* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

26. *Dryopteris goldiana* (Goldie's woodfern)

Dryopteris goldiana is a short-creeping, scaly fern with fronds up to 1 meter in length. It grows in moist, shaded woodlands. Its range is from New Brunswick to Ontario, south to Iowa, Tennessee, and North Carolina. Although it is known from several northern Illinois counties and Jackson, Johnson, Pope, Union, and Williamson counties in southern Illinois, its previously known locations in southern Illinois are rarely relocated and several may be extirpated.

Dryopteris goldiana has been given a Global Heritage Status Rank of G4 by The Nature Conservancy in 1986 because of its status range-wide (NatureServe 2008). Threats range-wide include logging, development and agriculture. It is critically imperiled in Arkansas, Alabama, South Carolina, and Delaware, imperiled in Iowa, Missouri, New Hampshire and Maine, vulnerable in Minnesota, Georgia, North Carolina, Maryland, New Jersey, Connecticut, Massachusetts, and Quebec and New Brunswick, Canada. It is also listed as apparently secure in Ontario, Canada, Kentucky, West Virginia, Virginia, Vermont, and New York, and not ranked or under review in Wisconsin, Michigan, Indiana, Ohio, Pennsylvania, Rhode Island, and the District of Columbia. In southern Illinois, there are known locations within the Lusk Creek Wilderness.

Environmental Impacts:

Alternative 1 is expected to have negative direct and indirect short-term and long-term effects on *Dryopteris goldiana* with the lack of herbicide use. Nepalese browntop and Japanese

honeysuckle is invading the sites where this species is currently known from and will eventually outcompete this species.

Although Alternative 2 will have no impacts regarding prescribed fire, it will have positive direct and indirect short-term and long-term impacts resulting from the use of herbicides. Selective spraying will help control encroaching invasive species that threaten the few locations that this species inhabits.

Alternative 3 may have negative indirect long-term impacts by the lack of herbicides. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to be re-treated. All of the trails that this species occurs near will not be suitable for a truck to transport the hot foam to so this method will not be able to be used.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternative 3, in the long-term, populations of *Dryopteris goldiana* may become suppressed or out-competed by Japanese honeysuckle, Poison ivy, or Nepalese browntop.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Dryopteris goldiana* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Dryopteris goldiana* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

27. *Echinacea simulata* (Wavyleaf purple coneflower)

Echinacea simulata is a perennial herb found from southern Illinois, southern Indiana, southeast Missouri, western Kentucky to central Tennessee and northern Georgia. Gleason and Cronquist (1991) report it from northeastern Arkansas. It is found in thin soil of dry open woods, prairies, and glades underlain by limestone bedrock. In Illinois its habitat includes the open woods and prairies. It strongly resembles *Echinacea pallida* and can only be distinguished from it while in

flower by observing its pollen color, which is yellow versus white or cream-colored. It generally flowers from July through August.

Threats to this species include fire suppression, which allows open habitats to close; encroachment of habitat by eastern red cedar and other woody species; herbicide use on railroad rights-of-way; limestone quarries; recreational uses of glades, barrens, and hill prairies; development; and especially by digging of roots and excessive seed collection for medicinal purposes. It is listed as vulnerable in Kentucky, imperiled in Georgia, and critically imperiled in Tennessee. It is currently not ranked in Illinois. NatureServe (2010) erroneously lists it as an exotic in Illinois. This species is currently not ranked in Missouri, Arkansas, Indiana, and Alabama. The Global Rank of G3 was assigned by The Nature Conservancy in 2000.

In southern Illinois, *Echinacea simulata* is thought to occur in Hardin, Johnson, Pope, and Union counties. Its habitat is listed as limestone barrens and glades. It has been verbally reported from areas such as LaRue-Pine Hills/Otter Pond Research Natural Area, Simpson Township Barrens Ecological Area, and Whoopie Cat Research Natural Area but no voucher collections were available to verify at the time of this writing. The only three populations documented by collections are from Piatt, Richland and Madison counties (Danderson 2004d). These specimens may be possible misidentifications and require further study (Danderson 2004d).

Environmental Impacts:

It is unlikely that there will be any impacts to this species from Alternatives 1-3 since there are no valid vouchers from the Forest. Potential habitat does occur in prairie and barrens remnants, however, this species has not been seen or properly documented as actually existing on the Forest. However, if it does occur on the Forest, prescribed burns will only enhance the habitat and no *Echinacea* species can be mis-identified as being exotics here so there will be no danger of herbicide use destroying unknown populations.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Echinacea simulata* could possibly inhabit. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Echinacea simulata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

28. *Eleocharis wolfii* (Wolf's spikerush)

Eleocharis wolfii is perennial, rhizomatous sedge of marshes, swamps, wet prairies and other wetland habitats from New York to North Dakota south to Texas and Georgia. This species flowers from May – July and requires high levels of light to produce seed (NatureServe 2004). In southern Illinois, this species is found in marshes, wet prairies, around lakes, rivers and ditches, flatwoods, swamps, floodplain forests, and ephemeral pools.

According to NatureServe (2004), the primary threats to this species are loss of native wetland and grassland habitats. It is also threatened by encroachment from exotic species and succession from woody species in prairie areas where the historic fire regime is now absent (NatureServe 2004). Indiscriminant herbicide application along railroad and highway right-of-ways has also threatened populations located in these areas. The Nature Conservancy ranked this species G3G4 in 2006 (NatureServe 2010). Continued drainage and alteration of wet areas for agriculture, development and grazing areas have resulted in this species being listed as ‘critically imperiled in Illinois, Iowa, Wisconsin, Minnesota, Ohio, Virginia, Tennessee, Georgia, Alabama, Kansas, and Texas. It is imperiled in Indiana and Nebraska, and vulnerable in Arkansas, Missouri, and Louisiana. It is also possibly extirpated in North Dakota, and listed as introduced (exotic) in New York. It is not ranked or under review in Mississippi, Oklahoma, and Saskatchewan, Canada (NatureServe 2010). The continued decline of *Eleocharis wolfii* is likely due to loss of wetlands and conversion/development of its preferred habitats.

In southern Illinois it is found in Gallatin (flatwoods 1.5 mi SE of Equality), Jackson (Oakwood Bottoms), Massac (flatwoods at Mermet Swamp Nature Preserve), Pope (unknown locations), Saline (flatwoods NE of Harrisburg), and Union (floodplain forest at LaRue-Pine Hills/Otter Pond Research Natural Area) counties. Historical populations are known from 20 counties in the state of Illinois but only 15 counties are known to have extant populations (Phillippe 2004b). Of the 41 discrete extant populations, 7 are known from Forest Service managed lands (Phillippe 2004).

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, it may be some negative indirect long-term impacts resulting aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Eleocharis wolfii* populations within the Forest. In particular, Japanese honeysuckle, amur honeysuckle, and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Garlic mustard has been identified as a species that keeps reoccurring after hand-pulling methods and propane-torching have been applied. This species is spreading at an alarming rate up the slopes and can easily move into the swamp edges. Open sunny swamps benefit *Eleocharis wolfii*. The lack of fire in Alternative 1 will, most likely, have no negative impacts to this species in its native habitat, however, application of cool fires through the swamps could help in the ability for this species to compete with other species better.

Alternative 2 is not expected to have any impacts on this species. If there are impacts, Alternative 2 may have positive indirect long-term impacts on *Eleocharis wolfii* through prescribed burning and integrated pest management at LaRue-Pine Hills/Otter Pond Research Natural Area. This species is readily identifiable and can be easily avoided during the use of herbicides. Observations on the Forest have been documented that this species requires a partially open canopy to allow sunlight to reach the swamps within the forest. Populations thrive best when there are large openings in the canopy.

Alternative 3 is also not expected to have impacts to this species. If there are impacts, they would likely be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Eleocharis wolfii* populations within their habitats. In particular, Japanese honeysuckle, amur honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire would contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps and flatwoods on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps and the adjacent wetlands and bottomland hardwoods are a primary threat to this species; the majority of former swamplands and wetlands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps and wetlands have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever care is not taken in perpetuating these areas. Moderately open canopy areas within and adjacent to the LaRue and Grantsburg swamps benefit *Eleocharis wolfii* and must be monitored for the longterm. If woody

and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species seems somewhat tolerant to cropland chemical runoff yet requires unpolluted wetlands and spring-fed ditches to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamps and adjacent wetlands and bottomland hardwoods, then exceptional care should be taken not to directly or indirectly impact the *Eleocharis wolfii* populations within the area.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit *Eleocharis wolfii*, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps and associated wetlands and wet woods to dry up and the demise of this species in Illinois could result. In particular at the LaRue-Pine Hills/Otter Pond location, there is a danger that the hydrology of the wet woods could be greatly altered with a dense invasion of woody shade-tolerant species. Over the last few decades, the composition of the forest in this area has changed and non-native aggressive species have encroached in this species' native habitat.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Eleocharis wolfii* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Eleocharis wolfii* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. Developed recreational site may have negative impacts to this species in all alternatives because of the combination developed recreation site/natural area designations.

29. *Eupatorium hyssopifolium* (Hyssop leaf thoroughwort)

Eupatorium hyssopifolium var. *hyssopifolium* is a composite that is found in the eastern United States. It is known from one location in southern Illinois in an open sandstone barrens and adjacent open woods at Dean East Ecological Area and a second location was reported along a state highway/interstate.

Eupatorium hyssopifolium var. *hyssopifolium* has been given a Global Heritage Status Rank of G5 by The Nature Conservancy in 1984 (NatureServe 2008). Threats range-wide include loss of prairie/barrens habitat. It is critically imperiled in Illinois and West Virginia, vulnerable in New York and Kentucky, secure in Virginia and North Carolina, and not ranked or under review in Rhode Island, New Jersey, Maryland, District of Columbia, Florida, Georgia, Alabama, Mississippi, Louisiana, and Texas.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Eupatorium hyssopifolium* var. *hyssopifolium* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Eupatorium hyssopifolium* var. *hyssopifolium* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Eupatorium hyssopifolium* var. *hyssopifolium* through integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Eupatorium hyssopifolium* var. *hyssopifolium* populations within their habitats. In particular, Autumn olive, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. Many of the locations that this species occurs in at in the Dean East Ecological Area are not suitable for a truck to transport the hot foam to, so this method would unlikely be used.

Impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Eupatorium hyssopifolium* var. *hyssopifolium* populations within Dean East EA. Open sunny barrens benefit *Eupatorium hyssopifolium* var. *hyssopifolium* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Eupatorium hyssopifolium* var. *hyssopifolium* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Eupatorium hyssopifolium* var. *hyssopifolium* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

30. *Festuca paradoxa* (Clustered fescue)

Festuca paradoxa is tufted perennial grass found from Pennsylvania west to Minnesota south to Georgia and Texas. It is found in different habitats from dry glades and bluffs to wet open woods and prairies (Olson 2002). In Illinois, Mohlenbrock described the species as more commonly found on drier sites (Mohlenbrock *in* Olson 2002). It is scattered in the southern ¾ of Illinois and is known from eight counties in southern Illinois.

Primary threats to this species include loss of habitat from changes in land use patterns, encroachment of woody vegetation and exotic species. The Nature Conservancy ranked this species G5 in 1984 (NatureServe 2010). This species is currently listed as vulnerable in Illinois, Iowa and Virginia, it is critically imperiled in Indiana, Pennsylvania and Tennessee, and imperiled in Kansas. It is possibly extirpated in Nebraska and Wisconsin and presumed extirpated in Delaware. It is not ranked or is under review in 10 states.

Festuca paradoxa is known from Jackson, Johnson, Massac, Pope, Pulaski, Saline, Union and Williamson counties. There was no specific collection location information available at the time of this writing. The state of Illinois does not list *Festuca paradoxa* on its Endangered and Threatened species list (2009) but it has not been collected on the Forest in over 20 years. Trends for this species are not clearly stated in the available literature, but according to Vlaszek (In KSNPC 2004), he believes it may be extirpated from Illinois although Olson (2002) notes it from at least 20 counties in Illinois. According to the Illinois Natural History Survey Herbarium, collections of this species were made in 1952, 1990, 1999 and 2008 in Saline County and during 1993 in Jackson County.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Festuca paradoxa* populations within the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny woodlands benefit *Festuca paradoxa* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Festuca paradoxa* through prescribed burning and integrated pest management at sites that it may occupy. This species requires open sunlight; populations thrive best when there are large openings in the canopy.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Festuca paradoxa* populations within their habitats. Prescribed fire would contribute to positive direct and indirect short-term and long-term impacts to habitat for populations by stimulating native species and helping reduce the competition of invasive species.

In Alternative 3 the use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. This fire-adapted grass will likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other plants.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. Alternative 1 will have negative indirect impacts in the long-term to populations of *Festuca paradoxa*, which may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Autumn olive, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations and open up the canopy for more light to the forest floor. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species inhabits.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

Since there are records that this species once occurred in over 20 counties, it is highly probable that these populations once occupied a greater area and were most likely more widespread. At the present time, this species has not been relocated on the Forest.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Festuca paradoxa* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Festuca paradoxa* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. Developed recreational site may have negative impacts to this species in all alternatives because of the continued influx of aggressive invasive species.

31. *Gentiana alba* (Plain Gentian)

Gentiana alba is a stout perennial herb that is found in the eastern United and adjacent Canada. It occurs in mesic prairies and open forests. It generally flowers from September through October. Threats to this species include fire suppression, canopy closure in open forests and barrens, land use conversion, habitat fragmentation, and forest management practices. It is listed as vulnerable in Iowa and Wisconsin, imperiled in Indiana, Ohio and Kansas, critically imperiled in Kentucky, Michigan, Nebraska, West Virginia, Oklahoma, and Ontario, Canada, and possibly extirpated in North Carolina and Pennsylvania. This species is not ranked or currently under review in 5 states. The Global Rank of G4 was assigned by The Nature Conservancy in 1984 (NatureServe 2010).

Gentiana alba is scattered throughout Illinois and is known in southern Illinois from Alexander, Jackson, Massac, and Pope counties. In southern Illinois it has been found in barrens remnants and open upland forests. On the Forest it is known from Burke Branch Research Natural Area and Ozark Hill Prairie Research Natural Area.

Environmental Impacts:

Alternative 1 may have some negative indirect long-term impacts to *Gentiana alba* as it pertains to invasive species encroachment. Multiflora rose, Japanese honeysuckle, and Nepalese browntop easily invade the habitat that this species occurs in.

Alternative 2 should have beneficial direct and indirect short- and long-term impacts to this species pertaining to invasive species management through the use of herbicides. Prescribed burns will not have any impacts since the Ozark Hill Prairie population is already being burned under a separate project. Being a grass, this species favors fire and does well following a burn. The effects of fire are known to have positive effects on this species and its habitat on the Forest. Burke Branch Research Natural Area and Ozark Hill Prairie Research Natural Area both have had prescribed fires and this species has persisted as have other rare species.

Alternative 3 will have the same impacts to this species as Alternative 1 as it pertains to the use of herbicide and Alternative 2 as it pertains to prescribe burning. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Gentiana alba* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Gentiana alba* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Gentiana alba* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

32. *Helianthus silphioides* (Rosinweed sunflower)

Helianthus silphioides is a perennial sunflower (composite) from a short, stout rhizome that is found from Arkansas and Missouri south to Oklahoma and Louisiana and east to Alabama, Kentucky, and Tennessee. Habitat for this species is field edges, open upland habitats, old fields

and roadsides (KSNPC 2004). The flowering period for *Helianthus silphioides* is from July to late October. It is not currently known from any extant populations on the Shawnee National Forest, but two historical collections from prairies exist from Alexander County and St. Clair County.

According to NatureServe (2004), the primary threats to this species are the loss/conversion of existing habitats to closed-canopy pine plantations, agriculture, or pastureland, and the invasion of exotic species such as kudzu or Japanese honeysuckle (Kral *in* NatureServe 2004). The Nature Conservancy assigned this species a ranking of G4 in 2006 (NatureServe 2010). This species is currently listed as critically imperiled in Illinois, Kentucky and Oklahoma, imperiled in Tennessee, and vulnerable in Louisiana. It is apparently secure in Mississippi and not ranked or currently under review in Missouri, Arkansas, and Alabama. Trends for this species are not clearly stated in available literature, however it is possible that this species has been extirpated from Illinois (Vlaszek *in* KSNPC 2004). Management for this species includes maintaining an open canopy and monitoring known locations for exotic species that could out-compete *Helianthus silphioides* (NatureServe 2004).

Only one account of this species is documented from southern Illinois at a prairie remnant in Alexander County. Information regarding that site is lacking in the literature other than it was collected by Otto Kuntze in Cairo, IL during 1874. The only other county that it is known from is St. Clair County with the latest collections being made in 2003. It is likely that this species has been extirpated from Alexander County.

Environmental Impacts:

It is unlikely that there will be any impacts to this species from Alternatives 1-3 since it is presumed extirpated from the Forest. Potential habitat does occur in prairie and barrens remnants, however, this species has not been seen for well over a century.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Helianthus silphioides* could possibly inhabit. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Helianthus silphioides* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

33. *Heteranthera reniformis* (Kidneyleaf mudplantain)

Heteranthera reniformis is a low growing perennial herb from a creeping rhizome found in shallow water or emersed in muddy soil from Connecticut and New York west to Iowa and Illinois south to Florida and Texas and into Tropical America. It reaches its northern range limit in southern Illinois where it is found in wetlands and floodplains of rivers.

A primary threat to this species is the diminishment of its native habitat, in particular the permanent alteration of the hydrology of its habitat. The Nature Conservancy has given this species the Global Heritage Status Rank of G5 (1994) because in general, this species is not threatened globally. It is possibly extirpated in Connecticut, critically imperiled in Illinois, Iowa, Ohio, South Carolina, and West Virginia, imperiled in North Carolina, and vulnerable in New York and Georgia. It is apparently secure in Kentucky, Virginia, New Jersey, and Delaware. It is not ranked or is currently under review in 12 states (NatureServe 2010).

