SHAWNEE NATIONAL FOREST
BIOLOGICAL EVALUATION
FOR
REGIONAL FORESTER'S SENSITIVE PLANT SPECIES

FOREST PLAN REVISION

February 3, 2005

The information for the 63 Regional Forester's sensitive plant species is taken from the Shawnee National Forest list compiled on June 15, 2004, NatureServe (2004), Plants Database (2004), the State heritage database, and available literature.

Table 1. Regional Forester's Sensitive Plant Species (RFSS) on the Forest known to occur or have been documented as historically occurring within the 11 counties of southern Illinois. 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 (1986). Note: T = Illinois Threatened, E = Illinois Endangered, EX = presumed extirpated in the State, A = Alexander, G = Gallatin, H = Hardin, Ja = Jackson, Jo = Johnson, M = Massac, Po = Pope, Pu = Pulaski, S = Saline, U = Union, and W = Williamson.

Counties													
A	**G**	**H**	**Ja**	**Jo**	**M**	**Po**	**Pu**	**S**	**U**	**W**	**Scientific Name**	**Common Name**	**IL E/T**
X						X	*	X			**1. *Amorpha nitens***	**Shining false indigo**	E
			X					X	X		**2. *Asplenium bradleyi***	**Bradley's spleenwort**	E
*			*						X		**3. *Asplenium resiliens***	**Black-stem spleenwort**	E
						X					**4. *Bartonia paniculata***	**Twining screwstem**	E
			X								**5. *Berberis canadensis***	**American barberry**	E
						X					**6. *Buchnera americana***	**American bluehearts**	
						X					**7. *Calamagrostis porteri* ssp. *insperata***	**Porter's reedgrass**	E
	*	X		*		X		X			**8. *Carex communis***	**Fibrous-root sedge**	T
	*			X		X	*		X		**9. *Carex decomposita***	**Cypress-knee sedge**	E
			X	X	X		X		X		**10. *Carex gigantea***	**Giant sedge**	E
*		*	*	*	*	*	*	*	*		**11. *Carex lupuliformis***	**False hop sedge**	
		X									**12. *Carex oxylepis* var. *pubescens***	**Sharp-scaled sedge**	
X				X	X	X	X	X	X		**13. *Carex socialis***	**Low woodland sedge**	
		X			X	X					**14. *Chamaelirium luteum***	**Fairywand**	E
*	*	X	X	X	*	*	*		*		**15. *Chelone obliqua* var. *speciosa***	**Red turtlehead**	
	X	X	X	X	*	X					**16. *Cimicifuga rubifolia***	**Appalachian bugbane**	T
X	*										**17. *Cladrastis kentuckea***	**Kentucky yellowwood**	E
						X					**18. *Corydalis micrantha* ssp. *australis***	**Smallflower fumewort**	E

Counties													
A	**G**	**H**	**Ja**	**Jo**	**M**	**Po**	**Pu**	**S**	**U**	**W**	**Scientific Name**	**Common Name**	**IL E/T**
X			X	X	X	X			X	X	**19. *Cypripedium pubescens***	**Greater yellow lady's slipper**	
				X					X		**20. *Dichanthelium joorii*****	**Variable panic grass**	E
		X				X			*		**21. *Dichanthelium ravenelii***	**Ravenel's rosette grass**	E
						X					**22. *Dichanthelium yadkinense*****	**Yadkin's panic grass**	E
			X	X		X		X	X	X	**23. *Dodecatheon frenchii***	**French's shooting star**	T
		X		X		X			X		**24. *Echinacea simulata***	**Wavyleaf purple coneflower**	
	X		X		X	X		X	X		**25. *Eleocharis wolfii***	**Wolf's spikerush**	
			X	X	X	X	X	X	X	X	**26. *Festuca paradoxa***	**Clustered fescue**	
X			X		X	X					**27. *Gentiana alba***	**Plain gentian**	
*											**28. *Helianthus silphioides***	**Rosinweed sunflower**	
*						X			*		**29. *Heteranthera reniformis***	**Kidneyleaf mudplantain**	E
		X	*			*					**30. *Hexalectris spicata***	**Spiked crested coralroot orchid**	E
			X	X		X			X		**31. *Hottonia inflata***	**American featherfoil**	
						X					**32. *Isotria verticillata***	**Purple fiveleaf orchid**	E
X		X	X	X	X	X	X	X	X	X	**33. *Juglans cinerea***	**Butternut**	
	X	X	X	X		X				X	**34. *Lilium superbum***	**Turk's-cap lily**	
			X								**35. *Lonicera dioica* var. *glaucescens*****	**Limber honeysuckle**	E
			X			X					**36. *Lonicera flava***	**Yellow honeysuckle**	E
						*					**37. *Lysimachia fraseri***	**Fraser's yellow loosestrife**	EX
		X				X					**38. *Oxalis illinoensis***	**Illinois wood sorrel**	E
X		X	X	X	X	X		X	X		**39. *Panax quinquefolius***	**American ginseng**	
	X	X			X	X					**40. *Phaeophyscia leana***	**Wreath lichen**	E
			X	X		X		X			**41. *Plantago cordata***	**Heartleaf plantain**	E
						X					**42. *Platanthera clavellata***	**Small green wood orchid**	E
				X	X						**43. *Platanthera flava* var. *flava***	**Pale green orchid**	E
			*			*					**44. *Poa alsodes***	**Grove bluegrass**	E
					*	X					**45. *Polygala incarnata***	**Procession flower**	E
									X		**46. *Pycnanthemum albescens***	**Whiteleaf mountainmint**	E
*			*			*					**47. *Pycnanthemum torrei***	**Torrey's mountainmint**	EX
				X		X					**48. *Rhynchospora glomerata***	**Clustered beaksedge**	E
						X	X				**49. *Rudbeckia fulgida* var. *sullivantii***	**Sullivant's coneflower**	
						X	*		*		**50. *Sagittaria australis***	**Longbeak arrowhead**	E
						*					**51. *Schoenoplectrus purshianus***	**Weakstalk bulrush**	E
		X									**52. *Silene ovata***	**Blue Ridge catchfly**	E

Counties												
A	**G**	**H**	**Ja**	**Jo**	**M**	**Po**	**Pu**	**S**	**U**	**W**	**Scientific Name**	**Common Name**	**IL E/T**
		X									**53. *Silphium pinnatifidum***	**Tansy rosinweed**	
		*									**54. *Silphium trifoliatum***	**Whorled rosinweed**	Ex
	X		X	X	*	X	X		X		**55. *Stenanthium gramineum***	**Eastern featherbells**	E
X											**56. *Styrax grandifolius***	**Bigleaf snowbell**	E
			X							X	**57. *Synandra hispidula***	**Guyandotte beauty**	E
						X					**58. *Thelypteris noveboracensis***	**New York fern**	E
	X	X		X		X			X		**59. *Trichomanes boschianum***	**Appalachian bristle fern**	E
	*		X	X							**60. *Trifolium reflexum***	**Buffalo clover**	T
		X				*					**61. *Vaccinium stamineum***	**Deerberry**	E
			X						X		**62. *Vitis rupestris***	**Sand grape**	
						*					**63. *Waldsteinia fragarioides***	**Appalachian barren strawberry**	EX

B. Environmental Effects and Cumulative Effects of Alternatives on Regional Forester's Sensitive (S), and State of Illinois listed plant species known to occur or documented as historically occurring on the Shawnee National Forest.

Much of the following range, habitat and plant descriptions come from Herkert (1991), Herkert and Ebinger (2002), Fernald (1950), Mohlenbrock (1986; 2002), and NatureServe (2004). A Forest county distribution and state listing category summary can be found in Table 1 above.

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. *Amorpha nitens* (Shining false indigo)

Amorpha nitens is a branching, leguminous shrub. It is a very rare species that has been documented from approximately 50 localities 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. This species occurs in a variety of habitats within its range including dry rocky upland barrens-like habitat and prairies (Taft 2004a).

According to NatureServe (2004) primary threats to *Amorpha nitens* include the destruction of habitat through agricultural conversion, grazing, and hydrological perturbations (such as dam construction). The Nature Conservancy assigned *Amorpha nitens* the Global Ranking of G3 in 1995 and has been determined it to be critically imperiled in Illinois and Georgia, and vulnerable in Kentucky.

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 (collection #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 Effects:

For all alternatives, restrictive management and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects on *Amorpha nitens*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2 and 4 but fire may have some short-term direct effects if the root crown is in an errosive area or if adventitious buds are directly burned in a fire. 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 lacking. 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 direct and indirect long-term effects for alternative 3. These effects may come from exotic species encroachment, which may cause a reduction in health and vigor of *Amorpha nitens* populations on the Forest.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. In the long-term, populations of *Amorpha nitens* may become suppressed by other aggressive woody native species, such as Poison ivy and Sugar maple. In addition, aggressive exotic plant species may eventually out compete the native *Amorpha nitens* since the two Forest populations occur near roadways, which also serve as corridors for exotic species.

Restrictive resource management and aquatic resource management are expected to benefit the species but the use of prescribed fire and integrated pest management, may only benefit the species by eliminating the competition from the other more aggressive species. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

2. *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 is historically documented from 19 states. It reaches its northern range limit in southern Illinois where it is 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. A risk analysis done on this species by the southern tier forests in Region 9, demonstrated that although reported from several counties in Missouri, *Asplenium bradleyi* is critically imperiled in Illinois and Indiana. 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 is known to occur on the Forest within the LaRue-Pine Hills/Otter Pond 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Asplenium bradleyi*. Timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Roads and trails management, recreational trail/road use, dispersed recreational use, and developed recreational site use may have some long-term negative effects in alternatives 1, 2, and 4 if use is too close to known populations. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives but fire may have some direct short-term and long-term negative effects if the surrounding forest or that forest on the bluffs results in drying and erosion; on the otherhand, positive effects 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 Research Natural Area 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 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.

There may also be some negative direct and indirect long-term effects for alternative 3. 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.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. In the long-term, populations of *Asplenium bradleyi* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper.

Restrictive resource management is expected to benefit the species but the use of prescribed fire and integrated pest management may only benefit the species by eliminating the competition from the other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

3. Asplenium resiliens (Black-stem spleenwort)

Asplenium resiliens is a wiry evergreen fern 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 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 uncommon or unranked in the majority of the 27 states that it is documented from. It has been determined to be critically imperiled in Illinois and Georgia, vulnerable in Kentucky, presumed extirpated in Louisiana, and possibly extirpated in Ohio.

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) may still be present but has not been observed for over 10 years, and the Union County locations at LaRue-Pine Hills/Otter Pond Research Natural Area (2 possible stations) have not been seen since 1987. 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Asplenium resiliens*. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Dispersed recreational use may have some short-term and long-term negative effects in all alternatives if over-collection of the only remaining populations results. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives but fire may also have some direct short-term and long-term negative effects 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.

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.

There may also be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual 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.

Cumulative Effects:

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

Restrictive resource management is expected to benefit the species but the use of prescribed fire and integrated pest management may only benefit the species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

4. 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, Kickasola Cemetery, and Snow Springs Ecological Areas. The Snow Springs population was first documented in 1967 (Schwegman 1969) and the now-dehydrated area is dominated by shading Red maple and River birch. The Snow Springs area was searched during 1995 but *Bartonia paniculata* was not relocated (e-mail from Eric Ulaszek to Steven Hill and Elizabeth Shimp on January 24, 2003). 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 was discovered October 21, 1994 (J. Shimp collection #5376). The Kickasola Barrens "New Spring" collection was made on September 27, 1994 (E. Ulaszek collection #2289).

