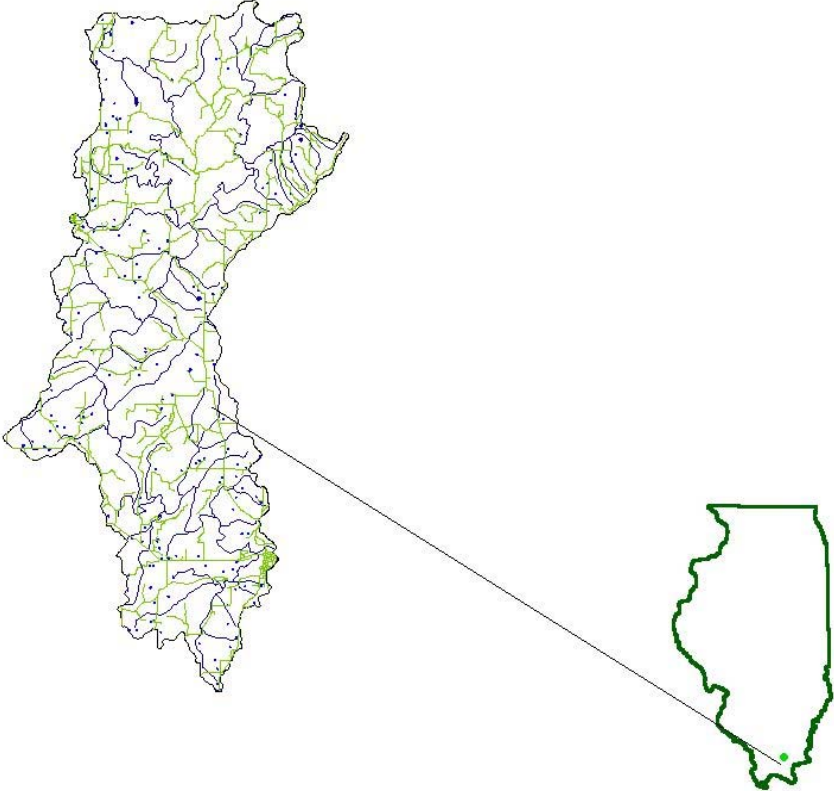


Lusk Creek Watershed Assessment



Shawnee National Forest



**LUSK CREEK
WATERSHED ASSESSMENT**

AUGUST, 2003

Vienna Ranger District
Shawnee National Forest

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Lusk Creek Watershed

Lusk Creek originates near Delwood, Illinois (Page et al. 1992) and flows southeastward to its confluence with the Ohio River (river mile 902) near Golconda, Illinois. Lusk Creek, a 4th order stream (Carmody 1989), is 40 kilometers (km) long and averages seven meters (m) in width (Page et al. 1992). Tributaries of Lusk Creek include Flick Branch, Beatty Branch, Miller Creek, Quarrel Creek and Little Lusk Creek. The Lusk Creek watershed comprises 22,368.85 hectares in Pope County, 9178.08 of which are managed by the USDA Forest Service. Elevations within the watershed range from 91 to 324 m above sea level.

Annual precipitation averages 117 centimeters (cm), and maximum temperatures in the drainage area can exceed 100 degrees Fahrenheit (F) in the summers and minus fourteen degrees F in the winters.

The 227.5-square km watershed of Lusk Creek is considered to be a highly valued stream in Illinois. Substrate within the watershed is predominately coarse, consisting of gravel, cobble, boulder, and bedrock (Hite et al. 1990). Mean velocity of the stream was 11.5 cm per second (cm/s), with a range from 0 to 125.0 cm/s (Carmody 1989). Turbidity ranges from 0 to 60 JTU, and pH from 6.5 to 9.0 (Carmody 1989). Consequently, Lusk Creek is categorized as a high-quality stream that supports a relatively diverse fish and mussel fauna, as well as many other aquatic organisms (Carmody 1989).

Air Resources

Shawnee National Forest management must comply with the federal Clean Air Act and amendments and applicable state laws and regulations. The Illinois Environmental Protection Agency (IEPA) has been designated by the State to administer the laws and regulations required by the Clean Air Act. All air pollution emissions from the USDA Forest Service projects and activities will meet applicable pollution control requirements.

Forest management activities that have the potential to affect air quality are prescribed fires. Wildfires can also affect air quality. Between 1994 and 1998 the Shawnee National Forest averaged eighteen wildfires per year. In the early 1990's the Forest Service prescribed burns averaged 1300 acres per year; but in the late 1990's the average dropped to a few hundred acres. Prior to each burning season a burning permit is obtained from the IEPA that includes all areas prescribed for burning. In addition to the state permit, burn plans are written to comply with Forest Service regulations. The permit and burn plan help ensure that emissions will be low and that smoke is safely dispersed.

Airsheds are classified as Class I or Class II. Class I areas are basically large national parks and wilderness areas. Class II airsheds are remaining areas of the country not designated Class I. A greater amount of air pollution can be added to Class II areas than to Class I and still remain within state compliance. The entire Shawnee National Forest is designated as a Class II airshed. The nearest air quality monitoring station is in Carbondale, Illinois. According to IEPA, air within the Shawnee National Forest meets state air quality standards.

Section 1. Aquatic Populations



Figure 1.1—Lusk Creek Upper Drainage

Step 1. Characterize the Watershed

1.1) Aquatic Populations

Lusk Creek is a high-quality spring-fed stream that supports a diverse assemblage of aquatic organisms (Page et al. 1992, Carmody 1991, Hite et al. 1990). The presence of exceptional habitat conditions such as clean gravel riffles and cold springs provide premium space for many fish species. Several uncommon and State of Illinois-listed endangered fish are present within the watershed, including the black redhorse (*Moxostoma duquesnei*), least brook lamprey (*Lampetra aepyptera*) and northern hog sucker (*Hypentelium nigricans*) (Burr and Mayden 1979). One spring in the upper portion of the drainage supports a state-listed endangered species of amphipod (*Crangonyx anomalous*) that is unknown elsewhere in Illinois (Table 1.1).

The high water quality and substrate stability of Lusk Creek provides excellent habitat for freshwater mussels (Carmody 1991). Fifteen species of native and two species of introduced mussels are components of Lusk Creek's mussel composition (Table 1.2). Crayfish within an aquatic environment are generally limited to one of two species (Rabeni 1985). Lusk Creek supports four species of aquatic crayfish including *Orconectes illinoiensis*, endemic to southern

Illinois, and one species of terrestrial crayfish, *Fallicambarus fodiens* (Table 1.3). High crayfish diversity within the Lusk Creek drainage is additional evidence of its biological uniqueness.

Table 1.1—Listed Invertebrates within the Lusk Creek Watershed.

Common Name	Genus / Species	Habitat	Status Within Illinois
Anomalous spring amphipod	<i>Crangonyx anomalus</i>	Sp	Endangered
Species Count	1		
Habitat		Status	
P = Ponds R = River L = Lakes S = Streams T = Terrestrial Sp = Spring		* = Indicates an introduced species.	
Names herein are after: Illinois Endangered Species Protection Board. 1999. Checklist of Endangered and Threatened Animals and Plants of Illinois. Springfield, Illinois.			

Table 1.2—Mussels of the Lusk Creek Watershed.

Common Name	Genus / Species	Habitat	Status Within Illinois
flat floater	<i>Anodonta suborbiculata</i>	P, L, S	Common
cylindrical papershell	<i>Anodontoides ferussacianus</i>	S	Common
gaint floater	<i>Pyganodon grandis</i>	P, L, S	Widespread & Common
squawfoot	<i>Strophitus undulatus</i>	R, S	Widespread & Common
paper pondshell	<i>Utterbackia imbecillis</i>	P, L, R, S	Widespread & Common
threeridge	<i>Amblema plicata</i>	R, L	Widespread & Common
mapleleaf	<i>Quadrula quadrula</i>	R, L	Widespread & Common
fatmucket	<i>Lampsilis siliquoidea</i>	L, S	Widespread & Common
yellow sandshell	<i>Lampsilis teres</i>	R	Common
fragile papershell	<i>Leptodea fragilis</i>	S	Widespread & Common
pondmussel	<i>Ligumia subrostrata</i>	P, S	Common
threehorn wartyback	<i>Obliquaria reflexa</i>	R	Widespread & Common
pink heelsplitter	<i>Potamilus alatus</i>	R	Widespread & Common
pink papershell	<i>Potamilus ohioensis</i>	R	Widespread & Common
lilliput	<i>Toxolasma parvus</i>	P, L, R, S	Widespread & Common
Asia clam *	<i>Corbicula fluminea</i>	L, S	Widespread & Common
zebra mussel *	<i>Dreissena polymorpha</i>	L, S	Widespread & Common
Species Count	15 (2 non-native)		
Habitat		Status	
P = Ponds R = River L = Lakes S = Streams T = Terrestrial		* = Indicates an introduced species.	
Names herein are after: Cummings, K. S., and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.			

Table 1.3—Lusk Creek Watershed Crayfish Assemblage.

Common Name	Genus / Species	Habitat	Status Within Illinois
Not available	<i>Cambarus diogenes</i>	S, L, T	Common
Not available	<i>Cambarus tenebrosus</i>	S	Uncommon
Not available	<i>Fallicambarus fodiens</i>	T	Uncommon
Not available	<i>Orconectes illinoiensis</i>	S, L	Common in Southern Ill.
Not available	<i>Procambarus acutus</i>	P, L, R, S	Common in Central Ill.
Species Count	5		
Habitat		Status	
P = Ponds R = River L = Lakes S = Streams T = Terrestrial		* = Indicates an introduced species.	
Names herein are after: Page, L. M. 1985. The Crayfish and Shrimps (Decapoda) of Illinois. Illinois natural History Survey Bulletin, Vol. 33, Art. 4. p. 335-448.			

Step 2. Issue Identification

1.2) Fisheries

- 1.2.1) Maintain or enhance the present fish population and diversity.
- 1.2.2) Identify and evaluate fish populations within the watershed.
- 1.2.3) Identify and determine impact on the watershed of non-native aquatic species.

Step 3. Description of Current Conditions

1.3.1) Fish Community Structure

To maintain and enhance fish populations and diversity, baseline population and presence-absence data must be obtained and analyzed. The following sources were used in compiling a comprehensive fish species list and associated habitat for the Lusk Creek watershed: Page et al. 1992, Hite et al. 1990, and Burr and Mayden 1979. Additional species accounts were provided by the Illinois Department of Natural Resources (IDNR) and Southern Illinois University at Carbondale (SIUC).

In the late 1970's, a study was conducted by SIUC to compile a species list for the Shawnee National Forest and to summarize information on habitat, distribution, and ecology (Burr and Mayden 1979). This study yielded distributional data on 27 species of fish from the Lusk Creek watershed. Beginning in 1986, the IDNR began fish sampling within Lusk Creek watershed. Fifty-eight species of fish were collected during these surveys; the bluntnose minnow (*Pimephales notatus*), largemouth bass (*Micropterus salmoides*), longear sunfish (*Lepomis megalotis*), and striped shiner (*Luxilus chrysocephalus*) representing the most common species collected. Supplementary sampling by the IDNR near the Lusk Creek confluence with Ohio River provided documentation of several additional species, including the bighead carp (*Hypophthalmichthys nobilis*) and silver chub (*Macrhybopsis storeriana*). Museum records from

the Illinois Natural History Survey and SIUC provided verification of an additional seven species for the watershed. Museum, state, and literature records have provided accounts and associated habitat data for 75 species of fish that are known to or have been known to inhabit the Lusk Creek watershed (Appendix A).

1.3.2) **Threatened and Endangered (Status Fish)**

Currently the least brook lamprey, a state-listed species (Illinois Endangered Species Protection Board. 1999), is the only known status fish within the watershed. The least brook lamprey is a nonparasitic lamprey adapted to life in clear, permanent, headwater streams with stable beds of silt and gravel (Pflieger 1997). The known distribution of the least brook lamprey in Illinois is limited to a few streams in the southeastern portion of the state (Weitzell et al. 1998). Lusk Creek is home to the largest known population of least brook lamprey in Illinois and the only site within the state where spawning activity has been documented (Weitzell et al. 1998).

1.3.3) **Non-native Aquatic Species**

Bighead carp (*Hypophthalmichthys nobilis*), common carp (*Cyprinus carpio*), and silver carp (*Hypophthalmichthys molitrix*) are currently the only non-native fish species documented from the watershed. However, the closely related grass carp (*Ctenopharyngodon idella*) also might be present within the drainage. Bighead and silver carp are biologically similar (Courtenay and Stauffer 1984) and were first imported into the United States in 1972. Since their introduction, these two species quickly spread using the nation's major rivers (Mississippi, Missouri, Ohio) as dispersal corridors. Today, bighead and silver carp inhabit over eighteen states.

Zebra mussels (*Dreissena polymorpha*) are small, triangular-shaped mussels native to the Black Sea introduced into the United States in the mid-1980's. Vectors for their introduction were human shipping activities. Since its introduction the zebra mussel has spread throughout large portions of the Mississippi and Ohio River basins. Rapid growth rate, high fecundity, and capacity for down-stream dispersal make the zebra mussel highly invasive.

Step 4. Description of Reference Condition

1.4.1) **Fish Community Structure**

Historically, the fish assemblage within Lusk Creek has been ranked as outstanding due to its high species diversity and the presence of high quality habitat (clear rock-bottomed pools, gravel riffles, and cold springs) (Smith 1971). Recently, in a stream characterization conducted by the state of Illinois, the majority of Lusk Creek's main stem was designated as either a Unique Aquatic Resource or Highly Valued Aquatic Resource. Factors that supported this designation were high species richness, proportional trophic composition, and fish abundance and condition (Bertrand et al. 1993).

Because human populations adjacent to stream corridors directly impact stream quality (Hite et al. 1990), it is reasonable to assume that changes in human populations within stream corridors influence fish community structure. Lusk Creek watershed lies completely within Pope County,

Illinois. Since the turn of the century, Pope County has experienced dramatic population changes. In 1820 the population was 2,610, and peaked at over 14,000 by 1890 (Kandl 1990). The population then dropped to 7,996 in the 1930's, and was down to 4,250 by 1980. Local population declines were triggered by farm failures during the Great Depression, resulting in considerable emigration from the area. Population declines of this type have been documented in other parts of the United States following farmland degradation (USDA 2000). It can be assumed that the period of greatest stream impact occurred around the turn of the century when human density was highest.

1.4.2) Threatened and Endangered (Status Fish)

The least brook lamprey was first reported from Lusk Creek on March 28, 1982. Since then it has been collected on five other occasions (Weitzell et al. 1998). All records of the least brook lamprey from the watershed have originated from only a few locations, indicating a highly localized population.

Reproductive success of the least brook lamprey is dependent on the presence of clean, sand-gravel substrates. Impoundments and channelization of southern Illinois streams has effectively reduced the availability of this type of habitat. Limited spawning sites, combined with a narrow geographic distribution, have caused the least brook lamprey population to decline in Illinois (Burr et al. 1986).

1.4.3) Non-native Aquatic Species

Common carp were imported to the United States as early as 1831 (Pflieger 1997). Today common carp are a permanent component of lakes, rivers, swamps, and ponds throughout the United States. Negative impacts resulting from the introduction of common carp have ranged from increased turbidities to species exclusion (Seegert 1987, Carlander 1969). Currently, common carp are widespread within the Lusk Creek watershed. In 1997, the first bighead carp was reported from Lusk Creek; one year later the first silver carp was documented within the drainage. Early evidence suggests that bighead and silver carp are as adaptive and ecologically disruptive as the common carp.

The current distribution of the zebra mussel within Lusk Creek is restricted to the area near its confluence with the Ohio River. Reproductive mode and early life-stage characteristics precluded zebra mussel from up-stream colonization. Upstream colonization within the watershed can only occur through an outside transport mechanism (i.e., human intervention) (Clarke et al. 1999).

Step 5. Synthesis and Interpretation

1.5.1) Fish Community Structure

Although a few fish species have disappeared from the Shawnee National Forest since human development began (Burr and Mayden 1979), Lusk Creek still supports a diverse fish assemblage (75 species). Degradation associated with human population influences is lower today than it

was in 1890. Population decline and changes in land use (agriculture to forest) since the turn of the century have reduced sedimentation and allowed the development of larger riparian zones, thus enabling the watershed to revert to a more natural state (Kandl 1990).

1.5.2) Threatened and Endangered (Status Fish)

Weitzell et al. (1998) suggest that least brook lampreys in Lusk Creek spend their entire lives within a 1000-m stream-reach. This type of restricted distribution makes a population dependent on local environmental conditions and exceedingly sensitive to localized changes within that environment. During 1997-1998 the area adjacent to the only documented spawning site on Lusk Creek was cleared of trees, resulting in erosion and increased siltation to the spawning riffle. It is currently unknown what affect this had on the population.

1.5.3) Non-native Aquatic Species

Bighead and silver carp are effective filter-feeders that can consume large amounts of phytoplankton and microzooplankton. This type of feeding behavior makes them direct competitors with larval fish, native mussels, and several species of adult fish. Bighead carp can grow up to five pounds in a single year and reach a maximum size of 40.8 kilograms (kg), (Pflieger 1997) enabling them to out-compete native species and evade predation early in life. The large adults of these two carp species increase their reproductive capacity to a level much higher than most native fish. Bighead and silver carp exhibit reproduction and growth capabilities that represent a significant threat to any aquatic system they invade.

Zebra mussels, in large numbers, are capable of removing nearly all the phytoplankton and zooplankton from the water-column; as a result they compete with native fish and mussel populations. Native mussels not only have to compete with zebra mussels for food, they have to contend with literally being inundated by them. Habitat selection by zebra mussels focuses on positive rheotaxis, making the areas around the exhalant and inhalant siphons of larger native mussels preferred habitat. This type of species-to-species interaction has led to the decline of native mussels throughout the expanding range of the zebra mussel. Several non-native species currently in the Lusk Creek system have the potential to cause significant biological damage.

Step 6. Opportunities

1.6.1) Fish Community Structure

Fish population-monitoring within the watershed is limited to bi-annual surveys by the IDNR. These surveys are conducted at one to four standardized sampling locations. While this sampling protocol provides valuable community trend-data it is limited in its ability to identify isolated populations and provide comprehensive species data. Spring environments are known to support distinctive and highly specialized fauna; these biologically unique locations within the watershed need to be identified and inventoried. Development of random monitoring methods would provide a more finely detailed representation of fish diversity and community structure within the watershed, thus enabling the Forest Service to target diverse or highly unique locations should acquisition opportunities arise.

The fragile nature of high quality sections of Lusk Creek makes them extremely vulnerable to impacts from human activities (Hite et al. 1990). Identification and procurement of high quality areas would increase the continuity and stability of the watershed.

1.6.2) Threatened and Endangered (Status Fish)

Presently the least brook lamprey is known from only six sites in Illinois. The city of Marion is proposing to construct a water reservoir, inundating one of these sites and drastically impacting another (Weitzell et al. 1998). Of the four remaining sites, one is in danger due to proposed bridge construction and another is experiencing the impact of increased siltation due to tree clearing. A high percentage of the known habitat for the least brook lamprey in Illinois falls within the Shawnee National Forest, providing the forest with the opportunity, through monitoring and habitat improvement, of ensuring that the least brook lamprey does not become extirpated in Illinois.

1.6.3) Non-native Aquatic Species

Existing data suggests that the encroachment of bighead and silver carp into Lusk Creek watershed is confined to the lower section of the drainage adjacent to the Ohio River; however, this assessment is based on limited information. A comprehensive survey is needed to determine the actual distribution of these two carp species. Zebra mussels are currently limited to the bottom-most section of the watershed. Steps to contain the zebra mussel within the lower portion of the drainage should be taken. Public education has been an effective method in other parts of the United States in slowing the spread of non-native species, and could help the Shawnee National Forest in limiting the spread of exotic species within the Lusk Creek drainage.

Section 2. Botany

Step 1. Characterize the Watershed

2.1.1) Terrestrial Plant Ecology

The Lusk Creek watershed includes a diversity of ecosystems, including a clear, rock-bottom stream with several tributaries, massive bluffs of Pennsylvanian sandstone, deep ravines, mesic woods, dry and dry-mesic upland oak-hickory woods, old fields, and pine plantations. The watershed includes the Lusk Creek Canyon National Natural Landmark, encompassing approximately 291.38 ha, Lusk Creek Canyon Ecological Area (approximately 102.38 ha), Lusk Creek North Ecological Area (approximately 1.01 ha), and Lusk Creek Zoological Area (the creek from bank to bank). Outside of the landmark, the designated natural areas are Martha's Woods Ecological Area (approximately 14.16 ha), Chimaphila Site Botanical Area (approximately .12 ha), Reddick Hollow Botanical Area (approximately 1.61 ha), Pleasant Valley Limestone Barrens Ecological Area (approximately 1.82 ha), and Copperous Branch Limestone Barrens Ecological Area (approximately 10.52 ha). All of these areas are protected under the Forest Plan) management prescription for natural areas.

A tremendous amount of relief is displayed from east to west in the Lusk Creek Canyon Ecological Area. At the Lusk Creek Gorge, the ridge-top to the northeast rises to an elevation of 216 m above sea level, while the stream elevation is only 121.92 m above sea level (Hopkins, 1968). This geologic feature was created by the runoff waters from the Illinois Glacier melt as it cut its way through the blocks of Pennsylvanian sandstone approximately 200,000 years ago.

The varying exposures offered by the steep cliff formations and canyons provide a diversity of plant communities within the Lusk Creek watershed. The stream community includes the clear rock-bottom stream and the immediate riparian community. River birch, smooth alder, black willow, and sycamore dominate the riparian community. Lowland forests are found on relatively flat ground with moderately deep soils and characterized by cool air currents and a dense undergrowth of trees and shrubs. The lowland-forest community also includes the ravine areas. The wet bluffs and ledges create microhabitats that might be unique to this area. Mesic, shaded, north-facing bluffs and cliff faces, some reaching 27 m to 30 m in height, are essentially undisturbed. Sandstone glades and xeric forest communities are perched on the driest exposures. Dry-mesic forests of white oak, black oak, and hickories, with beech, sugar maple, red oak, and tulip tree occur throughout the watershed. Many of the ridge tops are composed of oldfield communities.

Within the past decade equestrian use within the watershed has increased significantly. Much of the land administered by the Forest Service has a maze of user-developed equestrian trails that threaten many botanical resources. Various categories of disturbance imposed by these user-developed trails have become evident within the Lusk Creek Canyon Ecological Area. These include trampling and removal of vegetation, compaction of soils, alteration of natural drainage patterns, erosion and transfer of soil, removal of upper soil horizons, and microhabitat modification (*e.g.* higher light levels) (Shimp 1999). This ecological area has been closed to equestrian use and other threatening recreational activities, and former user-developed equestrian trails are “healing” by the natural re-establishment of surrounding vegetation. Areas that are highly eroded remain evident especially on steep slopes, although some former user-developed trails have been brushed or have been improved with water bars or check dams.

2.1.2) Federally-Listed Threatened or Endangered Plants

Based upon historical records and the most current (November 29, 2000) distribution list for Illinois, there are no federally-listed threatened, endangered, or proposed plants known to occur within the Lusk Creek watershed.

2.1.3) Regional Forester Sensitive, Forest-listed and State of Illinois Threatened or Endangered Plants

Table 2.1—Regional Forester Sensitive, Forest-listed and State of Illinois-listed endangered or threatened plants of the Lusk Creek watershed.

Common Name	Genus / Species	Status
roundstem foxglove	<i>Agalinis gattereri</i>	FS*
wavy-leaved aster	<i>Aster undulatus</i>	FL
supplejack	<i>Berchemia scandens</i>	FL, SE

Ofer Hollow reedgrass	<i>Calamagrostis porteri</i> ssp. <i>insperata</i>	FS
black-edged sedge	<i>Carex nigromarginata</i>	FL, SE
shaved sedge	<i>Carex tonsa</i>	FL
Willdenow's sedge	<i>Carex willdenowii</i>	FL, ST
spotted wintergreen	<i>Chimaphila maculata</i>	FL, SE
black cohosh	<i>Cimicifuga rubifolia</i>	FS
Carolina thistle	<i>Cirsium carolinianum</i>	FL
large yellow lady's slipper	<i>Cypripedium pubescens</i>	FS
hay-scented fern	<i>Dennstaedtia punctilobula</i>	FL, SE
Yadkin's panic grass	<i>Dichantherium yadkinense</i>	FS, SE
French's shooting star	<i>Dodecatheon frenchii</i>	FS
butternut	<i>Juglans cinerea</i>	FS
Common Name	Genus / Species	Status
wild hairy lettuce	<i>Lactuca hirsuta</i> var. <i>sanguinea</i>	FL, ST
superb lily	<i>Lilium superbum</i>	FS
yellow honeysuckle	<i>Lonicera flava</i>	FS, SE
Fraser's loosestrife	<i>Lysimachia fraseri</i>	FS, SE
creeping loosestrife	<i>Lysimachia radicans</i>	FL, SE
climbing milkweed	<i>Matelea obliqua</i>	FL, LT
large wood sorrel	<i>Oxalis illinoensis</i>	FS, SE
American ginseng	<i>Panax quinquefolius</i>	FS
Lea's bog lichen	<i>Phaeophyscia leana</i>	FS, SE
heart-leaved plantain	<i>Plantago cordata</i>	FS, SE
arching dewberry	<i>Rubus enslenii</i>	FL
spring ladies' tresses	<i>Spiranthes vernalis</i>	FL, SE
pink valerian	<i>Valeriana pauciflora</i>	FS*
Total Species Count	<u>28</u>	
	Status	
	FS = Regional Forester's Sensitive FL = Forest-listed SE = State Endangered ST = State Threatened FS*removed from FS list since 1992 Forest Plan	
Names herein are after: Mohlenbrock, R.H. 1986. Guide to the Vascular Flora of Illinois, revised and enlarged edition, southern Illinois University Press, Carbondale and Edwardsville.		

Step 2. Issue Identification

- 2.2.1) Maintain and enhance native plant communities, including ecological restoration and the use of prescribed fire.
- 2.2.2) Enhance Regional Forester's sensitive species habitat so that negative impacts do not result in a trend to federal listing or a loss of viability.
- 2.2.3) Maintain, enhance, and protect threatened, endangered, Regional Forester's sensitive, and rare plant populations.

- 2.2.4) Control and/or eradicate noxious and other non-native invasive species by various methods, including mechanical and chemical means.

Step 3. Description of Current Conditions

2.3.1) Natural Community Structure

The varying exposures offered by the steep cliff formations and canyons provide microhabitats and a diversity of ecosystems within the Lusk Creek watershed. Mesic, shaded north-facing bluffs and cliff faces, some reaching 27 m to 30 m in height, are essentially undisturbed. Sandstone glades and xeric forest communities are perched on the driest exposures. Dry-mesic forest of white oak (*Quercus alba*), black oak (*Quercus velutina*), hickories (*Carya* species), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), northern red oak (*Quercus rubra*), and tulip tree (*Liriodendron tulipifera*) occur throughout the watershed. River birch (*Betula nigra*), smooth alder (*Alnus serrulata*), black willow (*Salix nigra*), and sycamore (*Platanus occidentalis*) dominate the riparian community. A large number of the ridge tops are composed of oldfield communities. Plant succession in many of these oldfields has created savanna-like communities dominated by red cedar (*Juniperus virginiana*) and little bluestem (*Schizachyrium scoparium*).