In southern Illinois it is known from Alexander, Pope, and Union counties. On the Forest it is known from LaRue Swamp at LaRue-Pine Hills/Otter Pond Research Natural Area. This site was last observed in 1977. A search for this species at this location in 1988 did not detect its presence. A population occurs at Homberg Spring in Pope County and was last monitored there in 1990. The information regarding the Alexander County population is lacking in the literature.

Environmental Impacts:

Alternative 1 is not expected to have any impacts on *Heteranthera reniformis*. However, in the long-term, aggressive invasive species may make their way into this species' habitat at LaRue Swamp. Attention should be paid to the area that this species was last seen in during 1977 and an attempt should be made to control invasive species.

Alternative 2 is not expected to have any negative impacts in regards to prescribed burning. Fire is not expected to enter the swamp and pond areas with such force that any damage would be done. There is a very good possibility that the fire would not get into the swamp.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The swamps in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the

Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever care is not taken in perpetuating these areas. Open sunny areas within the LaRue swamps benefit *Heteranthera reniformis* and must be monitored for the longterm. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is sensitive to cropland chemical runoff and requires clean spring water to survive. This is also demonstrated by its occurrence in a spring on private land. If pesticides are required in Alternative 2 for aggressive control/eradication of invasive species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Heteranthera reniformis* population within the area.

Alternative 3 will have the same impacts as Alternative 2 as it pertains to prescribed fire. Although no chemical herbicides would be used in this alternative, great care must be made with the vinegar/clove oil in the swamp areas. There is not enough information available to assess the impacts this substance would have in the swamp areas. The same conclusion can be made for the hot sugar foam method. If possible, exotics should be hand-pulled from the swamps rather than using the natural weed killer methods.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit this species, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps to dry up and the demise of this species in Illinois could result. In particular at the LaRue-Pine Hills/Otter Pond swamp road, there is a danger that the continued gravelling of the road could eventually disrupt the natural springs and alter the hydrology along the road. This is the area that the *Heteranthera reniformis* has been found most frequently.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Heteranthera reniformis* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Heteranthera reniformis*

resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

34. *Hexalectris spicata* (Spiked crested coralroot)

Hexalectris spicata is a rhizomatous perennial orchid known from the southern United States and northern Mexico. This species occurs in extremely dry sunny limestone habitats where vegetative competition is minimal. As some orchids behave, it does not always appear in its known location annually and often, it reappears after years of not showing itself. This species occurs in some of the natural areas in southern Illinois that have been prescribed burned.

A primary threat to this species is the diminishment of its native habitat. The Nature Conservancy has given this species the Global Heritage Status Rank of G5 (1999). It is possibly extirpated in Maryland, critically imperiled in Illinois, Oklahoma, and West Virginia, and imperiled in North Carolina, Indiana, Mississippi, Louisiana, Arkansas and New Mexico. It is considered vulnerable in Arizona, Ohio, Virginia, Georgia, Alabama, and Florida. It is either not ranked or under review in South Carolina, Tennessee, Missouri, Texas, and Kansas. The Global Rank reflects the wide range of this species although only one state, Kentucky, has apparently secure populations.

In southern Illinois, *Hexalectris spicata* is historically known from Hardin, Jackson and Pope counties. The Fountain Bluff population in Jackson County has not been seen since 1974 and the Jackson Hollow Ecological Area population in Pope County has not been seen since 1950. The Whoopie Cat Mountain Research Natural Area population in Hardin County was last seen in 2008 where at least 16 plants were found. In 1989, 13 plants appeared in the dry woodland following a prescribed burn (it was first discovered in 1976 with 29 plants but not seen again until 1989). The Barker Bluff Research Natural Area population was discovered in 1993 with 17 plants and relocated in 1994 with 8 plants. This population has not been seen since then. There is an unconfirmed report of this species occurring at Leisure City Barrens Ecological Area. In Illinois it is found in dry calcareous woods and dry prairie openings primarily along the Mississippi River bluffs and on limestone glades within the Shawnee National Forest.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Hexalectris spicata* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Hexalectris spicata* and cannot be achieved without prescribed fire and

will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Hexalectris spicata* through prescribed fire and herbicide use. This species is readily identifiable and can be easily avoided during the use of herbicides. The effects of fire are known to have positive effects on this species and its habitat on the Forest. Whoopie Cat Research Natural Area has had prescribed fires and this species has persisted as have other rare species. Open sunny barrens benefit *Hexalectris spicata* and other fire-dependent species and cannot be achieved without prescribed fire and, at times, selective tree and shrub removal.

Alternative 3 will have the same impacts to this species as Alternative 2 as it pertains to prescribed fire but is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Hexalectris spicata* populations within their habitats. In particular, Autumn olive, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. Many of the locations that this species occurs in areas that are not suitable for a truck to transport the hot foam to, so this method would unlikely be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Hexalectris spicata* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Hexalectris spicata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

35. *Hottonia inflata* (American featherfoil)

Hottonia inflata is an aquatic winter annual that occurs in quiet water of swamps and permanently wet ditches from Maine west to Illinois and Missouri and south to Texas and Georgia. This species germinates and grows in the fall and winter, then reaches the waters surface and flowers in the spring. In southern Illinois it is known from Jackson, Johnson, and Union counties. It is known from swamps at LaRue-Pine Hills/Otter Pond Research Natural Area.

According to NatureServe (2010), the primary threats to this species are the loss/conversion of wetlands, alteration of hydrology and deteriorating water quality. Invasive species, severe floods and removal of beaver populations are also listed as threats to *Hottonia inflata* (NatureServe 2010). The Nature Conservancy assigned this species a rank of G4 in 1994 (NatureServe 2010). This species is currently listed as presumed extirpated in Pennsylvania, possibly extirpated in Ohio, critically imperiled in West Virginia, Maine, Rhode Island, New Jersey, Maryland, Georgia, South Carolina, North Carolina, New Hampshire, and Mississippi, imperiled in Illinois, Missouri, Indiana, Tennessee, New York, Delaware, and Alabama, and vulnerable in Connecticut, Massachusetts, Virginia and Texas. This species is apparently secure in Kentucky, and either not ranked or under review in Oklahoma, Arkansas, Louisiana, and Florida. *Hottonia inflata* populations are in decline over much of its range (NatureServe 2010). Populations in southern Illinois currently appear to be stable as most locations are protected, but many of the primary threats to this species including exotic species encroachment, severe fluctuations in water levels, wetland drainage and siltation remain a threat. (NatureServe 2010).

In southern Illinois it has been collected from: Cave Valley (Silvey Pond) in Jackson County, Heron Pond, Little Black Slough and private land near West Vienna in Johnson County, Round Pond in Pope County (this pond borders and drains into Massac County), near Carrier Mills in Saline County, and several locations from LaRue-Pine Hills/Otter Pond Research Natural Area (pool of water at base of cliff, LaRue Swamp and Winter's Pond) in Union County.

Environmental Impacts:

Alternative 1 is not expected to have any impacts on *Hottonia inflata*. However, in the long-term, aggressive invasive species may make their way into this species' habitat at LaRue Swamp. Attention should be paid to the area that this species occurs and an attempt should be made to control invasive species.

Alternative 2 is not expected to have any negative impacts in regards to prescribed burning. Fire is not expected to enter the swamp and pond areas with such force that any damage would be done. There is a very good possibility that the fire would not get into the swamp.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The swamps in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the

1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and blufftops. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever care is not taken in perpetuating these areas. Open sunny areas within the LaRue swamps benefit *Hottonia inflata* and must be monitored for the longterm. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is sensitive to cropland chemical runoff and requires clean spring water to survive. This is also demonstrated by its occurrence in a spring on private land. If pesticides are required in Alternative 2 for aggressive control/eradication of invasive species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Hottonia inflata* population within the area.

Alternative 3 will have the same impacts as Alternative 2 as it pertains to prescribed fire. Although no chemical herbicides would be used in this alternative, great care must be made with the vinegar/clove oil in the swamp areas. There is not enough information available to assess the impacts this substance would have in the swamp areas. The same conclusion can be made for the hot sugar foam method. If possible, exotics should be hand-pulled from the swamps rather than using the natural weed killer methods.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit this species, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps to dry up and the demise of this species in Illinois could result. In particular at the LaRue-Pine Hills/Otter Pond swamp road, there is a danger that the continued gravelling of the road could eventually disrupt the natural springs and alter the hydrology along the road. This is the area that the *Hottonia inflata* has been found most frequently.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive

species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Hottonia inflata* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Hottonia inflata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

36. *Hydrolea uniflora* (One-flowered false fiddleleaf)

Hydrolea uniflora is a decumbent perennial herb from southern Illinois, Indiana, and Missouri south to Florida and Texas. It occurs in swamps, wet shores, and roadside ditches. It reaches its northern range limit in southern Illinois.

Hydrolea uniflora has been given a Global Heritage Status Rank of G5 by The Nature Conservancy in 1988 (NatureServe 2008). Threats range-wide include loss of swamp habitat. It is critically imperiled in Illinois and Kentucky, and not ranked or under review in Indiana, Tennessee, Alabama, Mississippi, Missouri, Arkansas, Louisiana, Oklahoma, and Texas. This species is known from LaRue-Pine Hills/Otter Pond Research Natural Area in Union County (LaRue Swamp and Winter's Pond), Route 3 ditch in Jackson County, Grantsburg Swamp, and on private property at Black Bottoms in Massac County.

Environmental Impacts:

Alternative 1 is not expected to have any impacts on *Hydrolea uniflora*. However, in the long-term, aggressive invasive species may make their way into this species' habitat at LaRue Swamp. Attention should be paid to the area that this species occurs and an attempt should be made to control invasive species.

Alternative 2 is not expected to have any negative impacts in regards to prescribed burning. Fire is not expected to enter the swamp and pond areas with such force that any damage would be done. There is a very good possibility that the fire would not get into the swamp.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The swamps in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at

the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species.

Hydrological disturbances leading to the drying out of swamps are a primary threat to this species; the majority of former swamplands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever care is not taken in perpetuating these areas. Open sunny areas within the LaRue swamps benefit *Hydrolea uniflora* and must be monitored for the longterm. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

This species is sensitive to cropland chemical runoff and requires clean spring water to survive. This is also demonstrated by its occurrence in a spring on private land. If pesticides are required in Alternative 2 for aggressive control/eradication of invasive species within the swamp, then exceptional care should be taken not to directly or indirectly impact the *Hydrolea uniflora* population within the area.

Alternative 3 will have the same impacts as Alternative 2 as it pertains to prescribed fire. Although no chemical herbicides would be used in this alternative, great care must be made with the vinegar/clove oil in the swamp areas. There is not enough information available to assess the impacts this substance would have in the swamp areas. The same conclusion can be made for the hot sugar foam method. If possible, exotics should be hand-pulled from the swamps rather than using the natural weed killer methods.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. Although fire may benefit this species, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps to dry up and the demise of this species in Illinois could result. In particular at the LaRue-Pine Hills/Otter Pond swamp road, there is a danger that the continued gravelling of the road could eventually disrupt the natural springs and alter the hydrology along the road. This is the area that the *Hydrolea uniflora* has been found most frequently.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Hydrolea uniflora* inhabits.

Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Hydrolea uniflora* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

37. *Hylotelephium telephioides* (Allegheny stonecrop)

Hylotelephium telephioides is a succulent perennial herb that occurs in the eastern United States and adjacent Canada. It is found in dry, rocky places typically in the mountains and is disjunct in Louisiana, western Kentucky, southern Indiana, and southern Illinois. On the Forest, it occurs in thin soil pockets on sandstone cliffs, ledges, and slide blocks.

The Nature Conservancy assigned this species a rank of G4 in 1988 (NatureServe 2008). This species is currently listed as presumed extirpated in New Jersey, possibly extirpated in New York, imperiled in Indiana, and Kentucky, and vulnerable in Pennsylvania. This species is apparently secure in West Virginia, Virginia, and North Carolina, and either not ranked or under review in Illinois, Ohio, Louisiana, South Carolina, the District of Columbia, Maryland, and Connecticut. Ontario, Canada lists this species as an exotic. *Hylotelephium telephioides* is known from areas such as Jackson Hollow, Lusk Creek Canyon and Bell Smith Springs Ecological Area (mesic upland forest) of Pope County, Stoneface (Saline County), and Cave in Rock (Hardin County). The primary threats to this species in southern Illinois is the loss of habitat because of recreational use on the cliff tops and cliff faces.

Environmental Impacts:

Alternative 1 should have no direct and indirect short-term impacts on *Hylotelephium telephioides*, however, there may be some negative indirect impacts in the long-term for this species where it occurs outside of natural areas and lands that are not being prescribed burned. This would be because prescribed fire in adjacent areas would not be permitted in Alternative 1 for the purpose of TES species or habitat enhancement unless covered under another analysis. There would also be some negative indirect impacts in the long-term without the use of herbicide. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat. These effects may come from the aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Hylotelephium telephioides* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species, as well as excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Hylotelephium telephioides* through prescribe burning and herbicide use. This species is readily

identifiable and can be easily avoided during the use of herbicides. If these locations are sprayed with herbicide, precautions would be taken to protect *Hylotelephium telephioides* from any adverse impacts.

A trail runs near the Garden of the Gods Ecological Area site so it would be included in this project. In addition, *Alliaria petiolata* (the invasive Garlic Mustard) will be herbicided at specific sites here but *Hylotelephium telephioides* does not occur near these sites. Prescribed burns have occurred a few times at Stoneface RNA and this species has persisted and done well here. It's adaptation to fire allows it to compete well with other vegetation for its position in the cliff and rock outcrop communities.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. There may also be some negative direct and indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Hylotelephium telephioides* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive woody encroachment in the understory. Prescribed fire in adjacent areas will certainly contribute to positive indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Hylotelephium telephioides* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Hylotelephium telephioides* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

38. *Isotria verticillata* (Large whorled pogonia)

Isotria verticillata is a rhizomatous, perennial orchid, with stems up to 35 cm tall. It is known from the eastern United States and adjacent Canada. In southern Illinois two colonies occur next to seep springs near the bottom of forested ravine slopes.

The Nature Conservancy assigned this species the Global Heritage Status Rank of G5 in 1984(it is historically documented from 30 states) although it is highly threatened by land-use conversion, habitat fragmentation, and forest management practices (allowing shade-tolerant species and exotics to encroach on its habitat). It is presumed extirpated in Maine, critically imperiled in Ontario (Canada), Illinois, Missouri, Oklahoma, Texas, New Hampshire, and Florida, and imperiled in Michigan, North Carolina, Vermont, Delaware, and Alabama. It is also listed as being vulnerable in Indiana, Louisiana, Georgia, Rhode Island, Mississippi, Maine, New York, and Connecticut. It is apparently secure in Kentucky, and secure in West Virginia, and Virginia. It is currently not ranked or is under review in 7 states.

This species occurs at Cretaceous Hills Ecological Area (mesic upland forest, seep springs). Threats to this species in southern Illinois include over-collecting and the encroachment of shade-tolerant species. At this only site in Illinois, the exotic plant species Japanese honeysuckle (*Lonicera japonica*) poses a threat to the population.

Environmental Impacts:

Alternative 1 will have negative direct and indirect short-term and long-term impacts on *Isotria verticillata* at Cretaceous Hills Ecological Area. Japanese honeysuckle has encroached on most of the populations and threatens to choke out this orchid. Without the use of herbicides, this exotic invasive species will certainly outcompete it. In addition, Nepalese browntop has crept into the seep springs and poses a second threat to the majority of the populations. Without the removal or spraying of this annual grass, it will also outcompete the orchid in its rare habitat. These impacts may come from the eventual woody species and aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Isotria verticillata* populations within the seep springs on the Forest, but may lead to the extirpation of the species in Illinois.

Alternative 2 will have positive direct and indirect short-term and long-term impacts on this species with the use of prescribed fire and herbicide use. This orchid is readily identifiable and will be protected while herbicide is used to control the exotics. Fire has been reported as benefiting *Isotria verticillata* and may encourage flowering (Klinkenberg 1986). Seep springs occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs on the Forest are habitat to several native fire-adapted species.

There may be some negative direct and indirect short-term and long-term impacts for alternative 3 without the use of herbicides but there will be positive direct and indirect short-term and long-term impacts from the use of prescribed fire. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the

overstory and saplings and shrubs in the understory. Hydrological disturbances leading to the drying out of these seep springs are a primary threat to this species; an example is Massac Tower Springs, which is all but dried out and the invasive grass Nepalese browntop (*Microstegium vimineum*) has taken over portions of the former seep spring habitat. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit *Isotria verticillata* and cannot be achieved without prescribed fire and selective tree and shrub removal. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and must be re-treated repeatedly. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Isotria verticillata* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Isotria verticillata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

39. *Juglans cinerea* (Butternut)

Juglans cinerea is a deciduous, nut-bearing tree of the northeastern United States and adjacent Canada. It is a species of rich woodlands and is found scattered throughout the state of Illinois.

The Nature Conservancy assigned this species the Global Heritage Status Rank of G4 in 2006 reflecting more than 100 occurrences from at least 17 states. The abundance and condition of this species are in rapid decline due to butternut canker disease, with no remedy at this time. It is listed as critically imperiled in Alabama, the District of Columbia, and New Hampshire, imperiled in Georgia, Illinois, Missouri, Mississippi, North Carolina, and Maryland, and vulnerable in Minnesota, Wisconsin, Arkansas, Indiana, Michigan, Kentucky, West Virginia, Virginia, New Jersey, Tennessee, South Carolina, New Hampshire, Vermont, Delaware and 3 Canadian provinces. It is listed as introduced (exotic) in Washington and 2 Canadian provinces,

and is either not ranked or currently under review in North Dakota, Iowa, Connecticut, Rhode Island, and Maine (NatureServe 2010).

Juglans cinerea is known from all of the counties on the Forest except for Gallatin County. It is known to occur within the LaRue-Pine Hills Research Natural Area and at a single site at Burke Branch Research Natural Area where it is leaning into the creek. This species achieves its best growth on well-drained soils of bottomlands and floodplains, but rarely occurs in pure stands. It is seldom found on dry, compact, or infertile soils, and is shade-intolerant, growing best in full sunlight. Although butternut canker is the primary global threat to this species, *Juglans cinerea* is also threatened by plant succession where open conditions no longer exist.