The Nature Conservancy assigned this species the Global Ranking of G5 in 1984 but it is critically imperiled in 6 states and imperiled in 3 of the 29 states and 5 Canadian provinces where it occurs. It had been determined to be presumed extirpated in Illinois until identified in three seep areas on the Forest during the early 1990's.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Bartonia paniculata*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management

are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 20 *Bartonia paniculata* flourished in the seep during 1993.

There may be some negative direct and indirect long-term effects for alternative 3. These effects 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 Eulalia (*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 Eulalia has taken over portions of the former seep spring habitat. A large population of Eulalia 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 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 benefit *Bartonia paniculata* and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Bartonia paniculata* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or exotics such as Eulalia. 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 Illinois will be inevitable.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

5. *Berberis canadensis* (American barberry)

Berberis canadensis is an erect shrub that occurs in southeastern United States, and ranges northwest to Illinois. In most states, this species is an inhabitant of former savannas and openland woodland habitats. It is extremely rare in the western part of its range and is recently known from a single Illinois site on a sandstone bluff near the Mississippi River. In Illinois, this species generally flowers during the month of May.

Primary threats to *Berberis canadensis* in Illinois are habitat destruction and agricultural eradication efforts. NatureServe (2004) lists the global short-term trend to be a continuing downward decline because of the loss a natural fire regime and continued eradication efforts. Although the eradication efforts are primarily focused towards the European Barberry (*Berberis vulgaris*), this species has also become a target because wheat rust uses the native barberry as an alternate host. The Nature Conservancy assigned this species the Global Ranking of G3 in 1997. It is historically known from 14 states but is presumed extirpated in Pennyslvania and possibly extirpated in Alabama and Maryland. It is critically imperiled in Illinois, Indiana, Kentucky, West Virginia, and Georgia, imperiled in Missouri, Tennessee, and North Carolina, and listed as vulnerable in Virginia. It may possibly be extirpated in Illinois but further searches should be made. Range-wide there are only approximately 50 known occurrences of this species. Since settlement, much of its habitat had been destroyed; habitat has been converted to cultivated fields, land development, and urban areas.

There is an undocumented report that this species is historically known from a steep bluff in northern Illinois (Tazewell County) but there is a substantiated report of the single location at the rim of a dry sandstone cliff at the Fountain Bluff Station in Jackson County. This area is not part of the Fountain Bluff Geological Area. The Fountain Bluff population, first discovered in 1973, was last observed in 1987 but not relocated during searches in 1988 and 2002 (John Schwegman personal communication in Hill 2003c).

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Berberis canadensis*. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Dispersed recreational use may have some short-term and long-term negative effects in all alternatives if over-collection results from visits to the population site on the Forest. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives. The protection of the hydrological characters of the thin soil layer at the only Forest site may be critical as well as maintaining an open habitat (Hill 2003c). Tree and shrub removal, the 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.

In other states where this species persists, fires have not negatively impacted populations. On the Forest, this species has 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 numerous populations of rare species perpetuated and endured the harsh conditions. These fires may have had brief negative short-term effects on this species, but the dense root mass (Hill 2003c) may have been a vantage point for this population by its re-establishing itself and competing well with other aggressive species.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of the only remaining *Berberis canadensis* population on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where this population occurs, may become detrimental to this species. This threat may also be compounded by excessive shading from trees and shrubs above the cliff face. This species does not occur within a protected natural area on the Forest and because of this, it may be more difficult to control over-collecting by plant enthusiasts, and may be difficult to implement prescribed burning and aggressive tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. In the long-term, populations of *Berberis canadensis* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper.

Restrictive resource management is expected to benefit the species as well as the use of prescribed fire and integrated pest management by eliminating the competition from other more aggressive species. A prescribed fire may also add nutrients back to the microhabitat. If a root mass is still present, the fire may permit this suppressed population to wax rather than wane in this native habitat. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

6. *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 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 (2004), 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, Tennessee, and Kansas. 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 10 years does not mean that it is still not in the seed bank. In order for this species' seeds to germinate, a light requirment 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Buchnera americana*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 citings of a least two clusters of individuals on each of the publicly managed lands (personal commmunication 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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects 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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Buchnera americana* may become overshaded, suppressed or out-competed by aggressive exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

7. *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 6 states and is presumed extirpated from Arkansas, critically imperiled in Illinois, Indiana, Ohio, and Kentucky, and vulnerable in Missouri. 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. 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 Effects:

For all alternatives, restrictive management, roads and trails management, recreational trail/road use, dispersed recreational use, vegetation treatments, fire management, and integrated pest management use are expected to have positive direct and indirect short-term and long-term effects on *Calamagrostis porteri* ssp. *insperata*. Timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. 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.

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. Mitigation measures common to all alternatives require the protection of threatened, endangered, and Regional Forester's Sensitive species and, therefore, trails will be adjusted and/or modified to avoid further trampling and destruction of these populations. 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 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 is currently 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 is permitted to hit the forest floor. Tillers, which were depauperate in stature, have been transplanted to greenhouses where they have been 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).

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 prescibed fire.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 prescribed fire may also add nutrients back to the microhabitat and will help stimulate suppressed populations.

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

8. *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, Missouri, and Mississippi, imperiled in Arkansas, and vulnerable in Iowa and North Carolina. The Global Ranking by The Nature Conservancy was determined to be G5 in 1986.

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 has 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.

Environmental Effects:

For all alternatives, restrictive management, roads and trails management, recreational trail/road use, dispersed recreational use, vegetation treatments, fire management, and integrated pest management use are expected to have positive direct and indirect short-term and long-term

effects on *Carex communis*. An exception would be that restrictive management would have negative effects in the long-term for this species where it occurs in Wilderness Areas (in this case, the Garden of the Gods Wilderness Area). This would be because prescribed fire would not be permitted in Alternatives 1-4 for the purpose of TES species or habitat enhancement. Timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. 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 and Garden of the Gods.

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 Illlinois 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. Mitigation measures common to all alternatives require the protection of threatened, endangered, and Regional Forester's Sensitive species and, therefore, trails will be adjusted and/or modified to avoid further trampling and destruction of these populations. It is highly probable that the population at Bell Smith Springs may be suppressed or has succumbed to over-shading from the enclosing canopy.

Negative direct and indirect long-term effects may also result from Alternative 3 if aggressive exotic plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful.

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 contributers.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 prescribed fire may also add nutrients back to the microhabitat and will help stimulate suppressed populations. An exception would be that restrictive management would have negative effects in the long-term for this species where it occurs in Wilderness Areas. This would be because prescribed fire would not be permitted in

Alternatives 1-4 for the purpose of TES species or habitat enhancement. The lack of any management actions may eventually lead to the demise of these populations.

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

9. *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 20 states and the District of Columbia but is listed as presumed extirpated in Michigan and possibly extirpated in New York, Maryland, and the District of Columbia. It is critically imperiled in Illinois, Ohio, North Carolina, Delaware, Alabama, Louisiana, and Texas, imperiled in Indiana, Kentucky, Tennessee, Virginia, Georgia, and Arkansas, and vulnerable in Missouri and Mississippi. Unofficially, it is possibly extirpated in Virginia and North Carolina. The Nature Conservancy assigned the Global Ranking of G3 in 1997.

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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Carex decomposita*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 blufftops. 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 inhabitat 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 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. 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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 may already be occurring although research is lacking in this area. This is the location that the *Carex decomposita* was once found most frequently. If the species is negatively impacted at this location, there will be negative cumulative effects to the species in southern Illinois.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

10. *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, and Missouri, imperiled in Kentucky and Arkansas, and vulnerable in Maryland. The Nature Conservancy assigned this species the Global Ranking of G4 in 1984.

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 (last observed November 28, 1967). A population discovered at Sielbeck Woods 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 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Carex gigantea*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 blufftops. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species. At LaRue-Pine Hills/Otter Pond *Carex gigantea* inhabitats 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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

11. *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 1997 and is listed as having widespread declines throughout its range. It is presumed extirpated in Iowa, critically imperiled in Quebec and Ontario, Canada, Wisconsin, Pennsylvania, Virginia, Vermont, New Jersey, Delaware, Maryland, North Carolina, and Texas. It is also listed as imperiled in Michigan, Indiana, Ohio, New York, Vermont, Connecticut, and Tennessee, and vulnerable in Illinois.

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 several 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Carex lupuliformis*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 blufftops. 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* populations within the area.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

12. *Carex oxylepis* var. *pubescens* (Sharp-scaled 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 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.

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 Effects:

For all alternatives, restrictive management, vegetation treatments, fire management, and integrated pest management use are expected to have positive direct and indirect short-term and long-term effects on *Carex oxylepis* var. *pubescens*. Developed recreational site, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Roads and trails management, recreational trail/road use, and dispersed recreational use may have negative impacts in the short-term to this species in all alternatives because of the occurrences on user-developed and designated trails. In the long-term, only Alternative 1 will continue to have negative impacts where use will not be restricted to designated trails. All other alternatives should have no long-term negative effects to the species or their populations at known locations.

Closed canopies may be detrimental to the vegetative performance of this species, which is why it may be appearing more frequently along user-developed 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. 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. Mitigation measures common to all alternatives require the protection of threatened, endangered, and Regional Forester's Sensitive species and, therefore, trails will be adjusted and/or modified to avoid further trampling and destruction of these populations. But at this time, Alternative 1 does not restrict hiker/equestrian use to designated trails and, therefore, it will be difficult to keep users off of the user-developed trails. 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.

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 will most likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other competing plants. In some cases, population enhancement may not be

fully achieved without selective tree and shrub removal, such as in a pine plantation, and should additionally be maintained by prescribed fire.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 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 prescribed fire may also add nutrients back to the microhabitat and will help stimulate suppressed populations.

It is highly probable that these populations once occupied a greater area and were most likely more widespread. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

13. *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 1995 and has determined it to be vulnerable in Illinois and Kentucky, and imperiled in Missouri and Indiana. It is noted as being locally common at some locations in the Coastal Plain and lower Mississippi Valley (Homoya and Rayner 1987).

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Carex socialis*. Roads and trails management, recreational

trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

14. *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. .

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, along the sandy banks of 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Chamaelirium luteum*. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, dispersed recreational use, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. The seep springs on the Forest are habitat to several native fire-adapted species. Following

prescribed fire in Cretaceous Hills Ecological Area, the population of *Chamaelirium luteum* has persisted.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Chamaelirium luteum* populations within the seep springs on the Forest and in other habitat. In particular, Japanese honeysuckle and Eulalia (*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 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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Chamaelirium luteum* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Poison ivy, and/or exotics such as Eulalia. 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

15. *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 seen1931), 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, imperiled in Missouri and critically imperiled in Iowa. 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Chelone obliqua*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

16. *Cimicifuga rubifolia* (Appalachian bugbane)

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

Cimicifuga rubifolia has been given a Global Heritage Status Rank of G3 by The Nature Conservancy in 2001 because of its rarity range-wide. 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. The sightings in Pennsylvania are presumed to be exotic or introduced to the state.