Within these various communities, equestrian use is allowed, except within natural areas. Prior to the closure of these areas, natural resource damage was documented, causing public and agency concern (Faulkner 1993, Shimp 1999). During the 1990s, the public and various agencies undertook examination of the controversial issues surrounding multiple use and its impacts within natural areas and other vulnerable locations throughout the Forest. The Lusk Creek watershed has been one of the focal points of this examination.

2.3.1.1) Vegetation

Partial list of lichens from the Lusk Creek watershed: Species list according to Hopkins (1968). Nomenclature has not been updated.

Stream: large boulders and rocks near stream on sandstone substrates. *Buellia stigmaea*, *Bacidia inundata*, *Caloplaca flavovirescens*, *Candelariella vitellina*, *Collema rysssoleum*, *Dermatocarpon fluviale*, and *Ionaspis epulotica*.

Lowland Forest: Oak-hickory-maple forest. On trees are *Anzia colopodes*, *Bacidia shweinitzii*, *Bacidia suffusa*, *Cladonia decorticata*, *Coccocarpia cronia*, *Parmelia austrosinensis*, and *Usnea strigosa*.

Wet Bluffs and Ledges: On sandstone substrate. *Anaptychia palmulata*, *Cladonia cylindrica*, *Cladonia furcata*, *Cladonia squamosa*, *Nephroma helveticum*, and *Parmelia caperata*.

Dry Bluffs: Associated with *Juniperus*, *Vaccinium*, and *Quercus*. On trees are *Catillaria atropurpurea*, *Centraria juniperina*, *Dermatocarpon tuckermanii*, *Lecania cyrtella*, *Parmelia caroliniana*, *Parmelia hypotropa*, and *Physcia tribacoides*. On sandstone substrates are

Cladonia boryi, *Cladonia caroliniana*, *Cladonia chlopophaea*, *Cladonia degenerans*, *Cladonia mateocyantha*, *Cladonia rangiferina*, and *Cladonia uncialis*. On soil are *Cladonia verticillata*, *Diploschistes caruposus*, *Lecidea macrocarpa*, *Parmelia conspersa*, *Parmelia reticulata*, *Peltigera canina*, and *Sarcogyne simplex*.

Upland Forest: Dry oak-hickory forest. On trees are *Lecanora caesiorubelia*, *Lecanora subfusca*, *Lecanora subfuscata*, *Ochrolechia pallescens*, *Parmelia dilatata*, *Parmelia multipuncta*, and *Physcia orbicularis*. On sandstone substrate are *Parmelia madagascariacea*, and *Parmelia tinctorum*.

Oldfields: Associated with *Diospyros*, *Sassafras*, and *Ulmus*. On trees are *Buellia parasema*, *Candelaria concolor*, *Lecanora chalarona*, *Lecanora cupressi*, *Parmelia galbina*, *Physcia aipolia*, and *Physcia stellaris*. On soil are *Cladonia subtenuis* and *Cladonia cristatella*.

Partial list of vascular flora from the Lusk Creek watershed: species list compiled from Shawnee National Forest floristic surveys (using Mohlenbrock 1968 for nomenclature) and Hopkins 1968 (nomenclature has not been completely updated from thesis). Please see Appendix B for species list compiled.

2.3.2 & 2.3.3) Federally-listed Endangered and Threatened, Regional Forester's Sensitive (FS), Forest-listed (FL), and State of Illinois-listed Endangered or Threatened (SE or ST) Plant Species

Agalinis gattingeri (roundstem foxglove - removed from Regional Forester's sensitive species list in 1994): An herbaceous perennial occurring in argillaceous to siliceous slopes, open woods, and barrens of southwestern Ontario and southeastern Michigan to southern Minnesota and eastern Nebraska, then south to Alabama, Louisiana and eastern Texas. It flowers August to early October.

It is uncommon to occasional throughout Illinois and found in dry, often rocky woods. Natural succession is a primary threat for *Agalinis gattingeri* throughout its range. The loss of fire as a historical disturbance/management regime might be leading to the destruction of habitat throughout much of the species' range. This species was removed from the Regional Forester's Sensitive Species (RFSS) list in 1994 because its Global Ranking by The Nature Conservancy changed from G3 to G4 (NatureServe 2001), reflecting that it was not as uncommon in portions of its range as previously thought. The Association for Biodiversity Information (1999) has determined that this species is vulnerable in Illinois. It is found in the wilderness area north of the Lusk Creek Canyon Ecological Area in upland oak-hickory woods along the Lusk Creek Zoological Area where it has been documented as rare.

Aster undulatus (wavy-leaved aster), FL: A perennial herb occurring in the eastern United States. In Illinois, it is known only from the Shawnee Hills Natural Division. Here it occurs in dry, open, upland forests where it typically blooms from August through October.

Natural succession is a primary threat for *Aster undulatus* throughout its range. The loss of fire as a historical disturbance/management regime might be leading to the destruction of habitat

throughout much of its range. This species was removed from the Regional Forester's Sensitive Species (RFSS) list in 1994 because its Global Ranking by The Nature Conservancy changed from G3 to G4, reflecting that it was not as uncommon in portions of its range as previously thought. The Association for Biodiversity Information has determined that this species is vulnerable in Illinois. Found within the Lusk Creek watershed, its presence along trails, woodland openings, and roadsides is believed to be a result of more sunlight reaching the forest floor at these sites. The plants noted within the watershed area appear to be scattered. This species is becoming more commonly found within southern Illinois in the dry uplands and barrens areas and is not considered as rare as it once was. It also is apparently resilient to disturbances along trails and roads. It was de-listed by the state of Illinois in 1999.

Berchemia scandens (supplejack) FL, SE: A perennial woody vine of the southeastern United States. It reaches its northern range limit at a single Illinois site within an upland forest and adjacent pine plantation. In Illinois, this species typically flowers between April and June, and fruits between August and October.

Threats to this species include clear-cutting, grazing, recreational use of habitat, and loss of habitat to primarily agriculture. It is assigned a G5 Global Ranking by The Nature Conservancy and is reported from fifteen states. It is critically imperiled in Illinois and Kentucky, and apparently secure in North Carolina. It is found within the Lusk Creek watershed, the only known site in Illinois. Approximately 20-30 stems have been counted along a 50-meter length on both sides of an old Forest Service fire lane. The population is in a successional area that includes the edge of a pine plantation and the fire lane. The population occurs partially on private land and partially on Forest Service land.

Calamagrostis porteri ssp. *insperata* (Ofer Hollow reedgrass) FS: 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 agriculture. It was assigned a G4T3 Global Ranking by The Nature Conservancy in 1996. It is known from six states, one in which it is presumed extirpated and four where it has been designated as critically imperiled. It is found within three natural areas in Pope County and these are the only known locations in Illinois. One of these sites is within the Lusk Creek Canyon watershed. There are two very small populations on the edge of one of the natural areas.

Carex nigromarginata (black-edged sedge) FL, SE: A densely-tufted perennial sedge. It occurs in the Gulf and Atlantic states from Texas to Florida to New Jersey, and inland to southern Ohio, Kentucky, Illinois, Missouri, and Arkansas. It is thought to be a species of fire systems and is found on dry to mesic, acidic, sandy, or rocky substrates in deciduous woods edges, openings, and road banks in the eastern United States. In Illinois this species flowers between April and June.

A primary threat to this species appears to be the succession of shrubby species following disturbances. Otherwise, it does well in areas where there is minor disturbance in the canopy, such as tree-fall. The Global Heritage Status Rank is G5, indicating that it may be viewed as relatively common across a large geographic range. In Illinois, *Carex nigromarginata* is rare and is considered critically imperiled. In adjacent Missouri, it is found to be secure. It was thought to occur within the Lusk Creek watershed, since it had been documented as occurring near bluff tops where the habitat is dry. Recently, however, it was concluded that this documented determination was questionable (Schwegman, 2001 personal communication with Elizabeth Shimp); but potential habitat does occur within Lusk Creek Wilderness.

Carex tonsa (shaved sedge) FL: A sedge known from the eastern United States and Canada. In Illinois its status is critically imperiled. Surrounding states have reported this species; but a status is not identified except for Iowa, which describes it as vulnerable. Its Global Heritage Rank is G4 G5; but its status in the United States and Canada is N?, implying that not enough information is available for a proper determination. In Illinois this species flowers between April and June.

The species is known to occur within the Lusk Creek watershed. It is also a species of deep, dry sand deposits along the Mississippi and Illinois rivers. At Lusk Creek Canyon Ecological Area it was found in an area of wet bluffs and ledges, with ledges varying from a few centimeters to several meters. It was found associated with peat moss. Threats to this species are increased recreational uses of its habitat.

Carex willdenowii (Willdenow's sedge) FL, ST: A perennial sedge that occurs in the eastern United States and adjacent Canada. In Illinois it is restricted to the Shawnee Hills Natural Division, where it occurs in dry to mesic upland forest habitats. In Illinois, it flowers from mid-April to mid-May.

Primary threats to this species include native habitat destruction and natural succession. This species has a Global Heritage Status Rank of G5. It is critically imperiled in Illinois, Missouri, and Arkansas. It is reported from Indiana, but a status has not been determined. Found within the Lusk Creek watershed, it is currently known from the Lusk Creek Canyon Ecological Area, which is protected by a closure order restricting certain recreational uses. With this protection, there are no recreational threats and its habitat has no immediate threat of shading, which it does not tolerate well.

Chimaphila maculata (spotted wintergreen) FL, SE: A perennial herb whose range is the eastern United States and adjacent Canada. In southern Illinois it is known from a dry-mesic upland sand forest and within a pine plantation adjacent to a natural area. In Illinois, it generally flowers between June and July.

Primary threats to this species include soil disturbance and soil compaction; it requires an organic litter layer of needles or leaves and grows best in rich, undisturbed soils. This species has a Global Heritage Status Rank of G5. It is critically imperiled in Canada, Illinois and Maine; imperiled in Mississippi and New Hampshire; and vulnerable in Arizona and Indiana. It is reported from twelve other states, but a status has not been determined. It is known within the

Lusk Creek watershed at the *Chimphila* Site Botanical Area in dry-mesic upland woods. This population was first discovered in the late 1970's. The location is near a user-developed equestrian trail but there appeared to be no immediate threats to it in 1996.

Cimicifuga rubifolia (black cohosh) FS: A perennial herb that occurs in portions of Virginia, Tennessee, Kentucky, Alabama, Indiana, and Illinois. This species is limited in its geographical range and there are approximately 50 known occurrences. Of these, 26 distinct populations are found within seven counties in southern Illinois (Miller 1999). In Illinois it flowers between July and September.

The species has been given a Global Heritage Status Rank of G3 by The Nature Conservancy because of its rarity nationally. Threats range-wide include logging and land-use change. Threats on the Shawnee National Forest are primarily illegal all-terrain vehicle (ATV) use and widespread equestrian use. It is known to occur within the Lusk Creek Canyon Ecological Area and the Lusk Creek Wilderness. In these areas it is found in rich woods and confined to one to a few metapopulations. Over the last few years, it has been rare to find any populations on the Shawnee National Forest that have not been negatively impacted by equestrian use. This species is globally rare but found locally abundant in a few of its populations on the Shawnee National Forest. Continued negative impacts to unprotected populations will likely cause a trend to federal listing or loss of species viability. At this time, a closure order restricting certain recreational uses within natural areas has helped in protecting populations of the species. Just east of Saltpeter Cave in Lusk Creek Wilderness, a population is experiencing excessive damage because of extensive equestrian use. An administrative closure of this area to horses would greatly benefit this population and would help in its recovery and the revegetation of its habitat. Close monitoring of this species is indicated on the Shawnee National Forest, in accordance with the Forest Plan.

Cirsium carolinianum (Carolina thistle) FL: A fibrous-rooted biennial occurring in the southeastern United States. It is a species of open dry-mesic upland woods. In Illinois it is associated with barrens areas and rocky woods and is considered rare. This species generally flowers between the months of June and July.

The Global Heritage Status Rank is G5, indicating that this species is not under immediate threat; but it is listed as imperiled in Illinois, Indiana, and Ohio. Threats to this species include canopy-closure and fire-suppression. This species appears to respond well to fire and appears more frequently in upland woods and barrens that have been burned. This species was de-listed in 1994 by the state of Illinois because of the number of occurrences resulting from active fire management on the Shawnee National Forest. It is known from the Lusk Creek watershed: at least one occurrence has been documented in this area. In southern Illinois this species is usually found as single individuals or a few very scattered individuals within a population.

Cypripedium pubescens (large yellow lady's slipper) FS: A rhizomatous perennial orchid found in most of the United States, less eight of the southern states, and Canada. It is known from 52 counties in Illinois; but populations have been in decline or have been extirpated, in many cases, by orchid collectors. Its habitat is rich, moist or dry woods. This species flowers between April and May.

The Nature Conservancy has assigned this species the Global Heritage Status Rank of G5T4T5; but not all states where it occurs have status ranks. Available information suggests that this species is in decline nation-wide. 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, and horticultural and medicinal collecting. Most populations have fewer than 30 individuals and no known populations have more than 400 individuals. In Illinois it is not common, but found in scattered counties throughout the state. It is known to occur within the Lusk Creek watershed within the Lusk Creek Canyon Ecological Area, and is considered very rare on the oak-hickory wooded slope that it inhabits. Protection is offered to this species at this location by a closure order restricting certain recreational uses within this natural area.

Dennstaedtia punctilobula (hay-scented fern) FL, SE: An arching perennial that occurs in the eastern United States and adjacent Canada. In Illinois it is known from four counties where it inhabits moist, shaded sandstone ravines.

The Global Heritage Status Rank is G5; but it is listed as imperiled in Illinois, Missouri, and Arkansas. In Indiana, it is listed as vulnerable. Primary threats to this species include the loss of native habitat and droughty conditions. It is found within the Lusk Creek watershed, from along the Lusk Creek Zoological Area, and within the Lusk Creek Canyon Ecological Area and Lusk Creek North Ecological Area. At these sites, this it is found in areas of wet bluffs and ledges that vary in length from a few centimeters to several hundred meters. Often it is found associated with peat moss.

Dichanthelium yadkinense (Yadkin's panic grass) FS, SE: A perennial grass of the southeastern United States. It is a species of rich or damp woods, thickets, bottomlands, and swamps. In Illinois it is found in a couple of southern counties on damp or wet ground. This species flowers between May and September.

A Global Heritage Status Rank has not been determined for this species. In Illinois, the primary threat to this species is extensive equestrian use in its habitat along creeks and within creek floodplain terraces. It is known to occur within the Lusk Creek watershed, found in the Lusk Creek Canyon Ecological Area, along the banks and creek terrace of Lusk Creek Zoological Area, and within a creek tributary in the Lusk Creek Wilderness. At these locations, it is a species of mesic forests, wet soil, and gravelly streambeds. Although it is protected within natural areas where it occurs by a closure order prohibiting certain recreational uses, it is not protected on the floodplain terrace in the Lusk Creek wilderness. Here damage to the population continues because of extensive equestrian use.

Dodecatheon frenchii (French's shooting star) FS: A perennial herb known from Wisconsin, Illinois, Indiana, Missouri, Kentucky, Arkansas, and Alabama. In Illinois it is confined to the southern one-eighth of the state, where it is found under overhanging sandstone cliffs. At times, it can be locally abundant, especially where recreational activities are minimal. This species generally flowers between April and May.

The Global Heritage Status Rank for this species is G3. Illinois appears to have the most occurrences, and its status, as well as in Kentucky, is listed as vulnerable. It is well established

in southern Illinois, possibly because of its endemic nature. Its status in Indiana and Arkansas is imperiled, and it is critically imperiled in Missouri and Alabama. Primary threats to this species have been recreational activities such as equestrian use under sandstone overhangs, disturbances caused by artifact hunters, rock climbing, illegal ATV use, and camping/campfires. Logging also has been considered a threat when sufficient buffer has not been afforded to populations. It is known to occur within the Lusk Creek watershed, in the Lusk Creek Canyon Ecological Area and the Lusk Creek Wilderness. It is found beneath sandstone overhangs and along drip-lines at the base of bluffs. This species also has been found in the immediate adjacent woods and associated sandstone boulders.

Although this species is protected within natural areas where it occurs, it is not protected on the floodplain terrace in Lusk Creek wilderness. Damage to the populations here continues because of extensive equestrian use along the drip-lines of the cliffs near the creek, particularly in the Saltpeter Cave area. Administrative closure of these areas would benefit this species because it has the potential to revegetate its native habitat with time. Continued negative impacts to unprotected populations in southern Illinois will likely cause a trend to federal listing or loss of species viability. Close monitoring of this species is indicated on the Shawnee National Forest, in accordance with the Forest Plan.

Juglans cinerea (butternut) FS: A deciduous 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. In Illinois this species generally flowers between April and May.

The Nature Conservancy has assigned this species the Global Heritage Status Rank of G3G4, reflecting more than 100 occurrences from at least seventeen states. The abundance and condition of this species are in rapid decline due to butternut canker disease, with no remedy at this time. In Illinois, Missouri, and Tennessee, it is imperiled, while other surrounding states have it listed as critically imperiled or vulnerable. It is found within the Lusk Creek watershed, documented near the Lusk Creek Zoological Area within the Lusk Creek Wilderness. 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.

Lactuca hirsuta var. *sanguinea* (wild hairy lettuce) FL, ST: An annual or usually biennial herb occurring in the eastern United States and adjacent Canada. In Illinois it is confined to the southern one-eighth of the state. Typically it is a species of dry-mesic open woods and generally flowers between July and October.

The Nature Conservancy has assigned this species the Global Heritage Status Rank of G5T5 because of the uncertainty of its status. This species is easily confused with a hairy variety of *Lactuca canadensis* when it is young and is easiest to identify during its flowering stage. Primary threats to this species are natural succession leading to overshadowing, and the loss of native habitat. It is found within the Lusk Creek watershed. At known locations, it is a species of dry-mesic forest openings, occurring within the Lusk Creek wilderness. There appears to be no immediate threats to this species within the watershed.

Lilium superbum (superb lily) FS: A bulbous perennial occurring in the eastern United States. This species is known from four counties in southern Illinois where it grows in low, moist woodlands and is considered rare. It generally flowers during July.

The Nature Conservancy has given this species the Global Heritage Status Rank of G5; but it is critically imperiled in Missouri, Arkansas, and Kentucky, and imperiled in Illinois. Indiana and Ohio have ranked it as vulnerable. In Illinois, this species rarely blooms, most likely the result of excessive shading. The primary threats to this species are overshading, extensive equestrian use, and illegal ATV use. It is a species of mesic woods and streambanks in southern Illinois. It is found within the Lusk Creek watershed, documented from the Lusk Creek Canyon Ecological Area and the Lusk Creek Wilderness. This species is protected within the Lusk Creek Ecological Area because of the closure order restricting certain recreational uses. However, a small population of three plants is threatened by extensive equestrian use near Saltpeter Cave.

Lonicera flava (yellow honeysuckle) FS, SE: A woody vine found in the southeastern United States. It reaches its northern range limit on forested sandstone bluffs in the Shawnee Hills and Ozark Natural Divisions in southern Illinois. This species is known from only two locations in two different counties in Illinois on sandstone cliffs within rocky woods, and generally flowers between April and May.

The Nature Conservancy has given this species a Global Heritage Status Rank of G5 and it is listed as being critically imperiled in Illinois, Tennessee, and Kansas. It has possibly been extirpated from Ohio. Threats to this species include loss of native habitat and droughty conditions. It is found within the Lusk Creek Canyon Ecological Area adjacent to the Lusk Creek Zoological Area. 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 centimeters to several hundred meters. There appear to be no immediate threats to this population at this time.

Lysimachia fraseri (Fraser's loosestrife) FS, SE: A rhizomatous perennial herb known from the southern Appalachians and westward in uplands. The only extant population in Illinois is along a creek in a pristine watershed. The population was surveyed in 1991 and 100 plants were counted. In 1998, only three plants were found, and in 1999 only one plant was found. During 2000, no plants were found at this location. It is unclear as to what has happened with this population. Further monitoring will take place. This species flowers between July and August.

The Nature Conservancy has given this species a Global Heritage Status Rank of G2, indicating that it is extremely rare and is likely to become federally listed in the future. It is known from seven states and is ranked as critically imperiled in Illinois, 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 also have posed serious threats. It has been found within the Lusk Creek watershed, where the single population was known to occur on the sandy creek bank in the Lusk Creek Canyon Ecological Area. The habitat of this population is protected by the closure order restricting certain recreational uses.

Lysimachia radicans (creeping loosestrife) FL, SE: A perennial herb of the Mississippi embayment and eastern Virginia. It is known from swamps and floodplain forests. It occurs in the swamps of Johnson County in Illinois and typically flowers between July and August.

The Nature Conservancy has given this species a Global Heritage Status Rank of G4G5 and it is ranked as critically imperiled in Illinois. A primary threat to this species is loss of native habitat. It has been documented as occurring in the Lusk Creek watershed in Pope County; however, the population has not been verified by anyone other than Hopkins (1968). The occurrence was cited as being in “woods, moist” and “rare” within the Lusk Creek Wilderness.

Matelea obliqua (climbing milkweed) FL, LT: A perennial twining herb of the southeastern United States. It is known from four counties within southern Illinois where it is a species of rocky woods and limestone glades. This species flowers between May and June.

The Nature Conservancy has given this species a Global Heritage Status Rank of G4, and it is listed as critically imperiled in Illinois and imperiled in Indiana and Ohio. Threats to this species include loss of native habitat and shading by successional woody species. This species does well under a fire regime and in open woodlands, where it receives bright sunlight. It is found within the Lusk Creek watershed in the wilderness area. This population is currently being negatively affected by extensive equestrian use, divided by a user-developed trail. Damage to individual plants was seen in 1999 where plants were adjacent to the trail. There is no protection afforded to this population at this time.

Oxalis illinoensis (large wood sorrel) FS, SE: A perennial herb whose range is the Interior Lowland Plateau Province of the southeastern United States. In the Shawnee Hills Natural Division of Illinois, it occupies mesic forests over limestone or other calcareous substrates. It is known from only four states, and in Illinois is only known from Pope County. This species flowers between June and September.

The Nature Conservancy has given this species a Global Heritage Status Rank of G2G3Q and it is listed as critically imperiled in Illinois, imperiled in Indiana, and unranked in Kentucky. It also is reported from Tennessee. The primary threat to this species in the Lusk Creek watershed is extensive equestrian use. Populations are known from Reddick Hollow Botanical Area, a site just outside of the Copperous Branch Ecological Area, Martha’s Woods Ecological Area, and a site along East Fork of Little Lusk Creek. At least two sites are being negatively impacted by user-developed equestrian trails. These populations are currently not protected.

Panax quinquefolius (American ginseng) FS: A perennial herb of the eastern United States and adjacent Canada. This species is found occasionally throughout the state of Illinois, where it grows in rich and/or rocky woods. It generally flowers between June and July.

The Nature Conservancy has given this species a Global Heritage Status Rank of G3G4 and it is listed as vulnerable in Illinois, Indiana, Iowa, and Tennessee. It is critically imperiled on its western range but apparently secure in many 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. It is known to occur within the Lusk Creek watershed, along the Lusk Creek Zoological Area, and in the Lusk Creek Canyon Ecological Area and other locations in the Lusk Creek Wilderness. 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.

Phaeophyscia leana (Lea's bog lichen) FS, SE: A lichen species that occurs in the Ohio River watershed, above the lock and dam at Smithland, Kentucky and below the dam at Uniontown, Kentucky. It is known to occur or to have occurred in the states of Illinois, Indiana, Kentucky, and Tennessee. It occurs on trees below the more recent high-water marks, where other lichen species are essentially absent. Tree species in Illinois on which it has been documented include pin oak (*Quercus palustris*), cherrybark oak (*Quercus pagodaefolia*), cottonwood (*Populus deltoides*), pecan (*Carya illinoensis*), and trees associated with the bottomland areas of old backwaters of the Wabash and Little Wabash rivers.

It is being studied as a potential candidate for the federal endangered species list. The Nature Conservancy has given this species a Global Heritage Status Rank of G2 at this time. The primary threats to this species are the irregular, high-volume floods, combined with the large wakes of river traffic that erode the shorelines at a rate much faster than cottonwoods of suitable size are being replaced, and the threat of overshadowing (Wilhelm and Masters 1994). This species grows best on the lower trunks and bases of trees, which are not shaded by understory or ground cover vegetation. These types of areas are typically boat landings or park-like areas where they are maintained by mowing or regular brush removal. This species occurs in the Lusk Creek watershed near the Ohio River.

Plantago cordata (heart-leaved plantain) FS, SE: 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. At one time it was scattered throughout the state along streams in woods, but is apparently rare now. This species flowers between April and July.

This species has declined throughout its range because of stream erosion and siltation from various activities. Other threats include habitat destruction from urbanization; clearcutting of surrounding woods; cattle-grazing and -trampling; industrial, agricultural, and domestic water pollution; and alteration of stream-flow through ditching, draining, or damming. The Nature Conservancy has given this species a Global Heritage Status Rank of G4; and it has been noted that populations have declined dramatically everywhere except in Missouri, where it appears to be stable. It is critically imperiled in Canada, Illinois, and nine other states, imperiled in one state, and vulnerable in three states. Four other states have it reported, but unranked. It occurs in the Lusk Creek watershed, known from Copperous Branch Ecological Area. It is protected at this site by a closure order restricting certain recreational activities.

Rubus enslenii (arching dewberry) FL: A shrub with almost prickle-less low-arching to trailing canes that occurs in the southeastern United States. It generally occurs on sandstone outcrops,

dry upland woods, and barrens of southern Illinois, and generally flowers between May and June.

The Nature Conservancy has not assigned this species a Global Heritage Status Rank. This species was once thought to be rare on the Shawnee National Forest; but it is increasingly being found in barrens and dry to dry-mesic upland rocky woods. This species responds well to prescribed fire and is found in many of the Forest's previously managed natural areas. It is found within the Lusk Creek watershed, known from the Lusk Creek Canyon Ecological Area and the Lusk Creek Wilderness. There appear to be no immediate threats to this species within the watershed.

Spiranthes vernalis (spring ladies' tresses) FL, SE: A perennial tuberous orchid that occurs in the southeastern and south-central United States, north into southern New England. It is known from seven counties in Illinois, where it has been documented in rich woods and prairies. In Illinois this species flowers between July and August.

The Nature Conservancy has assigned this species the Global Heritage Status Rank of G5. It is critically imperiled in Illinois and imperiled in Indiana. Although this species has a wide range, little information is available regarding its status in the United States. This species is typically found in dry oldfields and prairies where it is exposed to full sunlight. A primary threat to this species appears to be the loss of native habitat. It is found within the Lusk Creek watershed. There is one population in Lusk Creek Canyon Ecological Area. This population is protected by a closure order restricting certain recreational activities at this natural area.

Valeriana pauciflora (pink valerian - removed from the Regional Forester's Sensitive Species list since the 1992 Forest Plan): An herbaceous perennial occurring in eleven of the eastern United States. It is typically a species of mesic and/or rich woods in the southern half of Illinois. In Illinois it flowers between May and June.