Environmental Impacts:

Alternative 1 is expected to have negative direct and indirect short-term and long-term effects on *Juglans cinerea* with the lack of herbicide use. Japanese honeysuckle, autumn olive and other woody species are invading the sites where this species is currently known from and could eventually outcompete this species.

Although Alternative 2 will have positive direct and indirect short-term and long-term impacts resulting from the use of herbicides. Selective spraying will help control encroaching invasive species that threaten the few locations that this species inhabits.

Juglans cinerea can be susceptible to fire damage (USDA 1990). Habitat for this species in southern Illinois occurs adjacent to and within fire-dependent communities and, likely, burned periodically. Although the effects of fire may be harmful to this species, populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. Habitat for this species burned during these periods with no exception.

Alternative 3 may have negative indirect long-term impacts by the lack of herbicides. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to be re-treated. All of the locations that this species occurs at will not be suitable for a truck to transport the hot foam to so this method will not be able to be used.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Juglans cinerea* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Juglans cinerea* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

40. *Lilium superbum* (Turk's-cap lily)

Lilium superbum is a bulbous perennial occurring in the eastern United States. It is a species of the eastern half of the United States. Range-wide it is known from peaty meadows, swales, wet sand and swampy woods.

The Nature Conservancy has given this species the Global Heritage Status Rank of G5 (1990) because of its historically wide distribution within 26 states and the District of Columbia, but it is critically imperiled in Missouri, Arkansas, Kentucky, Louisiana, New Hampshire, and Florida. It is imperiled in Illinois and Alabama and is considered vulnerable in Indiana, Ohio, Georgia and Mississippi. This species is apparently secure in New York, New Jersey, North Carolina, and secure in Delaware, West Virginia, and Virginia. It is currently not ranked or under review in 9 states (NatureServe 2010). In Illinois, this species rarely blooms, most likely the result of excessive shading conditions.

Lilium superbum is a species of mesic woods and streambanks in southern Illinois. It is found within Gallatin, Pope, Johnson, Jackson, Williamson, and Hardin counties. It is known to occur within Lusk Creek Canyon, Jackson Hollow, Bell Smith Springs, Martha's Woods, Hayes Creek/Fox Den Creek (mesic woodland, north-facing slope), Fink Sandstone Barrens, Simpson Township Barrens, and Bulge Hole Ecological Areas, Ozark Hill Prairie Research Natural Area, Lusk Creek Canyon Zoological Area, and Lusk Creek Canyon Wilderness Area. It is also known from outside the Burke Branch Research Natural Area, east branch of Cedar Creek, Iron Furnace, along a tributary of Big Creek, Lake Kinkaid area, near Beaver Creek, on private land near Caney Creek, The Nature Conservancy's Gibbons Creek, State land at Lake Murphysboro, and US Fish & Wildlife land at Devils Kitchen Dam. Rarely do the populations reach a mature growth on the Forest. Typically, populations are non-flowering and remain in a juvenile stage, primarily because they are found in excessively shaded areas. At one site where a clear cut took place on private property, approximately 51 flowering individuals and 147 juveniles appeared in

a 200 square meter area during June 1991. These plants were exposed to full sunlight and appeared to be very healthy.

Environmental Impacts:

The majority of the populations of *Lilium superbum* occur along the streambanks and creeks and will not be affected in the short-term by Alternative 1 but in the long-term, over the next 10 years, most may experience negative indirect effects from the continued encroachment of invasive species. In many cases, the lack of prescribed fire will also have negative indirect long-term effects to these species. Many of these species are not located in areas that a prescribed burn would carry into, but the adjacent burned areas would have an influence on the habitat that these species occupy. *Lilium superbum* is currently threatened by Nepalese browntop and Chinese Yam along the creeks that it inhabits. This species cannot compete with the dense matting of the Nepalese browntop and Chinese Yam.

Alternative 2 will have beneficial direct and indirect short- and long-term effects on *Lilium superbum* at Bell Smith Springs, Hayes Creek/Fox Den Creek (mesic woodland, north-facing slope), Fink Sandstone Barrens, and Bulge Hole Ecological Areas from the use of prescribed fire if the fire actually reaches this species in its habitat. Prescribed burns are not planned in this assessment for the other areas that this species occurs in across the Forest. In regards to herbicide use, Alternative 2 will have beneficial direct and indirect short- and long-term effects resulting from the elimination or control of invasive species that compete for the same habitat for this species. Fires may not actually burn the immediate habitat that this species occurs, which is along the edges of creeks, because of little or no fuel available. The fires will burn adjacent areas that will benefit the species by opening up the canopy for more sun to reach the forest floor. In addition, if this species burns, its response will likely be positive like most grasses respond to fire.

Alternative 3 will have the same Environmental Impacts to this species as Alternative 1 as it pertains to the continued encroachment of invasive species and lack of herbicide use, and Alternative 2 as it pertains to prescribed burns. Alternative 3 will also have some direct short-term positive effects with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Chinese yam, Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with the vinegar/clove oil as well as with the hot foam method.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternatives 1 and 3, in the long-term, populations of *Lilium superbum* outside of natural areas may become over-shaded, suppressed or out-competed by other aggressive woody native species, Nepalese browntop, Chinese yam and invasive plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. Alternative 1-3 will have long-term negative impacts to this species since there will be an inability to prescribe burn the habitat for this species in the Lusk Creek Wilderness Area and

other areas across the Forest. Fires generally benefit *Lilium superbum* as seen with past fires at Simpson Barrens and Fink Sandstone Barrens. The prescribed fire at the sites that it does occur in may also add nutrients back to the microhabitat will help stimulate the suppressed populations.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Lilium superbum* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Lilium superbum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

41. *Lonicera dioica* var. *glaucescens* (Limber honeysuckle)

Lonicera dioica var. *glaucescens* is a twining, shrubby vine found in eastern Canada and adjacent northeastern United States, then, it is disjunct southward in southern Illinois. This variety, with a glabrous hypanthium, hairy leaf undersurfaces, and a glandular corolla tube, is often included in a broadly defined *Lonicera dioica* by some botanists. This disjunct population is several hundred miles from the nearest populations in Iowa, Michigan, and Oklahoma.

The Nature Conservancy has included this variety in *Lonicera dioica* and assigned this species the Global Heritage Status Rank of G5 in 1984. This variety has been reported in 17 states (Hill 2003e). In Illinois it is found associated with *Berberis canadensis*, American barberry.

Two populations of *Lonicera dioica* var. *glaucescens* occur in Jackson County on north-facing sandstone ledges of a massive sandstone bluff-line. Both populations occur within the Greater Shawnee Hills Section of the Shawnee Hills Division at the rim of a dry sandstone cliff at Fountain Bluff Station and Little Grand Canyon/Horseshoe Bluff Ecological Area in Jackson County. The Fountain Bluff Station is not part of the Fountain Bluff Geological Area. Recent searches for this variety at these two locations yielded 2 separate sterile individuals, which the positive identification became questionable (Hill 2003e).

Environmental Impacts:

Alternative 1 could have some negative indirect impacts in the long-term without the use of herbicide at locations where *Lonicera dioica* var. *glaucescens* is known to occur. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation

and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat. These effects may come from the aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Lonicera dioica* var. *glaucescens* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species, as well as excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Lonicera dioica* var. *glaucescens* through herbicide use. This species is readily identifiable and can be easily avoided during the use of herbicides. If these locations are sprayed with herbicide, precautions would be taken to protect *Lonicera dioica* var. *glaucescens* from any adverse impacts. There will be no impacts from prescribed fire since these sites are not planned to be burned. Tree and shrub removal, the manual control and/or eradication of aggressive native and exotic species, and prescribed fire at this habitat may be beneficial to this species on the Forest (Hill 2003e).

Alternative 3 is expected to have some negative indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Lonicera dioica* var. *glaucescens* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive woody encroachment in the understory. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

In the long-term, populations of *Lonicera dioica* var. *glaucescens* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper. Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Lonicera dioica* var. *glaucescens* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Lonicera dioica* var. *glaucescens* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts

resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

42. *Lonicera flava* (Yellow honeysuckle)

Lonicera flava is a woody vine found from southern Illinois and Ohio south to Georgia, Alabama, and Oklahoma. It reaches its northern range limit on forested sandstone bluffs in the Shawnee Hills and Ozark Natural Divisions in southern Illinois. It is known from Jackson and Pope counties, where it is found at the edge of forested sandstone bluffs and ledges where seepage is frequent and *Sphagnum* spp. is a common associate. These ledges vary from a few inches to several hundred feet.

The Nature Conservancy assigned this species a Global Heritage Status Rank of G5? in 1984. It is documented from 12 states. It is listed as presumed extirpated in Ohio, critically imperiled in Illinois, and Tennessee, imperiled in Kansas and South Carolina, and vulnerable in Alabama and Georgia. This species is apparently secure in Kentucky and is not ranked, or is under review, in Missouri, Oklahoma, and Arkansas. Threats to this species include loss of native habitat and droughty conditions.

Lonicera flava is found within Pope and Jackson counties. On the Forest it is known to occur within Lusk Creek Canyon Ecological Area adjacent to the Lusk Creek Canyon Zoological Area, Bell Smith Springs (mesic north-facing rocky slope and upland forest) and Little Grand Canyon/Horseshoe Bluff Ecological Areas. The Fountain Bluff and the Reeds Canyon North populations in Jackson County are on private property. There is also a report that it occurs on a north-facing wooded slope at Bear Creek Relict Site, however it appears that it may also be on the sandstone cliff and it is unclear whether it is on National Forest or private land. This rare species is found associated with peat moss and in areas of wet bluffs and ledges, the ledges varying from a few inches to several hundred feet.

Environmental Impacts:

Alternative 1 could have some negative indirect impacts in the long-term without the use of herbicide at locations where *Lonicera flava* is known to occur. Surrounding areas adjacent to this species' habitat will continue to become encroached with woody vegetation and invasive exotic species, thus encouraging negative competition for light, nutrients, and habitat. These effects may come from the aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Lonicera flava* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species, as well as excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Lonicera flava* through herbicide use. This species is readily identifiable and can be easily avoided during the use of herbicides. If these locations are sprayed with herbicide, precautions would be taken to protect *Lonicera flava* from any adverse impacts. There will be no impacts

from prescribed fire since these sites are not planned to be burned. Tree and shrub removal, the manual control and/or eradication of aggressive native and exotic species, and prescribed fire at this habitat may be beneficial to this species on the Forest (Hill 2003f).

Alternative 3 is expected to have some negative indirect long-term impacts for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Lonicera flava* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive woody encroachment in the understory. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

In the long-term, populations of *Lonicera flava* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper. Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Lonicera dioica* var. *glaucescens* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Lonicera flava* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

43. *Lysimachia fraseri* (Fraser's yellow loosestrife)

Lysimachia fraseri is a rhizomatous perennial herb of open woodlands, roadsides, powerline right-of-ways, and streambanks from North Carolina, Tennessee, and South Carolina, Georgia, Alabama, with disjunct populations in western Kentucky and southern Illinois. It reaches its northern range limit in southern Illinois where it is known from two localities in Pope County.

The Nature Conservancy assigned this species a Global Heritage Status Rank of G3 in 2008 indicating that this species is rare throughout its range. In 1990, it was known from 7 states and

21 counties with a center of distribution in the southern Appalachian Mountains of North and South Carolina (Basinger 2000), however the populations from Illinois and Kentucky are likely no longer extant. Many of these populations are now extirpated. According to NatureServe (2010), it is listed as presumed extirpated in Kentucky, possibly extirpated in Illinois, critically imperiled in Alabama (2 counties) and Georgia (5 counties), imperiled in Tennessee (5 counties) and North Carolina (5 counties), and vulnerable in South Carolina (1 county) (NatureServe 2010). Succession poses the greatest threat to this species in its preferred habitat. This species' habitat is maintained by disturbance regimes such as periodic flooding or fire. Competition and woody growth have also posed serious threats to this species.

Lysimachia fraseri is historically known from Pope County. At one site, it is known to occur along the sandy creek bank within the Lusk Creek Canyon Ecological Area and Lusk Creek Canyon Zoological Area (found by W.E. Hopkins 3 Jun 1966, collection #280, and annotated by E.F. Ulaszek 11 Aug 1995; a second specimen was found by Hopkins 14 Aug 1966, collection #808, and annotated by R. Athey 18 Feb 1976). This site is currently threatened by the exotic Chinese yam. This population was last seen in 1999, when only a single plant was found (Basinger, 2000). A second site for this species was found in 1968 by John Schwegman along a creek in Burke Branch Research Natural Area but has not been relocated in recent years. This species is feared extirpated in the state and has been delisted by the Illinois Endangered Species Protection Board.

Environmental Impacts:

The populations of *Lysimachia fraseri* occur along the streambanks and creeks and will not be affected in the short-term by Alternative 1 but in the long-term, over the next 10 years, both populations may experience negative indirect effects from the continued encroachment of invasive species. At Burke Branch, the lack of prescribed fire will also have negative indirect long-term effects to these species. Many of these species are not located in areas that a prescribed burn would carry into, but the adjacent burned areas would have an influence on the habitat that these species occupy. *Lysimachia fraseri* is currently threatened by Nepalese browntop and Chinese Yam along the creeks that it inhabits. This species cannot compete with the dense matting of the Nepalese browntop and Chinese Yam.

Alternative 2 will have beneficial direct and indirect short- and long-term effects on *Lysimachia fraseri* at Burke Branch from the use of prescribed fire if the fire actually reaches this species in its habitat. Fire is proposed here in a separate EA. Prescribed burns are not planned in this assessment for the Lusk Creek population. In regards to herbicide use, Alternative 2 will have beneficial direct and indirect short- and long-term effects resulting from the elimination or control of invasive species that compete for the same habitat for this species. Fires may not actually burn the immediate habitat that this species occurs, which is along the edges of creeks, because of little or no fuel available. The fires will burn adjacent areas that will benefit the species by opening up the canopy for more sun to reach the forest floor. In addition, if this species burns, its response will likely be positive as it has in the past.

Alternative 3 will have the same Environmental Impacts to this species as Alternative 1 as it pertains to the continued encroachment of invasive species and lack of herbicide use, and

Alternative 2 as it pertains to prescribed burns. Alternative 3 will also have some direct short-term positive effects with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Chinese yam, Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with the vinegar/clove oil as well as with the hot foam method. The hot sugar foam method will not likely be used at these two sites since there are no trails or roads nearby to bring the proper equipment in.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternatives 1 and 3, in the long-term, populations of *Lysimachia fraseri* outside of natural areas may become over-shaded, suppressed or out-competed by other aggressive woody native species, Nepalese browntop, Chinese yam and invasive plant species. Alternative 1-3 will have long-term negative impacts to this species since there will be an inability to prescribe burn the habitat for this species in Lusk Creek and Burke Branch, however Burke Branch is proposed for prescribed fire in a separate EA. Fires generally benefit *Lysimachia fraseri* as seen with past fires at Burke Branch. The prescribed fire at the sites that it does occur in may also add nutrients back to the microhabitat will help stimulate the suppressed populations.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Lysimachia fraseri* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Lysimachia fraseri* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

44. *Matelea obliqua* (Climbing milkvine)

Matelea obliqua is a perennial herbaceous vine of the southeastern United States. Range-wide, it is found in rocky woods and thickets in acidic or alkaline soils. This species does well under a fire regime and in open woodlands where it receives bright sunlight. In southern Illinois it occurs in rocky dry to dry-mesic upland forests and limestone glades.

The Nature Conservancy assigned this species a rank of G4? in 1988 (NatureServe 2010). This species is currently listed as presumed extirpated in the District of Columbia, possibly extirpated

in North Carolina, critically imperiled in Illinois, Maryland and Pennsylvania, imperiled in Mississippi, Georgia, and Indiana, vulnerable in Ohio and West Virginia, apparently secure in Kentucky, and either not ranked or under review in Alabama, Tennessee, and Virginia. On the Shawnee National Forest, it is known natural areas including Copperous Branch EA, Leisure City EA, Robnett Barrens EA, Dog Barrens EA, Whoopie Cat Mountain RNA, Simpson Barrens EA, Fink Sandstone EA, and Dennison Hollow RNA. It is also known from private property and other sites on the Forest including Cove Hollow, Thacker Hollow, Lusk Creek Wilderness, and the Bay Creek area.

Environmental Impacts:

Alternative 1 will have negative indirect long-term impacts to *Matelea obliqua* in the areas that will not be prescribe burned. This species occurs in fire-adapted and fire-dependent plant communities that are being encroached by maple trees, shrubs, and exotic invasive species. This species responds well to fire and is able to compete better in its habitat in those areas that are prescribe burned. Negative long-term impacts will mostly come from woody species encroachment and invasive species encroachment. Invasive species currently impacting the habitat that this species occurs in include Nepalese browntop, amur honeysuckle, Japanese honeysuckle, multiflora rose, and an overabundance of poison ivy. With time, possibly over the next ten years, this rare species may be outcompeted by the aggressive invasive species and may become extirpated from several of their previously known locations.

Alternative 2 will have positive direct and indirect short- and long-term impacts to *Matelea obliqua* from prescribe burning and the use of herbicide to control aggressive invasive species. Controlling and/or eradicating aggressive invasive species that threaten these species and their community type will greatly enhance the ability of this rare species to compete and persist.

Alternative 3 will have the same environmental impacts to *Matelea obliqua* as Alternative 1 as it pertains to invasive species encroachment and Alternative 2 as it pertains to prescribe burns. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Matelea obliqua* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The rich open woods on the Forest are habitat to several native fire-adapted species. Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. Populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with

raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The locations where this species exists today are no exception.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Matelea obliqua* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Matelea obliqua* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

45. *Oxalis illinoensis* (Illinois wood sorrel)

Oxalis illinoensis is a perennial herb that occurs in rich mesic forests often overlying limestone or other calcareous substrates from southern Illinois, southern Indiana, and western Kentucky. It is known from extreme southeastern Illinois where it occurs in Hardin and Pope counties.

The Nature Conservancy assigned this species a Global Heritage Status Rank of G4Q in 2004 (NatureServe 2010). It is listed as critically imperiled in Illinois, imperiled in Indiana, and apparently secure in Kentucky. Schwegman (1982) cites specimens from Tennessee but other sources do not report this species as occurring in Tennessee. Threats to this species include loss of native habitat and droughty conditions.