Cimicifuga 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 22 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, War Bluff, Lusk Creek Canyon Ecological Area, Lusk Creek Canyon Zoological Area, Lusk Creek Canyon Wilderness Area, Jackson Hollow Ecological Area, outside of the Jackson Hollow Ecological Area, and Jackson Falls Recreation Area. In these areas it is found in rich woods and is considered rare. The Grindstaff Hollow population was not relocated in 1999 and may be extirpated (Miller 1999). The primary threat to this species in southern Illinois has been unregulated equestrian use. In one case case, the threat is unauthorized all-terrain-vehicle use and, in another case, the threat is the negative effects to a population on Forest Service managed land from the past logging on adjacent private land.

Environmental Effects:

There are approximately 50 occurrences/populations of *Cimicifuga rubifolia* known world-wide. At least 3 of the 22 populations are currently being impacted by unregulated equestrian use on Forest managed lands. These populations will continue to be negatively impacted by equestrian use in Alternative 1. 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.

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Cimicifuga rubifolia*. An exception would be that restrictive management would have negative effects in the long-term for this species where it occurs in Wilderness Areas. This would be because prescribed fire would not be permitted in Alternatives 1-4 for the purpose of TES species or habitat enhancement. 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. Roads and trails management, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, recreational trail/road use, dispersed recreational use, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 2, and 4. Negative effects may be expected from alternatives 1 and 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Negative effects are expected from recreational trail/road use and dispersed recreational use in Alternative 1.

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. If the surrounding forest becomes densely shaded, negative effects can be expected in the long-term. Negative direct and indirect long-term effects may also result from Alternative 3 if aggressive exotic plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful.

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 around Cedar Lake in Jackson County were no exception.

There may also be some negative direct and indirect long-term effects for alternative 3 pertaining to the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Cimicifuga 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.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Cimicifuga rubifolia* outside of natural areas or within Wilderness Areas may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Chinese Yam, Poison ivy, and/or Eulalia. An exception would be that restrictive management would have negative effects in the long-term for this species where it occurs in Wilderness Areas. This would be because prescribed fire would not be permitted in Alternatives 1-4 for the purpose of TES species or habitat enhancement. Surrounding areas adjacent to this species' habitat will continue to become encroached with invasive exotic species, thus encouraging competition for light, nutrients, and habitat. Although fire will benefit this species, 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).

Restrictive resource management is expected to benefit the species, with the exception of Wilderness Areas, but the use of integrated pest management and roads and trails management will benefit this species by eliminating the competition from other more aggressive species and restricting hiker/equestrian use to designated trails. Prescribed fires may also add nutrients back to the microhabitat, which should help stimulate populations.

Alternatives 1-4 restrict prescribed fire in Wilderness Areas. *Cimicifuga 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, user-developed trails, and habitat degradation. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

17. *Cladrastis kentukea* (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.

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 Effects:

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 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. The removal of threatening Japanese honeysuckle is desirable in this location.

Cumulative Effects:

Cumulative effects are similar to environmental effects to this species. Since there will be no negative environmental effects, there will be no cumulative effects to this species from any of the proposed actions in any of the alternatives. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

18. *Corydalis micrantha* ssp. *australis* (Smallflower fumewort)

***Corydalis micrantha* ssp. *australis* (= *Corydalis halei*)** is a winter-annual herb occurring in sandy soils of the southeastern United States. It is found from Texas to Florida, north to Virginia and west to Kansas, excluding Tennessee and Kentucky. It reaches its northern range limit in southern Missouri and southern Illinois where it is found in an open, dry, barrens community. *Corydalis micrantha* ssp. *australis* typically flowers from April to May.

Primary threats to this species include succession and shading from overstory canopy and loss of habitat to development (Edgin 2003). The Nature Conservancy assigned this species the Global Ranking of G5T5 in 2000 but it is listed as imperiled in Missouri and is currently under review in Illinois. According to Edgin (2003) this population may require management including periodic surveys and disturbances such as fire to insure it receives enough sunlight. Others suggest that the use of fire for more sunlight may not be the ultimate benefit for this species. There is a possibility that germination may be enhanced by fire, either through heat stimulated germination or smoke cues (Danderson 2004b). Being a spring ephemeral, there may be a lesser correlation between the canopy opening and seed germination than the direct impacts of fire to seed germination.

Corydalis micrantha ssp. *australis* has been recorded from the base of a limestone bluff in Monroe County and from a sandstone ledge of a barrens remnant in Pope County. The 1965 collection by James Ozment in Monroe County has never been relocated. The Pope County population was relocated April 26, 2003 by Bob Edgin (collection #5612 and #5613) and there were 8 plants, one in flower and one with fruit, at the time. John Taft took a photograph of *Corydalis micrantha* ssp. *australis* in its vegetative condition sprouting out of the stump of a charred black jack oak stump following a prescribed burn at the Pope County location (Danderson 2004b). It is important to note that this population was found on land managed by

The Nature Conservancy although potential habitat occurs on the immediately adjacent Forest Service managed land, Gibbons Creek Ecological Area.

Environmental Effects:

None of the activities proposed in any of the alternatives will negatively impact this species because the only currently known population within the Forest Proclamation Boundary is on adjacent land managed by The Nature Conservancy. If *Corydalis micrantha* ssp. *australis* occurs on adjacent Forest land (where potential habitat exists), none of the proposed activities except for integrated pest management in Alternative 3 will have any negative effects on this species. In the long-term, aggressive exotic species may deteriorate the open sunny habitat that this species inhabitats and may eliminate the potential habitat. Prescribed fires will keep the Gibbons Creek Ecological Area barrens open on the Forest managed land but competing species such as Japanese honeysuckle will need to be managed.

Cumulative Effects:

Cumulative effects are similar to environmental effects to this species. Since there will be no negative environmental effects to known populations on the Forest, there will be no cumulative effects to this species from any of the proposed actions in any of the alternatives. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

19. *Cypripedium pubescens* (Greater yellow lady's slipper)

Cypripedium 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 G5 in 2001 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, Wyoming, Arizona, Deleware, and Rhode Island, and imperiled in New Hampshire, Mississippi and New Mexico. It is considered as vulnerable in Illinois, Indiana, North Carolina, Alabama, and Georgia.

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 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. It is mostly known from unprotected sites across the Forest.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Cypripedium pubescens*. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, dispersed recreational use, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control.

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.

Alternatives 1-4 would have some negative direct and indirect long-term effects on *Cypripedium pubescens* where these species may occur within Wilderness Areas. This would be a result of the inability to prescribe burn the habitat in which these species occur because of restrictive management.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Cypripedium pubescens* populations outside of natural areas and within Wilderness Areas on the Forest. In particular, Japanese honeysuckle and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Cypripedium pubescens* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Cypripedium pubescens* that occur outside of natural areas or within Wilderness Areas may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. In addition, monitoring of known populations is essential in determining the extent of over-collection that may be taking place on the Forest.

Restrictive resource management is expected to benefit the species in all alternatives with the exception of Wilderness Areas where there will be an inability to prescribe burn for rare species or habitat enhancement. The use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

20. *Dichanthelium joorii* (Variable panic grass)

Dichanthelium joorii (*=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 joorii* 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Dichanthelium joorii*. Roads and trails management, recreational

trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 blufftops. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species. At LaRue-Pine Hills/Otter Pond *Dichanthelium joorii* inhabitats the swampy woods at the base of McGee Hill. 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 care is not taken in perpetuating these areas. Moderately open canopy areas within and adjacent to the LaRue and Grantsburg swamps benefit *Dichanthelium joorii* 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 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 *Dichanthelium joorii* populations within the area.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

21. *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 vulnerable in Delaware, imperiled in Maryland, North Carolina, and Virginia, and critically imperiled in Illinois. 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 Effects:

For all alternatives, restrictive management, vegetation treatments, fire management, and integrated pest management use are expected to have positive direct and indirect short-term and long-term effects on *Dichanthelium ravenelii*. Developed recreational site, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Roads and trails management, recreational trail/road use, and dispersed recreational use may have negative impacts in the short-term to this species in all alternatives because of the occurrences on user-developed and designated trails. In the long-term, only Alternative 1 will continue to have negative impacts where use will not be restricted to

designated trails. All other alternatives should have no long-term negative effects to the species or their populations.

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. Mitigation measures common to all alternatives require the protection of threatened, endangered, and Regional Forester's Sensitive species and, therefore, trails will be adjusted and/or modified to avoid further trampling and destruction of these populations. But at this time, Alternative 1 does not restrict hiker/equestrian use to designated trails and, therefore, it will be difficult to keep users off of the user-developed trails. 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.

Open sunny woodlands benefit *Dichanthelium ravenelii* and other upland species. This grass is very likely fire-adapted as are most grasses. Populations will most likely become enhanced following prescribed fire by opening up the canopy and reducing competition from other plants. In some cases, population enhancement may not be fully achieved without selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 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 prescribed fire may also add nutrients back to the microhabitat and will help stimulate suppressed populations.

It is highly probable that these populations once occupied a greater area and were most likely more widespread. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

22. *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 historically within the Snow Springs Ecological Area (reported in 1969). At these locations, it is a species of mesic forests, wet soil, seep springs and gravelly streambeds. In 1992, this species was 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Dichanthelium yadkinense*. Roads and trails management, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Recreational trail/road use and dispersed recreational use may have negative effects in Alternative 1 because unregulated hiker/equestian use on user-developed trails will be continued. These negative effects will be experienced outside of protected natural areas. Negative effects may also be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Alternatives 1-4 will all have the inability to prescribe burn Wilderness Areas for rare plant species and habitat enhancement. Grasses are generally stimulated by fires and suppressing or preventing fire may be detrimental in the long-term to 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 grass respond to fire.

The rich open woods and clear creeks 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. There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species

and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Dichanthelium yadkinense* populations outside of natural areas within the Forest. In particular, Eulalia, Chinese yam and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Dichanthelium yadkinense* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 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, Eulalia, Chinese yam and/or other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. Alternatives 1-4 will have negative impacts this this species regarding restrictive resource management 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*.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

23. *Dodecatheon frenchii* (French's shooting star)

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 1984. 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.

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 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, 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Dodecatheon frenchii*. Roads and trails management, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, recreational trail/road use, dispersed recreational use, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 2, and 4. Negative effects may be expected from alternatives 1 and 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Negative effects are expected from recreational trail/road use and dispersed recreational use in Alternative 1.

One exception would be that dispersed recreational use may continue to have negative impacts on *Dodecatheon frenchii*, which 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.

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 adjacent to *Dodecatheon frenchii* populations are no exception. Reducing the competion surrounding the populations allows for more sunlight to reach the Forest floor giving this rare species an

opportunity to compete. Alternatives 1-4 do not permit the burning within Wilderness Areas where this species occurs. Without reducing the surrounding competition and controlling exotic species, there could be negative impacts to certain populations.

There may also be some negative direct and indirect long-term effects for alternative 3 pertaining to the eventual woody species and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Dodecatheon frenchii* populations within the drip-line areas outside of natural areas on the Forest. In particular, Japanese honeysuckle and other aggressive vines may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Dodecatheon frenchii* outside of natural areas may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Chinese Yam, Poison ivy, and/or other exotics. Although fire will benefit this species in adjacent habitats, more aggressive management will be required to save the rare community type and habitat that this species requires. Human caused disturbances, which will negatively impact plants and habitat should be restricted. No camping, fires, rock climbing, or rappelling should be permitted beneath sandstone overhangs where this species occurs nor should trails be permitted to form in these sensitive locations.