The Nature Conservancy has assigned this species the Global Heritage Status Rank of G4. It is critically imperiled in Alabama, imperiled in Virginia, and vulnerable in Tennessee. It is reported as apparently secure in Illinois. There appears to be no immediate threats to this species in Illinois at this time. It is found within the Lusk Creek watershed Area, documented as occurring in the Lusk Creek Canyon Ecological Area. It also is known to occur within the wilderness area. Within the ecological area it is protected by a closure order restricting certain recreational activities.

2.3.4.1) Noxious and Invasive Weeds

Non-native invasive species are recorded from in and around the Lusk Creek watershed. They vary in their rate of invasion and spread. Humans and animals are very effective at facilitating their spread. The impacts of trail use include the introduction of exotic species (Marion 1994). Benninger-Truax *et al.* (1992) indicates that the number of exotic species is higher along trail corridors than in the forest interior. Benninger (1989) cites several studies as well as her own research that indicates trail corridors are important in the distribution of exotic species. Trail use might provide access for many non-native invasive species, including garlic mustard (*Alliaria*

petiolata), into the forest interior. Hikers as well as horses can carry the seeds of non-native invasive species off a trail and spread the plants to other areas.

Since horse manure collected along trails and at stables has contained viable seed, trail problems attributed specifically to horse use could include exotic-seed-containing manure. Non-native invasive species seeds also might be introduced from hay used for horse feed, equipment, and mud stuck to horses' hooves (Marion 1994). Deer dung can contribute to the spread of non-native invasive species; however, Campbell (1996) found that many exotic species were found germinating in horse dung samples but were rare in the deer dung in southern Illinois.

It is difficult to predict which non-native species might be the next, aggressive invasive. In southern Illinois, however, there is evidence that garlic mustard and eulalia (*Microstegium vimineum*) are the next aggressive exotics. And these are associated with trail development and use. Garlic mustard is a shade-tolerant herb that is a threat to deciduous communities and other, human-desired, landscapes. It occurs in dense stands that reduce the diversity of the native flora and might eliminate it (Shimp 1997). Eulalia is a shade-tolerant annual grass that seeds late in the fall and spreads aggressively along trails, roads, and creeks and their associated terraces.

Non-native invasive species already exist on most of the user-developed and designated trails on the Shawnee National Forest. The most aggressive species along Lusk Creek is Chinese yam (*Dioscorea oppositifolia*), which is rapidly out-competing native species along the creek banks and is working its way into the rich woods.

2.3.4.2) Non-native Species Inventory

Non-native species inventoried within the Lusk Creek watershed Area include: *Achillea millefolium*, *Agrostis alba*, *Allium ampeloprasum* var. *atroviolaceum*, *Artemisia annua*, *asparagus officinalis*, *Avena sativa*, *Barbarea vulgaris*, *Belamcanda chinensis*, *Bromus commutatus*, *Bromus inermis*, *Bromus tectorum*, *Capsella bursa-pastoris*, *Catalpa bignonioides*, *Chenopodium album*, *Chenopodium ambrosioides*, *Chenopodium hybridum*, *Chrysanthemum vulgare*, *Commelina communis*, *Coronilla varia*, *Dactylis glomerata*, *Datura stramonium*, *Daucus carota*, *Delphinium ajacis*, *Dianthus armeria*, *Digitaria sanguinalis*, *Draba verna*, *Elaeagnus umbellata*, *Eleusine indica*, *Euonymus fortunei*, *Festuca arundinacea*, *Festuca elatior*, *Glechoma hederacea*, *Iris X germanica*, *Kummerowia stipulacea*, *Kummerowia striata*, *Lactuca serriola*, *Lespedeza cuneata*, *Lespedeza stipulacea*, *Ligustrum vulgare*, *Lonicera japonica*, *Lonicera maackii*, *Lonicera sempervirens*, *Lythrum salicaria*, *Medicago lupulina*, *Melilotus alba*, *Melilotus officinalis*, *Microstegium vimineum*, *Morus alba*, *Narcissus poeticus*, *Narcissus pseudo-narcissus*, *Ornithogalum umbellatum*, *Perilla frutescens*, *Phleum pratense*, *Pinus echinata*, *Pinus strobus*, *Pinus sylvestris*, *Pinus taeda*, *Plantago lanceolata*, *Plantago major*, *Poa annua*, *Poa compressa*, *Polygonum cespitosum* var. *longisetum*, *Polygonum hydropiper*, *Polygonum persicaria*, *Prunus persica*, *Pueraria lobata*, *Pyrus communis*, *Robinia pseudo-acacia*, *Rosa multiflora*, *Rumex acetosella*, *Rumex crispus*, *Rumex obtusifolius*, *Setaria faberi*, *Sorghastrum halepense*, *Stellaria media*, *Taraxacum officinale*, *Trifolium campestre*, *Trifolium dubium*, *Trifolium hybridum*, *Trifolium pratense*, *Trifolium repens*, *Verbascum thapsus*, *Veronica arvensis*, *Xanthium X strumarium*, and *Yucca flaccida*.

Species with rapid establishment and growth rates correlate directly with the greatest potential to overtake native plant communities and change ecological processes for those communities (www.invasivespecies.gov). In the Lusk Creek watershed, some of these plant species are crown vetch (*Coronilla varia*), autumn olive (*Elaeagnus umbellata*), privet (*Ligustrum vulgare*), Japanese honeysuckle (*Lonicera japonica*), white sweet clover (*Melilotus alba*), yellow sweet clover (*Melilotus officinalis*), Eulalia (*Microstegium vimineum*), kudzu (*Pueraria lobata*) and multiflora rose (*Rosa multiflora*),

Those with more moderate rates include oats (*Avena sativa*), yellow rocket (*Barbarea vulgaris*), hairy chess (*Bromus commutatus*), lambsquarter (*Chenopodium albidum*), common day flower (*Commelina communis*), orchardgrass (*Dactylis glomerata*), Deptford pink (*Dianthus armeria*), climbing euonymus (*Euonymus fortunei*), large Fescue (*Festuca arundinacea*), Korean bush clover (*Kummerowia stipulacea*), Japanese bush clover (*Kummerowia striata*), prickly lettuce (*Lactuca serriola*), sericea lespedeza (*Lespedeza cuneata*), black medic (*Medicago lupulina*), beefsteak plant (*Perilla frutescens*), timothy (*Phleum pratense*), Canadian bluegrass (*Poa compressa*), creeping smartweed (*Polygonum cespitosum* var. *longisetum*), smartweed (*Polygonum hydropiper*), smartweed (*Polygonum persicaria*), and curly dock (*Rumex crispus*), chickweed (*Stellaria media*), dandelion (*Taraxacum officinale*), low hop clover (*Trifolium campestre*), red clover (*Trifolium pratense*), and white clover (*Trifolium repens*).

Some species, although identified as NNIS, have become naturalized in southern Illinois. These species apparently do not have rapid growth and spread rates and pose less (in a relative sense) of a threat to native ecosystems. Some of these species are Queen Anne's lace (*Daucus carota*), bitter dock (*Rumex obtusifolius*), and yarrow (*Achillea millefolium*). Some species are native to the United States, but are not native to southern Illinois, or have escaped plantings. Some of these species include yucca (*Yucca flaccida*), white pine (*Pinus strobus*), shortleaf pine (*Pinus echinata*), and loblolly pine (*Pinus taeda*). Some species are not native, but are considered desirable nonnatives and are planted, or an occasional individual escapes cultivation. Some of these include *Iris X germanica*, white mulberry (*Morus alba*), peach (*Prunus persica*), pear (*Pyrus communis*), and black locust (*Robinia pseudo-acacia*).

Step 4. Description of Reference Conditions

2.4.1) Terrestrial Plant Community Structure

Within the past decade equestrian use within the watershed has increased significantly. Much of the land administered by the U.S. Forest Service has a maze of user-developed equestrian trails that threaten the botanical resources and natural plant community types. In the late 1970's, much of the land within the Lusk Creek watershed was infrequently used by equestrians and occasionally traversed by jeeps or other off-road vehicles. Most of the use was by hikers and back-packers, wildlife viewers, educators and researchers, campers, and hunters. The Lusk Creek Canyon Ecological Area and the Lusk Creek Zoological Area became outdoor classrooms for professors and researchers from SIUC. During the late 1950's, a proposal had been made to dam Lusk Creek and create a large fishing lake. Public outcry and outrage over the destruction of the unique and diverse canyon led to cancellation of the plan. Portions of the watershed had

been clearcut early on for timber and had been planted in pine brought in from the eastern and southern states.

Although much of the watershed had been disturbed by timbering, farming, and homesteading, some areas were left relatively undisturbed. Some of these areas are now designated natural areas, which are protected by the Forest Plan management prescription for natural areas. These areas include the Lusk Creek Canyon Ecological Area (approximately 102 hectares), Lusk Creek North Ecological Area (approximately 1.01 hectares), Lusk Creek Zoological Area (the creek from bank to bank), Martha's Woods Ecological Area (approximately 14.16 hectares), Chimaphila Site Botanical Area (approximately .12 hectares), Reddick Hollow Botanical Area (approximately 1.61 hectares), Pleasant Valley Limestone Barrens Ecological Area (approximately 1.82 hectares), and Copperous Branch Limestone Barrens Ecological Area (approximately 10.52 hectares).

Lusk Creek Canyon National Natural Landmark, which encompasses approximately 291 hectares, was designated by the National Park Service and the Forest Service because of the tremendous diversity of flora, fauna, and geologic features. Lusk Creek was determined to be one of the most diverse and pristine creeks in the state of Illinois. The area earned national recognition for its beauty and unique community composition.

2.4.2) Federally-listed Threatened or Endangered Plants

Based upon historical records, there have never been any federally-listed threatened, endangered, or proposed plants known to occur within the Lusk Creek watershed.

2.4.3) Regional Forester Sensitive, Forest-listed and State of Illinois-listed Endangered or Threatened Plants (TES)

Up until approximately ten years ago, there were no human threats to TES plant locations or populations. Disturbances were minimal and populations were being monitored by various individuals and researchers. Designated natural areas were being managed for the plant communities and the TES that they supported. Since that time, there has been an increase in the number of equestrian ranches and camps near Lusk Creek watershed, especially around Eddyville. Within ten years, the number of camps has increased from approximately five to in excess of 30. Advertisements promoted equestrian use in the natural areas on the Shawnee National Forest, areas that were intended to protect and enhance TES and unique community types. User-conflicts became an issue and continue to be, and TES (plants) continue to experience damage and population destruction from the extensive equestrian use within major portions of the Lusk Creek watershed.

2.4.4) Noxious and Invasive Weeds

Noxious and invasive plant species have been a problem since early settlement in southern Illinois. With the settlers came new seeds and plants from Asia and Europe. Various species were introduced for ornamental and agricultural purposes. Sometimes seed was unintentionally

introduced by merely adhering to a horse's coat or being trapped in the mud of a wagon wheel. Trails and roads became conduits for easy dispersal, and wildlife became adapted to feeding on the new vegetation brought in by the seed. Planting pine plantations with stock from other states also introduced new species. Up until a few decades ago, there didn't seem to be a major concern regarding exotic species because the problems were not as apparent. It was not suspected that the exotics could replace the native vegetation so quickly.

Chinese yam (*Dioscorea oppositifolia*) was introduced around 1959 when a school teacher who lived near the Garden of the Gods visited Florida. She brought back a beautiful vine with heart-shaped leaves that she had observed provided a cover along fencelines. She planted it in her yard and it established quite well, so well that it is now known in almost every county in southern Illinois, and can be readily found in almost every creek and adjacent terrace. Birds aided in the quick dispersal of this exotic, and the endless number of bulblits that were formed moved quickly into new territory. In most areas where this plant is found, it out-competes native vegetation and forms a colony, which replaces the natural diverse community.

Kudzu (*Pueraria lobata*) was found north of the Lusk Creek Wilderness approximately five years ago. Today, the population is still approximately the same size, unlike other kudzu populations across the Forest that have progressively increased in size. There is potential for this population to spread rapidly but it has remained in relatively the same location as when it was found. The winter of 2000-2001 brought a cold snap that included a twenty-day ice freeze. These conditions might have aided in the setback of this population, in that it appeared to be smaller in size during the summer of 2001 than in 2000.

Step 5. Synthesis and Interpretation of Information

2.5.1) Terrestrial Plant Community Structure

All plant communities follow a pattern of succession. They are in a dynamic state. The Lusk Creek watershed is no different. However, the extensive increase in equestrian use over the last ten years has significantly changed the integrity of native plant communities. Rarely can one find a portion of a creek terrace that doesn't have a user-developed trail along it. It is common to find endless, confusing trails and spurs within the watershed. Illegal ATV users add to the problems by creating new trails through the woods. Unless one is in a closed natural area, it is not unusual to find two or three user-developed trails paralleling themselves in a barrens or woodland community. The vascular flora is not the only vegetation to suffer from the extensive equestrian use; the lichens, mosses, and liverworts also fall victim to the swath-cutting of user-developed trails.

2.5.2) Federally-listed Threatened or Endangered Plants

Although there have never been any federally listed threatened, endangered, or proposed plants known within the Lusk Creek watershed, it is conceivable that at least three plant and one lichen species might one day become federally listed. *Lysimachia fraseri* (Fraser's loosestrife) might be extirpated in the state of Illinois, with the last location being within the Lusk Creek watershed. This species, which thrives on the natural creek disturbance that it is exposed to, has had its

population diminish from 100 plants in 1991 to three plants in 1998, then to 1 plant in 1999. During 2000 no plants were found in this population. It is unclear as to what the environmental forces were that have led to the demise of this species.

Dodecatheon frenchii (French's shooting star) and *Cimicifuga rubifolia* (black cohosh) are also negatively impacted on the Shawnee National Forest by extensive equestrian use and illegal ATV use. Nearly all of the populations on the Forest have been damaged or destroyed. Although the French's shooting star, an endemic species, was once found to be locally abundant, it is now found with its habitat seriously disturbed and, in some cases, destroyed where equestrians, hikers, and rock climbers have created trails or disturbance along the drip lines of cliffs. This species requires this habitat and the immediate adjacent areas for its perpetuation.

The black cohosh is found on the rocky, talus slopes of rich woods. Often, populations of these species are fragmented or nearly destroyed because of user-developed equestrian trails. Without stricter monitoring and control of user-developed equestrian trails, the efforts to protect this species are nearly futile. The only areas where this species is currently protected are within natural areas where there is a closure order restricting certain recreational uses.

It might be inevitable that *Phaeophyscia leana* (Lea's bog lichen) becomes federally listed. There is no change in management that the Shawnee National Forest can do that will aid in its recovery. Although it occurs in the Lusk Creek watershed area, it does not occur on National Forest land.

2.5.3) Regional Forester Sensitive, Forest-listed and State of Illinois-listed Endangered or Threatened Plants (TES)

Recent increases in human disturbances associated with hiker and equestrian trail use could potentially have a negative affect on several Regional Forester Sensitive, Forest-listed or State of Illinois-listed endangered or threatened (TES) plant species. These negative effects include the elimination or significant degradation of suitable habitat, and direct and indirect disturbances along existing trails and their vicinities.

In the Lusk Creek watershed, the following TES (plants) have been negatively impacted by extensive equestrian use and illegal and legal ATV use: *Cimicifuga rubifolia*, *Dichanthelium yadkinense* (Yadkin's panic grass), *Dodecatheon frenchii*, *Lilium superbum* (superb lily), *Matelea obliqua* (climbing milkweed), and *Oxalis illinoensis* (Illinois wood sorrel).

2.5.4) Noxious and Invasive Weeds

The spread of noxious and non-native invasive species is rampant on the Shawnee National Forest. In the Lusk Creek watershed, some of the more aggressive NIS (plant) are crown vetch (*Coronilla varia*), Chinese yam (*Dioscorea oppositifolia*), autumn olive (*Elaeagnus umbellata*), privet (*Ligustrum vulgare*), Japanese honeysuckle (*Lonicera japonica*), white sweet clover (*Melilotus alba*), yellow sweet clover (*Melilotus officinalis*), eulalia (*Microstegium vimineum*), and multiflora rose (*Rosa multiflora*),

Those with more moderate rates of invasion include oats (*Avena sativa*), yellow rocket (*Barbarea vulgaris*), hairy chess (*Bromus commutatus*), lambsquarter (*Chenopodium albidum*), common day flower (*Commelina communis*), orchardgrass (*Dactylis glomerata*), Deptford pink (*Dianthus armeria*), climbing euonymus (*Euonymus fortunei*), large Fescue (*Festuca arundinacea*), Korean bush clover (*Kummerowia stipulacea*), Japanese bush clover (*Kummerowia striata*), prickly lettuce (*Lactuca serriola*), sericea lespedeza (*Lespedeza cuneata*), black medic (*Medicago lupulina*), beefsteak plant (*Perilla frutescens*), timothy (*Phleum pratense*), Canadian bluegrass (*Poa compressa*), creeping smartweed (*Polygonum cespitosum* var. *longisetum*), smartweed (*Polygonum hydropiper*), smartweed (*Polygonum persicaria*), and curly dock (*Rumex crispus*), chickweed (*Stellaria media*), dandelion (*Taraxacum officinale*), low hop clover (*Trifolium campestre*), red clover (*Trifolium pratense*), and white clover (*Trifolium repens*).

Step 6. Opportunities

2.6.1) Terrestrial Plant Community

Better-managed equestrian use in the Lusk Creek watershed would be greatly beneficial in protecting and enhancing native plant communities. Currently, communities are fragmented by trails that disrupt populations of rare plant species. Many communities are made up of a matrix of somewhat conservative species that grow preferably, and at times exclusively, in particular habitats. Disrupting these communities unnecessarily promotes the degradation of intact communities and allows for the influx of weedy natives from other habitats and the introduction of exotics from other areas.

Persons with ATV permits also should be regulated to remain on designated trails and roadways. As they ride across terrain they are unaware if they are traversing areas that might contain required habitats for rare and TES plants. There are several instances where TES plants have been damaged or destroyed by ATV use.

Past prescribed burns have been extremely beneficial to the native species within the Pleasant Valley Limestone Barrens Ecological Area and the Copperous Branch Limestone Barrens Ecological Area. Fire is one of the Shawnee National Forest's best management tools for enhancing native populations and habitat, especially within the barrens and glade areas. In many cases, this tool allows the more conservative native species to have a competitive edge over the more aggressive exotics and weedy natives. Fire has proven to be effective in TES recovery programs; but caution must be taken that fire might not always be appropriate at certain locations. Also, the frequency of prescribed fires will be variable depending on the circumstances of each individual area.

2.6.2) Federally-listed Threatened or Endangered Plants

Lysimachia fraseri (Fraser's loosestrife) might be extirpated in the state of Illinois, with the last site location being within the Lusk Creek watershed. This species, which thrives on the natural creek disturbance that it is exposed to, has had its population diminish from 100 plants in 1991 to three plants in 1998, then to one plant in 1999. During 2000 no plants were found in this

population. It is unclear as to what the environmental forces were that have led to the demise of this species. There is certainly a trend leading this species to federal listing and a loss of viability range-wide. At this point, the only opportunity that might be available is to continue monitoring the population location and search for plants along the rest of Lusk Creek where potential habitat exists. Some of the creek's banks have already been searched. Understanding this species' requirements is essential, and we are attempting that through conservation assessments, conservation strategies, research, and status reports.

There is an opportunity within the Lusk Creek watershed to protect the Regional Forester's species *Dodecatheon frenchii* (French's shooting star) and *Cimicifuga rubifolia* (black cohosh). These two species are currently being negatively impacted on the Shawnee National Forest by extensive equestrian use and ATV use. Populations that occur within natural areas are protected by a closure order that restricts certain recreational activities. Populations outside of these designated natural areas are not afforded any type of protection, and are being damaged and, in some cases, destroyed. These locations should be restricted and marked appropriately to prevent further damage to them. These species are globally rare; but in southern Illinois they were once considered locally abundant within their habitats. The lack of closer monitoring and protection is likely to cause a trend to federal listing or loss of viability.

2.6.3) Regional Forester Sensitive, Forest-listed and State of Illinois-listed Endangered or Threatened Plants (TES)

In the Lusk Creek watershed, the following TES plant species have been negatively impacted by extensive equestrian use and illegal and legal ATV use: *Cimicifuga rubifolia*, *Dichanthelium yadkinense* (Yadkin's panic grass), *Dodecatheon frenchii*, *Lilium superbum* (superb lily), *Matelea obliqua* (climbing milkweed), and *Oxalis illinoensis* (Illinois wood sorrel). *Cimicifuga rubifolia* and *Dodecatheon frenchii* have already been discussed. There is an opportunity to protect the other mentioned species by limiting equestrian and ATV use within the watershed.

2.6.4) Noxious and Invasive Weeds

Noxious and non-native invasive species are not new to the Shawnee National Forest but the attention that they are receiving is. Non-native invasive plants that were once overlooked or noted, but not regarded as threats, have now become the focus of eradication and control plans. Scoping has recently been done on three projects addressing three different methods of control. Kudzu (*Pueraria lobata*) is north of the Lusk Creek Wilderness and the Forest Service is proposing herbicides to control the population. Chinese yam (*Dioscorea oppositifolia*) is scattered the length of Lusk Creek. A large population feeding seeds into the head of the creek just outside of the wilderness area was burned using propane torches during July of 2001. The intent was to keep the plants from forming bulbils and to kill as much of the plants above ground as possible. Eulalia (*Microstegium vimineum*) is being hand-pulled from within the natural areas since it is easily removed by this means. The large populations are exceptionally difficult to remove from the creek beds that they have invaded. The objective is to remove as much as possible before this species flowers and goes to seed in late summer and early fall.

Section 3. Wildlife

Step 1. Characterize the Watershed

3.1) Terrestrial Wildlife Habitat

The varying exposures offered by the steep cliff formations and canyons provide microhabitats and a diversity of ecosystems within the Lusk Creek watershed. Mesic, shaded north-facing bluffs and cliff faces, some reaching 27.4 to 30.4 m in height, are essentially undisturbed. Sandstone glades and xeric forest communities are perched on the driest exposures. Dry-mesic forest of white oak, black oak, and hickories with beech, sugar maple, red oak, and tulip tree occur throughout the watershed. River birch, smooth alder, black willow and sycamore dominate the riparian community. A large number of the ridge tops are composed of oldfield communities. Plant succession in many of these oldfields has created savannah-like communities dominated by juniper and little blue stem. Nearly 90 percent of the land within the watershed is forested. The remaining ten percent is farmland. The Lusk Creek Canyon, a 102.3-hectare site, and the Lusk Creek Zoological Area are located within the Lusk Creek watershed.

Within the past decade equestrian use within the watershed has increased significantly. Much of the land administered by the U.S. Forest Service is crisscrossed with a spaghetti-like maze of user-developed equestrian trails that threaten the aquatic resources and, to a lesser degree, terrestrial wildlife.

Various categories of disturbance imposed by these user-developed trails become evident within Lusk Creek Canyon. These include the trampling and removal of vegetation, compaction of soils, alteration of natural drainage patterns, erosion and transfer of soil, removal of upper soil horizons, and microhabitat modification (e.g. higher light levels) (Shimp 1999).

3.1.1) Federally-listed Threatened or Endangered Terrestrial Wildlife

Based upon historical records and the most current distribution list for Illinois (November 29, 2000), the following federally-listed threatened, endangered, and proposed terrestrial wildlife or their habitat is known to occur within the Lusk Creek watershed.

Table 3.1—Federally-listed threatened or endangered terrestrial wildlife of the Lusk Creek watershed

Watershed. Common Name	<i>Genus / Species</i>	Habitat	Status
bald eagle	<u><i>Haliaeetus leucocephalus</i></u>	T, Rp, R, S, L	FT, SE
least tern	<u><i>Sterna antillarum</i></u>		FE, SE
gray myotis	<u><i>Myotis grisescens</i></u>	T, W, C	FE, SE
Indiana bat	<u><i>Myotis sodalis</i></u>	T, W, C	FE, SE
Total Species Count	<u>4</u>		

<u>Habitat</u>	<u>Status</u>
M = Marshes W = Woodlands T = Terrestrial C = Caves Rp = Riparian Zone P = Ponds R = River L = Lakes S = Streams T = Thickets SW = Swamps	SE = State Endangered ST = State Threatened FE = Federal Endangered FT = Federal Threatened
Names herein are after: Bull, J., and J. Farrand.1994. National Audubon Society Field Guide to North American Birds. Chanticleer Press, Inc., New York, New York.	

3.1.2) Regional Forester Sensitive, Forest-listed and State of Illinois-listed Endangered or Threatened Terrestrial Wildlife

Table 3.2—Regional Forester Sensitive, Forest-listed and State of Illinois-listed endangered or threatened birds of the Lusk Creek watershed

Common Name	Genus / Species	Habitat	Status
Henslow’s sparrow	<u><i>Ammodramus henslowii</i></u>	T	FS, SE
migrant loggerhead shrike	<u><i>Lanius ludovicianus migrans</i></u>	T	FS, ST
cerulean warbler	<u><i>Dendroica cerulea</i></u>	T	FS
Swainson’s warbler	<u><i>Limnothlypis swainsonii</i></u>	T	FS, SE
Cooper’s hawk	<u><i>Accipiter cooperi</i></u>	T	FL
sharp-shinned hawk	<u><i>Accipiter striatus</i></u>	T	FL
red-shouldered hawk	<u><i>Buteo lineatus</i></u>	T	FL, ST
Bewick’s wren	<u><i>Thryomanes bewickii</i></u>	T	FL, SE
Bachman’s sparrow	<u><i>Aimophila aestivalis</i></u>	T	FL, SE
Total Species Count	<u>9</u>		
<u>Habitat</u> T = Terrestrial Get Scott Lewis Distribution	<u>Status</u> FS = Regional Forester Sensitive FL = Forest-listed SE = State Endangered ST = State Threatened		
Names herein are after: Bull, J., and J. Farrand.1994. National Audubon Society Field Guide to North American Birds. Chanticleer Press, Inc., New York, New York.			

Table 3.3—Regional Forester Sensitive, Forest-listed, and State of Illinois-listed endangered or threatened mammals of the Lusk Creek watershed

Common Name	Genus / Species	Habitat	Status
Southeastern myotis	<u><i>Myotis austroriparius</i></u>	W, C	FS, SE
Bobcat	<u><i>Felis rufus</i></u>	M, W, C, T, SW	FL
golden mouse	<u><i>Ochrotomys nuttalli</i></u>	W, T	FL, ST
river otter	<u><i>Lutra canadensis</i></u>	M, Rp, P, R, L, S, SW	FL, ST
marsh rice rat	<u><i>Orzomys palustris</i></u>	M, SW	FL, ST
Total Species Count	<u>5</u>		

<u>Habitat</u>	<u>Status</u>
M = Marshes W = Woodlands C = Caves Rp = Riparian Zone P = Ponds R = River L = Lakes S = Streams T = Thickets SW = Swamps	FS = Regional Forester Sensitive FL = Forest-listed SE = State Endangered ST = State Threatened
Names herein are after: Whitaker, J.O., 1996. National Audubon Society Field Guide to Mammals. Chanticleer Press, Inc., New York, New York.	