It occurs within Martha's Woods, Reddick Hollow, and Copperous Branch Ecological Areas, East Fork *Oxalis illinoensis* Botanical Area, and along Lusk Creek in Pope County and Big Creek Zoological Area in Hardin County. This species was relocated at these sites during 2003 by Bob Edgin (Edgin 2003). This species was first described in 1982 (Schwegman 1982) and was distinctly separated from the closely related *Oxalis grandis*.

Environmental Impacts:

The majority of the populations of *Oxalis illinoensis* occur along the streambanks and creeks and will not be affected in the short-term by Alternative 1 but in the long-term, over the next 10 years, most may experience negative indirect effects from the continued encroachment of invasive species. Many of these species are not located in areas that a prescribed burn would

carry into, but the adjacent burned areas would have an influence on the habitat that these species occupy. *Oxalis illinoensis* is currently threatened by Nepalese browntop and Chinese Yam along the creeks that it inhabits. This species cannot compete with the dense matting of the Nepalese browntop and Chinese Yam.

Alternative 2 will have no impacts on *Oxalis illinoensis* from the use of prescribed fire. Prescribed burns are not planned in this assessment for the areas that this species occurs in across the Forest. In regards to herbicide use, Alternative 2 will have beneficial direct and indirect short- and long-term effects resulting from the elimination or control of invasive species that compete for the same habitat for this species. Fires may not actually burn the immediate habitat that this species occurs, which is along the edges of creeks, because of little or no fuel available. The fires may burn adjacent areas that will benefit the species by opening up the canopy for more sun to reach the forest floor. In addition, if this species burns, its response will likely be positive like most sorrels response to fire.

Alternative 3 will have the same Environmental Impacts to this species as Alternative 1 as it pertains to the continued encroachment of invasive species and lack of herbicide use, and Alternative 2 as it pertains to prescribed burns. Alternative 3 will also have some direct short-term positive effects with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Chinese yam, Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with the vinegar/clove oil as well as with the hot foam method. The hot sugar foam method will not likely be used since there are no trails or roads near enough this species for the equipment to be brought in.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternatives 1 and 3, in the long-term, populations of *Oxalis illinoensis* outside of natural areas may become over-shaded, suppressed or out-competed by other aggressive woody native species, Nepalese browntop, Chinese yam and other invasive plant species.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Oxalis illinoensis* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Oxalis illinoensis* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning

and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

46. *Panax quinquefolius* (American ginseng)

Panax quinquefolius is a perennial herb of the eastern United States and adjacent Canada. This species has a fleshy rootstock with medicinal value found and is frequently dug up for its roots. In Illinois it blooms during June and July and fruit is typically ripe in mid August (Fiebig *et al.* 2001). Throughout its range, it is found in rich mesic woods under the closed canopy of deciduous hardwoods (Anderson and Peterson 2000). This species is scattered throughout Illinois in rich dry-mesic to mesic upland and mesic floodplain forests and in southern Illinois it is known from Alexander, Hardin, Jackson, Johnson, Massac, Pope, Saline, and Union counties. It is known from LaRue-Pine Hills/Otter Pond Research Natural Area.

According to NatureServe (2010) the primary threats to *Panax quinquefolius* are commercial overharvest and logging of mesic hardwoods. Exotic species, although not mentioned specifically on NatureServe, could decrease the amount of suitable habitat and potentially outcompete *Panax quinquefolius*. Even in protected areas such as National Parks and Forests, there is a great deal of poaching due to its valuable root in overseas markets and the difficulty of enforcing existing laws (NatureServe 2010).

The Nature Conservancy gave this species a Global Heritage Status Rank of G3G4 in 2005 (NatureServe 2010). It is possibly extirpated in the District of Columbia, critically imperiled in Rhode Island, South Dakota, Nebraska, Kansas, Oklahoma, and Louisiana, imperiled in Ontario and Quebec, Canada, Michigan, New Jersey, Delaware, and New Hampshire, and listed as vulnerable in Illinois, Indiana, Iowa, Minnesota, Kentucky, Tennessee, Mississippi, Georgia, West Virginia, Virginia, Maryland, New York, Connecticut, Vermont, and Maine. It is apparently secure in Wisconsin, Pennsylvania, Missouri, Arkansas, Alabama, South Carolina, and North Carolina and is not ranked or currently under review by Ohio. This species occurs at generally low densities over a very broad range. Population sizes of this plant have decreased significantly primarily because of the extensive root digging for commercial sale. Although various regulations are in effect to protect this species (including CITES listing), populations continue to decline because of noncompliance with these regulations and insufficient enforcement.

Panax quinquefolius is found within Alexander, Gallatin, Pope, Johnson, Jackson, Massac, Saline, Union, and Hardin counties. It very likely occurs in Williamson County although available literature does not have it listed. It is known to occur within Thacker Hollow, Lusk Creek Canyon Ecological Area, Lusk Creek Canyon Zoological Area, Lusk Creek Wilderness Area, Bulge Hole Ecological Area, Jackson Hollow Ecological Area, LaRue-Pine Hills/Otter Pond Research Natural Area, Burke Branch Research Natural Area, and Double Branch Hole Ecological Area among other areas on the Forest. This plant grows in rich woods, and low mesic woods. On the Shawnee National Forest, populations have been over-collected by illegal root-diggers. Population totals rarely exceed one or two dozen young plants. In Illinois, *Panax quinquefolius* is documented in 84 of 102 counties and is likely present in more (Anderson *et al.* 1993).

Environmental Impacts:

Alternative 1 will have negative indirect long-term impacts to *Panax quinquefolius* in several of the areas that will not be treated with herbicides. This species is not fire-dependent but is adapted to fire and would respond well to prescribe burns. The plant communities that this species inhabits are being encroached by maple trees, shrubs, and exotic invasive species. Negative long-term impacts will mostly come from woody species encroachment and invasive species encroachment. Invasive species currently impacting the habitat that this species occurs in include Nepalese browntop, amur honeysuckle, Japanese honeysuckle, multiflora rose, and an overabundance of poison ivy. With time, possibly over the next ten years, this species may be outcompeted by the aggressive invasive species.

Alternative 2 will have positive direct and indirect short- and long-term impacts to *Panax quinquefolius* from the use of herbicide to control aggressive invasive species. Controlling and/or eradicating aggressive invasive species that threaten these species and their community type will greatly enhance the ability of this rare species to compete and persist. Prescribed burning is expected to benefit this species in the areas that it occurs in.

Alternative 3 will have the same environmental impacts to *Panax quinquefolius* as Alternative 1 as it pertains to invasive species encroachment and Alternatives 1 and 2 as it pertains to prescribe burns. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Panax quinquefolius* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Panax quinquefolius* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Panax quinquefolius* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

47. *Phaeophyscia leana* (Wreath Lichen)

Phaeophyscia leana is a lichen species that occurs primarily in the Ohio River watershed, above the Lock and Dam at Smithland, Kentucky and below the dam at Uniontown, Kentucky. It also occurs along the Caney Fork River in middle Tennessee. It occurs on trees below the more recent high-water marks, where other lichen species are essentially absent. Tree species that it has been documented on in Illinois include *Acer rubrum*, *Acer saccharinum*, *Fraxinus lanceolata*, *Fraxinus tomentosa*, *Liquidambar styraciflua*, *Quercus macrocarpa*, *Quercus palustris*, *Quercus pagodaefolia*, *Populus deltoides*, *Carya cordiformis*, *Carya illinoensis*, *Carya laciniosa*, *Ulmus americana*, *Taxodium distichum* and trees that are associated with the bottomland areas of old backwaters of the Wabash and Little Wabash rivers. Its original type location is in Cincinnati, Ohio and the species was thought to be extinct until rediscovered by A.C. Skorepa, 400 km downstream in 1978 (Wilhelm *et al.* 2000).

According to NatureServe (2010) the primary threats to this species are bank erosion, heavy river and barge traffic, sustained floods and understory vegetation. The Nature Conservancy ranked this species G2 in 2004 (NatureServe 2010). Trends for this species are uncertain due to the relatively recent rediscovery but are thought to be declining due to bank erosion, prolonged flood events and heavy river traffic. In southern Illinois this species occurs on trees adjacent to the Little Wabash and Ohio Rivers and in backwater swamps and sloughs in Gallatin, Hardin, Massac, and Pope counties. In addition to Ohio, there are approximately 24 historically known locations in Illinois, 8 in Kentucky, and 1 in Tennessee. It is only known from one site on Shawnee National Forest managed lands at Tower Rock Recreation Area (Phillippe 2004c) in Hardin County. The Massac and Gallatin counties populations no longer exist because of bank erosion as well as 2 of the Hardin County populations (Phillippe 2004c).

Primary management needs (beyond limiting flood crests and duration, and reducing erosion of river banks) include maintaining open understory conditions. According to Wilhelm and Masters (1994) 3 of the known locations of *Phaeophyscia leana* are in areas that are mowed and cleared of brush regularly. The Tower Rock population was censused by Elizabeth Longo Shimp and Troy Lear during February 2010 and it was found on approximately 200 trees throughout the floodplain and a small portion of the campground.

Environmental Impacts:

None of the activities proposed in any of the alternatives will negatively impact *Phaeophyscia leana* because the only currently known populations within the Forest Proclamation Boundary are along the Ohio River where the Forest Service cannot control the water fluctuations.

Cumulative Impacts:

Cumulative Impacts are similar to Environmental Impacts to this species. Since there will be no negative Environmental Impacts to known populations on the Forest, there will be no Cumulative Impacts to this species from any of the proposed actions in any of the alternatives.

These Cumulative Impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

48. *Pinus echinata* (Shortleaf pine)

Pinus echinata is an evergreen tree. It is a species of the southeastern United States. In southern Illinois, it is restricted to two locations on dry sandstone and chert slopes. This species is known from LaRue-Pine Hills/Otter Pond Research Natural Area (dry, cherty slopes).

The Nature Conservancy assigned this species a rank of G5 in 1984 (NatureServe 2008). This species is currently listed as critically imperiled in Illinois, New York and Pennsylvania, vulnerable in Delaware, apparently secure in Kentucky, West Virginia, Alabama, New Jersey, and Maryland, secure in North Carolina and Virginia, and either not ranked or under review in Ohio, the District of Columbia, South Carolina, Georgia, Florida, Tennessee, Mississippi, Missouri, Arkansas, Louisiana, Oklahoma, and Texas.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Pinus echinata* populations within the LaRue-Pine Hills RNA. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Open areas benefit *Pinus echinata* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well, or even express itself in its native habitat, in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Pinus echinata* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Pinus echinata* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Pinus echinata* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the community type and habitat that this species requires.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These communities must be aggressively managed to remove the invasive species that threaten this community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Pinus echinata* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Pinus echinata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

49. *Plantago cordata* (Heartleaf plantain)

Plantago cordata is a perennial aquatic herb that is known from the eastern and central United States and Ontario, Canada. In Illinois it usually occurs in sand or gravel bars of shallow, clear-water streams under a forest canopy. It has a very narrow habitat preference but can be locally common. In southern Illinois, this species rarely blooms nor gets very tall in stature, most likely the result of excessive shading conditions.

This species has declined throughout its range because of stream erosion and siltation from various activities. The Nature Conservancy gave this species the Global Heritage Status Rank of

G4 in 1994 (NatureServe 2010) because populations have declined dramatically everywhere except for Missouri. It has been historically documented in 20 states and Ontario Canada but is possibly extirpated from Iowa, Kentucky, Virginia, Maryland, District of Columbia, and Florida. It is critically imperiled in Ontario, Wisconsin, Illinois, Michigan, Ohio, Indiana, Tennessee, Mississippi, Alabama, and North Carolina, and imperiled in Arkansas. New York, Missouri and Georgia list it as being vulnerable and South Carolina is the only state that has it under review but no documentation of occurrences is available.

Plantago cordata is known from Jackson, Johnson, Pope, and Saline counties. It has been documented as occurring at Lake Kinkaid, Cedar Lake, Cave Hill Research Natural Area, Simpson Township Barrens Ecological Area, north of Flat Rock Hollow (not relocated during 2004 searches; siltation evident in creek with horse trail and ATV use apparent, likely extirpated), state land at Lake Murphysboro, private land at Flat Lick Branch, Gyp Williams Hollow Ecological Area (not relocated, likely extirpated), and Copperous Branch Ecological Area.

Environmental Impacts:

The majority of the populations of *Plantago cordata* occur in and along the streambanks and creeks and will not be affected in the short-term by Alternative 1 but in the long-term, over the next 10 years, most may experience negative indirect effects from the continued encroachment of invasive species. In many cases, the lack of prescribed fire will also have negative indirect long-term effects to these species. Many of these species are not located in areas that a prescribed burn would carry into, but the adjacent burned areas would have an influence on the habitat that these species occupy. *Plantago cordata* is currently threatened by Nepalese browntop and Chinese Yam along the creeks that it inhabits. This species cannot compete with the dense matting of the Nepalese browntop and Chinese Yam.

Alternative 2 will have no direct and indirect short- and long-term effects on *Plantago cordata* at its known locations from the use of prescribed fire. Prescribed burns are not planned in this assessment for the areas that this species occurs in across the Forest, however, fires are planned for the Cave Hill and Simpson Barrens locations in a separate EA. In regards to herbicide use, Alternative 2 will have beneficial direct and indirect short- and long-term effects resulting from the elimination or control of invasive species that compete for the same habitat for this species. Fires may not actually burn the immediate habitat that this species occurs, which is along the edges of creeks, because of little or no fuel available. The fires will burn adjacent areas that will benefit the species by opening up the canopy for more sun to reach the forest floor. In addition, if this species burns, its response is known to be positive since it has done very well with past burns at Cave Hill and Simpson Barrens.

Alternative 3 will have the same Environmental Impacts to this species as Alternative 1 as it pertains to the continued encroachment of invasive species and lack of herbicide use, and Alternative 2 as it pertains to prescribed burns. Alternative 3 will also have some direct short-term positive effects with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Chinese yam, Japanese honeysuckle

and other woody and perennial species. Resprouting of perennial plants is expected with the vinegar/clove oil as well as with the hot foam method. The hot sugar foam method will not likely be used since there are no trails or roads that could be utilized to bring the equipment in.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternatives 1 and 3, in the long-term, populations of *Plantago cordata* outside of Cave Hill and Simpson Barrens may become over-shaded, suppressed or out-competed by other aggressive woody native species, Nepalese browntop, Chinese yam and other invasive plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. Alternative 1-3 will have long-term negative impacts to this species since there will be an inability to prescribe burn the habitat for this species in other areas across the Forest. Fires generally benefit *Plantago cordata* as seen with past fires at Cave Hill and Simpson Barrens.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Plantago cordata* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Plantago cordata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

50. *Platanthera clavellata* (Small green wood orchid)

Platanthera clavellata is a perennial, tuberous orchid that occurs in the eastern United States and adjacent Canada. It is typically found in acidic bogs and wet soil. In southern Illinois it occurs in acidic, forested seeps, usually associated with *Sphagnum* spp. It generally flowers from June through August.

Threats to this species include destruction of wetland habitat through woody species invasion (seep springs), drainage, channelization, logging, and gravel-mining, predation by white-tailed deer, cattle grazing, herbicide runoff from nearby fields or powerline corridors, and invasion of habitats by exotic and native woody vines (e.g. *Lonicera japonica* and *Smilax* spp.). It is possibly extirpated in North Dakota, critically imperiled in Iowa, Illinois, Oklahoma, and Florida, imperiled in Missouri, Rhode Island, and Prince Edward Island, Canada, and vulnerable

in Indiana and Minnesota. It is apparently secure in Ontario, New Brunswick and Quebec Canada, New York, New Jersey, North Carolina, Tennessee, Kentucky, Ohio, and West Virginia, and secure in Newfoundland and Nova Scotia, Canada, Virginia, Delaware, and Georgia. It is currently not ranked or under review by Maine, New Hampshire, Vermont, Maryland, Connecticut, Massachusetts, Pennsylvania, Michigan, Wisconsin, Alabama, Mississippi, Louisiana, Texas, and Arkansas. The Global Rank of G5 was assigned by The Nature Conservancy in 1995 (NatureServe 2010).

Platanthera clavellata is known primarily from several mesic sand prairies, woodland thickets, and forested seep springs in northern Illinois. It is known from Pope County in southern Illinois where it occurs in acidic forested seep springs. It is known from seep springs at Cretaceous Hills, Dean Cemetery East Barrens, Massac Tower Springs, and Kickasola Cemetery Ecological Areas. The population of *Platanthera clavellata* has not been seen in Massac Tower Springs for many years and the hydrological disturbances to this seep, as well as the invasion of exotic species and woody vegetation, may have led to the demise of this population.

Environmental Impacts:

Alternative 1 will have negative direct and indirect short-term and long-term impacts on *Platanthera clavellata*. Japanese honeysuckle has encroached on most of the populations and threatens to choke out this orchid. Without the use of herbicides, this exotic invasive species will certainly outcompete it. In addition, Nepalese browntop has crept into the seep springs and poses a second threat to the majority of the populations. Without the removal or spraying of this annual grass, it will also outcompete the orchid in its rare habitat. These impacts may come from the eventual woody species and aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Platanthera clavellata* populations within the seep springs on the Forest, but may lead to the extirpation of the species in Illinois. Prescribed fire is also required for this species to help reduce encroaching woody species and stimulate vigor and health.

Alternative 2 will have positive direct and indirect short-term and long-term impacts on this species with the use of prescribed fire and herbicide use. This orchid is readily identifiable and will be protected while herbicide is used to control the exotics. Seep springs occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs on the Forest are habitat to several native fire-adapted species.