Restrictive resource management is expected to benefit the species except for Wilderness Areas where prescribed fire will not be available to help reduce competion from encroaching species. The use of integrated pest management and roads and trails management will benefit this species by eliminating the competition from other more aggressive species and restricting hiker/equestrian use to designated trails. Prescribed fires may also add nutrients back to the microhabitat, which should help stimulate populations.

The populations of *Dodecatheon frenchii* are restricted to rock shelter habitats. 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

24. *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. 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. It is known from limestone barrens and glades. It is 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Echinacea simulata* except in Wilderness Areas where there will be an inability to prescribe burn for rare species and habitat enhancement. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

The effects of fire are known to have positive effects on this species and its habitat range-wide. LaRue-Pine Hills/Otter Pond Research Natural Area, Simpson Township Barrens Ecological Area, and Whoopie Cat Research Natural Area have all had prescribed fires and this species have been reported as persisting as have other rare species.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Echinacea simulata* populations outside of the natural areas. The rare barrens community types, such as these, will succumb to successional species if intensive management is not implemented. Alternatives 1-4 would have some negative direct and indirect long-term effects on *Echinacea simulata* where this species may occur within Wilderness Areas. This would be a result of the inability to prescribe burn the habitat in which these species occur because of restrictive management. Open sunny barrens benefit *Echinacea simulata* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Negative direct and indirect long-term effects may also result from Alternative 3 if aggressive exotic plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Echinacea simulata* may become overshaded, suppressed or out-competed by other aggressive woody native species outside of natural areas. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species except in Wilderness Areas where there is an inability to prescribe burn for rare plants and habitat enhancement. The use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

25. *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 G3 in 2003 (NatureServe 2004). 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 and several other states in its range (NatureServe 2004). 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Eleocharis wolfii*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 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 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 unpoluted 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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

26. *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 2004). This species is currently listed as vulnerable in Illinois and Ohio, and it is critically imperiled in Indiana and Tennessee.

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 (2004) but it has not been collected on the Forest in over 13 years. Trends for this species are not clearly stated in the available literature, but according to Vlaszek (In KSNPC 2004), this species may be extirpated from Illinois although Olson notes it from at least 20 counties in Illinois.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Festuca paradoxa* except in Wilderness Areas where there is an inability to prescribe burn for rare plant species and habitat enhancement. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are

expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, dispersed recreational use, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control.

Alternatives 1-4 would have some negative direct and indirect long-term effects on *Festuca paradoxa* where this species may occur within Wilderness Areas. This would be a result of the inability to prescribe burn the habitat in which these species occur because of restrictive management. Open sunny barrens benefit *Festuca paradoxa* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Festuca paradoxa* populations within the Forest. In particular, Japanese honeysuckle and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the otherwise open areas.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Festuca paradoxa* outside of natural areas may become over-shaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. In addition, monitoring of known populations is essential in determining the extent to which this species occurs on the Forest.

Restrictive resource management is expected to benefit the species with the exception of Wilderness Areas where there will be an inability to prescribe burn for rare plant species and

habitat enhancement. The use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

27. *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, critically imperiled in Kansas, Kentucky, Michigan, Nebraska, Ohio, and Oklahoma, and possibly extirpated in North Carolina, Pennsylvania, and West Virginia. The Global Rank of G4 was assigned by The Nature Conservancy in 1984.

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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Gentiana alba*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Gentiana alba* 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 *Gentiana alba* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Gentiana alba* may become overshaded, suppressed or out-competed by exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

28. *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 in Illinois, 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 patureland, 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 G3G4 in 1994. This species is currently listed as critically imperiled in Illinois, Kentucky and Oklahoma, and imperiled in Tennessee and Louisiana. 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 the Forest at a prairie remnant in Alexander County. Information regarding that collection is lacking in the literature.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Helianthus silphioides*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

The effects of fire are known to have positive effects on barrens and prairie species and their habitat on the Forest. Several barrens and prairies have had multiple prescribed fires and these species have persisted as well as reducing competition from weedy species and exotics. This species also occurs on the Mark Twain National Forest and is most commonly found in dry, rocky chert woodlands, sometimes in cherty dry to dry-mesic bottomland woodlands; it does well in prescribed burn sites (Molano-Flores 2004c).

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Silphium pinnatifidum* populations within the natural area. The rare barrens community types, such as these, will succumb to successional species if intensive management is not implemented. Open sunny barrens benefit *Helianthus silphioides* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Helianthus silphioides* may become overshaded, suppressed or out-competed by exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

29. 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, and West Virginia, imperiled in North Carolina, and vulnerable in New York and Georgia.

In southern Illinois it is known from Alexander, Pope, and Union counties. On the Forest it is known from a 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Heteranthera reniformis*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 *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 demonstated by its occurrence in a spring on private land. 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 *Heteranthera reniformis* population within the area.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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* is found most frequently. If the species is negatively impacted at this location, there will be negative cumulative effects to the species in southern Illinois.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

30. *Hexalectris spicata* (Spiked crested coralroot orchid)

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 (1995). It is critically imperiled in Illinois, Kansas, Oklahoma, and West Virginia, and imperiled in Indiana, Arkansas, Louisiana, Mississippi, New Mexico, and Mississippi. It is considered vulnerable in Arizona, Ohio, Virginia, Georgia, and Florida. 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 1994 where 3 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). 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Hexalectris spicata*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Hexalectris spicata* outside of natural areas may become overshaded, suppressed or out-competed by other aggressive woody native species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

31. *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 (2004), 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 2004). The Nature Conservancy assigned this species a rank of G4 in 1994 (NatureServe 2004. This species is currently listed as presumed extirpated in Pennsylvania, critically imperiled in Ohio, West Virginia, Maine, Rhode Island, New Jersey, Maryland, Georgia, and Mississippi,

imperiled in Illinois, Missouri, Indiana,Tennessee, New York, Connecticut, Delaware, North Carolina, and Alabama, and vulnerable in Virginia and Texas. *Hottonia inflata* populations are in decline over much of its range (NatureServe 2004). 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 2004).

In southern Illinois it has been collected from: Cave Valley 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), and several locations from LaRue-Pine Hills/Otter Pond Research Natural Area in Union County.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Hottonia inflata*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 demonstated by its occurrence in a spring on private land. 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 *Hottonia inflata* population within the area.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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* is found most frequently. If the species is negatively impacted at this location, there will be negative cumulative effects to the species in southern Illinois.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

32. *Isotria verticillata* (Purple fiveleaf orchid)

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, Vermont, Delaware, and Alabama. It is also listed as being vulnerable in Indiana, Louisiana, Georgia, North Carolina, Rhode Island, and Connecticut.

A single population with two colonies occurs at Cretaceous Hills Ecological Area (Pope County). 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Isotria verticillata*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 long-term effects for alternative 3. These effects may come from the eventual woody species and 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. 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. 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 Eulalia (*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 verticiallata* and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Istotria verticiallata* may become overshaded, suppressed or out-competed by Japanese honeysuckle and other exotics such as Eulalia. 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 Illinois will be inevitable.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

33. *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 G3G4 in1997 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, Georgia, the District of Columbia, and New Hampshire, imperiled in Illinois, Missouri, Mississippi, North Carolina, Maryland and Tennessee, and vulnerable in Minnesota, Wisconsin, Arkansas, Indiana, Michigan, Kentucky, Ohio, West Virginia, Virginia, New Jersey, and Delaware.

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 Effects:

Juglans cinerea is susceptible to fire damage (USDA 1990). Habitat for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. 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. Habitat for this species burned during these periods with 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 but if it is, the trees will be protected from the fires. Selective tree and shrub removal will aid in more sunlight reaching the forest floor and will benefit this species. The removal of threatening Japanese honeysuckle is desirable in location where this species occurs.

Cumulative Effects:

Cumulative effects are similar to environmental effects to this species. Since there will be no negative environmental effects, there will be no cumulative effects to this species from any of the proposed actions in any of the alternatives. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

34. *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 (1983) because of its historically wide distribution within 26 states and the District of Columbia, but it is critically imperiled in Missouri, Arkansas, Kentucky, Louisiana, and Florida. It is imperiled in Illinois and Alabama and is considered vulnerable in Indiana, Ohio Georgia and Mississippi. 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, 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Lilium superbum*. Roads and trails management, recreational trail/road use, developed recreational site use, dispersed recreational use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Alternatives 1-4 may have negative effects pertaining to

restrictive resource management in Wilderness Areas where prescribed fires will not be permitted for rare plant and habitat enhancement.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. This is demonstrated by the perpetuating *Lilium superbum* at Simpson Township Barrens and Fink Sandstone Barrens Ecological Areas. Several individuals of this species were found in Fink Sandstone Barrens for the first time on May 27, 1997 (observations made by Elizabeth Longo Shimp and Stephen Widowski) following a prescribed burn April 2, 1997. The leaf litter had burned off as well as killing some small sugar maple trees, which dominated the area along a ravine. A prescribed burn at Simpson Township Barrens on March 12, 1997 included the creek terrace that *Lilium superbum* inhabits. This population was discovered in the early 1990s following prescribed burns and has perpetuated at this location and was last noted September 29, 1997 (observations made by Elizabeth Longo Shimp and Nicholas Giannettino) after the species had already senesced. This same area was viewed in spring of 2004 and it was noted that the canopy at this location is once again closing in and becoming very shaded.

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. There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Lilium superbum* populations outside of natural areas within the Forest. In particular, Japanese honeysuckle and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Lilium superbum* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Lilium superbum* outside of natural areas may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. In addition, monitoring of known populations is essential in determining the extent of over-collection that may be taking place on the Forest.

Restrictive resource management is expected to benefit the species except in Wilderness Areas where there will be an inability to prescribe burn for rare plants and habitat enhancement. The use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

35. *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 in1984. 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Lonicera dioica* var. *glaucescens*. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Dispersed recreational use may have some short-term and long-term negative effects in all alternatives if over-collection results from visits to the population site on the Forest. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives. 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).

On the Forest, this species 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 numerous populations of rare species perpetuated and endured the harsh conditions.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of the only remaining *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. This threat may also be compounded by excessive shading from trees and shrubs above the cliff face. At one site this species does not occur within a protected natural area on the Forest and because of this, it may be more difficult to control over-collecting by plant enthusiasts, and to implement prescribed burning and aggressive tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. In the long-term, populations of *Lonicera dioica* var. *glaucescens* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper. Alternative 3 may pose a problem if chemical use is prohibited when hand-pulling of exotic species is unsuccessful where this species occurs.

Restrictive resource management is expected to benefit the species as well as the use of prescribed fire in surrounding habitat and integrated pest management (particularly hand-pulling) by eliminating the competition from other more aggressive species. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

36. *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 possibly being extirpated in Ohio, critically imperiled in Illinois, Tennessee and Kansas, imperiled in North Carolina and South Carolina, and vulnerable in Alabama and Georgia. 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 and Little Grand Canyon/Horseshoe Bluff Ecological Areas, and Fountain Bluff. It is a very rare species 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Lonicera flava* except in Wilderness Areas where there will be an

inability to prescribe burn for rare plants and habitat enhancement. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Dispersed recreational use may have some short-term and long-term negative effects in all alternatives if over-collection results from visits to the population site on the Forest. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives. 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).