Table 3.4—Regional Forester Sensitive, Forest-listed or State of Illinois-listed endangered or threatened amphibians and reptiles of the Lusk Creek watershed

Common Name	Genus / Species	Habitat	Status
timber rattlesnake	<u><i>Crotalus horridus</i></u>	W, C	FS, ST
copperbelly water snake	<u><i>Nerodia erythrogaster neglecta</i></u>	M, Rp, P, R, L, S, SW	FS
Eastern ribbon snake	<u><i>Thamnophis sauritus</i></u>	M, Rp, P, L, S, SW	FL, SE
Total Species Count <b style="text-align: center;">3			
<u>Habitat</u>	<u>Status</u>		
M = Marshes W = Woodlands C = Caves Rp = Riparian Zone P = Ponds R = River L = Lakes S = Streams T = Thickets SW = Swamps	FS = Regional Forester Sensitive FL = Forest-listed SE = State Endangered ST = State Threatened		
Names herein are after: Whitaker, J.O., 1996. National Audubon Society Field Guide to Mammals. Chanticleer Press, Inc., New York, New York.			

Table 3.5—Regional Forester Sensitive, Forest-listed or State of Illinois-listed endangered or threatened invertebrates of the Lusk Creek watershed

Common Name	Genus / Species	Habitat	Status
cobweb skipper	<u><i>Hesperia metea</i></u>	B	FL, ST
Total Species Count <b style="text-align: center;">1			
<u>Habitat</u>	<u>Status</u>		
M = Marshes W = Woodlands C = Caves B = Barrens Rp = Riparian Zone P = Ponds R = River L = Lakes S = Streams T = Thickets SW = Swamps	FS = Regional Forester Sensitive FL = Forest-listed SE = State Endangered ST = State Threatened		
Names herein are after: Whitaker, J.O., 1996. National Audubon Society Field Guide to Mammals. Chanticleer Press, Inc., New York, New York.			

3.1.3) Forest Fragmentation and Forest Interior Bird Habitat

Habitat fragmentation is a serious threat to the biological diversity of forests and other communities. Habitat fragmentation is a process that results in habitat conversion, habitat discontinuity, and eventually the isolation of the original habitat. The process of fragmentation occurs across a range of landscape patterns. At one extreme, it is represented by small disturbance-patches that disrupt the continuity of an area. At the other extreme, widespread

habitat conversion causes isolation of remnants of the original habitat (USDA Forest Service 1995). Lusk Creek watershed is characterized by small disturbance-patches that occurred when forests were cleared for agricultural use, and by the fragmentation of forest age-classes that leaves a forest matrix intact but with different age-classes or serial stages. Human-caused disturbances, such as user-developed equestrian trails and hiking trails have a subtler, indirect effect on wildlife within the watershed. Increases in the number and miles of these trails have created disturbances along these travel corridors that convert otherwise acceptable breeding, feeding, or resting habitat to forms that are unavailable or unacceptable for use by some terrestrial wildlife.

Of major concern is the impact of forest fragmentation on “interior” neotropical migratory birds (NTMBs). NTMBs breed in North America during summer and migrate to Central and South America to winter. Breeding-bird surveys indicate that some populations of NTMBs have declined over the last few decades. Loss and fragmentation of breeding habitat has been suggested as one cause of these declines. Neotropical migrant birds nesting in fragmented forest typically have low reproductive success, due to brood parasitism by brown-headed cowbirds (*Molothrus ater*), and nest predation by other birds, mammals, and snakes. Predator and cowbird numbers are greater in landscapes fragmented by non-forest land uses. In the Midwest, in landscapes that are less than 50 percent forested, only 8 to 23 percent of nests fledge young and, on average, 50 to 75 percent are parasitized (Robinson et al. 1995). Data from a study of Illinois woodlots demonstrated the importance of large habitat-patches for many forest species (Blake and Karr 1987).

Declining populations of NTMBs are not limited to species that nest in interior forest habitats. Many NTMBs, such as the golden-winged warbler (*Vermivora chrysoptera*), chestnut-sided warbler (*Dendroica pensylvanica*), blue-winged warbler (*Vermivora pinus*), Bell’s vireo (*Vires belii*), and prairie warbler (*Dendroica discolor*) that inhabit shrublands are declining also. Grassland species in decline include the dickcissel (*Spiza americana*) and bobolink (*Dolichonyx oryzivorus*).

Step 2. Issue Identification

3.2) Federally-listed Threatened or Endangered Terrestrial Wildlife Issues

- 3.2.1) Maintain or enhance existing federally-listed threatened or endangered terrestrial wildlife habitat within the Lusk Creek watershed.
- 3.2.2) Identify and evaluate the status of existing federally-listed threatened or endangered terrestrial wildlife within the Lusk Creek watershed

Regional Forester Sensitive, Forest-listed or State of Illinois-listed Endangered or Threatened Terrestrial Wildlife Issues

- 3.2.3) Maintain or enhance existing Regional Forester sensitive terrestrial wildlife habitat within the Lusk Creek watershed.

3.2.4) Identify and evaluate the status of existing Regional Forester sensitive terrestrial wildlife habitat within the Lusk Creek watershed.

Forest Fragmentation and Forest Interior Bird Habitat Issues

3.2.5) Identify and evaluate the impact of forest fragmentation on “interior” NTMBs.

Step 3. Description of Current Conditions

3.3.1 & 3.3.2) Federally-listed Threatened (FT) and Endangered (FE) Terrestrial Wildlife

Bald eagle (*Haliaeetus leucocephalus*) FT (also State of Illinois-listed threatened): Bohlen (1978) considered the bald eagle a fairly common migrant and winter resident along the Illinois and Mississippi Rivers and in southern Illinois on wildlife refuges. Bald eagles require undisturbed roost and nesting sites located near these rivers or other large bodies of water, where they can obtain fish for food. Bald eagles are known to forage within the Lusk Creek watershed.

The Wabash and Mississippi River Valleys and large inland lakes comprise the most likely potential nesting sites in Illinois (personal communication, M. Sweet, IDNR). With proper management, available habitat in Illinois could support up to twenty breeding pairs by the year 2000 (Grier et al., 1983). Currently, bald eagles winter in and around Crab Orchard NWR, Union and Horseshoe Lake State Wildlife Management Areas, the Ohio and Mississippi Rivers, Lake Kinkaid, and several other large lakes in southern Illinois.

Bald eagles normally nest where there is an open view of a large body of water. In recent years there has been a resurgence of bald-eagle nesting in good-quality nesting habitats. This includes successful nesting at Crab Orchard since 1980, Horseshoe Lake since 1990, and Union County since 1991. There are no known nest sites within the Lusk Creek watershed.

Least Tern (*Sterna antillarum*) FE (also State of Illinois-listed threatened): This species is documented as an uncommon migrant and local summer resident in southern Illinois. Habitats for the species in southern Illinois are large river systems, including sandbars and islands. In the late 1970's, breeding colonies were reported in Gallatin and Pope Counties along the Ohio River and in Madison County along the Mississippi. In 1989, 75 to 100 pairs were nesting on Baumgar and Brown's Bar in the Mississippi River between Cape Girardeau and Cairo (personal communication, R. Smith, U.S. Forest Service). In 1993, the least terns were unable to breed due to flooding. In 1994, only a few dozen were counted from Grand Tower Island to Cairo (personnel communication, R. Smith, U.S. Forest Service). Since that time, personnel from the IDNR have found a few scattered nestings on the sandbars and islands in the Mississippi River, including in Jackson County.

Least terns nest on sandbars and sandy beaches along coasts and large rivers. They feed on minnows in shallow water near nesting habitat. The most important factors influencing the location of nesting colonies are sandbars, feeding areas, and favorable water levels (Sheviak & Thom 1982).

Gray Myotis (*Myotis grisescens*) FE (also State of Illinois-listed endangered): Gray bats roost in caves in both winter and summer. Different caves are used in different seasons, but the same caves are used year after year. Gray bats are known to forage over rivers, lakes, and streams, generally no more than three kilometers from their cave roosts (Gardner and Hoffman 1986). The only known roost within the Lusk Creek watershed, which is privately owned, is over eight kilometers from Lusk Creek (Whitaker 1975).

Indiana Bat (*Myotis sodalis*) FE (also State of Illinois-listed endangered): Indiana bats have been documented in 28 counties scattered throughout the state, including most counties in southern Illinois (Herkert, 1992), and within the Lusk Creek watershed. Indiana bats hibernate in caves and mines during the winter and roost beneath loose tree bark or in hollow trees during the summer months. Recently, small groups of hibernating Indiana bats have been found in some small cave systems in Pope County. This hibernaculum is approximately 1.6 kilometers from the Lusk Creek Zoological area.

There are no known maternity roosts within the Lusk Creek watershed. There are, however, potential maternity roost trees within the watershed. The application of management guidelines to protect Indiana bats and other tree-roosting bats during tree removals will assure that these sites are protected. The management guidelines are as follows:

If it is necessary to cut a dead tree or live tree that has the potential to serve as a bat roost (presence of exfoliating bark or cavities) during the Indiana bat maternity and tree roosting periods (April 1 through November 15 in this instance), then the tree will be evaluated for the presence of roosting bats. This evaluation will be completed within three weeks of the date scheduled for removal of the tree. If bats are found in a tree, that tree will not be removed or damaged by project activities until the bats leave the tree for hibernation or migration. When no bats are found, the tree can be removed. Once on the ground, the tree will be checked again for bats. If any dead bats are found, all further tree removal will cease until the dead bat(s) is (are) identified by either Forest Service or U.S. Fish and Wildlife Service personnel. Any dead bats will be frozen and brought to the Marion, Illinois Sub-office of U.S. Fish and Wildlife Service as soon as possible for necropsy and contaminant analysis (USDA Forest Service, 1992)

3.3.3 & 3.3.4) Regional Forester Sensitive (FS), Forest-listed (FL) and State of Illinois-listed Endangered (SE) or Threatened (ST) Terrestrial Wildlife

Henslow's sparrow (*Ammodramus henslowii*) RF, SE: This species originally nested in prairie habitat, but now also nests in abandoned fields, broomsedge fields, pasturelands, and hayfields with tall-dense cover. Special habitat requirements for this species include dense herbaceous vegetation, ground litter, an intermediate moisture range, and singing perches. Burning prevents nesting in established breeding areas until cover is reestablished (Zimmerman 1988, Herkert 1991). In Illinois, Henslow's sparrows also are dependent upon relatively large grasslands for nesting (Herkert 1991), rarely occurring on grasslands less than 50 hectares in size.

Migrant loggerhead shrike (*Lanius ludovicianus migrans*) - FS, ST: This species prefers brushy, old fields, hedgerows, and fencerows, and is often observed perched along roadsides on telephone wires and fences (Hands et al. 1989). The species uses scattered, densely-branched

trees and shrubs such as redcedar (*Juniperus virginiana*), most pines, and multiflora rose (*Rosa multiflora*) for nesting and perching. The shrike is currently a rare-to-uncommon resident and migrant species in the Lusk Creek watershed.

Cerulean warbler (*Dendroica cerulea*) FS: This species prefers forested areas with large trees (Hamel 2000). It is most numerous in mature bottomland forest along streams and rivers, but also is found in mature upland forests (Hamel 2000). Cerulean warblers nest on lateral limbs of deciduous hardwood trees in both overstory and midstory canopies (Hamel 2000). Cerulean warblers also occur in some disturbed forest areas where the canopy has opened up. In Illinois, their nests are often parasitized by brown-headed cowbirds (*Molothus ater*) (Vanderah 1993). In general, their populations are declining precipitously throughout their range in the United States. In Illinois, the species is not endangered or threatened, but is on the state watch list. Cerulean warblers are known to occur within the Lusk Creek watershed. Locally, populations of breeding birds in southern Illinois and on the Shawnee National Forest are relatively high, especially in high quality habitats such as Cedar Creek and Cave Valley (Vanderah and Robinson 1992).

Swainson's warbler (*Limnothlypis swainsonii*) FS, SE: In Illinois, Swainson's warbler's nest in forested areas with a high degree of canopy closure (80 percent) and an understory of giant cane that exceed 10,000 stems/hectare. They often nest near open water and also are dependant upon large contiguous tracts of forest, possibly requiring tracts as large as 350 ha (Eddleman et al. 1980).

Cooper's hawk (*Accipiter cooperi*) FL, **Sharp-shinned hawk** (*Accipiter striatus*) FL, **Red-shouldered hawk** (*Buteo lineatus*) FL, ST: All three species nest in pole and sawtimber-sized trees, including both non-native pines and hardwoods. The red-shouldered hawk nests predominantly in bottomland hardwoods, but also can nest in pines and hardwoods in stream corridors. These three woodland and woodland-edge raptors are locally uncommon summer residents, uncommon migrants, and winter residents in the Lusk Creek watershed.

Bewick's wren (*Thryomanes bewickii*) FL, SE: The Bewick's wren is known historically from the Lusk Creek watershed. Populations of this species have declined dramatically throughout its range in the eastern United States, including southern Illinois. Reasons for the decline are not fully known. Habitat for the species is thickets, brushy areas and hedgerows in farming country, openland, and riparian woodlands.

Bachman's sparrow (*Aimophila aestivalis*) FL, SE: Current nest sites for this species are unknown in Illinois. However, it was observed during the summers of 1972 through 1975 in Johnson, Pope and Jackson counties. (Bohlen 1978). Historically, Bachman's sparrow occupied open woods with adjoining grass, barrens, prairie, and savannah remnants, and old fields throughout Illinois (Brooks 1938). The species is extremely rare in southern Illinois, southeastern Missouri and southern Indiana (Hands et al. 1989). It is now apparently restricted to old fields and barrens remnants because of the almost complete loss of savanna habitat. Large hardwood clearcuts dominated by hardwood and pine regeneration have been documented as providing nesting habitat for the species in the south.

Southeastern myotis (*Myotis austroriparius*) FS, SE: This species occupies caves, mines, and mature forested wetlands. Summer roosts are usually in hollow bottomland forest trees near water over which they forage, but roosts also can be in caves and mines. Winter hibernacula are generally caves. The species is classified as declining in Illinois.

Bobcat (*Felis rufus*) FL: Bobcats utilize a variety of habitats, including heavily wooded areas often among or near rocky outcrops, in brushy hollows, and in timbered swamps. Overall recent statewide population surveys indicate that bobcats appear to be faring well throughout the state. The species was recently removed from the State of Illinois endangered and threatened species list. The species is an uncommon resident throughout the Lusk Creek watershed.

Golden mouse (*Ochrotomys nuttalli*) FL, ST: The golden mouse is a common species in the Lusk Creek watershed. The species inhabits pine plantations with dense honeysuckle understory, old fields, bottomland forests and dense riparian woodlands. Dense understory vegetation including honeysuckle, catbrier, and grape are preferred nesting habitats.

River otter (*Lutra canadensis*) FL, ST: The river otter is an uncommon resident in the Lusk Creek watershed. This species prefers riparian habitat with extensive woodlands, good water quality, the presence of suitable den sites, and open water in the winter.

Marsh rice rat (*Oryzomys palustris*) FL, ST: One-third the size of the Norway rat, this species prefers wet swampy fields and marshes. It is often found along drainage ditches, farm ponds, marshy railroad right-of-ways, cypress swamps, lowland meadows, and wet ecotonal areas of woods and grass. The globular dry grass nest of the marsh rice rat is often one of the highest, driest objects in a swamp of bottomland forest. Swampland predators (i.e., snakes, owls, hawks, minks, and raccoons) commonly feed upon rice rats. The species has been recorded from eleven counties, including Pope County, within the Lusk Creek watershed.

Timber rattlesnake (*Crotalus horridus*) FS, ST: Populations of this species in the State of Illinois and throughout its range in the eastern United States are low or declining compared to historical records. Threats to the species are indiscriminate killing by people and vehicles and clearing of forest habitats (Phillips et al. 1999). This species prefers mature forests along rocky outcrops and bluffs. They are active day and night. Their food consists extensively of mammals and birds. During the summer months timber rattlesnakes can be found in upland forests or even in cultivated fields. Brush piles are especially attractive places to find them. Gravid females tend to use rocky, more open sites closer to dens where they bask and feed. Most rattlesnake activity occurs within transient habitat or approximately 200 meters from the den site. In the fall, timber rattlesnakes congregate at denning sites that are usually near rock bluffs containing deep cracks and fissures. They are not aggressive and usually do not try to run when approached. They are very vulnerable to human disturbances at these locations.

Copperbelly water snake (*Nerodia erythrogaster neglecta*) FS: Like the green water snake, the copperbelly water snake prefers quiet waters of ponds, lakes, and cypress-tupelo swamps with abundant vegetation and muddy bottoms. Copperbelly water snakes are often seen in nearby forest where they leave the water's edge to forage on amphibians. Predators include other snakes, large shore birds, mink, and raccoons. People who mistake it for cottonmouth often kill

the snake. Through a conservation agreement with the U.S. Fish and Wildlife Service, the species is protected in Illinois.

Eastern ribbon snake (*Thamnophis sauritus*) FL, SE: This semi-aquatic snake utilizes a variety of natural environments, seldom wandering far from streams, ponds, bogs, or swamps. The snake prefers quiet, shallow water, dense plant growth and abundant sunlight. Amphibians make up most of the diet, but fish and invertebrates are also eaten. Predators include wading birds, mammals, and other snakes. (Phillips et al. 1999)

Cobweb skipper (*Hesperia metea*) FL, ST: This species inhabits loess hill prairies and barrens in Pope County. The larval food plants appear to be little bluestem and big bluestem (Sedman and Hess 1985, Heitzman and Heitzman 1987). Adults are frequently found on wild hyacinth (*Camassia scilloides*), wild strawberry (*Fragaria virginiana*), rosa verbena (*Glandularia canadensis*), and dwarf larkspur (*Delphinium tricornis*) (Heitzman and Heitzman 1987). Cobweb skippers appear to be dependant upon fire, because populations are highest immediately following fire and decline in subsequent years. This species is intolerant of vegetational change due to succession. Early successional stages following fire might be important in ensuring the survival of this species in Illinois.

3.3.5) Forest Fragmentation and Forest Interior Bird Habitat

Seven species of neotropical migrant song birds are identified in the Forest Plan as management indicator species. These indicator species are used to measure the effects of proposed management activities on groups of species that utilize similar habitats. These include the following: cerulean warbler, Kentucky warbler, worm-eating warbler, scarlet tanager, American redstart, wood thrush and prothonotary warbler. They prefer mature (greater than 50 years old) upland and/or bottomland hardwood forests.

All seven can be negatively affected by forest fragmentation and associated cowbird parasitism. The cerulean warbler is a Regional Forester's sensitive species on the Shawnee National Forest. Populations of cerulean warblers are declining precipitously throughout their range in the United States. In Illinois, the species is not endangered or threatened, but is on the state watch list. Locally, populations of breeding ceruleans in southern Illinois and on the Forest are relatively high. Large blocks of contiguous upland and bottomland forests within the Lusk Creek watershed provide potential habitat for the cerulean and other NTMBs, however, even these areas are fragmented by openings in the forest canopy that allow nest parasites such as the brown-headed cowbird to find and parasitize nests.

Populations of the Kentucky warbler, scarlet tanager, worm-eating warbler, American redstart and prothonotary warbler throughout the watershed appear to be stable. Recent research indicates that wood thrush populations are heavily parasitized and might be declining (personal communication Dr. S.K. Robinson, University of Illinois). The wood thrush nests in small trees and shrubs approximately three meters above the ground. Kentucky warblers and worm-eating warblers nest on the ground in hardwood forests. These three species are the most likely to be affected by human disturbances within the watershed.

Prothonotary warblers are cavity-nesters usually nesting in live or dead trees over standing water. Scarlet tanagers and American redstarts nest in the tree canopy and not on the ground. All three species are less likely to be affected by human-caused disturbances within the Lusk Creek watershed.

The Lusk Creek watershed contains one of seven designated 6.2 Management Areas. This Forest Interior Management Unit consists of approximately 526 hectares, of which 323.7 hectares are outside the designated wilderness boundary. The remaining 202.3 hectares are located within the 1,807.2-hectare Lusk Creek Wilderness. Together, the 6.2 Management Area and the designated wilderness area provide a significant contiguous block of closed canopy forest.

Management of the Forest Interior Management Unit is directed at sustaining a fully functioning natural upland or bottomland hardwood ecosystem, including viable populations of forest interior plant and animal species. Forest management practices selected for implementation within these units are designed to minimize the effects of forest fragmentation.

The Lusk Creek Forest Interior Management Unit is described as containing 58 percent or more upland/bottomland hardwoods with a canopy closure greater than 80 percent. Approximately fifteen percent is in pine. There are no utility corridors within the unit; however, a light-duty road with an open canopy is located in the west half of the area. Lusk Creek runs through the eastern third of the unit and has an open canopy. Five to fifteen percent of the unit is considered openland. Thirteen wildlife openings, the majority of which are no longer being maintained, are concentrated on the perimeter of the unit in the southwest quadrant. The area generally supports wildlife that utilize large hardwood trees and that depend on forest interior habitat.

The following table lists the forest interior birds that are known to utilize the oak-hickory forest-type within the Lusk Creek watershed for breeding, feeding, roosting or resting.

Table 3.6—Oak-Hickory Dependent Forest Interior Birds of the Lusk Creek Watershed

<i>Common Name</i>	<i>Scientific Name</i>	Status
acadian flycatcher	<i>Empidonax vireescens</i>	
American redstart	<i>Setophaga ruticilla</i>	MIS
American robin	<i>Turdus migratorius</i>	
black-and-white warbler	<i>Mniotilta varia</i>	
black-throated blue warbler	<i>Dendroica caerulescens</i>	
blackburnian warbler	<i>Dendroica fusca</i>	
blackpoll warbler	<i>Dendroica striata</i>	
blue grosbeak	<i>Guiraca caerulea</i>	
blue-gray gnatcatcher	<i>Polioptila caerulea</i>	
blue-winged warbler	<i>Vermivora pinus</i>	
brown-headed cowbird	<i>Molothrus ater</i>	
Canada warbler	<i>Wilsonia canadensis</i>	
cape may warbler	<i>Dendroica tigrina</i>	
cerulean warbler	<i>Dendroica cerulea</i>	FS

Table 3.6—Continuation of Oak-Hickory Dependent Forest Interior Birds of the Lusk Creek Watershed

<i>Common Name</i>	<i>Scientific Name</i>	<i>Status</i>
chestnut-sided warbler	<i>Dendroica pensylvanica</i>	
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	
common yellowthroat	<i>Geothlypis trichas</i>	
Connecticut warbler	<i>Oporornis agilis</i>	
cooper's hawk	<i>Accipiter cooperii</i>	
golden-crowned kinglet	<i>Regulus satrapa</i>	
golden-winged warbler	<i>Vermivora chrysoptera</i>	
gray catbird	<i>Dumetella carolinensis</i>	
great crested flycatcher	<i>Myiarchus crinitus</i>	MIS
hermit thrush	<i>Catharus guttatus</i>	
hooded warbler	<i>Wilsonia citrina</i>	
House wren	<i>Troglodytes aedon</i>	
indigo bunting	<i>Passerina cyanea</i>	
Kentucky warbler	<i>Oporornis formosus</i>	MIS
long-eared owl	<i>Asio otus</i>	
Louisiana waterthrush	<i>Seiurus motacilla</i>	
magnolia warbler	<i>Dendroica magnolia</i>	
Mississippi kite	<i>Letinia mississippiensis</i>	SE
morning warbler	<i>Oporornis philadelphia</i>	
Nashville warbler	<i>Vermivora ruficapilla</i>	
northern oriole	<i>Icterus galbula</i>	
northern parula	<i>Parula Americana</i>	
Olive-sided flycatcher	<i>Contopus borealis</i>	
orange-crowned warbler	<i>Vermivora celata</i>	
orchard oriole	<i>Icterus spurius</i>	
Ovenbird	<i>Seiurus aurocapillus</i>	
palm warbler	<i>Dendroica palmarum</i>	
Philadelphia vireo	<i>Vireo philadelphicus</i>	
pine siskin	<i>Carduelis pinus</i>	
prothonotary warbler	<i>Protonotaria citrea</i>	MIS
red-eyed vireo	<i>Vireo olivaceus</i>	
red-shouldered hawk	<i>Buteo lineatus</i>	ST
red-tailed hawk	<i>Buteo jamaicensis</i>	
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	
ruby-throated hummingbird	<i>Archilochus colubris</i>	

Table 3.6—Continuation of Oak-Hickory Dependent Forest Interior Birds of the Lusk Creek Watershed

Common Name (1)	Scientific Name	Status (2) (3)
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scarlet tanager	<i>Piranga olivacea</i>	MIS
sharp-shinned hawk	<i>Accipiter striatus</i>	
Solitary vireo	<i>Vireo solitarius</i>	
summer tanager	<i>Piranga rubra</i>	
Veery	<i>Catharus fuscescens</i>	
warbling vireo	<i>Vireo gilvus</i>	
whip-poor-will	<i>Caprimulgus vociferous</i>	
white-throated sparrow	<i>Zonotrichia albicollis</i>	
wood thrush	<i>Hylocichla mustelina</i>	MIS
worm-eating warbler	<i>Helmitheros vermivorus</i>	MIS
yellow breasted chat	<i>Ictera virens</i>	MIS
yellow warbler	<i>Dendroica petechia</i>	
yellow-bellied flycatcher	<i>Empidonax flaviventus</i>	
yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	
yellow-rumped warbler	<i>Dendroica coronata</i>	
yellow-throated vireo	<i>Vireo flavifrons</i>	
yellow-throated warbler	<i>Dendroica dominica</i>	
Status		
FS = Regional Forester Sensitive FL = Forest-listed SE = State Endangered ST = State Threatened MIS = Management Indicator Species		
Names herein are after: Whitaker, J.O., 1996. National Audubon Society Field Guide to Mammals. Chanticleer Press, Inc., New York, New York.		

Step 4. Description of Reference Condition

3.4) Terrestrial Wildlife Community Structure

The Lusk Creek watershed lies completely within Pope County, Illinois. Nearly 90 percent of the land within the watershed is forested. The remaining ten percent is farmland. The Lusk Creek Canyon, a 102.3-hectare site, and the Lusk Creek Zoological Area are located within the Lusk Creek watershed.

The varying exposures offered by the steep cliff formations and canyons provide micro-habitats and a diversity of ecosystems within the watershed. Mesic, shaded, north-facing bluffs and cliff faces, some reaching 27.4 to 30.4 meters in height, are essentially undisturbed. Sandstone glades and xeric forest communities are perched on the driest exposures. Dry-mesic forest of white oak (*Quercus alba*), black oak (*Quercus velutina*), and hickories (*Carya spp.*) with beech (*Myrica spp.*), sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), and tulip tree (*Liriodendron tulipifera*) occur throughout the watershed. River birch (*Betula nigra*), smooth alder (*Alnus serrulata*), black willow (*Salix nigra*), and sycamore (*Platanus occidentalis*) dominate the riparian community. A large number of the ridge tops are composed of oldfield communities. Plant succession in many of these old fields has created savannah-like communities dominated by juniper and little bluestem

Turkey vultures and swallows frequent the steep cliffs and bluffs. Great blue herons (*Ardea herodias*), Louisiana waterthrush (*Seiurus motacilla*), American redstart (*Setophaga ruticilla*), wood ducks (*Aix sponsa*), and woodcock (*Philohela minor*) are common streamside birds that occur within the watershed.