There may be some negative direct and indirect short-term and long-term impacts for alternative 3 without the use of herbicides but there will be positive direct and indirect short-term and long-term impacts from the use of prescribed fire. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Hydrological disturbances leading to the drying out of these seep springs are a primary threat to this species; an example is Massac Tower Springs, which is all but dried out and the invasive grass Nepalese browntop (*Microstegium vimineum*) has taken over portions of the former seep spring habitat. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit

Platanthera clavellata and cannot be achieved without prescribed fire and selective tree and shrub removal. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and must be re-treated repeatedly. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Platanthera clavellata* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Platanthera clavellata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

51. *Platanthera flava* var. *flava* (Palegreen orchid)

Platanthera flava var. *flava* is a colonial, perennial orchid with stems that may reach 60 cm in height. It is found in wetlands throughout the southeastern United States but is relatively uncommon. This species can form dense colonies that dominate the communities it occupies. Flowering time for this species is from June through August in most of its range. It reaches its northwestern range limit in southern Illinois in floodplain forests and swamps. It is known in Illinois from collections in Johnson, Massac, and Wabash counties.

According to NatureServe (2010) the primary threats to this species are loss of wetland habitats, alteration of hydrology, development of uplands adjacent to wetlands and collection for commercial markets. The Nature Conservancy ranked this species G4?T4?Q in 1994. The Conservation Status of this species is critically imperiled in Illinois, Indiana, and New Jersey, imperiled in Missouri, Texas, Alabama, Tennessee, and Nova Scotia, Canada and vulnerable in Georgia and Virginia. It is apparently secure in Kentucky and Mississippi and currently not ranked or under review in Oklahoma,

Louisiana, Florida, South Carolina, North Carolina, Maryland, and Michigan. Trends for *Platanthera flava* var. *flava* are listed as stable, however, the potential short and long-term threats to this species are listed as 'medium' due to habitat conversion (Dolan 2003).

In southern Illinois this species occurs in or adjacent to floodplain forests and swamps in 3 locations from 2 counties. The only Forest managed area is Grantsburg Swamp Ecological Area in Johnson County. The other two locations are at the State of Illinois managed lands of Heron Pond/Wildcat Bluff Nature Preserve in Johnson County and on private property at Black Bottoms in Massac County.

Active management of *Platanthera flava* var. *flava* may not be necessary for wetland sites but fire is thought to be necessary on wet prairie sites (NatureServe 2010). The specific frequency and intensity of fires that will benefit this species is not known at this time. Periodic monitoring, continued research and the protection of existing habitats appear to be the best management plan available at this time (NatureServe 2010).

Environmental Impacts:

Alternatives 1, 2 and 3 should have no impacts on this species since it is not in any of the project locations. Its location at Grantsburg Swamp is away from any corridor so the opportunity to use herbicide is not applicable in this project. At Grantsburg Swamp, *Platanthera flava* var. *flava* occurs in the bottomland forest adjacent to the swamp. This area is permanently wet soiled.

Hydrological disturbances leading to the drying out of swamps and the adjacent wetlands and bottomland hardwoods are a primary threat to this species; the majority of former swamplands and wetlands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps and wetlands have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest forever care is not taken in perpetuating these areas. Moderately open canopy areas within and adjacent to Grantsburg Swamp benefit *Platanthera flava* var. *flava* and must be monitored for the longterm. If woody and invasive species encroachment is detected, future prescribed fire and selective tree and shrub removal should be employed.

This species is most likely sensitive to cropland chemical runoff and requires unpoluted wetlands to survive. If pesticides are required for an aggressive control/eradication of exotic species within the swamps and adjacent wetlands and bottomland hardwoods, then exceptional care should be taken not to directly or indirectly impact the *Platanthera flava* var. *flava* populations within the area.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive

species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Platanthera flava* var. *flava* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Platanthera flava* var. *flava* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

52. *Poa alsodes* (Grove bluegrass)

Poa alsodes is a tufted perennial grass that is known from eastern Canada and the northeastern United States west to Minnesota and south to Illinois, Tennessee, and South Carolina. This grass grows in mesic forests and is known from several widely scattered locations in Illinois. There are historical collections from Giant City State Park in Jackson County and Hayes Creek Canyon (mesic woodland, north-facing slope) in Pope County. No extant populations have recently been seen in southern Illinois, although it is thought that the species still exists within the Shawnee National Forest.

Threats include the loss of native habitat and natural succession. The Nature Conservancy gave this species a Global Heritage Status Rank of G4G5 in 1997. It is listed as critically imperiled in Illinois, South Carolina, and Prince Edward Island, Canada, imperiled in Indiana and Maryland, and vulnerable in Quebec, Canada. It is apparently secure in New Brunswick and Ontario, Canada, Kentucky, West Virginia, Virginia, North Carolina, New Jersey, and Delaware, and secure in New York. Trends for *Poa alsodes* are not reported in the available literature. The only trend from the available literature would be an inference of a declining population due to its absence in the last 18 years. Management needs are also poorly understood and/or documented in the available literature.

In Indiana, it has been reported from dry soils in beech-maple woodlands as well as low woods (Deam 1940). In Illinois it is historically known from St. Clair, Jackson (Fern Rocks Nature Preserve, Giant City State Park 1953 by R.H. Mohlenbrock and last seen 1977) and Pope (Hayes Creek Canyon/Fox Den Ecological Area) counties. The last verified Element of Occurrence for *Poa alsodes* was at the Hayes Creek location in 1986 within a mesic forest on a north-facing slope (INHS Database 2002). After extensive unsuccessful searches to find any voucher specimens from Illinois, Hill (2007) has concluded that this species may not actually exist in the state but may instead be misidentifications.

Environmental Impacts:

We can assume that *Poa alsodes* does not actually occur in Illinois since there are no valid voucher specimens known, although, since it occurs in adjoining states, it can also be assumed that it could potentially occur here. This analysis will assume that it does not occur on the Forest until a specimen is located and correctly identified.

Alternatives 1, 2, and 3 will have no impacts to this species since it does not exist within the Forest or project areas. For the sake of potential habitat, the following is also true:

The effects of fire are known to have positive effects on grass species and their habitats on the Forest. The rich open woods on the Forest are habitat to several native fire-adapted species. Habitat described for this species in southern Illinois occurs within and adjacent to fire-dependent communities and, likely, burned periodically.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species' potential habitat by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Poa alsodes* could exist in. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Poa alsodes* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

53. *Polygala incarnata* (Procession flower)

Polygala incarnata is a slender annual herb found in the eastern and central United States and disjunct in southern Ontario, Canada. It occurs in roadsides, old fields, upland forests, barrens, and prairies. It generally flowers from June through August.

Threats to this species include fire suppression, overgrazing, habitat destruction for development and mining activities. This species is declining within the northern portion of its range. It is listed as imperiled in Ohio, Iowa and Maryland, critically imperiled in Delaware, Illinois, Indiana, Wisconsin, and Ontario, Canada, possibly extirpated in New Jersey and Pennsylvania, and presumed extirpated in Michigan and New York. It is apparently secure in Virginia, North Carolina, and Kentucky. It is currently unranked or under review by Nebraska, Kansas,

Oklahoma, Texas, Missouri, Arkansas, Louisiana, Mississippi, Tennessee, Alabama, Georgia, Florida, South Carolina, and the District of Columbia. The Global Rank of G5 was assigned by The Nature Conservancy in 1990 (NatureServe 2010), likely because of its relatively wide range.

Polygala incarnata is scattered throughout Illinois where it has been found in sand prairies, hill prairies, and barrens. In southern Illinois it is known from barrens remnants in Pope County in the Cretaceous Hills Section of the Coastal Plain Division. There is an unverified report of it from Massac County. It is known to occur in Poco Cemetery Barrens North (J. Shimp collection #5375, dry-mesic barrens), Poco Cemetery Barrens East (dry-mesic barrens), Cretaceous Hills (barren), and Dean Cemetery East Barrens Ecological Areas.

Environmental Impacts:

The effects of fire are known to have positive effects on this species and its habitat on the Forest. Poco Cemetery Barrens North, Poco Cemetery Barrens East, Cretaceous Hills, and Dean Cemetery East Barrens Ecological Areas have all had prescribed fires and this species has persisted as have other rare species.

There may be some negative direct and indirect long-term effects for alternative 1. These effects may come from the eventual exotic species encroachment, which may not only cause a reduction in health and vigor of *Polygala incarnata* populations within the natural areas. The rare barrens community types, such as these, will succumb to successional species if intensive management is not implemented. Open sunny barrens benefit *Polygala incarnata* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Polygala incarnata* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Polygala incarnata* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Polygala incarnata* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Polygala incarnata* populations within their habitats. In

particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Polygala incarnata* populations. Open sunny barrens benefit *Polygala incarnata* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Polygala incarnata* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species requires.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Polygala incarnata* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Polygala incarnata*

resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

54. *Polytaenia nuttallii* (Nuttall's prairie parsley)

Polytaenia nuttallii is a perennial herb of prairies and the plains preferring loamy soils in full sun. In southern Illinois it is found in the barrens and glades; at one time, there were over 40 counties in Illinois that this species occurred, however, this species has been extirpated in many of these counties because of habitat destruction and development. The greatest threats to this species are habitat loss, decline in habitat quality, and fire suppression, a component known to enhance Nuttall's prairie parsley habitat. It is known from areas including Simpson Barrens EA, along a creek in a dry-mesic woods (Johnson County) and along a Forest Road in a dry oak woodland (Pope County).

The Nature Conservancy gave this species a Global Heritage Status Rank of G5 in 1984 (NatureServe 2008). It is extirpated in Michigan and Kentucky, critically imperiled in Indiana and Tennessee, imperiled in Mississippi, and listed as vulnerable in Wisconsin, Minnesota, Iowa, and Louisiana. It is apparently secure in Nebraska and is not ranked or currently under review by North Dakota, Illinois, Missouri, Arkansas, Alabama, Kansas, Texas, and New Mexico.

Environmental Impacts:

Alternative 1 will have negative indirect long-term impacts to *Polytaenia nuttallii* in the areas that will not be prescribe burned. This species occurs in fire-adapted and fire-dependent plant communities that are being encroached by maple trees, shrubs, and exotic invasive species. This species responds well to fire and is able to compete better in its habitat in those areas that are prescribe burned. Negative long-term impacts will mostly come from woody species encroachment and invasive species encroachment. Invasive species currently impacting the habitat that this species occurs in include Nepalese browntop, amur honeysuckle, Japanese honeysuckle, multiflora rose, and an overabundance of poison ivy. With time, possibly over the next ten years, this rare species may be outcompeted by the aggressive invasive species and may become extirpated from several of their previously known locations.

Alternative 2 will have positive direct and indirect short- and long-term impacts to *Polytaenia nuttallii* from prescribe burning and the use of herbicide to control aggressive invasive species. Controlling and/or eradicating aggressive invasive species that threaten these species and their community type will greatly enhance the ability of this rare species to compete and persist. Prescribed burning is not planned for known locations of this species but will benefit this species if it does occur at these sites.

Alternative 3 will have the same environmental impacts to *Polytaenia nuttallii* as Alternative 1 as it pertains to invasive species encroachment and Alternative 2 as it pertains to prescribe burns. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil,

which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Polytaenia nuttallii* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The rich open woods on the Forest are habitat to several native fire-adapted species. Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. Populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The locations where this species exists today are no exception.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Polytaenia nuttallii* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Polytaenia nuttallii* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

55. *Pycnanthemum albescens* (Whiteleaf mountainmint)

Pycnanthemum albescens is a rhizomatous perennial mint that is found in the southern and south-central United States. In Illinois it is restricted to a single location in a dry, open, upland forest. It generally flowers from July through September.

Threats to this species include woody succession and canopy closure in once open upland forests. It is documented from 13 states and listed as critically imperiled in Georgia, Illinois, and

Kentucky, and possibly extirpated in Kansas. It is currently not ranked or under review in North Carolina, Florida, Alabama, Mississippi, Louisiana, Missouri, Arkansas, Oklahoma, and Texas. The Global Rank of G5 was assigned by The Nature Conservancy in 1988 (NatureServe 2010).

Pycnanthemum albescens is known in Illinois only from Union County. It was reported from cherty limestone slopes at LaRue-Pine Hills/Otter Pond Research Natural Area in 1973. It has not been relocated at this natural area since 1977 and may be extirpated in the state although there is considerable suitable habitat in the Ozark Hills Subsection.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Pycnanthemum albescens* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit *Pycnanthemum albescens* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well, or even express itself in its native habitat, in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Pycnanthemum albescens* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Pycnanthemum albescens* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of

Pycnanthemum albescens populations within the LaRue-Pine Hills/Otter Pond RNA, but may lead to the extirpation of the species in southern Illinois. Open sunny barrens benefit *Pycnanthemum albescens* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Pycnanthemum albescens* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species requires.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Pycnanthemum albescens* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Pycnanthemum albescens* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

56. *Pycnanthemum torrei* (Torrey's mountainmint)

Pycnanthemum torrei is a perennial, rhizomatous mint that originally occurred throughout most of the eastern United States. Now this species occurs in dry upland forests and thickets of south-central and eastern United States. It is rare in southern

Illinois and is known from two locations, one at a dry-mesic barrens and the other at the edge of a sandstone glade. It generally flowers from June through October.

Threats to this species include woody succession, invasion of habitat by exotic, weedy plants such as Japanese honeysuckle (*Lonicera japonica*), spraying of herbicides by railroad, highway, or utility crews for right-of-way maintenance, habitat destruction due to general development or road construction, timber harvest, trampling by humans, horses, and tractors, and recreational pressures. This species is apparently declining throughout its range. It was historically known from 17 states but there are now no more than 20 confirmed extant populations. It is listed as possibly extirpated in Illinois, Missouri, New Hampshire, and the District of Columbia, critically imperiled in Connecticut, Delaware, Maryland, New Jersey, New York, Tennessee, North Carolina, and West Virginia, and imperiled in Virginia. It is currently not ranked or under review in Pennsylvania, Kentucky, and South Carolina. The Global Rank of G2 was assigned by The Nature Conservancy in 2004 (NatureServe 2010).

Pycnanthemum torrei is known in Illinois only from Jackson and Pope counties. It has been found at the margin of a sandstone glade (Jackson County) and within a dry-mesic barrens remnant (Pope County). It is known from Cretaceous Hills Ecological Area in a field barrens near Long Springs. This location was found by John Schwegman September 27, 1967 (collection #82) but has not been seen since 1987. Herkert and Ebinger (2002) list the Jackson County report but no specific site locations are described. There are unconfirmed reports of this species from Alexander County (Herkert 1991). There are no known extant populations of this species in southern Illinois and it is presumed extirpated. This species has recently been delisted by the Illinois Endangered Species Protection Board.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Pycnanthemum torrei* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Pycnanthemum torrei* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well, or even express itself in its native habitat, in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Pycnanthemum torrei* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are

unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Pycnanthemum torrei* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Pycnanthemum torrei* populations within Cretaceous Hills EA, but may lead to the extirpation of the species in southern Illinois. Open sunny barrens benefit *Pycnanthemum torrei* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Pycnanthemum torrei* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species requires.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the

spread of invasive plant species into the communities in which *Pycnanthemum torrei* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Pycnanthemum torrei* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

57. *Rhexia mariana* (Maryland meadowbeauty)

Rhexia mariana is a rhizomatous perennial herb of the southeastern United States. It reaches its northwestern range limit in southern Missouri and Illinois where it is occasionally found in wet meadows, around ponds, and in seep springs. This species is known from a few scattered southern Illinois locations including Cretaceous Hills Ecological Area (barren) and Burke Branch Research Natural Area.

The Nature Conservancy gave this species a Global Heritage Status Rank of G5 in 1985 (NatureServe 2010). It is presumed extirpated in New York, critically imperiled in Massachusetts, Pennsylvania, and West Virginia, apparently secure in Kentucky, secure in Virginia and North Carolina, and is not ranked or currently under review by New Jersey, Delaware, Maryland, the District of Columbia, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi, Louisiana, Texas, Oklahoma, Kansas, Missouri, Illinois, Indiana, and Michigan.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Rhexia mariana* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Rhexia mariana* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Rhexia mariana* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are

unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Rhexia mariana* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Rhexia mariana* populations within Cretaceous Hills EA. Open sunny barrens benefit *Rhexia mariana* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Rhexia mariana* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species requires.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Rhexia mariana* inhabits.

Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Rhexia mariana* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

58. *Rhododendron prinophyllum* (Early azalea)

Rhododendron prinophyllum is a perennial shrub of portions of southeastern and northeastern United States. It reaches its northwestern range limit in southern Missouri and Illinois where it is occasionally found in dry to dry-mesic upland open woodlands. This species is known from a few scattered southern Illinois locations including Atwood Ridge RNA, Ozark Hill Prairie RNA, LaRue-Pine Hills/Otter Pond RNA (cherty slopes), Opossum Trot Trail BA, and within the Bear Creek area and Big Branch area, both in Jackson County.

The Nature Conservancy gave this species a Global Heritage Status Rank of G5 in 1984 (NatureServe 2010). Threats include habitat loss and fragmentation and forest management practices. It is critically imperiled in North Carolina, vulnerable in New Jersey, Ohio, and Kentucky, apparently secure in West Virginia, secure in Virginia and New York, and is not ranked or currently under review by Maine, New Hampshire, Vermont, Maryland, Rhode Island, Connecticut, Pennsylvania, Tennessee, Alabama, Georgia, Illinois, Missouri, Arkansas, and Texas.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Rhododendron prinophyllum* populations within the LaRue-Pine Hills RNA. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open areas benefit *Rhododendron prinophyllum* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well, or even express itself in its native habitat, in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Rhododendron prinophyllum* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are

unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Rhododendron prinophyllum* populations within their habitats. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. All of the locations that this species occurs at are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Impacts from Alternatives 1 and 3 may come from the eventual aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Rhododendron prinophyllum* populations within the LaRue-Pine Hills/Otter Pond RNA, but may lead to the extirpation of the species in southern Illinois. Open sunny barrens benefit *Rhododendron prinophyllum* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. With Alternative 1, in the long-term, populations of *Rhododendron prinophyllum* may become overshadowed, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Nepalese browntop.

Prescribed fire and herbicide use in Alternative 2 will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat and will help stimulate the suppressed populations. Although fire will certainly benefit this species, more aggressive management, such as herbicide use, may be required to save the barrens community type and habitat that this species requires.