On the Forest, this species 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 numerous populations of rare species perpetuated and endured the harsh conditions.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of the only remaining *Lonicera flava* populations on the Forest. Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where this population occurs, may become detrimental to this species. This threat may also be compounded by excessive shading from trees and shrubs above the cliff face. At one site this species does not occur within a protected natural area on the Forest and because of this, it may be more difficult to control over-collecting by plant enthusiasts, and to implement prescribed burning and aggressive tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. In the long-term, populations of *Lonicera flava* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper.

Restrictive resource management is expected to benefit the species except in Wilderness Areas. The use of prescribed fire will benefit the species in surrounding habitat as well as integrated pest management (particularly hand-pulling) by eliminating the competition from other more aggressive species. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

37. *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 G2 in 1997 indicating that this species is extremely rare and is likely to become federally listed in the future. Only 86 populations within 11 counties are known in the world with a center of distribution in the southern Appalachian Mountains of North and South Carolina (Basinger 2000). It is listed as critically imperiled in Illinois (possibly extirpated here), Kentucky, Alabama, Georgia, and South Carolina, and imperiled in Tennessee and North Carolina. 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. This population was last seen in 1999. A second site for this species was found in 1968 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Lysimachia fraseri*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and aquatic resource management expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to integrated pest management. This will result from areas that will not be treated for aggressive exotic species removal/control.

Alternatives 1-4 would have some negative direct and indirect long-term effects on *Lysimachia fraseri* where this species may occur within Wilderness Areas. This would be a result of the inability to prescribe burn the habitat in which this species occur because of restrictive management. The effects of fire are not well known to this species but it is certain that this species depends on natural disturbances, which create openings in the canopy. 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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Lysimachia fraseri* populations within the Forest. In particular, Japanese honeysuckle and other exotic species may become detrimental to this species, as well as

excessive shading from trees in the overstory and saplings and shrubs in the understory. Negative direct and indirect long-term effects may also result from Alternative 3 if aggressive exotic plant species are not controlled by the use of herbicides when non-chemical means are unsuccessful. Mesic rich woods within with sunny openings along the creek banks benefit *Lysimachia fraseri* and may not be achieved without selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Lysimachia fraseri* may become overshaded, suppressed or out-competed by Japanese honeysuckle and other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. In addition, monitoring of known populations is essential in determining the extent of over-collection that may be taking place on the Forest.

Restrictive resource management is expected to benefit the species except in Wilderness Areas because of the inability to prescribe burn the surrounding vegetation. The use of integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. Integrated pest management will not be able to be utilized in Alternative 3. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

38. *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 G2G3? in 1996. It is listed as critically imperiled in Illinois, imperiled in Indiana, and is not currently ranked 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Oxalis illinoensis*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment

are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control.

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. There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Oxalis illinoensis* populations outside of natural areas within the Forest. In particular, Japanese honeysuckle, Eulalia and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Oxalis illinoensis* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Oxalis illinoensis* outside of natural areas may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. In addition, monitoring of known populations is essential in determining the extent of over-collection that may be taking place on the Forest.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

39. *Panax quinquefolius* (American ginseng)

This species is scattered throughout Illinois in 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.

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). In Illinois it is found occasionally in rich and rocky mesic woods.

According to NatureServe (2004) 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 2004).

The Nature Conservancy gave this species a Global Heritage Status Rank of G3G4 in 2000. It is possibly extirpated in the District of Columbia, critically imperiled in South Dakota, Nebraska, Oklahoma, and Louisiana, imperiled in Ontario and Quebec, Canada, Michigan, South Carolina, New Jersey, Delaware, Vermont, New Hampshire, and Maine, and listed as vulnerable in Illinois, Indiana, Iowa, Minnesota, West Virginia, Tennessee, Georgia, Mississippi, Maryland, Massachusetts, Connecticut, and Tennessee. It is apparently secure in 9 eastern states. 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, Pope, Johnson, Jackson, Massac, Saline, Union, and Hardin counties. It very likely occurs in Gallatin, Pulaski, and Williamson counties although available literature does not have it listed. It is known to occur within 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, and Double Branch Hole Ecological Area. 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Panax quinquefolius*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from

areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control.

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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Panax quinquefolius* populations outside of natural areas within the Forest. In particular, Japanese honeysuckle and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Panax quinquefolius* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Panax quinquefolius* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or other exotic plant species especially outside of natural areas. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. In addition, monitoring of known populations is essential in determining the extent of over-collection that may be taking place on the Forest.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

40. *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 Cincinnatti, 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 (2004) 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 1995 (NatureServe 2004). 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 (NatureServe 2004). 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. There are approximately 20 historically known locations in Illinois (Dolan 2002). 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.

Environmental Effects:

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 Effects:

Cumulative effects are similar to environmental effects to this species. Since there will be no negative environmental effects to known populations on the Forest, there will be no cumulative effects to this species from any of the proposed actions in any of the alternatives. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

41. *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 has given this species the Global Heritage Status Rank of G4 (1994) 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Plantago cordata*. Roads and trails management, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Recreational trail/road use and dispersed recreational use may have negative effects in Alternative 1 because unregulated hiker/equestian use on user-developed trails will be continued. These negative effects will be experienced outside of protected natural areas. Negative effects may also be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Fires will not actually burn the immediate habitat that this species occurs in because of the spring-fed creeks that stay wet year-round or have 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.

Alternative 1 would have negative direct and indirect long-term effects on *Plantago cordata* where it occurs outside of NA management areas. These occurrences along and in the creeks are vulnerable to user-developed hiker/equestrian trails and, currently, populations of each of these two species are being negatively impacted.

The rich open woods and clear spring fed creeks 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. There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from exotic species encroachment, which may cause a reduction in health and vigor of *Plantago cordata* populations within the Forest. In particular, Japanese honeysuckle, Eulalia, Chinese yam and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Plantago cordata* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Plantago cordata* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Eulalia, Chinese yam and/or other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires.

Restrictive resource management is expected to benefit the species except in Wilderness Areas where there is an inability to prescribe burn for rare plants or habitat enhancement. The use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations.

In addition, user-created hiker/equestrian trails and cross-country equestrian riding in Alternative 1 will negatively effect certain locations of *Plantago cordata*. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

42. *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 presumed extirpated in North Dakota, critically imperiled in Iowa, Illinois, Oklahoma, and Florida, imperiled in Missouri, and vulnerable in Indiana and Minnesota. The Global Rank of G5 was assigned by The Nature Conservancy in 1995.

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.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Platanthera clavellata*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual 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 extipation of the species in southern Illinois. In particular, Japanese honeysuckle and Eulalia (*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 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 benefit *Platanthera clavellata* and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Platanthera clavellata* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Poison ivy, or Eulalia. 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 southern Illinois will be inevitable.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

43. *Platanthera flava* var. *flava* (Pale green 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 (2004) 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 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. 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 2004). 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 2004).

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Platanthera flava* var. *flava*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect

short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

The effects of fire are known to have positive effects on this species and its habitat within its range. 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 blufftops. Fires swept across the swamps adding nutrients and reducing competition from more aggressive wetland species. 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, 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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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 and associated wetlands and wet woods to dry up and the demise of this species in Illinois could result.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, integrated pest management, and tree and shrub removal will benefit this species by helping maintain the hydrology of the swamp 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

44. *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 in Pope County. No extant populations are known 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, imperiled in Indiana and Maryland, and vulnerable in Virginia and Quebec, Canada. 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). This species is known from eastern Canada and the northeastern United States, west to Minnesota and south to Illinois, Tennessee, and South Carolina. In Illinois it is historically known from St. Clair, Jackson and Pope 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).

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Poa alsodes*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the

natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control where potential habitat for this species occurs.

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 for this species in southern Illinois occurs adjacent to fire-dependent communities and, likely, burned periodically. There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Poa alsodes* populations within the Forest. In particular, Japanese honeysuckle and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Poa alsodes* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Poa alsodes* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Poison ivy, or other plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires. In addition, monitoring of known populations is essential in determining the extent of over-collection that may be taking place on the Forest.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

45. *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 common primarily in the southeastern and south-central United States and it is declining within the northern portion of its range. It is listed as imperiled in Iowa and Maryland, critically imperiled in Delaware, Illinois, Indiana, Ohio, and Wisconsin, possibly extirpated in New Jersey and Pennsylvania, and presumed extirpated in Michigan and New York. The Global Rank of G5 was assigned by The Nature Conservancy in 1985, 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 Countiy 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), Poco Cemetery Barrens East, Cretaceous Hills, and Dean Cemetery East Barrens Ecological Areas.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Polygala incarnata*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 3. 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.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Polygala incarnata* may become overshaded, suppressed or out-competed by exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

46. *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. The Global Rank of G5 was assigned by The Nature Conservancy in 1988.

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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Pycnanthemum albescens*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

The effects of fire are known to have positive effects on its habitat on the Forest. LaRue-Pine Hills/Otter Pond Research Natural Area has had prescribed fires and has opened up the canopy for the prairie associated species.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Pycnanthemum albescens* 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 *Pycnanthemum albescens* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this

species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

47. *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 only approximately 20 confirmed extant populations. It is listed as imperiled in Virginia, critically imperiled in Connecticut, Delaware, Illinois, Maryland, New Jersey, New York, Tennessee, and West Virginia, possibly extirpated in Missouri, New Hampshire, and North Carolina, and presumed extirpated in the District of Columbia. The Global Rank of G2 was assigned by The Nature Conservancy in 1994.

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 but has not been seen since 1987. Herkert and Ebinger (2002) state the Jackson County report but no specific site locations are listed. 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Pycnanthemum torrei*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

The effects of fire are known to have positive effects on its habitat on the Forest. Cretaceous Hills Ecological Area has had prescribed fires, which has been beneficial to the habitat for this species.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which cause a reduction in health and vigor of *Pycnanthemum torrei* 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 *Pycnanthemum torrei* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal. Exotic species such as Japanese honeysuckle may be detrimental to this species.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Pycnanthemum torrei* may become overshaded, suppressed or out-competed by aggressive exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

48. *Rhynchospora glomerata* (Clustered beak sedge)

Rhynchospora glomerata is a cespitose 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 are 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 critically imperiled in Illinois and imperiled in Delaware and Maryland.

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. 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Rhynchospora glomerata*. Roads and trails management, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Recreational trail/road use and dispersed recreational use may have negative effects in Alternative 1 because unregulated hiker/equestian use on user-developed trails will be continued. These negative effects will be experienced outside of protected natural areas. Negative effects may also be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Fires will not actually burn the immediate habitat that this species occurs in because of the spring-fed creeks that stay wet year-round or have 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.

The rich open woods and clear spring fed creeks 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. There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual woody species and and aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Rhynchospora glomerata* populations outside of natural areas within the Forest. In particular, Japanese honeysuckle, Eulalia, Chinese yam and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Rhynchospora glomerata* and may not be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Rhynchospora glomerata* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Eulalia, Chinese yam and other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative

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

49. *Rudbeckia fulgida* var. *sullivantii* (Sullivant'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.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Rudbeckia fulgida* var. *sullivantii*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual 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 on the Forest. In particular, Japanese honeysuckle and Eulalia (*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 Eulalia has taken over portions of the former seep spring habitat. A large population of Eulalia 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 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.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Rudbeckia fulgida* var. *sullivantii* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Poison ivy, or Eulalia. 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 on the Forest will be inevitable.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

50. *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 overshade 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 imperiled in Indiana and critically imperiled in the District of Columbia and New Jersey. The Global Rank of G5 was assigned by The Nature Conservancy in 2000. 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.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Sagittaria australis*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 population of *Sagittaria australis* at Cretaceous Hills Ecological Area is 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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual 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 extipation of the species in southern Illinois. In particular, Japanese honeysuckle and Eulalia (*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 an example of a seep spring that is all but dried up 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 benefit *Sagittaria australis* and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Sagittaria australis* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Poison ivy, or Eulalia. 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 southern Illinois will be inevitable.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

51. *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 Quebec, Canada, imperiled in Vermont, West Virginia, and Ohio, and vulnerable in Mississippi, New Jersey, Delaware, and Maryland. 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 (Illinois Natural Heritage Database 2002). 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Schoenoplectus purshianus*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Schoenoplectus purshianus* populations or its habitat within the lake margin.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations or habitat of *Schoenoplectus purshianus* may become overshaded, suppressed or out-competed by aggressive exotic species. Aggressive management such as selective tree and shrub removal along the lake margin may be beneficial if encroachment becomes a problem.