Gray squirrel (*Sciurus carolinensis*), beaver (*Castro canadensis*), muskrat (*Ondatra zibethica*), red fox (*Vulpes fulva*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), white-footed mouse (*Peromyscus leucopus*), pine vole (*Pitymys pinetorum*), and northern flying squirrel (*Glaucomys sabrinus*) are common inhabitants of the upland forest. The barred owl (*Strix varia*), wild turkey (*Meleagris gallopavo*), pileated woodpecker (*Dryocopus pileatus*), Cooper's hawk (*Accipiter cooperii*), broad-winged (*Buteo platypterus*) and sharp-shinned hawks (*Accipiter striatus*), Kentucky warbler (*Oporornis formosus*), wood thrush (*Hylocichla mustelina*), red-eyed vireo (*Vireo olivaceus*) white-breasted nuthatch (*Sitta carolinensis*), eastern wood pewee (*Contopus virens*), and worm-eating warbler (*Helmitheros vermivorus*) utilize the dry-mesic white oak (*Quercus alba*) and hickory forests (*Carya spp.*).

The southern two-lined salamander (*Eurycera cirrigera*), American toad (*Bufo americanus*), wood frog (*Rana sylvatica*), fence lizard (*Sceloporus undulatus*), eastern hognose snake (*Heterodon platirhinos*), copperhead (*Agkistrodon conortrix*), and timber rattlesnake (*Crotalus horridus*) occur in the diverse habitats of the Lusk Creek watershed.

Within the past decade, equestrian use within the watershed has increased significantly. Much of the land administered by the U.S. Forest Service is crisscrossed with a maze of equestrian trails that threaten the aquatic resources and, to a lesser degree, terrestrial wildlife.

Step 5. Synthesis and Interpretation

3.5.1 & 3.5.2) Federally-listed Terrestrial Wildlife Community Structure

The Lusk Creek watershed will continue to support foraging habitat for the bald eagle. Currently there are no active eagle nests within the watershed. However, recent increases in bald eagle populations in good-quality habitat suggest that nesting could occur within the Lusk Creek watershed within the current decade. Recent increases in human disturbances associated with hiker- and equestrian-trail use could potentially have a negative affect on any future eagle nesting activity on lands administered by the U.S. Forest Service within the watershed.

Although currently, there are no known Indiana bat maternity roost-sites within the Lusk Creek watershed, the probability of discovering a summer roost site remains high. The watershed will continue to provide suitable foraging and summer roost habitat.

Future maintenance and construction of hiker and equestrian trails could potentially have a negative affect on summer roosting habitat; however, the application of current management guidelines for the Indiana bat will help protect any maternity sites on lands administered by the U.S. Forest Service.

The only known gray myotis roost site within the Lusk Creek watershed is located on private land over 8 kilometers from lands administered by the U.S. Forest Service. Caves and foraging habitat within the watershed are not likely to be negatively impacted within the near future; thus habitat for the gray myotis should remain protected into the next decade.

3.5.3 & 3.5.4) Regional Forester Sensitive, Forest-listed or State of Illinois-listed Endangered or Threatened Terrestrial Wildlife Community Structure

Recent increases in human disturbances associated with hiker- and equestrian-trail use could potentially have a negative effect on several Regional Forester sensitive, Forest-listed or State of Illinois-listed endangered or threatened species. These negative effects include the elimination of suitable habitat or the significant degradation of suitable habitat, and both direct and indirect disturbances along existing trails and their vicinities. For some species, this effect is wider-ranging and can influence habitat up to two-tenths of a kilometer from the trail. Animal responses are usually avoidance of disturbed habitats altogether or at least during periods of trail use. For some species this can make otherwise acceptable breeding, feeding, or resting habitat unavailable or unsuitable. Those species that could be most likely affected by the increase in hiker and equestrian use include: cerulean warbler (*Dendroica cerulea*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), red-shouldered hawk (*Buteo lineatus*), timber rattlesnake (*Crotalus horridus*), Bewick's wren (*Thryomanes bewickii*), bobcat (*Felis rufus*), and golden mouse (*Ochrotomys nuttalli*).

Other species, such as the river otter (*Lutra canadensis*), might be adversely affected as trail erosion continues and existing user-developed trails across major streams within the watershed continue to contribute to stream sedimentation.

Habitat within the Lusk Creek watershed for species such as the Henslow's sparrow (*Ammodramus henslowii*), that requires large contiguous tracts of open land, does not appear to be threatened. Loss of bottomland wetlands with sufficient densities of giant cane to support breeding populations of the Swainson's warbler (*Limnothlypis swainsonii*) appears to be the biggest threat to this species within the Lusk Creek watershed. The number of large openland tracts within the watershed under Forest Service ownership has increased in the past decade, offering hope that the Bachman's sparrow (*Aimophila aestivalis*), last reported in southern Illinois in 1975, will once again return to breed in this area. Habitat for the southeastern myotis (*Myotis austroriparius*) appears to be secure within the watershed. Protection of caves and wetland habitat within the watershed will help insure the continued survival of this species. The protection of cypress swamps within the watershed will help insure the continued survival of the marsh rice rat (*Oryzomys palustris*). The retention of existing wetlands and protection of adjacent uplands will help insure the continued survival of the copperbelly water snake (*Nerodia erythrogaster neglecta*). Protection of riparian habitat and a reduction in the loss of suitable aquatic vegetation will help improve the recovery of the Eastern ribbon snake (*Thamnophis sauritus*) within the watershed. The increased use of prescribed fire in barrens and grasslands under Forest Service ownership within the watershed will further the recovery of the cobweb skipper (*Hesperia metea*).

3.5.5) Forest Fragmentation and Forest Interior Bird Habitat

Forest interior birds nesting in fragmented forests typically have low reproductive success, due to brood parasitism by brown-headed cowbirds and nest predation by birds, mammals, and snakes. Predator and cowbird numbers are greater in landscapes fragmented by non-forest land uses. Cowbird numbers and levels of brood parasitism are sometimes higher near edges, including agricultural edges and clearcuts.

There is strong evidence that the overall landscape pattern and composition (forest versus non-forest) is more important to the reproductive success of birds than any edge effects resulting from vegetation management practices, whether single tree selection, group selection, or clear cutting within the forest (Dettmers 1994, Robinson et al. 1995).

In the Ozark Highlands Section, relatively vast forests support large numbers of neotropical migrant birds with low parasitism and nest predation rates. Therefore, the Mark Twain and the Ozark-St. Francis National Forests might be population sources for fragmented parts of Missouri and Illinois (Robinson et al. 1995). This might have very important implications for the Shawnee National Forest, and suggests that populations of forest interior birds are linked and might even be dependent on the conditions of another forest.

For interior forest species, deleterious effects of forest fragmentation on lands administered by the Shawnee National Forest within the Lusk Creek watershed have been addressed in the Forest Plan. The plan provides standards and guidelines for the management of the most suitable habitat for forest interior birds within the watershed. The 1,807.2 hectares within the Lusk Creek Wilderness and the 101.1-hectare Lusk Creek Canyon Ecological Area will continue to provide suitable forest interior habitat within the watershed.

The maintenance of wider riparian corridors and the protection of natural corridors and migration routes will reduce the effects of fragmentation within the watershed. The utilization of existing roads, powerlines, and other linear features and the implementation of a designated equestrian trail system maintained under a closed-canopy forest will reduce future impacts on forest interior birds.

Step 6. Opportunities

3.6.1 & 3.6.2) Federal Listed Terrestrial Wildlife Community Structure

Nearly 90 percent of the land within the Lusk Creek watershed is forested. The U.S. Forest Service manages over 2,428 hectares as wilderness within the watershed. The Lusk Creek Natural Area protects the natural features including the unique flora and fauna occurring with an additional 102.3 designated hectares. The future preservation of habitat essential to the protection of federally-listed terrestrial wildlife communities within the watershed should continue into well into the future.

The Lusk Creek watershed will continue to support foraging habitat for the bald eagle. Currently there are no active eagle nests within the watershed. However, recent increases in bald eagle

populations in good-quality habitat suggest that nesting could occur within the Lusk Creek watershed within the current decade.

As research and habitat surveys continue, the likelihood of discovering Indiana bat maternity roost sites within the watershed increases. The mature forest cover within the watershed will continue to provide suitable foraging and summer roost habitat. Consideration of future acquisition of the only known cave within the watershed currently supporting a gray bat roost would further protect the species.

3.6.3 & 3.6.4) Regional Forester Sensitive, Forest-listed or State of Illinois-listed endangered or threatened Terrestrial Wildlife Community Structure

Those species most likely affected by the increase in hiker and equestrian use throughout the Lusk Creek watershed were identified in Section 5.2 above. Habitat succession within riparian corridors has resulted in the loss of much of the giant cane that once supported breeding populations of the Swainson's warbler. The loss of this habitat component is likely to continue as timber harvest on National Forest lands has virtually ended within the watershed. On the other hand, as both bottomland and upland hardwood stands continue to mature, habitat for the cerulean warbler and other forest interior birds will remain secure. Management of forest wildlife openings within the watershed has declined significantly in the past decade, thereby reducing the amount of forest fragmentation. Future management of the remaining openings will continue to address their affect on forest interior birds.

Management of openland habitat, including barrens and glade communities, under National Forest ownership will provide significant opportunities for improving habitat for the Henslow's sparrow and the cobweb skipper, and the future recovery of the Bachman's sparrow. The use of prescribed fire, and the conversion of large blocks of fescue-dominated pasture lands to native grasses on both national forest lands and private lands within the watershed will provide increased opportunities to improve the value of this habitat type for both upland game and non-game species.

Current forestwide standards and guidelines for the management of Regional Forester Sensitive, Forest-listed or State of Illinois-listed endangered or threatened species that occupy habitat under National Forest ownership will continue to protect existing habitat. Future revisions of these guidelines and the implementation of these revisions should offer increased opportunities for the recovery of many of these species.

3.6.5) Forest Fragmentation and Forest Interior Bird Habitat

Within the past decade, timber harvest on lands administered by the U.S. Forest Service within the Lusk Creek watershed has all but ended. This reduction in timber harvest in both bottomland and upland hardwood stands will continue to significantly reduce the negative effects of timber harvest on forest fragmentation.

The maintenance of wildlife openings has significantly declined in the past decade, thereby reducing the amount of forest fragmentation. The future maintenance of existing wildlife openings offers an opportunity to address their effects on forest interior birds and the need to maintain such areas for upland game. Prescribed burning of openlands, including barrens and glade communities, under national forest ownership, and the conversion of large tracts of fescue dominated grasslands to native grass species, offers a significant opportunity to provide future habitat for the grassland dependant species, such as the Henslow's sparrow.

The scheduled revision of the Forest Plan offers an opportunity to review the current guidelines for 6.2 Management Areas and incorporate the recent research findings that might further benefit forest interior birds within the Lusk Creek watershed.

Section 4. Forestry

Step 1. Characterize the Watershed

4.1) Forestry

Landscape structure and features: Presettlement conditions can be described as “very hilly, oak/hickory”, with some areas of “very hilly, thin soils. The stream bottoms surrounding Lusk Creek are generally described as “level and rich with poplar, and sugar maple or ash.” Today much of the area supports oak-hickory woods on the ridges and drier slopes. In addition, there is a large amount of non-native pine in the area.

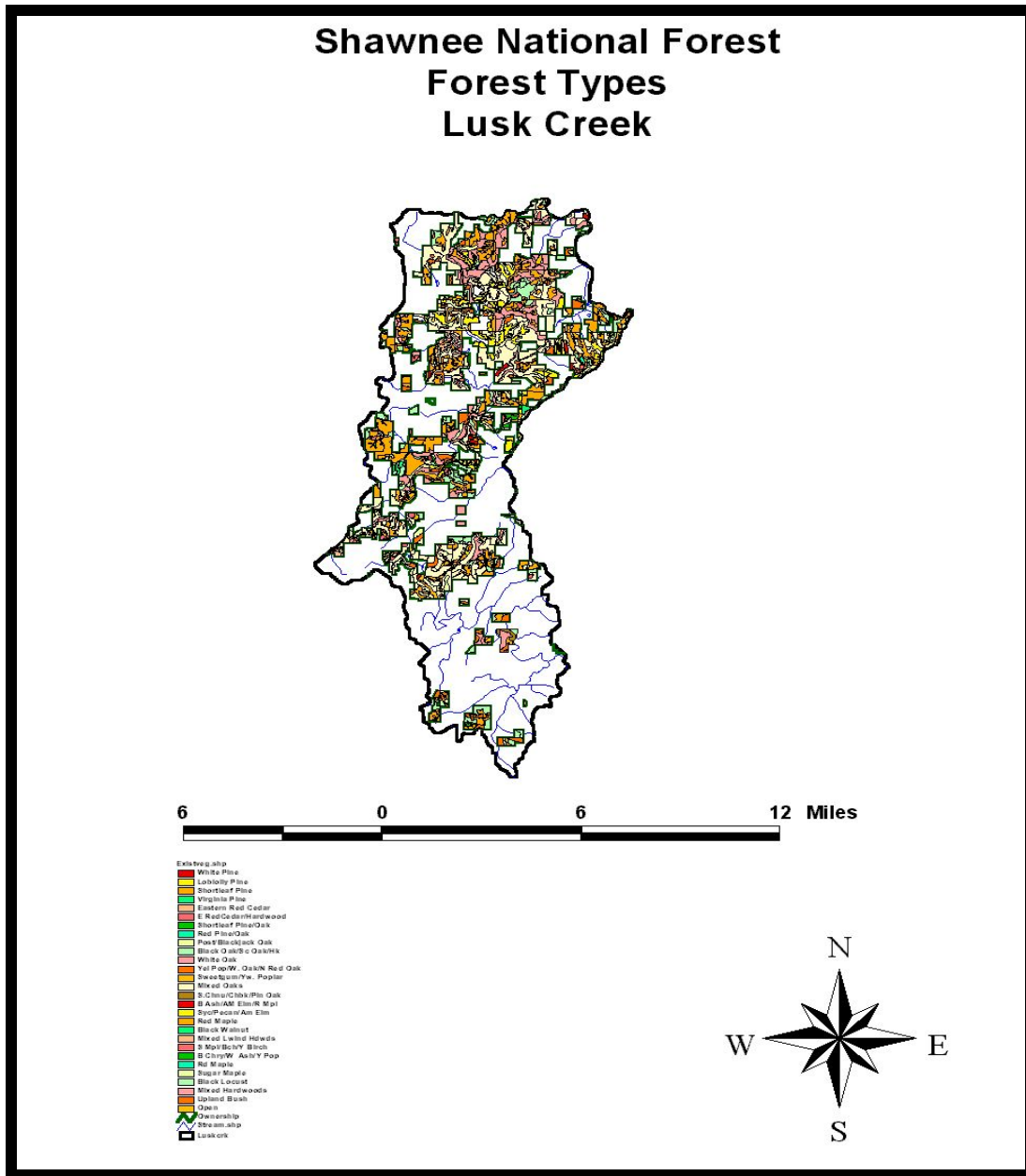
The Shawnee National Forest of today is a result of both inherent site characteristics such as topography, geology, and soil type, and past disturbances that included fire, grazing, logging, and agriculture. Prior to and during European settlement, fires regularly occurred in this region. During the late nineteenth century and early twentieth century, much the land was logged. The land-clearing allowed for the expansion of agriculture in the early twentieth century. However, by the 1930's many farms were abandoned due to erosion, drought, and the realization that the steep hills were unsuited for agriculture. In the 1930's, 1940's, and 1950's pine trees, particularly shortleaf and loblolly pine were planted to stabilize the soils.

The Lusk Creek watershed has the highest percentage of National Forest Service land of any watershed on the forest. Currently 63 percent of the Lusk Creek watershed is in National Forest Service ownership. As stated, “The watersheds with the highest percentage of National Forest Service lands are those where the Forest Service can have the greatest benefit to watershed health.” (USDA, An Analysis of Watershed Integrity).

Step 2. Issue Identification

4.2) Forestry Issues

4.2.1) Reduce non-native pine and increase native hardwood.



Map 1—Forest Types

Step 3. Description of Current Conditions

4.3.1) Forestry

The Table below shows a comparison between forest types. Hardwoods in this watershed are largely mature with an abundance of pine.

Table 4.1—Forest Types

Forest Type	Acres	Percentage
Pine	6291	27
Hardwoods	17209	73

The pine in this area was planted to stabilize the soil following the farming era. The pine trees planted on eroded hillsides have done an excellent job of stabilizing the. Most of the pine is at or nearing maturity. Some shortleaf and loblolly pine stands in this area have been thinned providing for some growing space and sunlight for hardwood regeneration. Many pine stands have not been thinned resulting in overstocking, thereby stressing trees and causing mortality due to overcrowding.

Step 4. Description of Reference Conditions

4.4.1) Forestry

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From 1970 to the present, vegetative management occurred sporadically. The harvesting objectives were to produce primarily even-aged stands of hardwoods and thinning the pine stands. The harvesting has created some early age class hardwoods.

Step 5. Synthesis and Interpretation

4.5.1) Forestry

Direction for ecological restoration and forest-wide priorities for converting existing non-native pine plantations to hardwoods are established in the Forest Plan, page IV-12. Ecosystem health, restoration and maintenance are the primary concerns of the vegetative management program on the forest. Other goals are to, protect our cultural heritage, provide for visually pleasing landscape, provide for recreation use, provide a useable land base, and provide for human and community development. In Forest-wide guidance, native plant and animal species and

communities are emphasized in management. Timber harvest and vegetative management are used within the context of perpetuating and enhancing biological diversity at different spatial scales, among the differing desired conditions within different management areas. Vegetation management might be employed to restore native plant and animal communities and ecosystems. The Forest Plan gives direction to provide early age classes and restore hardwoods. To be most cost efficient at producing early age classes and removing exotics, the harvest of merchantable pine should be emphasized.

Conversion of pine stands to hardwoods would lead to increased productivity of the sites. With proper provisions, snags and den trees could be emphasized for wildlife use. Converting pine stands to hardwood would increase diversity and lead to richer habitat.

Step 6. Opportunities

4.6.1) Forestry

Reduce the amount of pine in the watershed and increase native hardwoods.

Key Question	Inventory Needs/Actions	Monitoring Needs	Priority Ranking
Reduce the amount of pine in the watershed and increase native hardwoods.	Identify all pine stands by management area.	Monitor and display the changes in the pine stands.	1

Section 5. Water Quality

Step 1. Characterize the Watershed

In an intensive survey of Shawnee National Forest streams conducted in the late 1980's, the water quality of the Lusk Creek watershed was ranked as good-to-excellent, due to its low concentration of suspended solids, nutrients, iron, and manganese (Hite et al. 1990). The Illinois Environmental Protection Agency (IEPA 2000) designated Lusk Creek as a full or threatened support stream in 2000 (IEPA 2000). A single 18 kilometer section southeast of Eddyville, Illinois was defined as threatened by the IEPA. Factors that influenced this segment receiving a threatened ranking were linked to nutrient and siltation loads originating from agricultural (IEPA 2000). In general the comprehensive water quality of Lusk Creek is high.

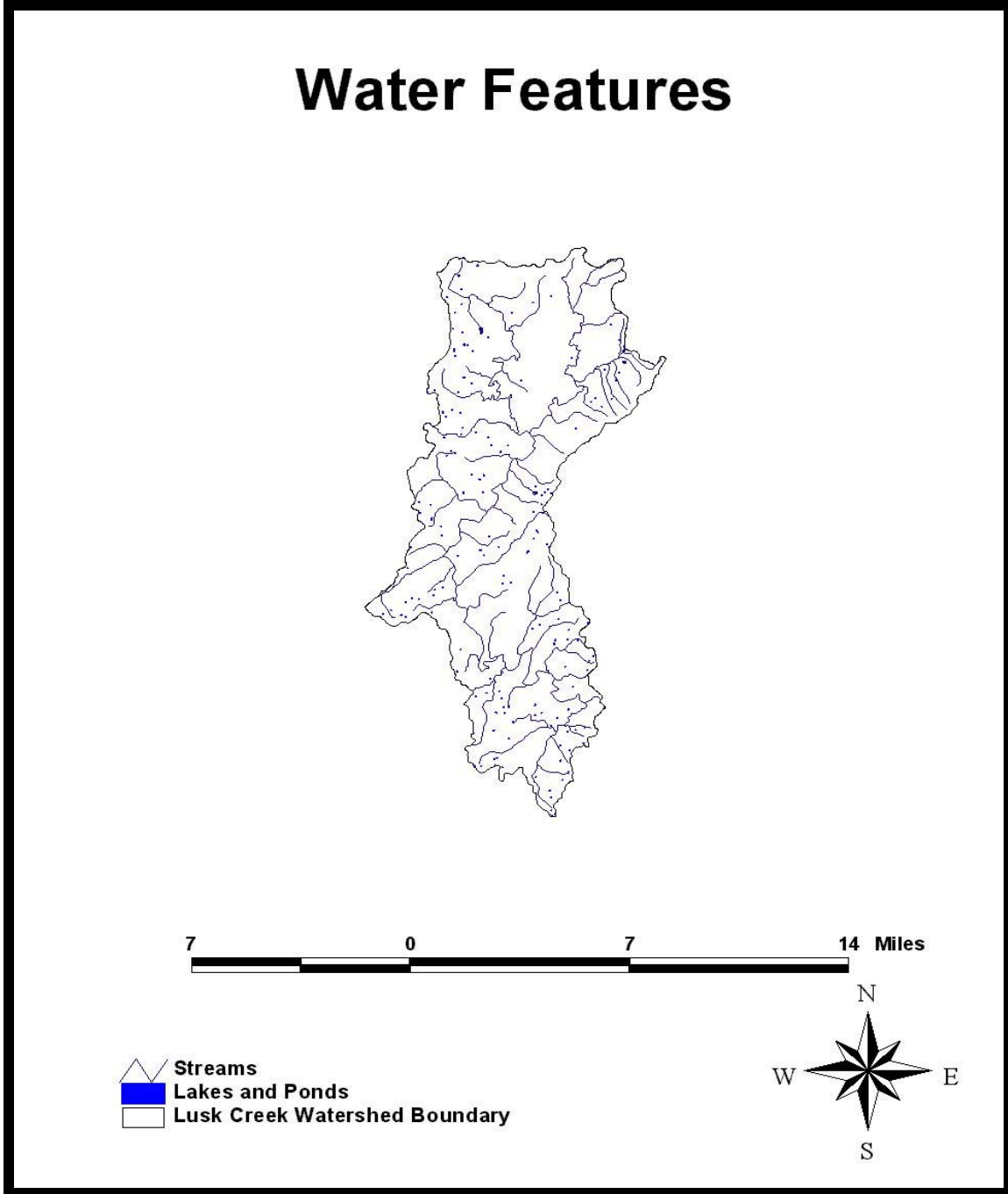
Step 2. Issue Identification

5.2) Water Quality Concerns / Issues

5.2.1) What are the sources of point and non-point pollution within the Lusk Creek watershed and what impact do these sources have on the watershed?

5.2.2) What are the impacts of nutrients and siltation within the Lusk Creek Watershed?

Water Features



Map 2—Water Bodies

Step 3. Description of Current Conditions

5.3.1) Point and Non-point Pollution

Point-source pollution originates from a single conveyance from which contaminants enter a stream; examples of point-source pollution include stormwater drains, mines pits, ditches and

industrial facilities (USDA 2000). Point-source pollution can be identified and monitored relatively easily. Currently there are two point-source pollution sites within the watershed: the Eddyville sewage treatment plant and Pope County High School northwest of Golconda. Neither of these sites have had a non-compliance violation.

Non-point-source pollution has been defined as the diffuse input of substances into an aquatic system resulting in negative impacts to water quality (Hite et al. 1990). Non-point-source pollution can be difficult to identify or monitor. Examples of non-point pollution include pesticides, fertilizers, mineral extraction, roads, and urbanization. Introduced species or exotic species are also considered sources of non-point pollution. For more information regarding the influence of introduced species within the Lusk Creek watershed see section 1.3.3.

Documentation of non-point pollution within the Lusk Creek watershed has been restricted to agricultural activities (IEPA 2000). Today approximately 40 percent of the land within the Lusk Creek watershed is composed of urban or agriculture land (Fitch and Widowski 2000).

5.3.2) Siltation and Nutrients

Heavy siltation can negatively impact invertebrate and fish populations by reducing water clarity and altering habitat (Lind 1985, Brigham et al. 1981, Starrett 1971, Smith 1971). Two indicators of siltation are turbidity and total suspended solids. To examine siltation within the Lusk Creek watershed these two variables were evaluated. Turbidity data for 1991-1998, and total suspended solids (TSS) data from 1981-1998 was obtain from the Illinois Environmental Protection Agency and plotted. Turbidity values ranged from a minimum of 1 to a maximum of 88 mg/l with a mean of 9.96 mg/l (Figure 5.1), TSS values ranged from 1 to 111 mg/l with a mean of 10.24 mg/l (Figure 5.2), well below the IEPA standard of 1500 mg/l.

Step 4. Description of Reference Condition

5.4.1) Point and Non-point Pollution / 5.4.2) Siltation and Nutrients

Comprehensive water quality data related to point and non-point pollution for the Lusk Creek watershed does not exist before 1980. However, the impact of point and non-point pollution and siltation and nutrient loads is directly related to the degree of human impact (farming and industrial development) a system is exposed to. Relative to today, larger portions of the Lusk Creek watershed were used for farming and industrial activities in the 1920's and 30's. This would indicate that earlier in the century the Lusk Creek watershed experienced higher siltation and nutrients loads and higher levels of pollution.

Step 5. Synthesis and Interpretation

5.5.1) Point and non-point pollution / 5.5.2) Siltation and Nutrients

It is logical to assume that the Lusk Creek watershed has experienced a reduction in siltation and nutrient loads and point and non-point pollution since the 1930's. This decline can be linked to a

reduction in farming and industrial activities within the watershed. Trend-data reveals no significant changes in pollution and nutrient levels since 1980.