Prescribed fire and non-chemical means of removing exotic species from the barrens communities in Alternative 3 may benefit this species, however, the repetitive nature of these applications, and the low success rate expected of non-chemical use, may mean that not all sites may be treated. These barrens communities must be aggressively managed to remove the invasive species that threaten this community type.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the

spread of invasive plant species into the communities in which *Rhododendron prinophyllum* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Rhododendron prinophyllum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

59. *Rhynchospora glomerata* (Clustered beaksedge)

Rhynchospora glomerata is a caespitose perennial sedge that occurs in the southeastern United States and reaches its northern range limit in southern Illinois. Within its range this sedge is found in wet, sandy soils near bogs, savannahs and meadows (Crow and Helquist 2000).

Threats to this species include the loss of native habitat, exotic species and natural succession. The Nature Conservancy has given this species a Global Heritage Status Rank of G5 (1990). *Rhynchospora glomerata* is possibly extirpated in the District of Columbia, critically imperiled in Illinois and imperiled in Delaware. It is listed as vulnerable in Maryland, apparently secure in North Carolina, and secure in Virginia, Kentucky, and Mississippi. It is currently not ranked or under review in Kansas, Oklahoma, Texas, Arkansas, Louisiana, Tennessee, Alabama, Georgia, Florida, South Carolina, and New Jersey.

This species is known from Johnson and Pope counties in southern Illinois. At Bell Smith Springs Ecological Area in Pope County it occurs along an intermittent stream in wet sandy soil (rocky stream bank). It is known from a second site near Camp Ondessonk in Johnson County. This population was found August 31, 1999 by John Schwegman in the bedrock crevices in the bed of rock-bottomed East Branch of Cedar Creek in a little sandstone gorge.

Environmental Impacts:

The majority of the populations of *Rhynchospora glomerata* occur within the bed of streams and creeks and will not be affected in the short-term by Alternative 1 but in the long-term, over the next 10 years, most may experience negative indirect effects from the continued encroachment of invasive species. In many cases, the lack of prescribed fire will also have negative indirect long-term effects to these species. This species is not located in areas that a prescribed burn would carry into, but the adjacent burned areas would have an influence on the surrounding habitat that this species occupies. *Rhynchospora glomerata* is currently threatened by Nepalese browntop and sericea lespedeza within the creeks that it inhabits. This species cannot compete with the dense matting of the Nepalese browntop and aggressive nature of sericea lespedeza.

Alternative 2 will have beneficial direct and indirect short- and long-term effects on *Rhynchospora glomerata* at Bell Smith Springs, from the use of prescribed fire if the fire actually reaches this species in its habitat or comes close to its habitat. Prescribed burns are not planned in this assessment for the other area that this species occurs in on the Forest. In regards to herbicide use, Alternative 2 will have beneficial direct and indirect short- and long-term effects resulting from the elimination or control of invasive species that compete for the same habitat for this species. Fires may not actually burn the immediate habitat that this species occurs, which is within the creeks, because of little or no fuel available. The fires will burn adjacent areas that will benefit the species by opening up the canopy for more sun to reach the forest floor and by knocking back species such as Japanese honeysuckle. In addition, if this species burns, its response will likely be positive like most grasses and sedges responses to fire.

Alternative 3 will have the same Environmental Impacts to this species as Alternative 1 as it pertains to the continued encroachment of invasive species and lack of herbicide use, and Alternative 2 as it pertains to prescribed burns. Alternative 3 will also have some direct short-term positive effects with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Chinese yam, Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with the vinegar/clove oil as well as with the hot foam method. All of the locations that this species occurs at are not suitable for a truck to transport the hot sugar foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternatives 1 and 3, in the long-term, populations of *Rhynchospora glomerata* outside of natural areas may become over-shaded, suppressed or out-competed by other aggressive woody native species, Nepalese browntop, Chinese yam and invasive plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. Alternative 1-3 will have long-term negative impacts to this species since there will be an inability to prescribe burn the habitat for this species in the Lusk Creek Wilderness Area and other areas across the Forest. Fires generally benefit *Rhynchospora glomerata* as seen with past fires at Simpson Barrens and Fink Sandstone Barrens. The prescribed fire at the sites that it does occur in may also add nutrients back to the microhabitat will help stimulate the suppressed populations.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Rhynchospora glomerata* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails,

roads and cross-country use. Since there should be no negative impacts to *Rhynchospora glomerata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

60. *Rudbeckia fulgida* var. *sullivantii* (Sullivan's coneflower)

Rudbeckia fulgida var. *sullivantii* is a composite perennial species of 9 of the eastern United States (Molano-Flores 2004d). It is documented from moist soil habitats in a few of the eastern Illinois counties that border Indiana. It is known to flower between July and September.

NatureServe (2004) does not list this species but USDA, NRCS (2004) lists it for Illinois, Indiana, Missouri, Arkansas, Michigan, Ohio, New York, Pennsylvania, and West Virginia. The distribution of this species in southern Illinois is not well known although the USDA, NRCS (2004) database lists a collection from Pulaski County.

A stand of *Rudbeckia fulgida* var. *sullivantii* was found in Pope County at Kickasola Cemetery Barrens Ecological Area on October 20, 1993 (memo from John Schwegman to Beth Shimp and Steve Widowski on October 29, 1993) following prescribed fire and tree girdling activities on March 5, 1992 and a spring burn in 1993. The stand was found just west of the seep spring. *Rudbeckia fulgida* has also been found in Bell Smith Springs (mesic upland forest) although it is unclear as to whether this is the variety *sullivantii*.

Environmental Impacts:

Alternative 1 will have negative direct and indirect short-term and long-term impacts on *Rudbeckia fulgida* var. *sullivantii*. Japanese honeysuckle has encroached on much of its surrounding habitat. Without the use of herbicides, this exotic invasive species will certainly outcompete it. In addition, Nepalese browntop has crept into the seep springs and poses a major threat to the populations. Without the removal or spraying of this annual grass, it will also outcompete the species in its rare habitat. These impacts may come from the eventual woody species and aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Rudbeckia fulgida* var. *sullivantii* populations adjacent to the seep springs on the Forest, but may lead to the extirpation of the species in Illinois. Prescribed fire is also required for the community that this species inhabits to help reduce encroaching woody species and stimulate vigor and health.

Alternative 2 will have positive direct and indirect short-term and long-term impacts on this species with the use of prescribed fire and herbicide use. This species is readily identifiable and will be protected while herbicide is used to control the exotics. Seep springs occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs and adjacent woodlands on the Forest are habitat to several native fire-adapted species.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. Prescribed fires have also benefited this species in other areas such as the Coastal Plain Marshes in Michigan (Kost and Penskar 2000). Seep springs occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs on the Forest are habitat to several native fire-adapted species. Following prescribed fire in 1992 in Kickasola Cemetery Barrens, a population of *Rudbeckia fulgida* var. *sullivantii* came up for the first time near the seep during 1993.

A large population of Nepalese browntop found within the Kickasola barrens has reached the seep springs and it is predicted that this aggressive invasive could possibly lead to the demise of this seep spring area. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs and their associated open woodlands benefit *Rudbeckia fulgida* var. *sullivantii* and cannot be achieved without prescribed fire and selective tree and shrub removal.

There may be some negative direct and indirect short-term and long-term impacts for alternative 3 without the use of herbicides but there will be positive direct and indirect short-term and long-term impacts from the use of prescribed fire. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Hydrological disturbances leading to the drying out of these seep springs are a primary threat to this species. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit *Rudbeckia fulgida* var. *sullivantii* and cannot be achieved without prescribed fire and selective tree and shrub removal. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and must be re-treated repeatedly. The location that this species occurs in is not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Rudbeckia fulgida* var. *sullivantii* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to

Rudbeckia fulgida var. *sullivantii* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

61. *Sagittaria australis* (Longbeak arrowhead)

Sagittaria australis is a stoloniferous emergent, perennial herb that is found in the eastern United States and extends north to southern Illinois where it reaches its northwestern range limit. It is found in shallow water or muddy shores of ponds, lakes, and swamps. It generally flowers from July through October. This taxon is more commonly known in Illinois as *Sagittaria longirostra*, though this name has been misapplied to this species.

Threats to this species in southern Illinois include invasion by woody species such as *Acer rubrum*, *Liquidambar styraciflua*, and *Liriodendron tulipifera* into seep springs. Woody species over time reduce the water table of the seep spring, which dries it out and makes it less suitable for herbaceous species. As the woody species increase in size they eventually outcompete and overshadow herbaceous species. The species diversity of the spring will be significantly reduced as the spring is converted to part of the surrounding forest. It is listed as critically imperiled in Illinois, New Jersey, and the District of Columbia, imperiled in Indiana, apparently secure in Delaware, Virginia, Kentucky, and Ohio, and secure in West Virginia. It is currently not ranked or under review in Pennsylvania, North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, and Iowa. The Global Rank of G5 was assigned by The Nature Conservancy in 2000 (NatureServe 2010). Little information is known about the population sizes and trends for this species throughout its range (Danderson 2004e).

Sagittaria australis is known in Illinois only from Pope, Pulaski, and Union counties. It was found in two nearby locations within forested acid gravel seep springs (1967 and 1977) at Cretaceous Hills Ecological Area. The records for the Pulaski and Union county locations are unclear.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. Seep springs occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs on the Forest are habitat to several native fire-adapted species. The two locations of the populations of *Sagittaria australis* at Cretaceous Hills Ecological Area are threatened by hydrological disturbances to the seep, as well as the invasion of exotic species and woody vegetation, which may lead to the demise of this population.

Environmental Impacts:

Alternative 1 will have negative direct and indirect short-term and long-term impacts on *Sagittaria australis*. Japanese honeysuckle has encroached on much of its surrounding habitat. Without the use of herbicides, this exotic invasive species will certainly outcompete it. In

addition, Nepalese browntop has crept into the seep springs and poses a major threat to the populations. Without the removal or spraying of this annual grass, it will also outcompete the species in its rare habitat. These impacts may come from the eventual woody species and aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Sagittaria australis* populations within the seep springs on the Forest, but may lead to the extirpation of the species in Illinois. Prescribed fire is also required for the community that this species inhabits to help reduce encroaching woody species and stimulate vigor and health.

Alternative 2 will have positive direct and indirect short-term and long-term impacts on this species with the use of prescribed fire and herbicide use. This species is readily identifiable and will be protected while herbicide is used to control the exotics. Seep springs occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs on the Forest are habitat to several native fire-adapted species.

There may be some negative direct and indirect short-term and long-term impacts for alternative 3 without the use of herbicides but there will be positive direct and indirect short-term and long-term impacts from the use of prescribed fire. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Hydrological disturbances leading to the drying out of these seep springs are a primary threat to this species. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit *Sagittaria australis* and cannot be achieved without prescribed fire and selective tree and shrub removal. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and must be re-treated repeatedly. The locations that this species occurs in are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Sagittaria australis* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Sagittaria australis* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative

cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

62. *Sanicula smallii* (Small's blacksnakeroot)

Sanicula smallii is a perennial herb with thickened roots that is found from Virginia south to Florida, east to Texas and north to southeast Missouri. This species is found in dry to moist upland forests and in Illinois is known from one unprotected site in Hardin County.

The Nature Conservancy gave this species a Global Heritage Status Rank of G5 in 1986 (NatureServe 2010). It is possibly extirpated in Missouri, critically imperiled in Illinois, imperiled in Indiana, vulnerable in West Virginia and Arkansas, apparently secure in Virginia, secure in Kentucky and North Carolina, and is not ranked or currently under review by Florida, Georgia, South Carolina, Tennessee, Alabama, Louisiana, Mississippi, and Texas.

Environmental Impacts:

Alternative 1 will have negative indirect long-term impacts to *Sanicula smallii* in the areas that will not be treated with herbicides. This species is not fire-dependent but is adapted to fire and would respond well to prescribe burns. Prescribe fires are not planned for locations where this plant is found. The plant communities that this species inhabits are being encroached by maple trees, shrubs, and exotic invasive species. Negative long-term impacts will mostly come from woody species encroachment and invasive species encroachment. Invasive species currently impacting the habitat that this species occurs in include Nepalese browntop, amur honeysuckle, Japanese honeysuckle, multiflora rose, and an overabundance of poison ivy. With time, possibly over the next ten years, this rare species may be outcompeted by the aggressive invasive species and may become extirpated from their previously known locations.

Alternative 2 will have positive direct and indirect short- and long-term impacts to *Sanicula smallii* from the use of herbicide to control aggressive invasive species. Controlling and/or eradicating aggressive invasive species that threaten these species and their community type will greatly enhance the ability of this rare species to compete and persist. Prescribed burning is not planned for known locations of this species but will benefit this species if it does occur at these sites.

Alternative 3 will have the same environmental impacts to *Sanicula smallii* as Alternative 1 as it pertains to invasive species encroachment and Alternatives 1 and 2 as it pertains to prescribe burns. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Sanicula smallii* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Sanicula smallii* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Sanicula smallii* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

63. *Schoenoplectus purshianus* (Weakstalk bulrush)

Schoenoplectus purshianus (= *Scirpus purshianus*) is a coarse, tufted, annual sedge of the eastern United States that fruits from July through October (Cusick 1982). It ranges from Quebec and Ontario in the north down the Atlantic coast to Mississippi, Alabama and Georgia in the south. It primarily occurs along the margins of sand ponds and lakeshores (Gleason and Cronquist 1991) and seep springs. It was only found in 4 counties within Illinois, one being on the Forest.

The Nature Conservancy has given this species a Global Heritage Status Rank of G4G5 in 1984. It is listed as critically imperiled in Illinois, Indiana, Missouri, District of Columbia, and Ontario and Quebec, Canada, imperiled in Vermont and Delaware, and vulnerable in Mississippi, New Jersey, West Virginia, Ohio, New York, and Maryland (NatureServe 2010). According to Dolan (2003) the primary threats to this species are generic threats to wetlands including drainage and manipulation of hydrology.

Schoenoplectus purshianus has been recently reported colonizing man-made ponds and temporary ponds in agricultural fields and is believed to be expanding its range westward (Yatskievych 1999 and McClain *et al.* 1997 in Dolan 2003). According to Cusick (1982) the recovery potential of this species is good due to its preference for disturbed habitats.

It has been collected in at least 3 other counties in northern and central Illinois. This species was found in 1952 in southern Illinois on a sandy beach at Lake Glendale, Pope County, but has not been relocated during searches since 1977 and it is feared extirpated in southern Illinois.

Environmental Impacts:

There should be no impacts from Alternative 1 to this species. If there are impacts, they may be negative long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Schoenoplectus purshianus* populations within the Forest. The open sandy beach at Lake Glendale benefits *Schoenoplectus purshianus*.

Alternative 2 is also expected to have no impacts to this species. If there are impacts, they would be positive indirect short-term and long-term impacts on *Schoenoplectus purshianus* through integrated pest management.

Alternative 3 is also expected to have no impacts to this species. If there are impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of the *Schoenoplectus purshianus* population within its habitat. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the community in which *Schoenoplectus purshianus* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads, cross-country use, and beach use. Since there should be no negative impacts to *Schoenoplectus purshianus* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

64. *Silene ovata* (Blue Ridge catchfly)

Silene ovata is multi-stemmed perennial, which is rare and locally found in rich woods ranging from western North Carolina and southeastern Kentucky to the uplands of Georgia, Alabama and Arkansas. It is known from rich woods at seven locations within Hardin County in southern Illinois.

Threats to *Silene ovata* include logging, clear-cutting, land-use conversion, and habitat fragmentation (Hill 2003g). *Silene ovata* is not an aggressive species and competition from exotic species can be a threat to the few populations in Illinois (Hill 2003g). Increased recreational use in the vicinity of populations of southern Illinois cause the greatest threat, especially at the Sturgeon Hill populations (Basinger 1998). User-created equestrian trails go through populations causing trampling, browsing, destruction of rootstalk, and removal of the thin-soil layers (Basinger 1998). The Global Rank of G3 was assigned by The Nature Conservancy in 2004. This species is known from 11 states and is listed as critically imperiled in Illinois, Indiana, Kentucky, Virginia, Mississippi, and Georgia, imperiled in Tennessee and Alabama, and vulnerable in Arkansas and North Carolina. It is presumed extirpated in South Carolina (NatureServe 2010).

Silene ovata is known in Illinois only from Hardin County. Three of the 6 areas occur on unprotected Forest Service managed lands, and two protected sites occur in Panther Hollow and Barker Bluff Research Natural Areas. Two areas occur on private property (one population occurs both on unprotected Forest Service land and on adjacent private property). The habitat for this species on the Forest has been in relatively undisturbed (high quality) dry, dry-mesic and mesic upland forests dominated by sugar maple and oak-hickory species as well as an adjoining sandstone cliff community with the exception of user-developed equestrian trails (Hill 2003g). Communities are consistently on often rocky, moderate to steep slopes with cliffs and slideblocks common (Basinger 1998). *Silene ovata* is so rare in Illinois that an emphasis should be to locate and protect all remaining populations (Hill 2003g).

Environmental Impacts:

Alternative 1 will have negative indirect long-term impacts to *Silene ovata* in the areas that will not be treated with herbicides. This species is not fire-dependent but is adapted to fire and would respond well to prescribe burns. Prescribe fires are not planned for locations where this plant is found. The plant communities that this species inhabits are being encroached by maple trees, shrubs, and exotic invasive species. Negative long-term impacts will mostly come from woody species encroachment and invasive species encroachment. Invasive species currently impacting the habitat that this species occurs in include Nepalese browntop, amur honeysuckle, Japanese honeysuckle, multiflora rose, and an overabundance of poison ivy. With time, possibly over the next ten years, this rare species may be outcompeted by the aggressive invasive species and may become extirpated from their previously known locations.

Alternative 2 will have positive direct and indirect short- and long-term impacts to *Silene ovata* from the use of herbicide to control aggressive invasive species. Controlling and/or eradicating aggressive invasive species that threaten these species and their community type will greatly enhance the ability of this rare species to compete and persist. Prescribed burning is not planned for known locations of this species but will benefit this species if it does occur at these sites.

Alternative 3 will have the same environmental impacts to *Silene ovata* as Alternative 1 as it pertains to invasive species encroachment and Alternatives 1 and 2 as it pertains to prescribe burns. Alternative 3 will also have direct short-term positive impacts with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the

appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with vinegar/clove oil as well as with the hot foam method. The hot foam method will not likely be used where the *Silene ovata* occurs since locations are inaccessible to vehicles that would be necessary to carry the hot sugary mixture.