Restrictive resource management, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

52. *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 G2G3 was assigned by The Nature Conservancy in 1997. This species is known from 11 states and is listed as critically imperiled in Illinois, Indiana, Kentucky, Virginia, Mississippi, Alabama, and Georgia, imperiled in Tennessee and North Carolina, and vulnerable in Arkansas. South Carolina has not ranked this species.

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 emphsis should be to locate and protect all remaining populations (Hill 2003g).

Environmental Effects:

Some of the populations of *Silene ovata* on the Forest are currently not protected and are being impacted by unregulated equestrian use. These populations will continue to be negatively impacted by equestrian use in Alternative 1. This species is globally rare and in Illinois, are isolated in a few populations on the Forest. Continued negative impacts to unprotected populations will likely cause a trend to federal listing or loss of species viability.

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Silene ovata*. Roads and trails management, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, recreational trail/road use, dispersed recreational use, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 2, and 4. Negative effects may be expected from alternatives 1 and 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Negative effects are expected from recreational trail/road use and dispersed recreational use in Alternative 1.

There may also be some negative direct and indirect long-term effects for alternative 3 pertaining to the exotic species encroachment, which may cause a reduction in health and vigor of *Silene ovata* 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.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Silene ovata* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Eulalia. Although it is not known if fire will benefit this species, more aggressive management will be required to save the populations and habitat that this species inhabitat. Steep, rich talus slopes can be easily disrupted by hydrological disturbances, which will eventually cause the sites to become dehydrated.

Restrictive resource management is expected to benefit the species but the use of integrated pest management and roads and trails management will benefit this species by

eliminating the competition from other more aggressive species and restricting hiker/equestrian use to designated trails. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

53. *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 supression 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 and imperiled in Tennessee. The Global Rank assigned by The Nature Conservancy in 2000 is a G3Q.

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 Vienna 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 prescibed 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Silphium pinnatifidum*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Silphium pinnatifidum* populations within the natural

area. The rare barrens community types, such as these, will succumb to successional species if intensive management is not implemented. Open sunny barrens benefit *Silphium pinnatifidum* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Silphium pinnatifidum* may become overshaded, suppressed or out-competed by other aggressive exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

54. *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 by Steven Olson (Olson 1989) and has not been observed since, but suitable habitat exists throughout the Lesser Shawnee Hills Subsection.

Threats to this species include fire supression 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 1997 is a G4?. It is listed as critically imperiled in Illinois and vulnerable in Tennessee, North Carolina, and Maryland.

Silphium trifoliatum is known in Illinois only from Hardin County. Four stems of this species occurred near the edge of dry upland forest in a somewhat shaded site, but 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).

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Silphium trifoliatum*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

The effects of fire are known to have positive effects on this species in prairie habitats throughout its range. 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.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Silphium trifoliatum* populations within the natural area. The rare barrens community types, such as these, will succumb to successional species if intensive management is not implemented. Open sunny barrens benefit *Silphium trifoliatum* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Silphium trifoliatum* may become overshaded, suppressed or out-competed by other aggressive exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

55. *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 (NatureServe 2004). 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, Arkansas and Louisiana. 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 steam 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Stenanthium gramineum*. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, dispersed recreational use, fire management, aquatic resource management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for alternatives 1, 2, and 4. Negative effects may be expected from Alternative 3 pertaining to vegetation treatments, fire management, and integrated pest management. This will result from areas outside of the natural areas that will not be prescribed burned or treated for aggressive exotic species removal/control. Alternatives 1-4 will have negative impacts to surrounding habitat for this species in Wilderness Areas where there will be an inability to use prescribe burns to enhance rare plants and their habitat.

Alternative 1 would have negative direct and indirect long-term effects on *Stenanthium gramineum* where it occurs outside of NA management areas. These occurrences along and in

the creeks are vulnerable to user-developed hiker/equestrian trails and, currently, at least one population of this species is being negatively impacted by this use.

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. An entire population in Spencer County, Indiana flowered following a timber cut to convert a woodland to farmland. This opening to sunlight benefitted the population but in the long-term would be detrimental because of the extreme disturbance and invasion of successional/exotic species. It is suspected that in areas where selective tree/shrub removal is not feasible, that prescribed fires will help reduce competition for sunlight and therefore, may be beneficial to this species (Phillippe 2004d).

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual aggressive native and exotic species encroachment, which may cause a reduction in health and vigor of *Stenanthium gramineum* populations outside of natural areas within the Forest. In particular, Japanese honeysuckle and other exotic species may become detrimental to this species, as well as excessive shading from trees in the overstory and saplings and shrubs in the understory. Mesic rich woods within with sunny openings benefit *Stenanthium gramineum* and may not be achieved without prescribed fire and/or selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Stenanthium gramineum* outside of natural areas may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Eulalia, Chinese yam and/or other exotic plant species. Although fire may benefit this species, more aggressive management will be required to save the habitat that this species requires.

Restrictive resource management is expected to benefit the species except in Wilderness Areas where there is an inability to prescribe burn for rare plants or habitat enhancement. The use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations.

In addition, user-created hiker/equestrian trails and cross-country equestrian riding in Alternative 1 will negatively effect certain locations of *Stenanthium gramineum*. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

56. *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. The Global Rank assigned by The Nature Conservancy in 1985 is G5 representing its wide distribution in southeastern United States.

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 Effects:

This species 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 competion 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 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 pummelled 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. 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. Most of the Multiflora rose was hand-pulled during 1987 (Schwegman 1992a).

Cumulative Effects:

Cumulative effects are similar to environmental effects to this species. Since there will be no negative environmental effects, there will be no cumulative effects to this species

from any of the proposed actions in any of the alternatives. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

57. *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, ususally 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 and Ohio. It is apparently secure in Kentucky. New Jersey has not ranked this species but its status is currently under review.

In Illinois, it is known in Jackson County from a State Park and from private land and in Williamson County from US Fish & Wildlife managed land. Sites managed by Forest Sevice include the unprotected sites north of the Natural Bridge and two other sites in the Cave Valley/Cedar Creek area 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 recomendations 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 Effects:

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 pummelled 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 all alternatives will negatively impact this species on the Forest. Fire will not be 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 Eulalia and Chinese Yam. Hand removal is preferred over herbicides.

Cumulative Effects:

Cumulative effects are similar to environmental effects to this species. Since there will be no negative environmental effects, there will be no cumulative effects to this species from any of the proposed actions in any of the alternatives. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

58. *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 critically imperiled in Illinois and Louisiana. The Global Rank assigned by The Nature Conservancy in 1984 is G5.

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 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 and observed on April 9, 2000 by Schwegman.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Thelypteris noveboracensis*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic

resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 long-term effects for alternative 3. These effects may come from the eventual 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. In particular, Japanese honeysuckle and Eulalia (*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 Eulalia has taken over portions of the former seep spring habitat. A large population of Eulalia 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 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 benefit *Thelypteris noveboracensis* and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Thelypteris noveboracensis* may become overshaded, suppressed or out-competed by Japanese honeysuckle, Poison ivy, or Eulalia. 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 Illinois will be inevitable.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate the suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

59. *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 *T. 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 (2004), 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 (NatureServe 2004). 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. This species is listed as endangered in Illinois (2004) and it also a Regional Forester's Sensitive Species (2004). Trends for *Trichomanes boschianum* are thought to be declining throughout much of its range (Hill 2003h)

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).

Populations 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, Double Branch Hole, Jackson Hollow, and Sand Ecological Areas, and Brown's Hole Zoological Area. Seven of the former locations are sites where the populations are feared extirpated.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Trichomanes boschianum*. Timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Roads and trails management, recreational trail/road use, dispersed recreational use, and developed recreational site use may have some long-term negative effects in alternatives 1, 2, and 4 if use is too close to known populations. Vegetation treatments, fire management, and integrated pest management

are expected to have positive direct and indirect short-term and long-term effects for all alternatives but fire may have some direct short-term and long-term negative effects if the surrounding forest or that forest on the bluffs results in drying and erosion; on the otherhand, positive effects may result from the burned forest adding nutrients to its microhabitat. With the current information available, fire appears to be neither beneficial nor detrimental to the populations on the Forest.

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 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 *Trichomanes boschianum* populations perpetuated and endured the harsh conditions.

There may also be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual native and exotic species encroachment, which may cause a reduction in health and vigor of *Trichomanes boschianum* populations on the Forest. Vines such as Japanese honeysuckle, Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. In the long-term, populations of *Trichomanes boschianum* may 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire and integrated pest management, may only benefit the species by eliminating the competition from the other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

60. *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 vulnerable in Missouri, critically imperiled in Illinois, Kentucky, North Carolina, Ohio, Tennessee, and Virginia, possibly extirpated in Nebraska, and presumed extirpated in the District of Columbia, New Jersey, and Pennsylvania. The Global Rank assigned by The Nature Conservancy in 1988 is a G5 (NatureServe 2004). 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 and at Little Grand Canyon/Horseshoe Bluff Ecological Area in Jackson County.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Trifolium reflexum*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

The effects of fire are known to have positive effects on this species and its habitat on the Forest. Simpson Township Barrens Ecological Area has had prescribed fires and this species has persisted as have other rare species. In addition, this species did not appear until after a prescribed fire took place in 1995 (collection by Elizabeth Longo Shimp on June 19, 1996). Following another prescribed fire in 1997, this species was again seen flourishing in the natural area. This population has not been relocated within the last few years and may be a response to the lack of fire. This species appears to thrive on natural disturbances and is found in rocky sloped dry-mesic areas on the Forest. According to Taft (2004b), there was very little use of fire as a management tool in recent times prior to 1981. Since that time, fire has been used as a management tool in habitats that *Trifolium reflexum* has been discovered in. The correlation between these areas being burned and the appearance of this species has implications that the increased use of fire has lead to some recovery of this species.

There may be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Trifolium reflexum* populations within the natural areas. The rare barrens

community types and dry open woodlands will succumb to successional species if intensive management is not implemented. Open sunny barrens benefit *Trifolium reflexum* and other fire-dependent species and cannot be achieved without prescribed fire and selective tree and shrub removal.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Trifolium reflexum* may become overshaded, suppressed or out-competed by aggressive exotic species. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal. Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

61. *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 Illinois, Kansas, Vermont, and Ontario, Canada. 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).