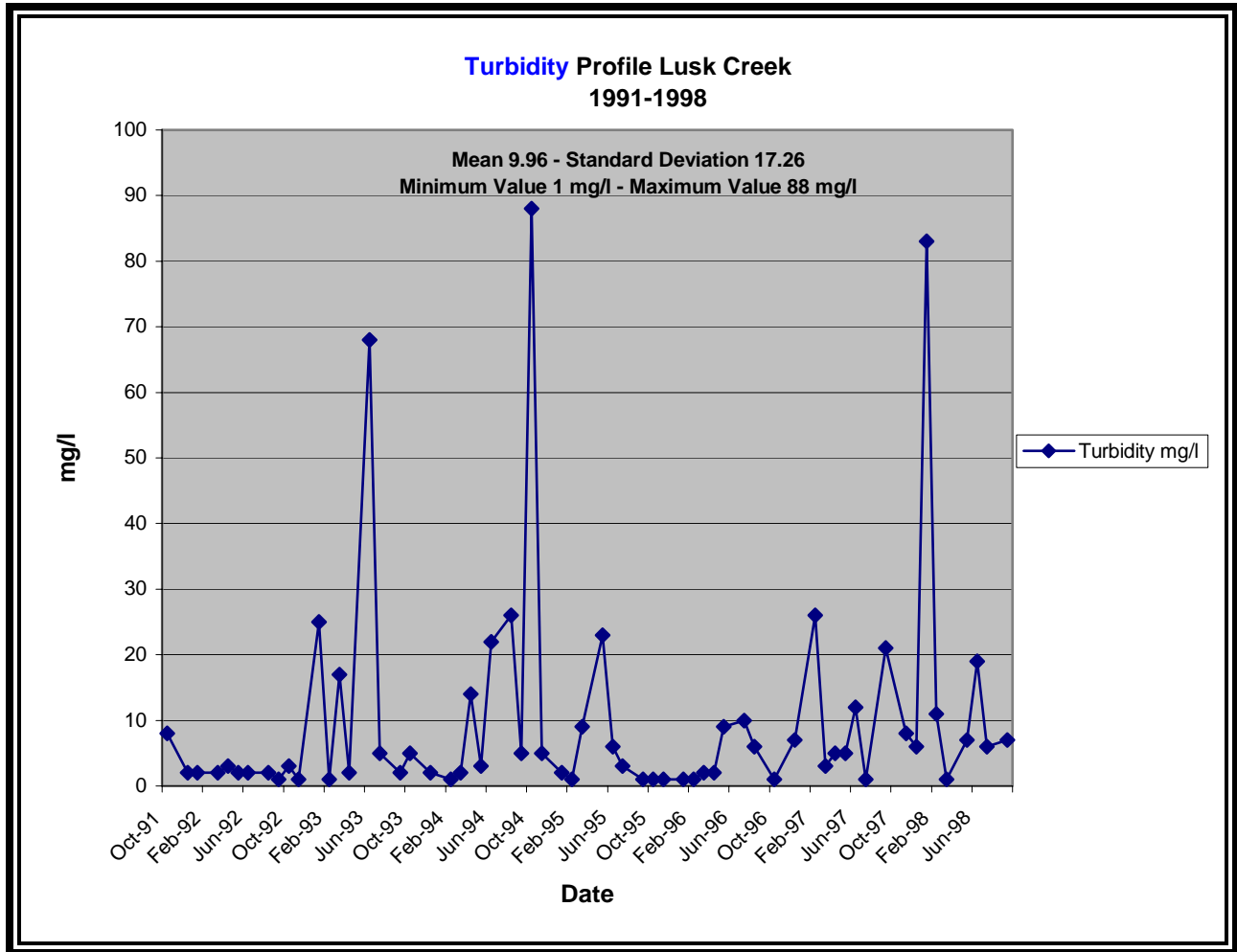
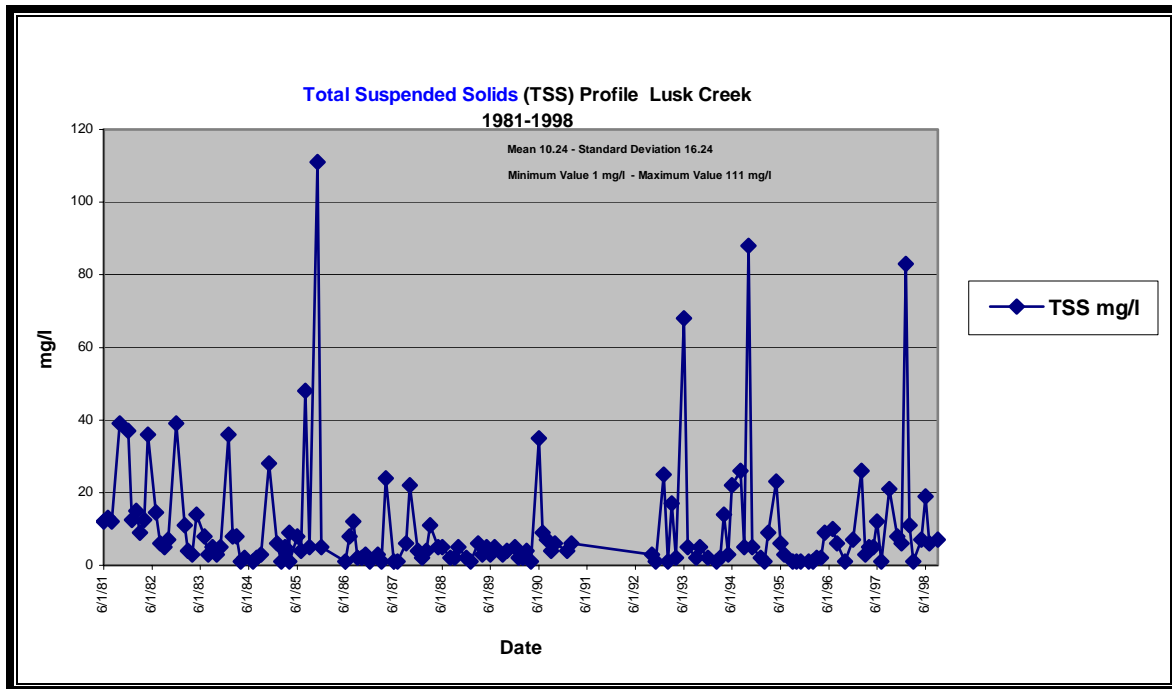


Figure 5.1—Turbidity Profile Lusk Creek

Step 6. Opportunities

5.6.1) Point and Non-point Pollution

From a watershed perspective point and non-point pollution levels currently are within acceptable levels within the Lusk Creek drainage. Monitoring of industrial and farming activities within the watershed would enable the Shawnee National Forest to define and quantify pollutant sources.



Figure

5.2—Total Suspended Solids Profile Lusk Creek

5.6.2) Siltation and Nutrients

Data suggests that while Lusk Creek experiences spikes in both turbidity and TSS, overall silt-load is low. Several aquatic species are highly sensitive to increases in nutrient and siltation levels (Huggins et al. 1985). Annual sampling of these populations would enable the Shawnee National Forest to develop a proactive strategy in detecting increases in siltation and nutrient loads. This type of sampling could be done in conjunction with the River Watch program, a state program designed to monitor stream health.

Section 6. Recreation

Applicable Management Prescriptions

The Lusk Creek watershed includes the following management prescriptions, as identified in Forest Plan:

- 2.1 – General Forest Management Area
- 5.1 – Lusk Creek Wilderness, including East Fork Special Management Area
- 6.4 – Forest Interior Management Units
- 6.6 – Recreation, Wildlife, Visual and Soil/Water Protection Emphasis
- 8.2 – Ecological, Geological, Zoological and Botanical Areas
- 8.3 – Heritage Resource Sites
- 9.2 – Wild and Scenic River Study Areas

Step 1. Characterize the Watershed

Roads:

The Lusk Creek watershed provides primarily roaded or dispersed recreation opportunities. There are about 100 miles of roads within this watershed. Road surface-types range from paved/asphalt to gravel and dirt. Recreational road-use consists of sight-seeing using street vehicles, access to favorite areas using street vehicles and/or off highway vehicles, and legal (with accessibility permit) and illegal ATV (All Terrain Vehicles – See Forest Plan for definition) or OHM (Off Highway Motorcycles – See Forest Plan for definition) use. Dirt roads are closed to vehicles from December to April. Heavy vehicle-use occurs during deer gun-hunting season. Access to National Forest lands within the watershed are by State Highway 145 and numerous county and Forest Service jurisdiction roads. There are no designated routes for the use of ATVs within this watershed or the Shawnee National Forest.

Developed recreation sites:

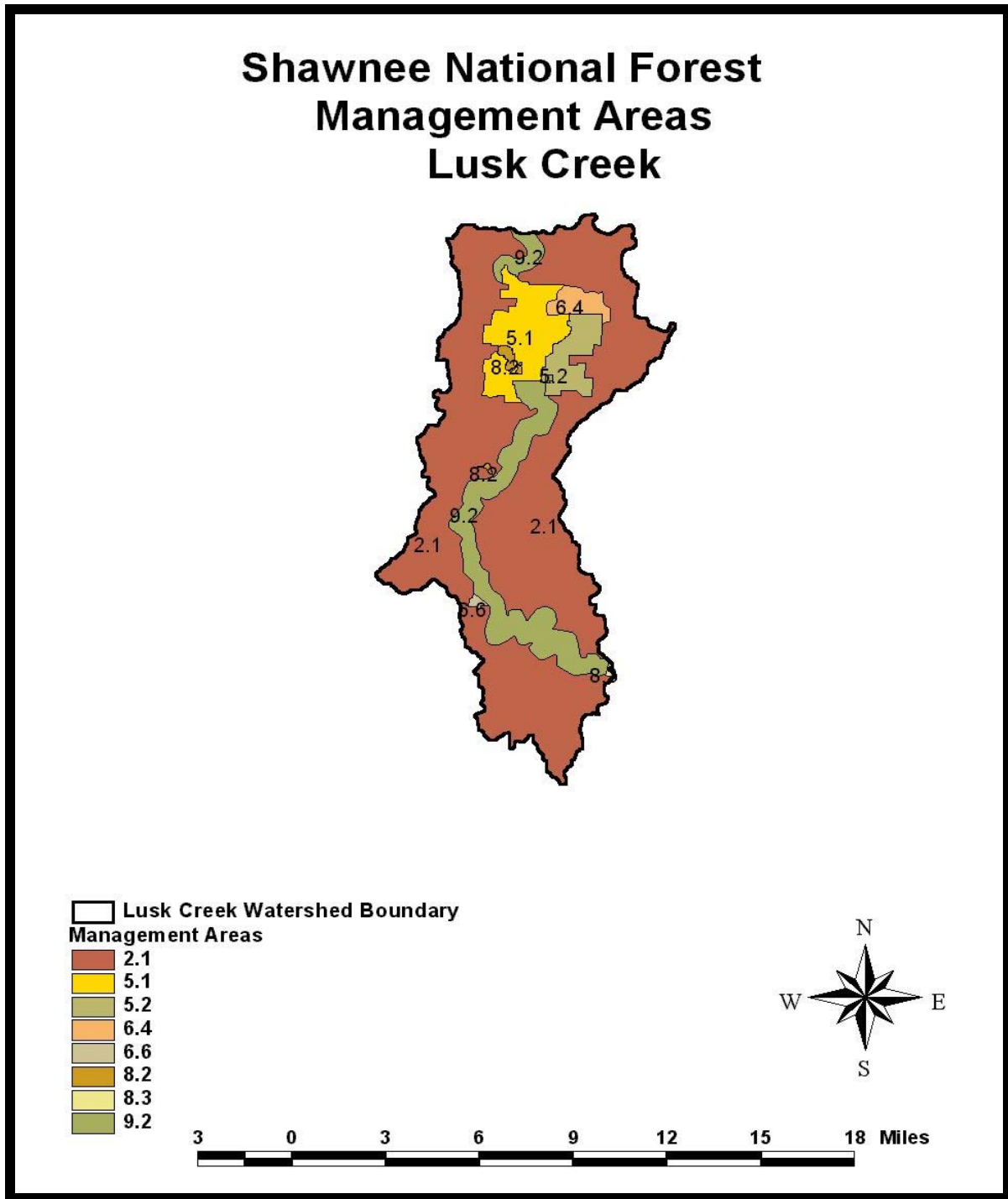
There are two developed recreation sites; both of them are trailheads to Lusk Creek Wilderness and provide parking and trail or wilderness information. Hikers and equestrians use them both.

There are three known developed campgrounds on private land within the watershed that cater primarily to equestrian recreation, and two within two miles of the watershed boundary. Riders from these campgrounds likely account for much of the equestrian use of National Forest lands within the watershed, particularly within Lusk Creek Wilderness. There is a tourism development effort in Pope County, promoting the rare opportunity to escape urban life in Illinois, as well as the Midwest, and gain access to the natural environment on horseback. As a result, commercial operations catering to equestrian recreational use have grown within and adjacent to this watershed.

Dispersed Camping:

White-tailed deer hunting season is a major attraction within Pope County, with the local Chamber of Commerce sponsoring a festival that attracts hunters and other sports enthusiasts from within and around the state. Most of the dispersed camping that occurs within this watershed is associated with the white-tailed deer hunting season. The favored sites for this dispersed camping is National Forest land west of Sulfur Springs Church and near Reddick Hollow. Dispersed camping by hunters also occurs near the historic location of the community of Oak and near Bethesda Church. Occupancy within these dispersed camping sites varies; however, most have within the range of three to twenty hunters. All of these dispersed camping sites are within the northern portion of the watershed. Hunters indicate they prefer this portion of the watershed due to a more consolidated federal land base. The direct environmental impacts associated with this dispersed camping are to soil and vegetation. The intensity of these direct impacts depends on weather conditions, and is amplified during wet periods. Adverse environmental impacts include rutting from vehicles parking on non-hardened sites, soil compaction from tents and intensive foot traffic, and destruction of low-growing vegetation. Wildfires associated with escaped campfires cause environmental impacts during dry periods.

Shawnee National Forest Management Areas Lusk Creek



Map 3—Management Areas

Wilderness:

Lusk Creek Wilderness was established within the Lusk Creek watershed by the Illinois Wilderness Act of 1990 in order to retain an environment free from human development, to promote primitive recreational opportunities, and to provide an opportunity for solitude. Within the wilderness are Lusk Creek Zoological Area (the creek from bank to bank), Lusk Creek

Canyon Ecological area (adjacent to the state-owned nature preserve), and two smaller natural areas. Only non-motorized and non-mechanized uses are allowed within the wilderness boundary. The wilderness area consists of 6,419 acres.

The natural integrity of the wilderness is present in part; however, many acres show evidence of past agricultural uses, roads, and conversion of the native oak-hardwood overstory to non-native pine. The opportunity for primitive recreation is present. The opportunity for solitude, however, is sometimes limited due to use by large equestrian groups.

Trails:

There are about 10.4 miles of Forest System hiker-equestrian trails within the wilderness and two miles in the watershed outside of wilderness. The system trails are River to River Trail, No. 001 (about 8 miles); Indian Kitchen, No. 433 (1.4 miles); Little Lusk, No. 425 (1.7 miles); Dog Hollow, No. 459 (.6 mile); and Bethesda Church, No. 430 (.6 mile). Travel routes—existing roads, old roads, and/or user-developed routes—account for the largest dispersed use in this watershed. Primarily for horseback riding, these travel routes offer variety and lead to scenic attractions. The number of miles of these routes within wilderness was 40 miles in 1998. Outside of wilderness, these miles have not been counted, but there is likely to be another 40 or 80 miles that are utilized by equestrians, hikers or off-highway vehicles.

This table displays the acreage, number of system trail miles, travel routes, and trail densities within Lusk Creek Wilderness:

Table 6.1—Wilderness Acreages, Trail Miles and Trail Density

12-21-00, M.Walma

	Gross Acres (w/ pvt.) ref. only	Net Acres (NF Ownership)	Square Miles (of Net)	Total System Trail Miles	Total <i>old travelway + user created</i> Routes GPS'd in miles*	Total Trail and Route Miles	Density NF trails /routes per sq mile**
Lusk Creek	6789.5	6419.36	10.03	9.92	40.20	50.12	.99

There is roughly one mile per square mile of system trails within Lusk Creek Wilderness.

Lusk Creek Candidate Wild and Scenic River Study Corridor:

Lusk Creek is a candidate for study and possible inclusion in the National Wild and Scenic River System. A corridor ¼-mile wide on each side of the stream is managed under the 9.2 management prescription, identified in the Forest Plan. The waters of Lusk Creek are a zoological area managed under the 8.2 management prescription identified in the Forest Plan. The 8.2 and 9.2 prescriptions require protection of the attributes of the stream and its adjacent land. Canoeing takes place to some extent on this stream; use is seasonal, however, and low due to lack of developed ingress.

Equestrian Use:

Horseback riding is the primary dispersed recreational use. Equestrian use is allowed by the Forest Plan within the Lusk Creek watershed and wilderness cross-country and on user-

developed trails existing in 1992, except in natural areas. Tourism organizations, Pope County, and the business communities promote equestrian opportunities largely to increase economic revenue to these rural areas. The Shawnee National Forest is promoted as the number-one outdoor recreation tourism attraction in Illinois, and tourism development that relies on the Forest is viewed as a primary remedy for the economic problems suffered by this region due to the decline of agricultural and mining activities.

Commercial equestrian recreational use on National Forest land currently consists of organized equestrian events, although the permitting of outfitter and guide services is proposed. The largest annual event, “The Nine-Day Ride,” caters to about 2,500 horses and their owners. The event takes place on private lands outside the watershed; but there are occasional rides on National Forest lands within the watershed. Other equestrian recreation events, consisting of several hundred horseback riders per event are held on roads within the watershed. Guided or outfitted rides on the Forest are currently illegal; however, the permitting of this service is being analyzed for environmental effects.

Lusk Creek Wilderness is the primary natural attraction for horseback riders in the area due to the number of scenic vistas and bluffs; its relatively large, unbroken acreage; and the fact that motorized use is prohibited.

Other dispersed recreational uses:

Hiking, hunting, bird-watching, mushroom-hunting, berry-picking, fishing, canoeing, viewing scenery and wildlife, photography, and other nature-based activities are the many other recreational activities that take place in Lusk Creek Wilderness and within the watershed. Recreational activities occurring outside of the wilderness include all of the above, plus mountain-bicycle riding and motorized uses.

Step 2. Issue Identification

6.2.1) How can we reduce current resource degradation caused by extensive equestrian use and illegal ATV/OHM use?

Step 3. Description of Current Conditions

6.3.1) Trails and resource conditions

Equestrian Use:

The 12.4 miles of system trails within the watershed are heavily impacted by equestrian use. Allowing equestrian use on a trail all year (including freeze/thaw periods and wet periods) requires hardening with gravel in many areas, and frequent maintenance. Both are expensive and difficult to achieve, especially on the 10.4 miles of system trail within wilderness. In wilderness, trail improvements and maintenance must be done by non-motorized and non-mechanized means. Outside of wilderness, system trails are easier to improve and maintain. Another factor contributing to high impacts to system trails is the lack of funding for adequate design and construction, and personnel to maintain system trails.

Due to the high volume of equestrian use in this watershed, particularly within the wilderness area, and a policy that allows horses to ride cross-country, except in natural areas, adverse resource impacts are present and currently under-managed. About 40 miles of travelway—system roads, old roads, or user-developed trails—were located in Lusk Creek Wilderness in 1998. This is about five miles of travelway per square mile.

Equestrian use during freeze-thaw periods and during wet seasons; lack of drainage-control structures; poor travelway locations on steep slopes, along the base of bluffs, through plant populations, and into creeks over time accelerate resource degradation.

Maintenance and mitigation measures, including relocating travel routes from eroded old roads and travelways; implementing water-diversion measures, including water bars, dips, and outloping; hardening the trail-tread with gravel to protect the soil; installing high-lines or hitching racks to tie horses away from trees; relocating or constructing trails with less steep grades; equestrian-use and/or group-size restrictions; and others, singly or in combination, can contribute to increased recreational enjoyment, safety, and resource protection.

Motorized use:

Unauthorized ATV/OHM use occurs throughout the year and has adverse effects on soils and vegetation resources. In many cases, Forest Protection Officers enforce regulations where environmental damage is caused; however, violations are frequent due to lack of personnel and easy access to Forest lands.

Licensed four-wheel drive vehicles also use routes with dirt or grass surface. These vehicles can and do cause considerable damage to the road surface and system trails within this watershed due to a desire by some to drive when the roads or trails are wet.

Canoe access:

Another recreation use having the potential to conflict with the protection and maintenance goals of the management prescriptions for the watershed is the development of user-developed boat/canoe launches south of the Eddyville Blacktop. These sites receive heavy use during periods when the stream is high, usually in the spring. Another user-developed boat/canoe launch is located near Reddick Hollow. This site receives less use than the site near Eddyville. Both these user-developed launches have the potential to increase siltation in Lusk Creek and adversely affect the fauna of the stream. The Lusk Creek Conservancy, a public, governmental agency, has requested the development of a launch area with parking within the Lusk Creek corridor. Action on this request has been deferred until completion of the Wild and Scenic River Study.

Step 4. Description of Reference Conditions

6.4.1) Trail and resource condition

Prior to human influence, trails only existed as a result of wildlife activity, were probably very narrow, and caused little erosion. The area was occupied by Native Americans who traveled trail

routes. With the arrival of the European settlers, transportation routes were developed for travel by foot, horse, or wagon and, in recent times, motor vehicle.

The Forest Service began land acquisition for the Shawnee National Forest in 1933, and in the process purchased property containing old travelroutes and worn farmland. Many of these old travelroutes are still used, often in poor locations, with active erosion and/or soil compaction.

Equestrian use has become one of the most significant recreational and resource issues on the Forest today. While much of the use occurs on old travelways and user-developed trails existing in and prior to 1992, it is likely that many miles of new routes have resulted in spite of current Forest Plan policy.

Step 5. Synthesis and Interpretation

6.5.1) Trail Condition and Location

The development of human travelroutes, later to become recreational trails, probably increased adverse environmental impacts. Soil, water, and vegetation were particularly vulnerable in areas where the travelways were poorly located and not maintained. Today, trails serve as a recreational feature, rather than as transportation routes. They satisfy a societal need for recreation and are consistent with the Forest Service mission to provide recreational opportunities.

Under the description of current conditions, the existing system trails do not meet a standard that provides for the amount of equestrian use received and still protects resources. In addition, there are not enough miles of system hiker-equestrian trails to meet the high demands of this recreational activity, especially within the wilderness. Resource degradation is heavy due to insufficient management and regulation of equestrian use. However, the lack of an improved, maintained, and signed trail system is also a serious resource and recreation issue.

The primary recreational need in this watershed is the designation of the number of miles of system trails adequate to provide an enjoyable recreational experience.

The second recreational need is to adequately locate, design, construct, and maintain the system trails designated within the watershed. An adequate trail system will provide greater enjoyment, user safety, and much greater resource protection.

The third recreational need is to restrict equestrian use to designated trails, once an adequate system is identified. This will reduce adverse impacts to soil, vegetation and water. It will also eliminate recreational use-conflicts with hikers and hunters away from trails.

Additionally, consideration of group-size restrictions within wilderness is warranted in order to contribute to a greater opportunity for solitude than what currently exists today.

Step 6. Opportunities

(See Appendix G.)

Section 7. Soils

Step 1. Characterize the Watershed

7.1.1) Surficial Geology

Pennsylvania-age bedrock underlies the northern and central parts of the Lusk Creek watershed. Pennsylvanian bedrock in the watershed includes thin beds of siltstone, shale, and limestone. Mississippian-age bedrock underlies the lower and a small central portion of the watershed. These bedrocks include thick beds of sandstone with thin beds of shale and limestone. About one mile northeast of Waltersburg, Lusk Creek transcends from an upland physiography to the high terraces of the Equality Formation. These terraces are Ohio River sediments deposited during glacial times and consist of silty or loamy lacustrine deposits that are thinly bedded and contain sandy layers in some areas.

The glaciers that covered much of North America terminated just north of the watershed and affected all soils in the watershed. As the glaciers melted, suspended silts were deposited in river valleys. These loess deposits were then windblown across the Lusk Creek watershed and overlie the Pennsylvanian and Mississippian age bedrocks and the Equality Formation. Closer to the river valleys, the loess deposits thicken. About 50 percent of the soils in the watershed formed in thin to thick (> 60 inches) deposits of loess. Loess thickness is displayed in Appendix C as well as the surficial geology of Pope, Hardin and Massac Counties.

A much more recent deposit of Cahokia alluvium covers major floodplains and valleys in the watershed. This alluvium overlies sandstone and sandstone residuum in most cases. Alluvium is deposited by overbank flow and flooding, where erosional sediments, suspended in runoff and flood waters, are redeposited on floodplains and valley floors.

7.1.2) Ecoregion and Subregion

The Lusk Creek watershed is located in the Eastern Broadleaf Forest Province, the Interior Low Plateau, Shawnee Hills Section, and the Greater Shawnee Hills and Lesser Shawnee Hills subsections in the Forest Service National Hierarchical Framework of Ecological Units. The ecology of the Shawnee Hills Section is described in the publication *Ecological Subregions of the United States* (USDA Forest Service 1994).

7.1.3) Soil and Hydrologic Resources

Upland Soils

Grantsburg, Zanesville, and Wellston soils are predominating on the uplands, while Sharon, Burnside and Belknap soils are on floodplains. A stream-terrace consisting of Ginat, Sciotoville, and Weinbach and associated soils occupies a small area along and parallel to Lusk Creek.

Grantsburg and Zanesville are the two major soils in the watershed. Grantsburg soils make up 41 percent of the entire watershed. They consist of gently sloping to moderately steep, moderately well drained soils that are moderately deep to a fragipan. These soils occur on ridge tops and side slopes of ridge tops. Zanesville soils make up seventeen percent of the watershed and primarily occupy side slopes. Zanesville soils consist of strongly sloping to steep moderately well drained soils that are moderately deep to a fragipan. These soils are primarily on side slopes. Wellston soils and the Wellston-Berks complex make up another 23 percent of the watershed. They occur on side slopes that range up to 60 percent.

Grantsburg and Zanesville soils developed in Peoria, Roxana, and Loveland loess and the underlying bedrock. These soils range from four to twelve feet to bedrock (usually sandstone). Grantsburg and Zanesville soils contain fragipans usually at depth greater than two feet. These pans have a high bulk density that restricts permeability and root penetration. These soils are also alfisols with an argillic horizon that occurs above a fragipan in these soils. An argillic horizon is developed through intensive soil weathering where clay accumulates in the subsoil and is removed from the surface and subsurface horizons. There is an accumulation of clay in the subsoil that also inhibits permeability. Grantsburg soils typically occur on slopes from two to twelve percent, while Zanesville soils occur on slopes from seven to eighteen percent. These soils are very erodible due to the loess cover, and have slow to very slow permeability. Care has to be taken in managing these soils or erosion will be excessive.

Wellston soils are similar to Zanesville soils but do not contain a fragipan. Permeability is moderate. These soils generally occur on slopes of 12 to 30 percent slopes. They also have a loess cap of 40 to 72 inches above bedrock. Muskingum and Berks soils occur with or adjacent to Wellston soils. These soils contain 10 to 75 percent coarse fragments and are shallow to bedrock.

Less extensive upland soils that occur in the watershed are Hosmer and Beasley soils. Hosmer soils occur in the southern part of the watershed near the Ohio River. They are similar to Grantsburg soils, but have a less-developed fragipan and depth to bedrock can extend beyond ten feet. They also have a higher base saturation than Grantsburg soils. Beasley soils occur on side slopes and developed in thin loess and the underlying calcareous shales. These soils are shallow to bedrock and occur on slopes from 12 to 50 percent in the watershed. These soils typically support forest vegetation.

Soil associations are displayed in Appendix D. Soil associations are groups of soils that occur together on similar landscapes. The associations are named according to the dominant soils occurring on the landscape. The three associations in the watershed are the Grantsburg-Zanesville, Grantsburg-Zanesville-Wellston and the Ginat-Weinbach-Sciotoville. Grantsburg and Zanesville are the most common soils in the watershed.