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Silene ovata* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Silene ovata* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

65. *Silphium pinnatifidum* (Tansy rosinweed)

Silphium pinnatifidum is a perennial herb that is limited to Illinois, Indiana, Kentucky, Tennessee, Georgia, and Alabama. It is typically found in open woods, barrens, and prairies, often on calcareous substrates. It generally flowers from July through September.

Threats to this species include fire suppression and succession of woody vegetation into open habitats, conversion of remnant prairies and barrens for development, herbicide use on roadsides, invasion by exotic plant species, and quarries for limestone (NatureServe 2004; Molano-Flores 2004a). It is listed as vulnerable in Georgia and Kentucky, critically imperiled in Alabama, and imperiled in Tennessee. It is currently not ranked or under review in Indiana. The database for NatureServe does not list this species for Illinois, however, the PLANTS database (USDA/NRCS 2010) does. The Global Rank assigned by The Nature Conservancy in 2000 is a G3Q (NatureServe 2010).

Silphium pinnatifidum is known in Illinois only from Hardin County. It occurs in an open, rocky, dry upland forest at Keeling Hill South Ecological Area. Some controversy still exists as to the presence of this species in Illinois. However, there are two specimens at the Hidden Springs Ranger Station that fit the description of *Silphium pinnatifidum* that were collected by Dr. Lawrence Stritch (#2597, 15 June 1991; #4199, 30 September 1992). These discoveries were made following prescribed fires in the fall of 1989 and April 2, 1991. A suggestion has been made that the 1991 collection may, in fact, be *Silphium terebinthinaceum* that is showing

past introgression with *S. laciniatum*. Such specimens occur at the nearby Land Between the Lakes in Kentucky and Tennessee. Further study of this population is needed (personal communication between Mark Basinger and Beth Shimp on May 2, 1997).

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Silphium pinnatifidum* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Silphium pinnatifidum* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Silphium pinnatifidum* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. The effects of fire are known to have positive effects on this species and its habitat on the Forest. Keeling Hill South Ecological Area has had two prescribed fires and this species appeared and has persisted as have other rare species.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Silphium pinnatifidum* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. The location that this species occurs at is not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The

burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Silphium pinnatifidum* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Silphium pinnatifidum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

66. *Silphium trifoliatum* (Whorled rosinweed)

Silphium trifoliatum is a perennial herb that occurs in prairies, glades, barrens and savannas of the eastern United States less Florida and the New England states. It reaches its northwestern range limit in a single location at a limestone glade in Hardin County in southern Illinois. This species was first discovered in Illinois in 1986 (Olson 1989) but has not been observed since, however, suitable habitat exists throughout the Lesser Shawnee Hills Subsection.

Threats to this species include fire suppression and succession of woody vegetation into open habitats, conversion of remnant prairies and barrens for development, herbicide use on roadsides, invasion by exotic plant species, and quarries for limestone. The Global Rank assigned by The Nature Conservancy in 1994 is a G4?. It is listed as critically imperiled in the District of Columbia and vulnerable in Tennessee, North Carolina, and Maryland. It is apparently secure in Virginia, West Virginia, and Mississippi, and secure in Kentucky. It is currently not ranked or under review in Michigan, New York, Pennsylvania, Ohio, Indiana, South Carolina, Georgia, Alabama, and Louisiana. NatureServe does not have this species listed for Illinois (NatureServe 2010), however, the PLANTS database does (USDA/NRCS 2010).

Silphium trifoliatum is known in Illinois only Barker Bluff Research Natural Area in Hardin County. Four stems of this species occurred near the edge of dry upland forest in a somewhat shaded site, but an open limestone glade habitat was less than 10 m away (Olson 1989). Some controversy still exists as to the presence of this species in Illinois. However, there is a specimen at the Illinois Natural History Survey herbarium with the description of *Silphium trifoliatum* that was collected by Steven Olson (#444, 25 September 1986). Further study is required to determine if this species still occurs in southern Illinois (Molano-Flores 2004B).

This area, Barker Bluff Research Natural Area, is protected for its unique and rare limestone glade/dry upland forest community, which is listed as critically imperiled globally. The Barker Bluff limestone glade/dry upland forest complex is the largest of high quality in the Shawnee Hills of southern Illinois (Hutchison, Olson and Harris 1988). Barker Bluff Research Natural Area has had fire suppression for numerous decades and evidence of the glades diminishing are

strongly evident. Losing this unique and rare community type to succession would be scientifically and educationally irreplaceable. Selective tree and shrub removal with prescribed fires for maintenance would help bring back the rare limestone glade species that inhabit this unique area.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Silphium trifoliatum* populations within the prairie/barrens areas on the Forest, but may lead to the extirpation of the species in Illinois. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Silphium trifoliatum* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Silphium trifoliatum* through prescribed burning and integrated pest management. This species is readily identifiable and can be easily avoided during the use of herbicides. The effects of fire are known to have positive effects on this species and its habitat on the Forest. Keeling Hill South Ecological Area has had two prescribed fires and this species appeared and has persisted as have other rare species.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Silphium trifoliatum* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to these populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. The location that this species occurs at is not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private

properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Silphium trifoliatum* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Silphium trifoliatum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

67. *Stenanthium gramineum* (Eastern featherbells)

Stenanthium gramineum is a bulbous perennial herb that occurs in moist woods, floodplains, meadows, and streambanks from Texas east to Florida north to Pennsylvania, Michigan, and Illinois. It is scattered in the southern ½ of Illinois where it occurs in mesic floodplain forest and upland forests. In southern Illinois it is historically known from Gallatin, Jackson, Johnson, Massac, Pope, Pulaski, and Union counties. It is historically known from 13 counties in Illinois but is determined to be extant with 8 remaining populations in only 7 counties (Phillippe 2004d). Populations known to occur on Shawnee National Forest managed lands are 1 population in each of Gallatin and Johnson counties and 2 in Pope County (Phillippe 2004d).

Stenanthium gramineum is widespread but infrequent throughout its range. The Nature Conservancy assigned this species the rank of G4G5 in 1995. It is critically imperiled in Illinois, Indiana, Oklahoma, Mississippi, Pennsylvania, and Maryland, is imperiled in Ohio and Kentucky, and is listed as vulnerable in North Carolina, West Virginia, Arkansas and Louisiana. It is apparently secure in Virginia, however it is extirpated from the District of Columbia. It is currently not ranked or under review in Texas, Alabama, Georgia, Florida, South Carolina, Tennessee, and Missouri. Michigan lists it as an exotic (NatureServe 2010). Primary threats in Illinois include creek bank erosion, road construction, and trampling by equestrian use (Edgin 2002).

It is documented from rich mesic floodplains on the Forest. It is known from an unprotected area in a gravel wash in an intermittent stream in Gallatin County (horse trail going through colony), along the edge of a pond in Jackson County (not relocated in 2002), a gravel wash area in Ferne Clyffe State Park (not relocated in 2002), at Grantsburg Swamp in Johnson County, at Mermet Lake in Massac County (not relocated in 2002 and feared extirpated) (Edgin 2002), near Bay Creek, and in a mesic forest at Burke Branch Research Natural Area in Pope County, and a floodplain forest in Pulaski County.

Environmental Impacts:

The populations of *Stenanthium gramineum* occur along the streambanks and creeks and will not be affected in the short-term by Alternative 1 but in the long-term, over the next 10 years, populations may experience negative indirect effects from the continued encroachment of invasive species. At Burke Branch, the lack of prescribed fire will also have negative indirect long-term effects to these species. Many of these species are not located in areas that a prescribed burn would carry into, but the adjacent burned areas would have an influence on the habitat that these species occupy. *Stenanthium gramineum* is currently threatened by Nepalese browntop and Chinese Yam along the creeks that it inhabits. This species cannot compete with the dense matting of the Nepalese browntop and Chinese Yam.

Alternative 2 would have beneficial direct and indirect short- and long-term effects on *Stenanthium gramineum* at Burke Branch from the use of prescribed fire if the fire actually reaches this species in its habitat. Fire is proposed at Burke Branch in a separate EA. Otherwise, prescribed burns are not planned in this assessment for the *Stenanthium gramineum* populations. In regards to herbicide use, Alternative 2 will have beneficial direct and indirect short- and long-term effects resulting from the elimination or control of invasive species that compete for the same habitat for this species.

Alternative 3 will have the same Environmental Impacts to this species as Alternative 1 as it pertains to the continued encroachment of invasive species and lack of herbicide use, and Alternative 2 as it pertains to prescribed burns. Alternative 3 will also have some direct short-term positive effects with the use of vinegar/clove oil, which may be able to help control the Nepalese browntop if applied at the appropriate time of the growing season, however, this substance will be virtually ineffective in the long-term to Chinese yam, Japanese honeysuckle and other woody and perennial species. Resprouting of perennial plants is expected with the vinegar/clove oil as well as with the hot foam method. The hot sugar foam method will not likely be used at these two sites since there are no trails or roads nearby to bring the proper equipment in.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. With Alternatives 1 and 3, in the long-term, populations of *Stenanthium gramineum* outside of natural areas may become over-shaded, suppressed or out-competed by other aggressive woody native species, Nepalese browntop, Chinese yam and invasive plant species. Alternative 1-3 will have long-term negative impacts to this species since there will be an inability to prescribe burn the habitat for this species at its known locations, however Burke Branch is proposed for prescribed fire in a separate EA. Fires generally benefit *Stenanthium gramineum* as seen with past fires at Burke Branch. The prescribed fire may also add nutrients back to the microhabitat and would help stimulate the populations.

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive

species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Stenanthium gramineum* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Stenanthium gramineum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

68. *Styrax grandifolius* (Bigleaf snowbell)

Styrax grandifolius is a shrub or small tree to nine meters tall that occurs in the southeastern United States. It occurs in dry to mesic upland forest. It generally flowers in April and May.

Threats to this species include lack of genetic variability at the edge of the species range, inability to adapt to climatic or environmental change, land-use conversion, and habitat fragmentation. It is listed as vulnerable in Virginia, critically imperiled in Illinois and Indiana, and presumed extirpated in Ohio. It is apparently secure in North Carolina and not ranked or under review in Texas, Arkansas, Louisiana, Mississippi, Alabama, Tennessee, Georgia, South Carolina, and Florida. The Global Rank assigned by The Nature Conservancy in 1985 is G5 representing its wide distribution in southeastern United States (NatureServe 2010).

Styrax grandifolius is known in Illinois only from Alexander County. It is found in a rich, rocky, mesic upland woods at Wolf Creek Botanical Area. This site represents the northern range limit for this species and is a disjunct location north and west from the species normal range. This site is heavily shaded, flowering rarely occurs, and most reproduction is asexual.

Environmental Impacts:

Alternative 1 may have negative indirect long-term impacts in regards to not using herbicide. Multiflora rose is a continuous problem at this site and difficult to pull up without it resprouting.

Alternative 2 will have positive direct and indirect impacts on this species with the use of herbicides. Eliminating or controlling aggressive invasive species will allow this species a competitive edge for perpetuation.

Styrax grandifolius may be injured by fire and is not recommended. Flowering potential may be more a response to previous winters freezing conditions than to other factors. This species will flower in the presence of shade but may wane with competition from other woody species and exotic species. Flowering potential was documented in earlier observations (Schwegman 1992a).

Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. The rich woods that this species occurs in is also habitat to the Kentucky Yellowwood (*Cladastris lutea*). Although the effects of fire may be harmful to this species, populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires pummeled the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The Wolf Creek Botanical Area in Alexander County was no exception.

None of the activities proposed in all alternatives will negatively impact this species on Forest land. Fire will not be prescribed in the locations that this species occurs in at Wolf Creek Botanical Area. Selective tree and shrub removal will aid in more sunlight reaching the forest floor, although this may not be necessary immediately. Most beneficial would be the removal or girdling of sassafras and flowering dogwood, which are competing with this species in its habitat. The removal of threatening Japanese honeysuckle and Multiflora rose is also highly desirable in this location. A considerable amount of the Multiflora rose was hand-pulled during 1987 (Schwegman 1992a).

Cumulative Impacts:

In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Styrax grandifolius* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Styrax grandifolius* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

69. *Synandra hispidula* (Guyandotte beauty)

Synandra hispidula is a biennial mint (herb) occurring in a few of the southeastern states. It reaches its northwestern range limit in southern Illinois in rich mesic forests in

Jackson and Williamson counties. This species generally grows in a restricted habitat of dense shade, often in cool, moist places, usually at the bases of deep, wooded ravines. Its thin shallow root system is found immediately below the detritus layer of thick leaf litter.

Range-wide, threats to *Synandra hispidula* include land-use conversion, habitat fragmentation, and forest management practices. The Global Rank assigned by The Nature Conservancy in 1988 is G4. It is known from only 10 states. It is possibly extirpated in North Carolina, critically imperiled in Illinois and Alabama, imperiled in West Virginia, Virginia, and Tennessee, and vulnerable in Indiana. It is apparently secure in Kentucky. It is currently not ranked or under review in New Jersey and Ohio (NatureServe 2010).

In Illinois, it is known in Jackson County from a State Park and from private land (listed as Fern Rocks Nature Preserve and Devil's Den) and in Williamson County from US Fish & Wildlife managed land. Sites managed by Forest Service include the unprotected sites north of the Natural Bridge and two other sites in the Cave Valley/Cedar Creek area (near Silvey Pond) within Jackson County. Site descriptions at Cave Valley/Cedar Creek seem to indicate that this species tends to prefer the upper reaches of stream terraces with generally a northern aspect. Management recommendations include isolation from trail construction, not allowing trampling to occur, no removal of the canopy layer, no logging (selective or clearcut), and no alteration of deer populations in the areas where *Synandra hispidula* occur (Moran 1986). Deer may act as dispersal agents most likely evolving with this species; plants are often observed browsed by deer and research has shown that the seed germinate readily upon artificial scarification (Moran 1986).

Environmental Impacts:

Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned at some point. The rich woods that this species occurs in does not generally require fire nor does an open canopy necessarily benefit this species. Although the effects of fire may be detrimental to this species, populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires pummeled the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations and other rare species perpetuated enduring the harsh conditions. The Cave Valley/Cedar Creek area in Jackson County was no exception.

None of the activities proposed in alternatives 1-3 will negatively impact this species on the Forest. Fire is not prescribed in the locations that this species occurs in on Forest Service managed lands. Selective tree and shrub removal will only be used when competition threatens the populations but that may not be necessary since this species

flourishes in deep rich shaded areas of the forest. The removal of threatening Japanese honeysuckle is desirable at these locations and other encroaching species such as Nepalese browntop and Chinese Yam. Hand removal is preferred over herbicides. The use of herbicides in Alternative 2 will be done with care to protect this species. The vinegar/clove oil method may help kill or damage many annuals but will be virtually ineffective on perennials. The hot sugar foam method will not likely be used since there are no roads or trails near the populations to take the equipment to.

Cumulative Impacts:

Cumulative Impacts are similar to Environmental Impacts to this species. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Synandra hispidula* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Synandra hispidula* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

70. *Thelypteris noveboracensis* (New York fern)

Thelypteris noveboracensis is a delicate, perennial, deciduous-leaved fern that grows from branching rhizomes. It is known primarily from the eastern United States and adjacent Canada. It is found in mixed conifer-hardwood forests, seep springs, swamp margins, sandstone cliffs, and roadsides. Mature spores are formed from June through September.

Threats to this species include natural succession and invasion of seep springs by woody species that reduces the diversity of herbaceous species (over shading and competition). It is listed as vulnerable in Arkansas and New Foundland, Canada and critically imperiled in Illinois and Louisiana. It is listed as apparently secure in Ontario and Quebec, Canada and secure in New Brunswick, Prince Edward Island, and Nova Scotia, Canada, New York, Virginia, West Virginia, North Carolina, and Kentucky. It is currently not ranked or under review in Maine, New Hampshire, Vermont, Maryland, Maine, Rhode Island, Massachusetts, Pennsylvania, Ohio, Indiana, Michigan, Tennessee, South Carolina, Georgia, Alabama, Mississippi, and Oklahoma. The Global Rank assigned by The Nature Conservancy in 1984 is G5 (NatureServe 2010).

Thelypteris noveboracensis was historically known from 5 scattered counties in Illinois in fens and moist sandy areas, but is now only known from a single location in southern Illinois within

Pope County. This species was originally documented in the damp sandy seep spring in the woods at Cretaceous Hills Ecological Area (mesic upland forest) on June 27, 1967 by John Schwegman (collection #82); a later description of the site states that it was located in a forested area adjacent to a seep spring at Cretaceous Hills Ecological Area. It was last collected in 1982 by Schwegman, and observed on May 30, 2007 by Schwegman, Martha Schwegman, and Elizabeth Longo Shimp.

Environmental Impacts:

Alternative 1 will have negative direct and indirect short-term and long-term impacts on *Thelypteris noveboracensis*. Japanese honeysuckle has encroached on much of its surrounding habitat. Without the use of herbicides, this exotic invasive species will certainly outcompete it. In addition, Nepalese browntop has crept into the seep springs and poses a major threat to the populations. Without the removal or spraying of this annual grass, it will also outcompete the species in its rare habitat. These impacts may come from the eventual woody species and aggressive native and exotic species encroachment, which may not only cause a reduction in health and vigor of *Thelypteris noveboracensis* populations within the seep springs on the Forest, but may lead to the extirpation of the species in Illinois. Prescribed fire is also required for the community that this species inhabits to help reduce encroaching woody species and stimulate vigor and health.

Alternative 2 will have positive direct and indirect short-term and long-term impacts on this species with the use of prescribed fire and herbicide use. This species is readily identifiable and will be protected while herbicide is used to control the exotics. Seep springs occur adjacent to fire-dependent communities and, likely, burned periodically. The seep springs on the Forest are habitat to several native fire-adapted species.

The effects of fire are known to have positive effects on rhizomatous species by reducing their competitors. Prescribed fires have occurred in the Cretaceous Hills adjacent to the seep spring areas. Although there is little information regarding the effects of fire on this species, it is presumed that this species will respond in a positive manner as other rhizomatous species do.