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 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*.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Vaccinium stamineum*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

There may be some negative direct and indirect long-term effects for alternative 3. 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 Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. With Alternative 3, in the long-term, populations of *Vaccinium stamineum* may become overshaded, suppressed or out-competed by other aggressive woody native species outside of the natural areas. The population within the natural area may have tree and shrub removal but the control of exotic species will not be utilized. Fire will benefit this species, as well as more aggressive management such as selective tree and shrub removal.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, integrated pest management, and tree and shrub removal will benefit this species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat will help stimulate suppressed populations. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

62. *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 (2004) 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 2004). This species has been reported to hybridize with other *Vitis* species if the occupy the same habitats (NatureServe 2004). The Nature Conservancy ranked this species G3 in 2001 (NatureServe 2004). The Conservation Status of this species is possibly extirpated in Tennessee, critically imperiled in Indiana, Texas, Alabama, West Virginia, Virginia, Pennsylvania, Maryland, and the District of Columbia, imperiled in Illinois and Kentucky, and vulnerable in Missouri. Trends for *Vitis rupestris* are listed as declining throughout much of its range, however, populations in the Ozarks appear to be stable (NatureServe 2004).

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.

Environmental Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Vitis rupestris*. Roads and trails management, recreational trail/road use, dispersed recreational use, developed recreational site use, timber harvest methods, opening/openland management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Vegetation treatments, fire management, integrated pest management, and aquatic resource management are expected to have positive direct and indirect short-term and long-term effects for all alternatives.

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 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 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 swamp benefit *Vitis rupestris*. If woody and invasive species encroachment is detected, prescribed fire and selective tree and shrub removal should be employed.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. 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.

Restrictive resource management is expected to benefit the species but the use of prescribed fire, aquatic resource management, 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. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

63. *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 G5T5 (1991). 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 critically imperiled' in Illinois while populations world-wide are considered secure. 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 (Hill 2003i). In the southern end of its range however, 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 ledge above Hayes Creek in Pope County. Recent searches for this species over the last 9 years 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 Effects:

For all alternatives, restrictive management is expected to have positive direct and indirect short-term and long-term effects on *Waldsteinia fragarioides*. Roads and trails management, recreational trail/road use, developed recreational site use, timber harvest methods, opening/openland management, aquatic resource management, minerals management, and land-ownership adjustment are expected to have no direct or indirect short-term or long-term effects to this species. Dispersed recreational use may have some short-term and long-term negative effects in all alternatives if over-collection of the only remaining populations results. Vegetation treatments, fire management, and integrated pest management are expected to have positive direct and indirect short-term and long-term effects for all alternatives and fire may result in positive effects from the burned forest adding nutrients to its microhabitat as well as reducing surrounding competition.

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.

There may also be some negative direct and indirect long-term effects for alternative 3. These effects may come from the eventual exotic species encroachment, which may cause a reduction in health and vigor of *Waldsteinia fragarioides* populations on the Forest. Japanese honeysuckle, as well as the native Virginia creeper and Poison ivy spreading on rockfaces, where these populations occur, may become detrimental to this species. There may also be excessive shading from trees above the cliff face and those growing at the base of the cliffs.

Cumulative Effects:

Cumulative effects for all alternatives would be comparable to the environmental effects. In the long-term, populations of *Waldsteinia fragarioides* may become overshaded, suppressed or out-competed by other aggressive woody native species, Japanese honeysuckle, Poison ivy, and/or Virginia creeper.

Restrictive resource management is expected to benefit the species but the use of prescribed fire and integrated pest management may only benefit the species by eliminating the competition from other more aggressive species. The prescribed fire may also add nutrients back to the microhabitat. These cumulative effects take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

/s/*Elizabeth L. Shimp*
Elizabeth L. Shimp
Botanist

E. LITERATURE CITED OR REVIEWED

Ambrose, D. M., W.R. Ostlie, M. R. Scheun and D. Walter. 1994. Element Steward Abstract for *Chelone oblique* var. *speciosa*. The Nature Conservancy. Arlington, Virginia.

Anderson, M. K. and J. S. Peterson. 2000. Natural Resource Conservation Service Plant Guide. USDA, NRCS, National Plant Data Center. Department of Environmental Horticulture, University of California, Davis, California. 3pp

Anderson, R. C., J. S. Fralish, J. E. Armstrong and P. K. Benjamin. 1993. The ecology andn biology of *Panax quinquefolius* L. (Araliaceae) in Illinois. American Midland Naturalist. 129:357-372.

Basinger, M.A. 1998. Distribution, habitat, and demographic characteristics of *Silene ovata* Pursh (Caryophyllaceae) populations in Illinois. Status report prepared for Illinois Department of Natural Resources. 34 pp.

Biological and Conservation Data System. 2001. Managed by The Nature Conservancy for Illinois Department of Natural Resources, Division of Natural Heritage.

Bittner, R.T. 1995. The distribution and microhabitat relations of a rare grass, *Calamagrostis porteri* ssp. *insperata*, in southern Illinois. A thesis submitted in partial fulfillment of the requirements for the Master of Science Degree, Dept. of Plant Biology, Southern Illinois Univeristy, Carbondale. 97 pp.

Bittner, R.T. and D. J. Gibson. 1993. Distribution and Ecology of Calamagrostis porteri ssp. insperata (Swallen) C. Greene in southern Illinois. Final Report submitted to Illinois

Department of Conservation, August 31, 1993. Dept. of Plant Biology, Southern Illinois University, Carbondale. 45 pp.

Bittner, R.T. and D. J. Gibson. 1998. Microhabitat relations of the rare reed bent grass, *Calamagrostis porteri* subsp. *insperata* (Poaceae), with implications for its conservation. Ann. Missouri Bot. Gard. 85:69-80.

Campbell, J.N., M. Evans, M.E. Medley and N.L. Taylor. 1988. Buffalo clovers in Kentucky (Trifolium stonloniferum and T. reflexum): historical records, presettlement environment, rediscovery, endangered status, cultivation and chromosome number. Rhodora 90(864)399-418.

Crow, G. E. and C. B. Hellquist. 2000. Aquatic and wetland plants: Vol. 2 Angiosperms: monocotyledons. The University of Wisconsin Press.

Cusick, A. W. 1982. *Scirpus purshianus* Fernald Pursh's Bulrush. Ohio Department of Natural Resources, Division of Natural Areas and Preserves Database at: http://www.dnr.state.oh.us/dnap/Abstracts/S/scirpurs.htm (Accessed 11/18/2002).

Cypher, E. Botanist, Bakersfield, CA. Personal communication with Raymond Smith, botanist with Forest Service, 1992.

Danderson, C.A.. 2004a. Unreviewed Draft Conservation Assessment for American Bluehearts (*Buchnera americana* L.). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated September 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 27 pp.

Danderson, C.A.. 2004b. Unreviewed Draft Conservation Assessment for Hales Corydalis (Corydalis halei [Small] Fern. and schub.). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated August 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 24 pp.

Danderson, C.A.. 2004c. Unreviewed Draft Conservation Assessment for Large Yellow Lady's-Slipper (*Cypripedium pubescens* Willd.). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated October 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 31 pp.

Danderson, C.A.. 2004d. Unreviewed Draft Conservation Assessment for Wavy-leaf Purple-Coneflower (*Echinacea simulata* R.L. McGregor). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated September 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 23 pp.

Danderson, C.A.. 2004e. Unreviewed Draft Conservation Assessment for Longbeak Arrowhead [*Sagittaria australis* (J.G. Smith) Small = *Sagittaria longirostra* (Micheli) J.G. Smith)]. Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated October 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 21 pp.

Danderson, C.A.. 2004f. Unreviewed Draft Conservation Assessment for Sand Grape (*Vitis rupestris* Scheele). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated September 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 23 pp.

Deam, C. C. 1940. Flora of Indiana. Department of Conservation, Division of Forestry. Indianapolis, Indiana.

Dolan, R. 2001. Species data collection form: *Phaeophyscia leana*- Lea's Bog Lichen. Butler University, Freisner Herbarium. Indianapolis, Indiana. 14pp

Dolan, R. 2003. Species data collection form: *Platanthera flava* var. *flava*- Southern Rein Orchid. Butler University, Freisner Herbarium. Indianapolis, Indiana. 12pp

Dolan, R. 2003. Species data collection form: *Scirpus purshianus* – Weakstalk bullrush. Butler University, Freisner Herbarium. Indianapolis, Indiana. 12pp

Dolan, R. 2003. Species data collection form: *Vitis rupestris* – Sand Grape. Butler University, Freisner Herbarium. Indianapolis, Indiana. 11pp

Dolan, R. 2001. Species data collection form: *Waldsteinia fragarioides* – Barren Strawberry. Butler University, Freisner Herbarium. Indianapolis, Indiana. 13pp

Edgin, B. 2003. Data sheets for relocations of *Corydalis halei, Oxalis illinoensis, Synandra hispidula,* and *Styrax grandifolia*.

Evers, R.A. 1963. Some unusual natural areas in Illinois and a few of their plants. Natural History Survey Division, Biological Notes No. 50.

Fernald, M.L. 1950. Gray's Manual of Botany. Eighth Edition. Dioscorides Press, Portland, Oregon. 1632 pp.

Fiebig, A. E., J. T. A. Proctor, U. Posluszny and D. P. Murr. 2001. The North American ginseng inflorescence: development, floret adscission zone, and the effect of ethylene. Canadian Journal of Botany. 79:1049-1056.

Gleason, H.A. 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. Macmillan Publishing Co., Inc., New York. 1732 pp, in 3 volumes.

Gleason, H.A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second Edition. The New York Botanic Garden, Bronx, New York. 910 pp.

Godfrey, R.K. and J.W. Wooten. 1979. Aquatic and Wetland Plants of Southeastern United States: Monocotyledons. The University of Georgia Press, Athens. 712 pp.

Godfrey, R.K. and J.W. Wooten. 1981. Aquatic and Wetland Plants of Southeastern United States: Dicotyledons. The University of Georgia Press, Athens. 933 pp.

Herkert, J.R. (editor). 1991. Endangered and Threatened Species of Illinois: Status and Distribution, Vol. 1: Plants. Illinois Endangered Species Protection Board, Springfield, Illinois. 158 pp.

Herkert, J.R. (editor). 1993. Additions, Deletions, and Changes to the Illinois List of Threatened and Endangered Species. Illinois Endangered Species Protection Board, Springfield, Illinois. 28 pp.

Hopkins, W.E. 1966. The Vascular Flora of Lusk Creek Canyon. M.A. Thesis, Southern Illinois University at Carbondale.

Homoya, M.A. 1993. Orchids of Indiana. Published by the Illinois Academy of Science, Indiana University Press, Bloomington and Indianapolis.

Homoya, M. A. and D. A. Rayner. 1987. *Carex socialis* (Cyperaceae): a new record from the Atlantic Coastal Plain. Castanea 52:311-313.

Hill, S.R. 2002a. Conservation Assessment for French's Shooting Star (*Dodecatheon frenchii* (Vasey) Rydb.). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 31, 2002. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 27 pp.

Hill, S. R. 2002b. Conservation Assessment for Deerberry (*Vaccinium staminium* L.). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 31, 2002. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 36 pp.

Hill, S.R. 2003a. Conservation Assessment for Bradley's Spleenwort (*Asplenium bradleyi* D.C. Eaton). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests January 6, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 27 pp.

Hill, S.R. 2003b. Conservation Assessment for Black-stem Spleenwort (*Asplenium resiliens* Kunze). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests January 6, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 30 pp.

Hill, S.R. 2003c. Conservation Assessment for Twining Screwstem (*Bartonia paniculata* (Michx.) Muhl.). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests April 28, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 33 pp.