Floodplains and Riparian Areas

Soils common to floodplains and riparian areas in the watershed are Burnside, Belknap, Sharon, and Bonnie soils. Burnside soils are moderately well drained and are located in narrow floodplains that extend into the uplands. They are on nearly-level to gently-sloping landscapes and range from zero to four percent slope. Burnside has 12 to 24 inches of silty alluvium overlying channery loam that overlies sandstone bedrock. These soils flood occasionally. Sharon soils are moderately well-drained soils that formed entirely in silty and silt loam alluvium. They also occur on floodplains and flood occasionally. The erosion hazard of Burnside and Sharon is slight and permeability is moderate. Belknap soils are similar to Sharon soils except they are somewhat poorly drained and occur on nearly level sites. Burnside, Sharon, and Belknap are strongly to very strongly acid and are inceptisols. Inceptisols lack the soil development of alfisols and do not contain an argillic horizon or fragipan.

Sciotoville soils are moderately well drained soils that occur on stream terraces along Lusk Creek near its confluence with the Ohio River. These soils are not extensive in the watershed. They formed in old Ohio River alluvium. They occur on terrace ridge tops and side slopes that range from zero to eighteen percent. Sciotoville is an alfisol with a weakly expressed fragipan and might rarely flood (i.e., during a 100-year flood). Weinbach soils are similar to Sciotoville, except they are somewhat poorly drained and lack a fragipan. They also developed in old Ohio River silty sediments. They occur on slopes ranging from zero to seven percent and the erosion hazard is slight to moderate. Ginat is a poorly drained version of Weinbach. They too developed in the silty old Ohio River sediments. These soils rarely flood and are higher on the landscape than Sharon and Burnside soils, but lower than the Grantsburg, Zanesville, and Wellston soils.

Appendix E displays (in blue) riparian areas and the floodplains in the watershed. The lower portion of the watershed contains more of these areas.

Wetlands

Hydric soils in the watershed are Bonnie and Ginat silt loam. Belknap silt loam might have inclusions of hydric soils such as Bonnie. There are approximately 1,000 acres of these soils that mainly occur on the lower end of the Lusk Creek floodplain. They are on private land that generally is in some type of agricultural use.

Hydrology

There are ten designated trail stream-crossings in the watershed. They are all on National Forest land. There are 61 Forest Service road stream-crossings in the watershed. They are low-water crossings that cross either ephemeral, intermittent, or perennial streams. Locations of crossings are in an Appendix F. Effects of these crossings on water quality are discussed in Step 3.

Smithland Dam, completed in 1979, is fifteen miles downstream of Golconda. The U.S. Army Corp of Engineers bought a flowage easement to elevation 330 feet. The old ordinary high-water mark was 319 feet at Golconda. The new ordinary high water mark is at 326.5 feet. This

impounds water further up the floodplain and for longer durations than historically occurred. Most flooding in the upper watershed is frequent but flashy. It occurs on an average of once every two years, but for short durations.

On private land, there is one ford across Quarrel Creek that is on a gravel road in Section 36, Township 12 S, Range 5E; and another across a tributary to Little Lusk Creek in Section 11, township 12S, Range 6E. They are maintained by the Pope County Road District #2. There is also a ford across Lusk Creek in Section 3, township 12S, R6E. This ford is downstream from the Lusk Creek Ecological Area.

Peak Flow Data- US Geological Survey

Below are gaging records from 1968 thru 1997 for Lusk Creek. The gaging station is on Lusk Creek at the Eddyville Blacktop bridge.

```
# Station name : Lusk Creek Near Eddyville, IL
# Station number: 03384450
# latitude (ddmmss)..... 372820
# longitude (dddmmss)..... 0883250
# state code..... 17
# county..... Pope
# hydrologic unit code..... 05140203
# basin name..... Lower Ohio-Bay
# drainage area (square miles)..... 42.9
# gage datum (feet above NGVD)..... 360.42
# base discharge (cubic ft/sec)..... 2600
# Gage heights are given in feet above gage datum elevation.
# Discharge is listed in the table in cubic feet per second.
# Peak flow data were retrieved from the
# National Water Data Storage and Retrieval System (WATSTORE).
# Format of table is as follows.
# Lines starting with the # character are comment lines describing the data
# included in this file. The next line is a row of tab-delimited column
# names. The next line is a row of tab-delimited data type codes that
# describe the width and type of data in each column. All following lines
# are rows of tab-delimited data values.
# ----Water Years Retrieved----
```

```
# 1967 - 1999
```

Type	Station	Date	Discharge	DisQual	GageAtPeak	GageQual	HighSince	PGDate		
	PeakHeight		PGQual							
1s	15s	10d	6n	12s	8n	4s	2s	10d	6n	4s
3	03384450	1968.04.04		4450		17.50				
3	03384450	1969.06.23		6140		21.73				
3	03384450	1970.05.10		6510		22.65				
3	03384450	1971.02.22		3710		15.46				
3	03384450	1972.04.15		5160		19.28				
3	03384450	1973.05.27		11200		23.45				
3	03384450	1973.12.26		3020		13.43				
3	03384450	1975.04.25		7940		20.34				
3	03384450	1976.07.03		4880		16.58				
3	03384450	1977.03.28		9860		22.21				
3	03384450	1978.03.13		4790		16.46				
3	03384450	1979.03.31		6010		18.13				

3	03384450	1980.07.03	2470		11.85
3	03384450	1981.05.19	3810		14.95
3	03384450	1982.01.31	4980		16.73
3	03384450	1983.04.30	10200		22.39
3	03384450	1984.05.06	3410		13.64
3	03384450	1985.08.24	6100	7	27.78
3	03384450	1986.05.16	4550		16.11
3	03384450	1987.02.28	3280	E	13.84
3	03384450	1987.12.26	3840	E	15.00
3	03384450	1989.07.02	5220		17.07
3	03384450	1990.01.20	5970		18.07
3	03384450	1991.03.22	5020	E	16.78
3	03384450	1992.03.18	1820	E	9.75
3	03384450	1993.01.04	5700		17.72
3	03384450	1993.11.17	6370		18.58
3	03384450	1995.04.20	5910		17.93
3	03384450	1996.04.29	4250		14.84
3	03384450	1997.03.01	8580		20.91
3	03384450	1998.08.07	2610	E	11.17
3	03384450	1999.01.22	7530	E	19.79
4	03384450	1967.12.02	3630		15.22
4	03384450	1968.02.01	3040		13.53
4	03384450	1968.03.20	4340		17.22
4	03384450	1968.12.27	3860		15.89
4	03384450	1969.01.30	5080		19.08
4	03384450	1970.04.19	3740		15.53
4	03384450	1970.06.15	3900		16.00
4	03384450	1970.06.16	3780		15.65
4	03384450	1972.03.15	3060		13.61
4	03384450	1972.12.08	3620		14.64
4	03384450	1973.01.21	2630		12.36
4	03384450	1973.03.11	3340		14.07
4	03384450	1973.04.19	4180		15.63
4	03384450	1973.04.23	2810		12.88
4	03384450	1974.11.04	3380		14.15
4	03384450	1975.02.23	3630		14.66
4	03384450	1975.03.28	4520		16.17
4	03384450	1976.02.17	4840		16.52
4	03384450	1977.03.03	2620		12.25
4	03384450	1977.12.05	3390		14.11
4	03384450	1978.12.03	2670		12.37
4	03384450	1978.12.31	2780		12.66
4	03384450	1979.02.23	5190		17.03
4	03384450	1979.02.25	3340		13.99
4	03384450	1979.03.23	2890		12.92
4	03384450	1979.04.11	2660		12.35
4	03384450	1981.05.30	3570		14.51
4	03384450	1981.06.20	3790		14.91
4	03384450	1982.01.22	4470		15.98
4	03384450	1982.12.03	7440		19.44
4	03384450	1982.12.25	9440		21.65
4	03384450	1983.04.08	3790		14.31
4	03384450	1983.04.14	3770		14.28
4	03384450	1983.05.03	6340		18.09
4	03384450	1983.05.15	3860		14.44
4	03384450	1983.07.03	5870		17.45

4	03384450	1983.11.23	3100	13.06
4	03384450	1984.11.01	4510	15.48
4	03384450	1984.12.21	5520	16.97
4	03384450	1984.12.31	2940	12.67
4	03384450	1985.03.30	4920	16.10
4	03384450	1985.03.31	4470	15.41
4	03384450	1985.05.01	2620	11.83
4	03384450	1985.09.05	7260	19.23
4	03384450	1986.03.12	3710	14.79
4	03384450	1988.12.28	3000	13.18
4	03384450	1989.02.02	3740	14.84
4	03384450	1989.02.13	4200	15.57
4	03384450	1989.03.31	3570	14.52
4	03384450	1990.02.15	4640	16.23
4	03384450	1990.04.28	3470	14.28
4	03384450	1990.05.17	5880	17.96
4	03384450	1990.05.26	3130	13.49
4	03384450	1993.05.06	3320	13.93
4	03384450	1993.06.09	3530	14.42
4	03384450	1994.07.16	2940	12.87
4	03384450	1995.05.18	5460	17.27
4	03384450	1996.04.28	3120	12.38
4	03384450	1996.11.07	3540	13.32
4	03384450	1996.12.23	5860	17.81
4	03384450	1997.01.22	2760	11.53
4	03384450	1997.05.31	6600	18.73
4	03384450	1997.06.01	2670	11.30

Step 2. Issue Identification

7.2) Soil Issues

7.2.1) What are the effects of road and trail use on soil and water resources?

7.2.2) What are the effects of agriculture and other land uses on soil and water resources?

Step 3. Description of Current Conditions

7.3.1) Soil Erosion

Soil erosion is soil loss from the earth's surface, normally caused by water or wind. Soil erosion is a natural process that has created many features on the earth's surface. Streams erode valleys, creating floodplains. The Appalachian Mountains were once similar to the Rockies; but, over hundreds of thousands of years, erosion has decreased their size and relief.

Geologic or natural erosion is the wearing away of the earth's surface by water, ice, wind, or other natural agents under natural environmental conditions of climate and vegetation that is undisturbed by man. Accelerated erosion is erosion that exceeds geologic rates due to human activities on the soil. Brady (1984) estimates geologic rates of erosion at 0.1 to 0.2 tons/acre/year, depending on vegetation, soils, climate, and topography. Troech et al. (1980), considered a rate of 0.45 tons/acre/year as an approximate average. Actual rates might vary from

near zero for many thousands of years to catastrophic events such as landslides that remove several feet of soil in a short period of time.

Accelerated erosion is loss of soil above geologic rates caused by human activity. Activities in the Lusk Creek watershed that can lead to these types of erosion are agriculture, silviculture, and development or construction. Rates of accelerated erosion can range as high as twenty tons/acre/year or more depending on soil characteristics, climate, slopes, and land use.

Wind erosion is a very minor component of erosion in the Lusk Creek watershed. Water erosion is the major cause of soil loss in the watershed. The analysis will focus on water erosion.

In the Lusk Creek watershed, sheet, rill, and gully erosion are the most common types of erosion caused by water. Sheet erosion occurs where soil is moved from a slope more or less in a uniform layer, as when raindrops hit bare soil and the impact dislodges soil particles that are then removed by runoff. Evidence of sheet erosion is small pedestals or exposed rock pebbles sitting on pedestals. Rill erosion occurs when soil is moved, creating small channels. Rills are caused by water runoff that concentrates into a channel, removing soil in its path by downward cutting. Rills are small and can easily be destroyed by tillage. Gullies are large rills or large channels that are caused from a major concentration of water runoff. Gullies might be two to as much as twenty feet deep.

There are five factors that determine rates of erosion. Wischmeier and Smith developed an equation using these factors to help predict erosion rates. These factors are the rainfall or climate factor (R), slope (LS) (both length and percent), soil erodibility (K), and management (C) and a conservation practice (P). The product $RKLSCP$ = average annual rate of erosion.

National Forest land comprises about 43 percent of the watershed. Many pines were planted for erosion control when the Forest Service began management in the 1930's. These pine plantations are effective at erosion control. Silvicultural activity has been limited in recent years. The largest impact to erosion and stream sedimentation are existing roads and trails that accelerate erosion beyond natural rates on trail or road tread. Erosion rates are site-specific and correlate to the amount of use, the time of year when use occurs, trail location on the slope (up or down versus across), amount of maintenance, percent and length of slope, and soil texture.

Silvicultural land management can cause accelerated erosion. Log landings, skid trails, and haul roads cause bare-soil exposure, increasing the risk for erosion. These practices generally are located on a small percentage of the area. Leaf residue and limbs remain on the soil surface, protecting the soil from rainfall impact and soil displacement.

Agriculture is a major land use in the watershed. Corn, soybeans, and wheat are major crops. Agriculture can cause accelerated erosion. Actual erosion rates are dependent on soil types, the percent of slope, the length of slope, and cropping practices. The Pope County Soil and Water Conservation District and the Natural Resource Conservation Service work with farmers to establish cropping practices that reduce erosion below tolerable levels (T-value). T-values are acceptable limits of erosion that a soil type can sustain while maintaining productivity and without compromising environmental integrity. T-values have been developed for each soil type

and are based on soil characteristics. Soils in the Lusk Creek watershed have T-values ranging from three to five tons/acre/year.

Bare soil is very susceptible to water erosion. Land use that exposes bare soil to water erosion can create conditions favorable for accelerated rates of erosion. Land-management activities and projects that create bare-soil conditions will potentially cause more erosion than those that leave residue and vegetation on the soil surface. Listed in Table 7.1 are the soil-erosion hazards for soil-map units in the Lusk Creek watershed. This information was taken from the soil-map unit descriptions and woodland-suitability ratings in the Pope, Hardin, and Massac Counties soil-survey report (USDA 1975). At the project level these interpretation ratings can be used to analyze effects. Preventative measures and mitigation at the project level can be based on soil-map units and their erosion-hazard ratings. The erosion-hazard rating is based on a soil's susceptibility to erosion when management can lead to bare-soil conditions. The forest management erosion hazard is rated according to the risk of erosion on well-managed forest that is not protected by special practices.

Table: 7.1—Soil Erosion Hazards

Symbol and Map Unit Name	Erosion Hazard	Forest Management Erosion Hazard
72 Sharon 0- 2% slopes	Slight	slight
108 Bonnie 0- 2% slopes	slight	slight
214B Hosmer 2-4 % slopes	moderate	moderate
214C2 Hosmer 4 – 7% slopes, eroded	moderate	moderate
214D2 Hosmer 7- 12% slopes, eroded	severe	moderate
214D3 Hosmer 7 -12% slopes, severely eroded	very severe	moderate
214E2 Hosmer 12 -18% slopes, eroded	very severe	moderate
214E3 Hosmer 12-18% slopes, severely eroded	very severe	moderate
214F2 Hosmer 18-30% slopes	very severe	moderate
301B Grantsburg 2-4% slopes	slight-moderate	moderate
301C2 Grantsburg 4-7% slopes, eroded	moderate	moderate
301D2 Grantsburg 7-12% slopes, eroded	severe	moderate
301D3 Grantsburg 7-12% slopes, sev eroded	severe	moderate
301E2 Grantsburg 7-12% slopes, eroded	very severe	moderate
301E3 Grantsburg 12-18% slopes, sev eroded	very severe	moderate
335B Robbs 1-4% slopes	slight	slight-moder
339E Wellston 12-18% slopes	very severe	moderate
339E3 Wellston 12-18% slopes, sev eroded	very severe	moderate
339F Wellston 18-30% slopes	very severe	moderate
340D2 Zanesville 7-12% slopes	severe	moderate
340D3 Zanesville 7-12% slopes, sev eroded	severe	moderate
340E2 Zanesville 12-18% slopes, eroded	very severe	moderate
340F2 Zanesville 18-30% slopes, eroded	very severe	moderate
382 Belknap 0-2% slopes	slight	slight
460 Gina, 0-2% slopes	slight	slight

461A Weinbach 0 to 2%, slopes	slight	slight
461B Weinbach 2 to 4%, slopes	slight	slight
461C2 Weinbach 4 to 7%, slopes, eroded	moderate	slight
462A Sciotoville 0-2%, slopes	slight	slight
462B Sciotoville 2-4%, slopes	slight	slight
462C2 Sciotoville 4-7%, slopes, eroded	moderate	slight
462D2 Sciotoville 7-12%, slopes, eroded	severe	slight
462D3 Sciotoville 7-12%, slopes, sev eroded	severe	slight
462E2 Sciotoville 12-18%, slopes, eroded	severe	moderate
463A Wheeling 0-2% slopes	slight	slight
463B Wheeling 2-4% slopes	slight	slight
463C2 Wheeling 4-7% slopes, eroded	moderate	slight
463D2 Wheeling 7-12% slopes, eroded	severe	slight
463E2 Wheeling 12-18% slopes, eroded	severe	moderate
467C2 Markland 2-7%, eroded	moderate	slight
467D2 Markland 7-15% slopes, eroded	severe	slight
469A Emma 0-2% slopes	slight	slight
469B Emma 2-7% slopes	moderate	slight
469D2 Emma 7-18% slopes, eroded	moderate	slight
691E Beasley 12-18% slopes	severe	moderate
691F Beasley 18-30% slopes	very severe	moderate
691G Beasley 30-50% slopes	very severe	severe
693 Hurst 0-2% slopes	slight	slight
955F Muskingum-Berks, 15-30%, slopes	very severe	moderate
955G Muskingum-Berks, 30-60%, slopes	very severe	severe
986E Wellston-Berks 12-18%, slopes	very severe	moderate
986F Wellston-Berks 18-30%, slopes	very severe	moderate
986G Wellston-Berks 30-60%, slopes	very severe	severe

7.3.2) Erosion of Roads and Trails

Accelerated erosion occurs on equestrian trails because metal horseshoes damage or destroy vegetation, disturb the protective duff layers, displace topsoil, and cause soil compaction. Erosion rates on equestrian trails are site-specific and correlate to the amount of use, time of year when use occurs, trail location on the slope (up and down versus across), level of maintenance, percent and length of slope, and soil texture.

Horses tend to follow each other in single file, therefore their impact is concentrated, especially when equestrians are riding in large groups. Erosion and gullying inevitably follow. Subsequent groups ride around the gullies and mud-holes, widening the area of disturbance (USDA Forest Service 1992). User-developed trails can be poorly located up and down the slope, on streambanks, and through rock structures and narrow passes. This increases the risk of erosion and makes the trails impossible to maintain with equipment. Where water-control structures cannot be constructed, water tends to channelize on the trail, causing gully erosion. Trail use exposes bare mineral soil and removes the protective duff layer that protects the soil surface

from raindrop impact. Raindrop impact breaks loose surface-soil particles that become suspended in surface runoff and are eroded. Trail use also compacts the surface which decreases infiltration and promotes runoff. Greater and longer slopes exhibit increased erosion (Dissmeyer 1984). The use of water-control structures is effective in reducing erosion because they shorten slope length. Compacted soils on steep, long slopes is the best combination for water erosion to occur.

Supporting Research

Dale and Weaver (1974) conducted a trail width and depth study in the Northern Rocky Mountains. They found that trail width increases with an increasing number of passes. Trails that receive both horse and foot traffic are similar in width or slightly narrower than those receiving foot traffic alone. Trails used by horses and people are deeper than those used by people alone. Depths of foot trails with 1,000-5,000 users per annum average 4.6 centimeters, while paths used by horses and hikers average 11.7 centimeters.

Wilson and Seney (1994) studied the erosional impact of hikers, horses, motorcycles, and off-road bicycles on mountain trails in Montana. They found that horses and hikers made more sediment available than wheels and that this effect was most pronounced on prewetted trails. Horse plots produced significantly more sediment than the bicycle, control, and hiker trail plots at the 0.05 significance level. Also, the greatest sediment yields were generated from prewetted trails. The increase in soil moisture reduces soil resistance, which reduces the soil's ability to bear load.

Summer (1986) found that on a weathered granite, soil erosion on the trail occurred at an average rate of 8 centimeters/year. In the same study, trail width increases were negligible to as much as 130 percent, depending on the site.

Soils Suitability and Limitations for Roads and Trails

Soil interpretation rating guides in the National Soil Survey Handbook rate soils in the watershed. Soils that are greater than eight percent slope and have silt-loam surfaces have severe limitations for trails because the soils erode easily. Soil erodibility is the inherent ability of the soil to erode. The two most significant soil characteristics influencing erosion are infiltration capacity and structural stability (Brady 1984). Soils developed in loess are more erodible than those developed in sandstone, limestone, and chert bedrock. The silt-loam textures of loess are very susceptible to erosion. A majority of the soils in the watershed have silt-loam surfaces. Soils formed in bedrock have lower erodibility (K value). Soils that are developed in bedrock and have greater than fifteen percent coarse fragments in the upper twelve inches are rated as severe if slopes are greater than 25 percent. Soil-map units are published in their respective county soil surveys.

Soil rating guides indicate the hazard or risk of soil loss from unsurfaced roads/trails (USDA NRCS 1993) (see figure 7.1).

Slight - Little or no erosion is likely.

Moderate - Some erosion is likely; occasional maintenance might be needed; simple erosion control measures needed.

Severe – Significant erosion can be expected; roads/trails require frequent maintenance; costly erosion control measures are needed.

Figure 7.2—Soil Rating Criteria for Potential Erosion Hazard (road/trail):

Factor	Slight	Moderate	Severe	Feature	Impact
Slope %					
Soil Erodibility Kw <.22 > 15 % rock fragments	< 10	10-25	> 25	Slope erodibility	Erosion and sedimentation; increased maintenance; land base loss
Soil Erodibility Kw >.22 < 15 % rock fragments	< 3	3-8	> 8	Slope erodibility	Erosion and sedimentation; increased maintenance; land base loss

7.3.2) Soil Productivity

Soil productivity is compromised by trail use. Removal of the duff layer and subsequent compaction and erosion will diminish soil productivity. However, this is over a localized area of the trail tread itself that, in the case of user-developed trails, is two to four feet wide in most cases. Soil productivity on user-developed trails in natural areas that are now closed to equestrian use can be improved by freezing and thawing, leaf accumulation, and constructing check-dams where necessary to control active erosion. Compaction occurs where horses are tethered over long periods of time. Compaction reduces soil productivity and infiltration, and increases runoff and erosion. Also, organic material is destroyed where tethering occurs and, many times, trees are injured or killed.

Soil Compaction

Soil compaction is an increase in bulk density and decrease in macropore space caused by the compression of the soil surface. Equipment use could potentially be the cause of compaction for a project. Soil compaction can affect site productivity, making it difficult to revegetate the site. Compaction reduces available water-holding capacity, infiltration, and soil permeability. It increases runoff and impedes root growth which inhibits revegetation. Construction should not be conducted when soils are wet, to minimize or eliminate compaction. Soil compaction is a retrievable and reversible effect because freezing and thawing, along with revegetation, will ameliorate soil compaction (Lull 1959). User-developed trails can be poorly located up and down slopes, which increases the risk for erosion. Erosion increases much more rapidly than runoff as the slope steepens (Dissmeyer and Foster 1984). User-developed trails tend to become

trough-like in shape. This causes runoff to become concentrated for long distances on the trail tread increasing erosion.

Supporting Research

The weight of an 800- to 1200-pound horse on four metal shoes causes soil compaction as well as destruction of organic horizons (litter) that are protecting the mineral soil surface from raindrop impact. Soil compaction is the packing together of soil particles by instantaneous forces exerted at the soil surface, resulting in an increasing soil density through a decrease in pore space (Lull 1959). Surface compaction destroys soil structure, reducing infiltration and increasing runoff. Compaction increases bulk density, and reduces available water-holding capacity, infiltration, and soil permeability. High soil moisture increases the compaction potential.

A study on trails in the Rocky Mountain National Park indicated that trail soils were 13 to 26 percent more compacted after one season of use (Summer 1980). Summer (1980) also found that trail deterioration was not always a direct result of horse use, but an interaction between horse traffic and the characteristics of the landscape.

Dale and Weaver (1978) conducted a study of the trampling effects of hikers, motorcycles and horses in meadows and forest near the Battle Ridge U.S. Forest Service Ranger Station in Bridger Range, Montana. They found that trail width increased with increased use. Trail depth increased with up to at least 1,000 passes. Trail depths tend to be greater on slopes than on level sites. Trail depths tend to be greater in a stone-free meadow soil than in a stony forest soil, at least for hikers and cycles. Trail depths were greatest under horse use and least under hiker use at all sites, which could be due to compaction and erosion. Soil compaction increased with the increasing number of passes and was greater on slopes than on level sites. It was generally greatest for horses and least for hikers.

Adkinson and Jackson (1996) conducted a study in three nature preserves in west central Indiana to determine the ecological changes that occur near trails. The predictions that organic matter should decrease and soil compaction should increase at trailside were supported by the data in this study.

Effects on Hydrology

Trail use causes a troughing effect on the trail tread. Because of this troughing effect, trails tend to catch sidehill runoff and concentrate (channel) it down the trail tread. This can affect the natural runoff patterns (hydrology). Trails also increase runoff rates by removal of the organic layer and compaction of the trail tread. These effects are separated by small drainage areas.

Trails and roads direct runoff into streams and rivers. Oftentimes runoff velocity increases and detachment and transportation of sediments is accentuated. Crossings are points where sediments generated on trails and roads directly enter the waterways and, therefore, can become a point-source of sedimentation. This depends on the slope, the amount of use, soil, and type of road surfacing.

There are ten designated-trail stream-crossings in the watershed. All are on National Forest land. Sediments can be generated from stream-crossings that directly enter the streams. Soils on streambanks are silty and have low shear strength. They are easily displaced by equestrians crossing streams. The combination of horses wearing away the bank and scour-erosion eventually creates a fairly low-gradient crossing. Several tons of soil can be removed from one bank.

There are 61 Forest Service road stream-crossings in the watershed. They are low-water crossings of either ephemeral, intermittent, or perennial streams. Sediments can be generated by erosion of the road tread itself and vehicles generating and displacing sediments into the stream as they cross. Most sediment is generated by gully erosion of the road treads, usually where there has been rutting.

Trail and road crossing are listed in Appendix F.

Step 4. Description of Reference Condition

7.4.1) Lusk Creek Watershed Mangement History

Prior to European settlement the watershed consisted of loess covered bedrocks vegetated with native hardwoods (i.e. oaks, hickories, maple). The watershed was nearly entirely forested, with small barrens occupying areas where soils were very shallow. Fire occurred periodically to help sustain the ecosystems. Europeans deforested the land and converted to agriculture starting in the early 1800's. These settlers often had 40 acres where they grew crops and livestock. The soils are not adapted to intensive agriculture and in many cases cropland eventually played out due to erosion and loss of inherent productivity.

Erosion was consistant with geologic rates of erosion prior to European settlement. Forested landscapes are well protected from rainfall impact and water erosion. Where slopes allowed, crops were grown. On more sloping areas trees were harvested and later pastured. There was a substantial amount of erosion during this time period causing a loss of soil productivity. Watershed health was probably the worst around the late 1800s and the early 1900s.