There may be some negative direct and indirect short-term and long-term impacts for alternative 3 without the use of herbicides but there will be positive direct and indirect short-term and long-term impacts from the use of prescribed fire. In particular, Japanese honeysuckle and Nepalese browntop may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Hydrological disturbances leading to the drying out of these seep springs are a primary threat to this species. Many of the seep springs have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny seep springs benefit *Thelypteris noveboracensis* and cannot be achieved without prescribed fire and selective tree and shrub removal. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are

expected to resprout and must be re-treated repeatedly. The locations that this species occurs in are not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Thelypteris noveboracensis* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking and equestrian use where this species occurs. Since there should be no negative impacts to *Thelypteris noveboracensis* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

71. *Trichomanes boschianum* (Appalachian bristle fern)

Trichomanes boschianum is a perennial fern occurring in the southeastern United States. This species occurs in moist, humid crevices of sandstone overhangs and rockhouses where temperature and moisture are typically constant year round. This species is limited to the Greater Shawnee Hills Section of the Shawnee Hills Division. Habitat for *Trichomanes boschianum* consists of slightly acidic rock outcrops with full shade and a constantly moist environment where the species is often found hanging from rock ceilings (Hill 2003h). In the Shawnee, this species is found along some sandstone overhangs in the Shawnee Hills that match its strict habitat requirements (Hill 2003h).

According to NatureServe (2010), the primary threat to this species is its limited distribution. Plants are also very sensitive to drought and have been damaged by over-collection, recreational activities including camping, illegal artifact hunting and rock climbing (Hill 2003h). The Nature Conservancy ranked this species G4 in 1986. The Conservation Status of this species, which is only known from 13 states, is critically imperiled in Indiana, Ohio, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Tennessee, and Mississippi, imperiled in Illinois and Arkansas, and vulnerable in Alabama and Kentucky (NatureServe 2010). This species is listed as endangered in Illinois and it also a Regional Forester's Sensitive Species. Trends for *Trichomanes boschianum* are thought to be declining throughout much of its range (Hill 2003h)

Populations in Illinois have been documented from sites in Gallatin (3), Hardin (1), Johnson (7), Pope (5) and Union (1) counties (Hill 2003h). It was relocated at 16 of its 23 original locations and additionally found at 2 new sites near former locations (Schwegman 1999). Areas that were relocated on Forest lands were Bell Smith Springs (north-facing sandstone shelter), Double Branch Hole (north-facing sandstone cliff), Jackson Hollow (first discovered by Mary Steagall on August 2, 1932, collection #37), and Sand Ecological Areas, and Brown's Hole Zoological Area. Seven of the former locations are sites where the populations are feared extirpated.

Environmental Impacts:

Alternatives 1, 2 and 3 should have no impacts to *Trichomanes boschianum* since they occur in moist crevices beneath bluff overhangs. Vines such as Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species in the long-term, however, they do not seem to be a problem at the current time.

There has been little research on the effects of burning for this species and there was no conclusive research that showed any beneficial or detrimental effects (Hill 2003h). Management to protect this species would include: moving trails that were close to populations, closing sensitive areas to camping and climbing, and monitoring the survival and population dynamics of known populations (Hill 2003h).

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. In the long-term, populations of *Trichomanes boschianum* could possibly become suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper. Trails and roadways (and a hog pen in one case) may be detrimental to this species by disrupting the microhabitat in making it drier. Vegetation near the overhangs appear to help protect the populations during harsh winter conditions.

Cumulative Impacts are similar to Environmental Impacts to this species. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Trichomanes boschianum* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads and cross-country use. Since there should be no negative impacts to *Trichomanes boschianum* resulting from prescribed fire and herbicide use in the proposed project, there will be no

cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

72. *Trifolium reflexum* (Buffalo clover)

Trifolium reflexum is an annual or biennial clover that is found in the eastern and central United States and adjacent Canada. It is typically found in open upland forests and prairies. It generally flowers from May through July.

Threats to this species include fire suppression of open woodlands and prairies, habitat destruction for agriculture and development, and invasion of non-native species. It is listed as presumed extirpated in Ontario, Canada, Pennsylvania, New Jersey, and the District of Columbia, possibly extirpated in Maryland, critically imperiled in Illinois, Kentucky, Nebraska, North Carolina, Ohio, Tennessee, West Virginia, and Virginia, imperiled in Kansas, and vulnerable in Missouri. This species is not ranked or is currently under review in Indiana, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Oklahoma, Texas, and Indiana. Iowa lists it as an exotic. The Global Rank assigned by The Nature Conservancy in 2004 is a G3G4 (NatureServe 2010). The decline of this and other native clovers may be attributed to habitat destruction, poor dispersal to new habitat, loss of a natural grazing regime (buffalo), competition from exotic plant species, and reduced fire frequency (Campbell *et al.* 1988).

Trifolium reflexum was once scattered throughout Illinois in dry-mesic savannas, upland forests, prairies, and flatwoods. It is now nearly extirpated in the state and occurs in less than half of the counties that it did historically. In southern Illinois it is known from extant populations in Jackson and Johnson counties. There is an unconfirmed report of this species from Gallatin County. It is known from a rocky, dry-mesic upland forest adjacent to limestone barrens at Simpson Township Barrens Ecological Area in Johnson County (collection by Elizabeth Longo Shimp, July 1996) and at Little Grand Canyon/Horseshoe Bluff Ecological Area (discovered by David King and collected by Jody Shimp in 1996, collection #5290) in Jackson County.

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Trifolium reflexum* populations within the prairie/barrens areas on the Forest. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Trifolium reflexum* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Trifolium reflexum* through herbicide use. This species is readily identifiable and can be easily avoided during the use of herbicides. The effects of fire are known to have positive effects on this species and its habitat on the Forest. Simpson Barrens Ecological Area has had previous prescribed fires and this species appeared and has persisted as have other rare species.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Trifolium reflexum* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Prescribed fire will contribute to positive direct and indirect short-term and long-term impacts to unknown populations by stimulating native species and helping reduce the competition of invasive species. It will also stimulate this species, if its present, as it is dependent on fire-disturbance. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. The location that this species occurs at is not suitable for a truck to transport the hot foam to, so this method will not be able to be used.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Trifolium reflexum* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Trifolium reflexum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

73. *Vaccinium stamineum* (Deerberry)

Vaccinium stamineum is a deciduous shrub occurring in the eastern United States and adjacent Canada. It is found in dry open rocky forests, thickets, and clearings in acidic,

often nutrient poor soils (Hill 2002b). It spreads vegetatively through rhizomes making it hard to determine how many individuals are actually in a population (Hill 2002b). The northern extent of its range is reached in southern Illinois.

The Nature Conservancy assigned this species the Global Heritage Status Rank of G5 in 1984. It is critically imperiled in Kansas, Vermont, and Ontario, Canada and secure in New Jersey, Delaware, Virginia, North Carolina, West Virginia, Kentucky, and Missouri. It is currently not ranked or under review in Maine, Massachusetts, Rhode Island, Connecticut, Maryland, the District of Columbia, Pennsylvania, Ohio, Indiana, South Carolina, Georgia, Tennessee, Alabama, Florida, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas. NatureServe (2010) erroneously lists this species as presumed extirpated.

Within the last few years, the state of Illinois delisted this species because it was presumed extirpated from the state but a very small population was found in 1998 near Kaskaskia woods within the Shawnee National Forest in Hardin County (found by Raymond G. Smith on May 12, 1998). It is unclear what the primary threats to this species are but the population that was located in 1998 was found adjacent to a gravel roadway on a low ridge. The first original site in Illinois, Hayes Creek Canyon (in Double Branch Hole Ecological Area on a south-facing sandstone ledge, found in 1962 by Robert H. Mohlenbrock), Pope County, has not been relocated since 1977 but collection information described the site as being a sandstone bluff top. When not in flower, this species could be confused with *Vaccinium arboreum* or *Vaccinium pallidum*.

With its thick rhizomes *Vaccinium stamineum* is very fire resistant and can form large thickets from resprouts. In most of its range, this species is not threatened but at its margins, such as southern Illinois, ecological conditions are marginal for its existence (Hill 2002b).

Environmental Impacts:

There may be some negative indirect long-term impacts resulting from Alternative 1. These impacts may come from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Vaccinium stamineum* populations within the prairie/barrens areas on the Forest. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Many of the barrens communities have already become invaded by exotic species and these rare community types will be lost from the Forest forever if intensive management is not implemented. Open sunny barrens benefit *Vaccinium stamineum* and cannot be achieved without prescribed fire and will be more beneficial if herbicide use could be implemented. This species is a fire-dependent species and does not do well in the absence of fire disturbance.

Alternative 2 is expected to have positive direct and indirect short-term and long-term impacts on *Vaccinium stamineum* through herbicide use. This species is readily identifiable and can be easily avoided during the use of herbicides. The areas that this species occurs in are not

scheduled in this assessment for prescribed burning, therefore, there will be no impacts from the burns.

Alternative 3 is expected to have negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause further reduction in health and vigor of *Vaccinium stamineum* populations within their habitats. In particular, Japanese honeysuckle may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated. The location that this species occurs at is not suitable for a truck to transport the hot foam to, so this method will not be able to be used. These effects may come from the eventual woody species exotic species encroachment, which may cause a reduction in health and vigor of *Vaccinium stamineum* populations within the natural area (Double Branch Hole Ecological Area) and outside of the natural area (near Kaskaskia Woods). The site outside of the natural area may become invaded with other native woody species as well as exotic species. The rare barrens community types, such as these, will succumb to successional species if intensive management is not implemented. Open sunny barrens benefit *Vaccinium stamineum* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exception of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial impacts to this species by reducing (although to a very small degree) the spread of invasive plant species into the communities in which *Trifolium reflexum* inhabits. Dispersed recreational use will still have some slight indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through hiking where this species occurs. Since there should be no negative impacts to *Trifolium reflexum* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of very slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

74. *Vitis rupestris* (Sand grape)

Vitis rupestris is a perennial low, bushy grape vine that rarely climbs and is typically found on gravel outcrops or sand embankments within creekbeds (Morano and Walker 1995). Research investigating the soils and habitats associated with 3 *Vitis* species by Morano and Walker (1995) found that this species was positively associated with water and a high percentage of soil gravel. Fruit can be present from April through June in much of its range (NatureServe 2004). This species ranges from Pennsylvania west to Missouri and Oklahoma, south to North Carolina, Tennessee, Arkansas, and Texas (Gleason and Cronquist 1991).

According to NatureServe (2010) the primary threats to this species are changes in the natural flood cycles, succession, pollution, siltation and damage from recreational uses. Grazing is also believed to be responsible for *Vitis rupestris*' disappearance from central and southern Texas (Morano and Walker 1995). Management for this species should include maintaining the natural hydrologic cycle and the removal of exotic/invasive species (NatureServe 2010). This species has been reported to hybridize with other *Vitis* species if they occupy the same habitats (NatureServe 2010). The Nature Conservancy ranked this species G3 in 2001. The Conservation Status of this species is critically imperiled in Indiana, Texas, Tennessee, Virginia, Pennsylvania, Maryland, and the District of Columbia, imperiled in Illinois, West Virginia and Kentucky, and vulnerable in Missouri. This species is listed as not ranked or is under review in Oklahoma and Arkansas and is listed as an exotic for California. Trends for *Vitis rupestris* are listed as declining throughout much of its range, however, populations in the Ozarks appear to be stable (NatureServe 2010).

In southern Illinois, it is known to occur on the rocky banks of the Mississippi River and in the River's floodplain forests. It is known from Jackson County and within the LaRue-Pine Hills/Otter Pond Research Natural Area in Union County.

Hydrological disturbances leading to the drying out of swamps and the adjacent wetlands and bottomland hardwoods are a primary threat to this species; the majority of former swamplands and wetlands in southern Illinois have already been converted to crop fields or developed sites. Many of the swamps and wetlands have already disappeared or are becoming invaded by exotic species and these rare community types will be lost from the Forest if care is not taken in perpetuating these areas. Moderately open canopy areas within and adjacent to the LaRue swamp benefit *Vitis rupestris*. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

Environmental Impacts:

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The cypress swamps in southern Illinois occur adjacent to fire-dependent communities and, likely, burned periodically. The swamps and flatwoods on the Forest are habitat to several native fire-adapted species. As seen with other rare species the effects of fire are not well studied but the populations have persisted following extensive wildfires between 1952 and 1955. According to former Forest Service employee Carl Joe Frick, intense wildfires swept the west side of the Forest during the 1950's to the point of some areas giving the appearance of clearcuts across the Jonesboro Ranger District (personal communication with Elizabeth Shimp during 1991 and

August 25, 2004). Dry conditions and fuel buildup (since the suppression of wildfires directed by the State of Illinois at the turn of the century) provided wildfires with raging opportunities across federal and private lands alike. Fires burned annually with great intensity, yet these populations perpetuated and endured the harsh conditions. The swamps of LaRue-Pine Hills/Otter Pond burned as well as the Shortleaf Pine-Oak woodlands on the steep ridges and bluffs. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species.

There should be no impacts from Alternative 1 to this species. If there are impacts, they may be negative long-term impacts resulting from aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Vitis rupestris* populations within the Forest.

Alternative 2 is also expected to have no impacts to this species. If there are impacts, they would be positive indirect short-term and long-term impacts on *Vitis rupestris* through integrated pest management.

Alternative 3 is also expected to have no impacts to this species. If there are impacts, they would be negative indirect long-term impacts if aggressive exotic and invasive plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. This pertains to the eventual exotic species encroachment, which may cause a reduction in health and vigor of the *Vitis rupestris* populations within its habitat. The use of the clove oil/vinegar will mostly kill or damage annuals but may be futile in the effort to kill perennial invasive species. Re-application of this treatment is expected and will take resources away from other sites requiring invasive species control. The hot sugar-foam method is also very limited in that it will also kill or damage annuals but perennials are expected to resprout and be re-treated.

Cumulative Impacts:

Cumulative Impacts for all alternatives would be comparable to the Environmental Impacts. In all alternatives, prescribed burns that otherwise take place on the Forest and on private properties, will contribute to some beneficial effects to the unburned areas on the Forest. The burns will help stimulate native vegetation while discouraging or suppressing most invasive species with the exceptions of some grasses, such as Nepalese browntop. Likewise, invasive species control (at up to 150 acres/year on the Forest and on private lands) will also contribute to some indirect beneficial effects to this species by reducing (although to a very small degree) the spread of invasive plant species into the community in which *Vitis rupestris* inhabits. Dispersed recreational use will still have some indirect negative effects to this species in all alternatives resulting from the continued introduction of invasive species through trails, roads, cross-country use, and beach use. Since there should be no negative impacts to *Vitis rupestris* resulting from prescribed fire and herbicide use in the proposed project, there will be no cumulative impacts for any of the three alternatives with the exception of slight negative cumulative impacts resulting from recreational use and slight positive cumulative impacts from prescribed burning and invasive species control. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

Although fire may benefit *Vitis rupestris*, more aggressive management may be required to save the rare community type and habitat that this species is restricted to. Hydrological disturbances could eventually cause the swamps and associated wetlands and wet woods to dry up and the demise of this species in Illinois could result. In particular at the LaRue-Pine Hills/Otter Pond location, there is a danger that the hydrology of the wet woods could be greatly altered with a dense invasion of woody shade-tolerant species. Over the last few decades, the composition of the forest in this area has changed and non-native aggressive species have encroached in this species' native habitat.

75. *Waldsteinia fragarioides* (Appalachian Barren Strawberry) (S)

Waldsteinia fragarioides is a low, perennial, rhizomatous herb with stalked clusters of small yellow flowers that typically flowers April to May (Hill 2003i). In more southern latitudes, its habitat is fertile soil on rocky talus slopes in dry to mesic upland forests (Hill 2003i). It occurs in eastern Canada, south into the northeastern United States, the Appalachians, and with disjunct populations in the Ozarks, being more common in northern latitudes with cooler summer temperatures (Hill 2003i).

According to Hill (2003i) the primary threats to *Waldsteinia fragarioides* are natural catastrophe, habitat loss, exotic species and long-term climate change. Recreational use near isolated populations is also thought to pose a significant risk (Hill 2003i).

The Nature Conservancy ranked this species as G5 (1993). It has been removed from the endangered list by the state of Illinois and is currently considered extirpated from the state (Schwegman *in* Hill 2003i). The Conservation Status of this species is possibly extirpated in Illinois, critically imperiled in New Brunswick, Canada, Maine, New Hampshire, Connecticut, and Arkansas, imperiled in Indiana, vulnerable in Minnesota, Kentucky, Maryland, and Quebec, Canada. It is also listed as apparently secure in West Virginia, Virginia, and Vermont, and secure in New York and Ontario, Canada. This species is currently not ranked or under review in New Jersey, Maryland, Pennsylvania, Ohio, Michigan, Wisconsin, Missouri, Tennessee, North Carolina, South Carolina, Georgia, and Alabama. Trends for *Waldsteinia fragarioides* are not currently available for North America due to a lack of trend data from enough states to make a determination however, in the southern end of its range it appears as though *Waldsteinia fragarioides* is in danger of extirpation (Hill 2003i).

It is known from a single location in extreme southern Illinois where it occurred on a north-facing sandstone cliff on a ledge above Hayes Creek in Pope County. Recent searches for this species (since its last observation in 1987) have not relocated this species and it is feared extirpated. This species has been recently delisted by the Illinois Endangered Species Protection Board.

Prescribed fire has been shown to increase *Waldsteinia fragarioides* in a study conducted in Canada (Lynham *et al.* *in* Dolan 2001). However, since this species has been reported as extirpated in Illinois (Schwegman *in* Hill 2003i), management efforts should focus on monitoring and protecting isolated populations or reintroduction if possible (Hill 2003i).

Environmental Impacts:

Alternatives 1, 2, and 3 will have no impact on *Waldsteinia fragarioides* since this species is no longer extant on the Forest.

Cumulative Impacts:

Since there are no environmental impacts to this species, there are no cumulative impacts to analyze for. These Cumulative Impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

/s/Elizabeth Longo Shimp

Elizabeth Longo Shimp

Botanist

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