Hill, S.R. 2003d. Conservation Assessment for Ofer Hollow Reedgrass (*Calamagrostis porteri* A. Gray ssp. *insperata* (Swallen) C.W. Greene). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests April 28, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 30 pp.

Hill, S.R. 2003e. Conservation Assessment for Red Honeysuckle (*Lonicera dioca* L. 'var. *glaucescens* (Rydb.) Butter'). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests March 31, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 40 pp.

Hill, S.R. 2003f. Conservation Assessment for Yellow Honeysuckle (*Lonicera flava* Sims) Butter'). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests April 4, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 37 pp.

Hill, S.R. 2003g. Conservation Assessment for Ovate catchfly (Silene ovat*a* Pursh). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests May 9, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 31 pp.

Hill, S. R. 2003h. Conservation Assessment for Appalachian Bristle Fern (*Trichomanes boschianum Sturm*). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests January 17, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 31 pp.

Hill, S. R. 2003i. Conservation Assessment for Barren Strawberry (*Waldsteinia fragarioides* (Michx.) Tratt. ssp. *fragarioides*). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests June 4, 2003. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 39 pp.

Hutchison, M., S.D. Olson and S. Harris, Jr. 1988. Establishment Record for the Barker Bluff Research Natural Area within the Shawnee National Forest, Hardin County, Illinois. 59 pp including maps and appendices.

Hutchison, M. and J. White. 1973. The Yellowwood, a rare tree in Illinois. A report compiled for the Illinois Nature Preserves Commission on September 17, 1973. 21 pp.

Illinois Endangered Species Protection Board. 1998. Illinois List of Threatened and Endangered Flora. List provided by agency. 8 pp.

Illinois Endangered Species Protection Board. 1999. Checklist of Endangered and Threatened Animals and Plants of Illinois. 20pp.

Illinois Endangered Species Protection Board. 2004. Notice of Proposed Amendments: Illinois List of Threatened and Endangered Flora. Illinois Department of Natural Resources. 28 pp.

Illinois Natural Heritage Database. 1996. Simple Element Occurrence Record: *Corydalis halei*.

Illinois Natural Heritage Database. 2002. Simple Element Occurrence Record: *Poa alsodes*

Illinois Natural Heritage Database. 2002. Simple Element Occurrence Record: *Scirpus purshianus*

Iverson, L.R., D. Ketzner, and J. Karnes. 1999. Illinois Plant Information Network. Database at http://www.fs.fed.us/ne/delaware/ilpin/ilpin.html. Illinois Natural History Survey and USDA Forest Service. (Accessed Dec. 10, 2002).

Johnson, R.T. 1969. The Vascular Flora of Little Grand Canyon, Jackson Co., IL. M.A. Thesis, Southern Illinois University at Carbondale.

Klinkenberg, R. 1986. Status report on the large whorled pogonia *Isotria verticillata* in Canada. Ontario Ministry of Natural Resources, southewestern region, London, Ontario. 40 pp.

Kost, M.A. and M.R. Penskar. 2000. Natural community abstract for coastal plain marsh. Michigan Natural Features Inventory, Lansing, MI. 5pp.

Kentucky State Nature Preserves Commission. Updated March 2004. Rare plants database at http://nrepcapps.ky.gov/NPRarePlants/details.aspx?species=Helianthus%20silphioides. (Accessed Sept. 2, 2004).

Miller, T.R., Jr. 1999. Status of *Cimicifuga rubifolia* Kearney, Black Cohosh or Appalachian Bugbane, in Illinois, 1999. Status Report prepared for the Illinois Department of Natural Resources, Wildlife Preservation Fund, June 1999-June 2000.

Mohlenbrock, R.H. 1985. Illinois Fora Update. Erigenia, the Journal of the Southern Illinois Native Plant Society. Southern Illinois University, Carbondale, Illinois. 5:53-64.

Mohlenbrock, R.H. 1986. Guide to the Vascular Flora of Illinois, Revised and Enlarged Edition, Southern Illinois University Press, Carbondale and Edwardsville. xii plus 507 pp.

Mohlenbrock, R.H. 1999. The Illustrated Flora of Illinois, Sedges: Carex. Southern Illinois University Press. Carbondale and Edwardsville, Illinois. 328 pp.

Mohlenbrock, R.H. 2002. Vascular Flora of Illinois. Southern Illinois University Press, Carbondale and Edwardsville. xiv plus 490 pp.

Mohlenbrock, R.H. and D.M. Ladd. 1978. Distribution of Illinois Vascular Plants. Southern Illinois University Press. Carbondale, Illinois. 282 pp.

Mohlenbrock, R. H. and J. Schwegman. 1969. A new species of *Carex* sect. *Bracteosae*. Brittonia 21:77-79.

Molano-Flores, B. 2004a. Unreviewed Draft Conservation Assessment for Prairie-Dock (*Silphium pinnatifidum* Elliott). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated October 1, 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 26 pp.

Molano-Flores, B. 2004b. Unreviewed Draft Conservation Assessment for Whorled Rosinweed (*Silphium trifoliatum* L.). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated October 1, 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 33 pp.

Molano-Flores, B. 2004c. Unreviewed Draft Conservation Assessment for Silphium Sunflower (*Helianthus silphioides* Nutt.). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated October 1, 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 28 pp.

Molano-Flores, B. 2004d. Unreviewed Draft Conservation Assessment for Sullivant's Coneflower (*Rudbeckia fulgida* var. *sullivantii* [C.L. Boynt. and Beadle] Cronq.). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004 (dated October 1, 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 16 pp.

Moran, V.S. 1986. A demographic and phenological study of a population of *Synandra hispidula* (Michx.) Baillon within the Wayne National Forest of southeastern Ohio. A thesis presented to the graduate faculty of The College of Arts and Sciences of Ohio University in partial fulfillment of the requirements for the degree of Master of Science. 107 pp.

Morano, L. D. and M. A. Walker. 1995. Soils and plant communities associated with three Vitis species. American Midland Naturalist. 134:254-263.

NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed July 16, 2004).

Olson, S.D. 1989. *Silpium trifoliatum* in Illinois. Trans. of IL Acad. of Sci 82(1,2):17-18.

Olson, S. 2002. Conservation Assessment for Cluster Fescue (*Festuca paradoxa*). Draft under review, provided to the USDA Forest Service, Shawnee and Hoosier National Forests November 2002. 10pp.

Phillippe, L. R. 1996. Botanist with Illinois Natural History Survey, Champaign, IL. Personal communication with Elizabeth Shimp, Botanist with Forest Service, on May 15, 1996.

Phillippe, L.R. 2004a. Unreviewed Draft Conservation Assessment for *Chelone obliqua* Linnaeus var. *speciosa* Pennell & Wherry). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 16, 2004 (dated 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 8 pp.

Phillippe, L.R. 2004b. Unreviewed Draft Conservation Assessment for *Eleocharis wolfii* (A. Gray). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 16, 2004 (dated 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 10 pp.

Phillippe, L.R. 2004c. Unreviewed Draft Conservation Assessment for *Phaeophyscia leana* (Tuckerman) Esslinger. Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 16, 2004 (dated 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 24 pp.

Phillippe, L.R. 2004d. Unreviewed Draft Conservation Assessment for *Stenanthium gramineum* (Ker Gawler) Morang. Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 16, 2004 (dated 2004). Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 128 pp.

Shimp, J.P. and E.L. Shimp. 1994. Personal observations of *Phaeophyscia leana*. Heritage Biologist for Illinois Department of Natural Resources and Botanist for Shawnee National Forest.

Robertson, K. R. and L. R. Phillippe. 1992. The current status of *Eleocharis wolfii* (Gray) Patterson in Illinois. Illinois Natural History Survey Center for Biodiversity Technical Report 1992(4), prepared for Illinois Endangered Species Protection Board, Springfield, IL. 42 pp.

Robertson, K. R. and L. R. Phillippe. 1993. The current status of *Agalinis skinneriana* (wood) Britton in Illinois. Illinois Natural History Survey Center for Biodiversity

Technical Report 1993(2), prepared for Illinois Department of Conservation, Division of Natural Heritage, Springfield, IL. 34 pp.

Schwegman, J. 1982. A new species of *Oxalis*. Phytologia 50(7):463-467.

Schwegman, J. 1992a. Plant Species Biology Summary for *Styrax grandifolia*, Bigleaf Snowbell Bush. Compiled for the Illinois Department of Conservation, Division of Natural Heritage on January 17, 1992. 5 pp.

Schwegman, J. 1992b. Plant Species Biology Summary for *Cladrastis kentuckea*, Yellowwood. Compiled for the Illinois Department of Conservation, Division of Natural Heritage on January 21, 1992. 4 pp.

Schwegman, J. 1999. A survey to determine the status of Filmy Fern (Trichomanes boschianum) sporophyte populations formerly known or reported from Illinois. Report by John E. Schwegman on April 15, 1999 to the Forest Service. 36 pages including maps.

Smith, R.G. 1988. The vascular flora of Jackson Hollow. M.S. Thesis, Southern Illinois University at Carbondale.

Steyermark, J.A. 1963. Flora of Missouri. The Iowa State University Press, Ames, Iowa. 1728 pp.

Stritch, L.R. 1982. A Floristic Survey of the Hayes Creek Canyon Watershed, Pope County, Illinois. M.S. Thesis, Southern Illinois University at Carbondale.

Taft, J.B. 2004a. Unreviewed Draft Conservation Assessment for *Amorpha nitens* Boynton. Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 21 pp.

Taft, J.B. 2004b. Unreviewed Draft Conservation Assessment for *Trifolium reflexum* L. Provided to the USDA Forest Service, Shawnee and Hoosier National Forests December 15, 2004. Illinois Natural History Survey, Center for Biodiversity, 607 East Peabody Drive, Champaign, Ill. 19 pp.

The Nature Conservancy. 2002. Science Archives: Conducting Prescribed Burns. Accessed from website http://nature.org on 12/10/2002.

USDA Forest Service. 1990. Silvics of North America, Volume 2 Hardwoods. Forest Service Agriculture Handbook 654. 877 pp.

USDA Forest Service. 1992. Shawnee National Forest, Amended Land and Resource Management Plan, Harrisburg, Illinois.

USDA Forest Service. 1992. Shawnee National Forest, Final Environmental Impact Statement for the Amended Land and Resource Management Plan, Harrisburg, Illinois.

USDA Forest Service. 1994. Eastern Region Regional Forester's Sensitive Species List, March 8, 1994. 72 pp.

USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Vellend, M. M.J. Lechowicz, and M.J. Waterway. 2000. Germination and establishment of forest sedges (Carex, CYPERACEAE): Tests for home-site advantage and effects of leaf litter. Amer. J. of Botany 87(10):1517-1525.

Wilhelm, G. and L. Masters. 1994. The current status of *Phaeophyscia leana* (Tuckerman) Esslinger in Illinois. A report prepared for the Illinois Department of Conservation, Resource Management. 17 pp.

Wilhelm, G., L. Masters and J. Shimp. 2000. The Illinois population of *Phaeophyscia leana*, one of the world's rarest lichens. Erigenia. 18:66-74.

Yatskievych, G. 1999. Steyermark's Flora of Missouri: Volume 1. Published by Missouri Department of Conservation in cooperation with Missouri Botanic Garden Press, St. Louis, Missouri. 991 pp.