Agricultural fields and deforested areas were the most affected. Aerial photography taken in 1938 shows that deforestation was probably near its peak (see photograph). White and light colored tones on the photograpy indicate excessive erosion. Since that time the Forest Service has reforested much of the watershed that is National Forest Land (1986 photo). These plantings usually occurred in former cropped fields. In most cases fields were abandoned (prior to National Forest ownership) because of a loss of productivity due to excessive erosion. Much of the erosion was sheet, rill and gully erosion. Between 1933 and 1980 approximately 6,300 acres of pines have been planted in the watershed, most of which is on National Forest Land. The remaining portion of National Forest Land in hardwood forest with the exception of roads, trails and small barren areas.

Stream channels probably were filled with sediments altering their morphology. Accordingly, streams became more narrow and deep, with much deposition taking place on floodplains. The

pinus have been very effective in controlling erosion. An organic layer has developed under pine plantations that protects the soil surface from rainfall impact and surface runoff. The pine plantations are maturing and will begin to die off in 10 to 20 years. Eventually these plantations will convert to a hardwood stand. Hardwood vegetation also provides excellent erosion protection.

Step 5. Synthesis and interpretation

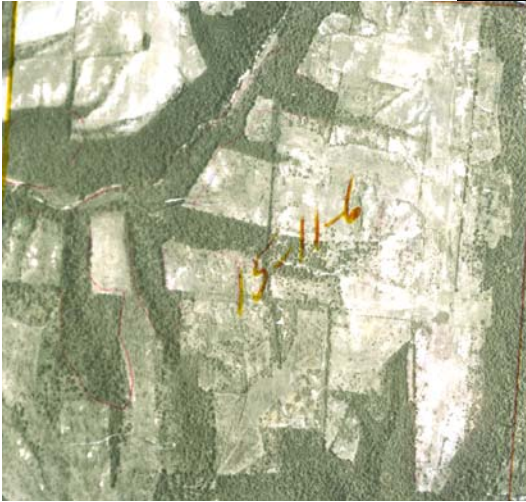
7.5.1) Watershed Conditions

Soil and water resources have improved since the early to mid 1900's due to reforestation and the implementation of better management and conservation practices. Also, moving away from row crop production to pasture management systems has improved conditions on agricultural lands in the watershed. Forest Service reforestation on former agricultural fields has reduced erosion to near geologic rates.

1986 Sec. 15 T. 11 S R. 6 E



1938 Sec. 15 T. 11 S R. E



Increased recreational use on National Forest land, as well as private land, is a watershed concern that needs to be addressed. Extensive equestrian use and the development of horse camps have increased deleterious effects on soils and water. Management of the trails system should be implemented to maintain a trail density that protects the soil and water resources while providing a quality recreational experience for equestrians. A designated trail system should be implemented in order to sign and maintain trails in the watershed. Those user-developed trails that are not designated should be closed. Monitoring of soil and water resources in heavy-use areas should be implemented to better understand and manage soil capability. Roads should be obliterated on National Forest land where possible, especially in wilderness.

The conservation reserve program, and conservation and best management practices promoted and recommended by the Pope County Soil and Water District and the Natural Resource Conservation Service have reduced erosion on agricultural lands. Farm planning conducted by these agencies that recognizes and emphasizes soil and water resource protection has also improved watershed conditions.

Land acquisition by the Forest Service, especially agricultural land will improve watershed conditions even further. However, the current trend in the watershed is that 40 to 80-acre parcels are being bought for development. People buy these small acreages to build homes, especially after retirement. This is increasing the price of land in the watershed and will make it more difficult for Forest Service acquisition.

Step 6. Opportunities

7.6.1) Roads and Trails

Trails and roads should be maintained annually. The Forest Service should have a designated trail system. Trail densities should be established and monitored. Roads should be obliterated where possible on National Forest Land. Rehabilitate closed trails that are continuing to erode.

7.6.2) Agricultural Land Acquisition

The Forest Service should consider land exchanges for, or the purchasing of, agricultural land.

Mitigation and Maintenance

User-developed trails can be poorly located up and down the slope, on streambanks and through rock structures and narrow passes. This increases the risk of erosion and makes the trails impossible to maintain with equipment. Water control structures cannot be constructed so water tends to channelize on the trail causing gully erosion.

Water-control structures, improved drainage, and top dressing with aggregates can be utilized on maintained trails to shorten length of slope and divert water off the trail, and thereby reducing the erosive energy of runoff. Also, the channelizing effect can be better corrected if trails are maintained.

Section 8. Fire

Step 1. Characterize the Watershed

8.1) Fire

Fire is a major historical agent of change or disturbance in ecosystems around the world, in North America, and in particular, in ecosystems that comprise the present day Midwestern United States (Mann 2000).

History

In pre-settlement times, the Shawnee National Forest occurred in the transitional zone between tall grass prairie on the west and eastern hardwood forest on the east (Unknown Author 1992, History of the Shawnee 7pp). Pre-settlement forests in Illinois were comprised of oak savannahs and grasslands, and open, park-like stands of upland, oak woodland carpeted with grass, forbs, and wildflowers (Unknown Author 1992, History of the Shawnee 7pp). The oak woodland itself was interspersed with prairie openings and glades. The most important influence shaping the forest landscape was wildfire (Unknown Author 1992, History of the Shawnee 7pp). Frequent wildfire, started both naturally by lightning or set intentionally or inadvertently by Native Americans, was a dominant influence in shaping the forests of Illinois. This includes those on the present day Shawnee National Forest and the plant and animal communities associated with these forests (Unknown Author 1992, History of the Shawnee 7pp).

In pre-settlement periods in the forests of the Midwest, millions of acres were burned frequently by Native Americans to improve game habitat, facilitate travel, reduce insect pests, remove cover for potential enemies, enhance conditions for berries, and to drive game. Edge species such as deer and wild turkey were common and hunted heavily (Hicks 2000).

Between 1800-1940, much of the midwestern forest in the Central Hardwoods region of the United States, including the Shawnee National Forest, was cleared and/or burned regularly for agriculture, timber products, and fuel (Hicks 2000). Regular burning (in many cases annual) followed the original clearing in many areas as a standard agricultural practice to stimulate livestock forages in both fields and forests, and to clear crop residues for annual plantings. Foresters in the 1930's, at the time of the creation of the Shawnee National Forest, identified the most important management problem on the Shawnee as fire prevention (Unknown Author 1992, History of the Shawnee 7pp).

From 1940-1975, fire generally was excluded from the Forest. Exceptions were small annual wildfires set by humans as a fuel reduction technique following timber harvests. Wildfire acreages during this period averaged approximately 202 ha/year on the Forest, with only small acreages and few fires in the Lusk Creek watershed. During this period, the forest developed primarily without the influence of fire.

From 1976- 1996, prescribed fire was used in timber, fire, and wildlife management activities on the Forest to reduce fuel, stimulate oak reproduction, enhance vegetation diversity in thinned pine plantations, provide wildlife food source diversity, retard ecological succession, and maintain wildlife openings, old fields, and natural plant communities. Numerous acres of pine plantations in the Lusk Creek watershed were burned following thinnings of the plantations to reduce fuels and to improve forage and cover conditions for white-tailed deer, wild turkey and bobwhite quail. The Copperous Branch and Pleasant Valley Barrens, two small natural areas in the Lusk Creek watershed, were burned 2-4 times since the late 1980's as part of management prescriptions to maintain barren community diversity in these areas. Many acres of wildlife openings were burned to maintain openland habitats and herbaceous plant diversity for game species.

Since 1996 very little prescribed burning has occurred on the Forest and in the Lusk Creek watershed compared to the previous twenty years. This is due to reductions in staffing and increases in the amount and complexity of environmental planning necessary to continue actions or institute new burning management actions.

The creation of the Lusk Creek Wilderness reduced the amount of prescribed burning in the watershed as well. Use of fire as a management tool in the Lusk Creek Wilderness is limited to controlling insects and disease, or to perpetuate unique plant communities or threatened, endangered, or sensitive species (ALRMP 1992). But the complexity of planning for prescribed fire in the wilderness has resulted in no prescribed burning in the Lusk Creek Wilderness for at least the last fifteen to sixteen years.

Step 2. Issues Identification

8.2) Fire Issues

8.2.1) Native openlands (including barrens, old fields, herbaceous openlands and wildlife openings) and oak-hickory forests require widespread and a high frequency of ecological disturbances from fire (primarily prescribed fire) to maintain their

diversity across the Forest including the Lusk Creek watershed.

8.2.2) Prescribed fire is needed to maintain wildlife habitat diversity and abundance within the watershed.

8.2.3) Prescribed fire is needed to reduce fuel in the urban interfaces across the Forest, including the Lusk Creek watershed.

8.2.4) Prescribed fire is allowed and needed within the Lusk Creek Wilderness for control of non-native honeysuckle and to maintain ecological communities.

Step 3. Description of Current Conditions

8.3) Current Fire Conditions

On average, one to two small wildfires occur annually in the Lusk Creek watershed. In the last five years no prescribed burning has occurred. Fuel in the wilderness and throughout the watershed including the urban interface continues to increase. During the last five years, openland and oak-hickory forest diversity declined in response to reductions in fire management and associated ecological disturbances.

Step 4. Description of Reference Conditions

8.4) Use and Management of Fire

Lack of extensive use of prescribed fire management has modified ecological conditions and fuels in the watershed. See the History sections above for specific information of the reference conditions for the watershed.

Step. 5. Synthesis and Interpretation

8.5) Prescribed Fire

The Forest Plan directed managers to conduct over 14,164 hectares of prescribed burns in the first decade following the 1992 plan amendment. The goals of these scheduled management practices were to improve wildlife and ecological diversity and abundance, and to improve oak regeneration across the Forest.

In years 1992-1996, the forest managers approached the annual prescribed burning goals. Since 1996, only small amounts of prescribed burning have been accomplished annually across the Forest, with little to none being done in the Lusk Creek watershed. Objectives of recent prescribed burning were to improve wildlife habitats and ecological diversity, enhance oak regeneration, and to reduce hazardous fuels.

The use and management of fire is essential in maintaining ecosystem health in the watershed. By using prescribed fire we can reduce the amount of understory and prevent conversion of oak stands to maple on higher and drier sites. The use of prescribed fire will reduce the threat of destructive fires in hardwoods, openlands and non-native pine stands. In the absence of prescribed fire, the pine stands create a large fire-safety concern.

Step 6. Opportunities

8.6) Prescribed Fire

The use of prescribed fire will provide the opportunity to restore and maintain the hardwood and openland communities, including natural areas dominated by barrens and dry forests, and in the Lusk Creek Wilderness. It also will provide the opportunity to maintain openland habitat diversity and abundance for dependent wildlife. By the use of fire, hazardous fuel loadings will be reduced to protect and prevent wildfires from affecting residences' in the watershed.

Lusk Creek watershed Opportunities

Key Question	Inventory Needs/Actions	Monitoring Needs	Priority Ranking
Plant community restoration using Rx fire.	Inventory needs to be completed.	Pre-and post-burn monitoring needs to be established.	4
Ecological restoration of barrens/dry forests	Inventory completed. Rx fire to be used.	Pre-Rx monitoring has been completed.	1
Use of Rx fire for site preparation for natural and artificial oak regeneration	Inventory needs to be completed.	Pre-and post- burn monitoring needs to be established.	3
Use of Rx fire for openland habitat management for dependent wildlife species	Inventory needs to be completed.	Pre-and post-burn monitoring needs to be established.	2
Use of Rx fire to reduce hazardous fuels in the urban interface.	Inventory of fuels and wildfire history needs to be completed.	Pre-and post-burn monitoring needs to be established.	5
Use of Rx fire for ecological and non-native honeysuckle management in the Lusk Creek	Inventory needs to be completed.	Pre-and post-burn monitoring needs to be established.	6

Wilderness			
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Section 9. Transportation

Step 1. Characterize the Watershed

9.1) Transportation System

The Lusk Creek watershed is located in Pope County, Illinois. The transportation network consists of asphalt, bituminous treatment, gravel, and native-surfaced roads and trails. The jurisdictions in this network include private, State of Illinois, Pope County, Road District Number 1, Road District Number 2, and the USDA Forest Service. The system is subject to use by passenger, delivery, hauling, agricultural, and recreational traffic. The network allows access to private property, public property, and recreational opportunities.

Step 2. Issue Identification

9.2) Transportation Issues

- 9.2.1) Maintain access to private and federal land.
- 9.2.2) Identify and evaluate jurisdiction of transportation routes.
- 9.2.3) Identify and evaluate unclassified routes.

Step 3. Description of Current Conditions

9.3.1) Access

The Lusk Creek watershed contains approximately 60 percent non-National Forest System lands, including small urban residential, agricultural, and forested areas. The access routes to these lands are by a combination of Forest Service, private, state, county and district roads. These routes are in various states of repair from good to poor.

National Forest System lands are also accessed by a combination of routes. The routes under Forest Service jurisdiction are either gravel or native-surfaced, and range in condition from fair to impassable. In addition, there are both classified and unclassified routes (see section 9.3.3).

9.3.2) Jurisdiction

The jurisdiction of a transportation route is defined as, “The legal right to control or regulate use of a transportation facility derived from fee title, an easement, an agreement, or other similar method. While jurisdiction requires authority, it does not necessarily reflect ownership” (FSM 7705).

Roads within the watershed are under a mix of jurisdictions. While the jurisdiction on the majority of the roads has been identified in the past, there are still questions regarding a few roads. These questions arise from roads that existed prior to Forest Service acquisition of the underlying property and lack of an identifiable maintainer.

9.3.3) Road Classification

There are three types of roads on the forest. The majority of the roads within the watershed are classified roads. Definitions of road types follow:

Classified Roads: Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service (36 CFR 212.1).

Temporary Roads: Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be a part of the forest transportation system and not necessary for long-term resource management (36 CFR 212.1).

Unclassified Roads: Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1).

Step 4. Description of Reference Condition

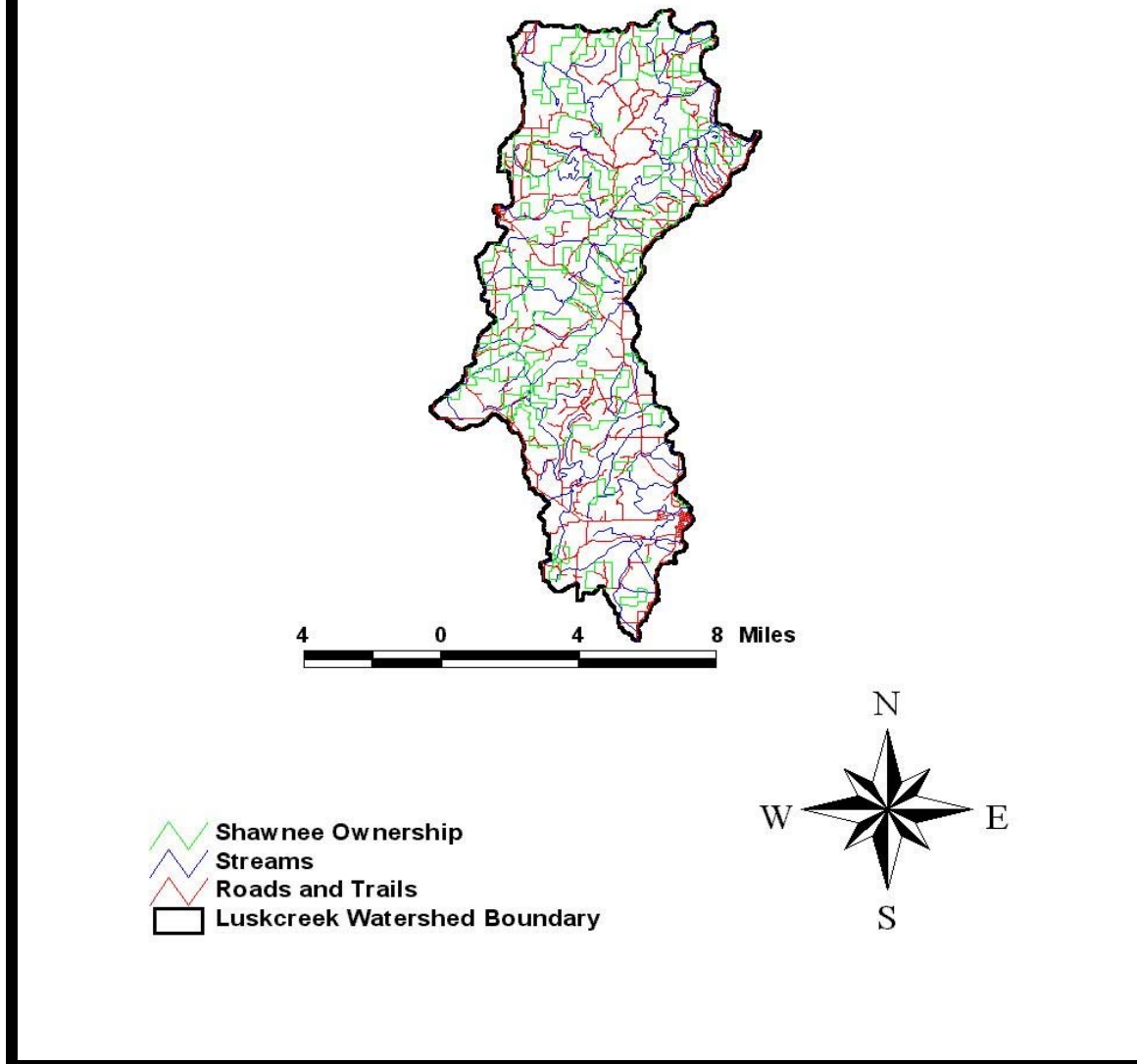
9.4.1) Access

Access to private and public lands is available through a variety of routes. The routes are traversable by vehicle, animal, or foot travel. While for most private lands the preferred access is by vehicle, there are some areas, such as wilderness, that are accessible only by animal or foot travel. Access to federal lands is much the same.

The majority of the travel routes were established in the 1800's. These routes were from town to town, from farm to farm, or from farmhouse to field or pasture. These routes were not surfaced, merely wagon tracks. As the people left the area, farms were combined and primary county roads were established to allow quicker travel from town to town, and use on many of the wagon paths ceased. Over the years, these routes have become overgrown and impassable.

As times changed the access needs, it also changed the access method from the horse-drawn wagons to larger, motorized vehicles. As the century ended, use has been further expanded to off-road vehicles and the recreational use of horses.

Shawnee National Forest Roads and Trails Lusk Creek



Map 4—Roads and Trails

9.4.2) Jurisdiction

The transportation system within the watershed is a mixture of jurisdictions, whether it is an older established route or a newly constructed road. The establishment of these jurisdictions has been through construction records, easements, and rights-of-ways. While these jurisdictions

have been readily identifiable for the majority of the roads within the watershed, there are some for which no records exist.

These roads, many of which affect National Forest System lands, provided access for agricultural lands and homesteads. A few were routes to the nearest town, and have been replaced by other roads. These routes were not adequately maintained until the early 1900's, when heavy equipment and tax dollars became available for maintenance. Routes maintained were usually those traveled to town. As use patterns changed and better routes were developed, the local governments abandoned many older paths.

With the establishment of the Forest in the 1930's came the conservation crews. These work crews were used to improve access to public lands. In many cases, these routes were those not maintained by the county and where use had decreased. The work was done without formal agreements between the governments and many times without right-of-ways or easements. The goal was to improve access for administration of federal lands.

As the century progressed, the Forest Service began aggressively managing its lands. Through timber cuts, new routes have been established with agreements and easements to establish jurisdiction. Jurisdictions of some of the older roads have also changed hands through formal agreements during this time.

During the last two decades, as federal budgets and management of federal lands have changed, maintenance patterns have changed as well. The forest has focused more on transferring jurisdiction for maintenance back to the public road agencies and resolving jurisdictional conflicts on routes affecting National Forest lands.

9.4.3) Road Classification

Classification of roads was a new initiative, beginning in January of 2001. The Forest Service is grappling with ways to identify its assets. Classification identifies the intended future use of a road. Routes that are necessary for administration of federal lands are kept in the system. Those routes deemed no longer useful in the administration of or access to federal lands are to be removed from the system and decommissioned.

Routes currently in the transportation atlas are considered classified. Routes existing on the ground on federal lands, but not in the atlas database are considered unclassified. As their use and necessity is analyzed for future projects, the decision will be made to either add them to the system or decommission them.

Step 5. Synthesis and Interpretation

9.5.1) Access

Migrating and user-developed routes indicate that although access routes have changed over time, access to Forest Service lands is still desirable. The purpose of the access is expanding to allow more recreational opportunities. Usage, traditionally horse and wagon, has shifted to more

motorization in the past century. In the past two decades, the recreational use of horses has increased as well. The access routes will continue to change as people and their interests change.

9.5.2) Jurisdiction

Jurisdiction questions will always arise as access patterns change. Previously abandoned routes will once again start receiving use. As these abandoned routes are resurrected, maintenance will be expected and in some cases required for continued use. Jurisdiction becomes a question at this point.

9.5.3) Classification

Classification of routes is a step in identifying the forest's assets. Access plays a key role in deciding the classification of a route. Routes providing the access necessary for administration and protection of the land are more likely to stay on the system as a classified road.

Step 6. Opportunities

9.6.1) Access

Access to both public and private lands should be considered in any future land management decisions. Whether access is to be restricted or full and free, public involvement in the process should take place. Traditional access patterns should also be taken into consideration. Monitoring of current access routes should occur to establish appropriate patterns for future use.

9.6.2) Jurisdiction

Questionable jurisdiction affects the Forest's ability to manage its lands. While not questioned on many routes within the watershed, the jurisdiction of any access route should be addressed as projects are identified. Monitoring access patterns, as once-abandoned routes start to receive use, can identify jurisdiction questions that need to be resolved as early in the project as possible.

9.6.3) Classification

Route-classification should be determined by the access patterns established above. Focus should be on unclassified routes; their necessity should be determined as early in a project as possible. Routes not necessary for access should be decommissioned. Appropriate actions should be taken to remove traces of the route from the ground.

Section 10. Heritage Resources

Step 1. Characterize the Watershed

10.1) Heritage Resources

Humans have inhabited and used the Lusk Creek watershed from approximately 12,000 years ago, until the present. From 10,000 B.C.E. to approximately 1500 A.D., prehistoric Native Americans occupied or utilized every available environment, including forested uplands, rock shelters, riparian areas, and floodplains.

American settlement began within the watershed shortly after the General Land Office Surveyors laid out the townships and ranges, beginning in 1807 (Buck 1967:50). During the Historic-American settlement period (post 1800), agriculturally-related activities such as habitation, farming and grazing, and rural industrial activities, such as logging, prospecting, and mining occurred within the Lusk Creek watershed.

Step 2. Issue Identification

10.2) Issues Related to Heritage Resources

10.2.1) Identify and determine the impact of prehistoric human activities on the Lusk Creek Watershed.

Step 3. Description of Current Conditions

10.3.1) Impacts of Prehistoric Native American Activities

Rock shelters are an important aspect of the archaeological record of the Lusk Creek watershed. Prehistoric rock shelters are generally characterized by lithic waste products from tool manufacturing and contain a few simple flake tools and occasional projectile points and pottery fragments. These shelters provided cover and protection for short term occupations ranging from the Late Paleo-Indian through Mississippian times, however, most do not show a great deal of use until the Middle Archaic (Butler 2001:23). Longer-term open-air Archaic-era camp sites are also present within the watershed. A small amount of raw material processing and subsistence-related activities (i.e., hunting and gathering, food processing and food preparation) occurred at these sites.

Later prehistoric cultures also utilized the Lusk Creek watershed. Exploitation of faunal species associated with upland habitats as well as riparian ecosystems occurred. White tailed deer is the most frequently occurring food remains, followed by smaller mammals, fish, and fresh water mollusks.

Two of southern Illinois' ten stone forts are located within the Lusk Creek watershed. It is unknown what kinds of activities occurred at these sites (Butler 2001:23). Lithic material representing chipped stone projectile points, pottery fragments and food remains have been recovered from excavations at stone forts. Whether these sites represent ceremonial sites or evidence of social conflict, large numbers of prehistoric Native Americans would have encamped on or near the site. Activities at ceremonial sites included renewing social ties and forging new social relationships through communal meals, and other family-oriented activities.

Subsistence activities would have been important in both instances. Food procurement (hunting meat and gathering seasonally appropriate food resources such as nuts, berries, greens and seeds), processing (skinning and cutting, and grinding) and preparation (cooking or baking with fire) would have been key activities related to these seasonal aggregations. The construction of temporary structures would have required the removal and use of some trees. If these ceremonies occurred annually, there would have been a significant impact on the natural resources of the watershed during the Late Woodland time period. Even if they occurred at greater intervals the impact on local resources would have been significant.

Later Mississippian-era peoples are known to have utilized the area in a number of ways, including as a transportation corridor connecting the late prehistoric metropolis of Cahokia on the Mississippi River with the Kincaid site in extreme south Pope and Massac Counties. In addition, Native American population numbers increased throughout prehistory, with the population reaching its zenith during the Mississippian period (A.D. 900-1600). Mississippians have been known to harvest timber resources in the area of their villages for fuel, housing and other tool use, and clearing agricultural fields. Researchers studying fresh water mollusk species suggest that Native American utilization of timber resources denuded ridge tops resulted in eroded hillsides as well as increased turbidity in the streambeds and a change in the species of mollusks present within the drainage. Mississippian houses required rebuilding approximately every 20 years. Mississippian occupations appear to have lasted approximately 200 years (1250-1450 A.D.), suggesting that houses at farmsteads located in the Lusk Creek drainage would have been occupied year round by one or two nuclear families. This would suggest that houses would be rebuilt a number of times during the occupation.

It is widely acknowledged that most prehistoric horticulturists practiced slash-and-burn or swidden farming (Hunt 1992:291). Swidden farming consists of rotating active and fallow fields. Field preparation was achieved through clearing and burning extant vegetation. There are many early historic accounts of field and agricultural clearing, as well as a great deal of archaeological evidence and ethnographic accounts. Archaeological evidence consists of charcoal-mottled soil lenses resulting from sheet erosion of nearby fields (Morse and Morse 1989:287). Historical accounts also describe horticultural activities. In the early seventeenth century Spelman wrote: "They take most commonly a place about their howses to sett ther corne, which if ther be much wood, in that place they cutt doune the greate trees sum half a yard above the ground, and ye smaller they burne at the roote pullinge a good part of the barke from them to make them die" (Arber 1884 in Swanton 1947:304). Later bone hoes or mattocks were used to: "weed the maize and cut down the canes in the preparation of a field. When the canes were dry they set fire to them, and to sow with Maize they made a hole with the hand in which they put some grains" (Le Page Du Pratz 1758 in Swanton 1947:310).

Because intensive horticulture involves depletion of the mineral and organic content of the soil, gardens must be moved periodically, perhaps every 20 years or so (Hunt 1992:291). John Winthrop, Jr. has given us a good idea of what Native American fields looked like: gardens were "loading the Ground with as much as it will beare," with cornstalks serving as beanpoles, squashes sending their tendrils everywhere, thus giving the effect of the entire garden being a

dense tangle of food plants (Cronon 1983:44). Such intensive horticulture severely depleted the mineral and organic content of the soils.

10.3.2) Impacts of Historic American Activities

During the Historic-American settlement period (post 1800), habitation, farming and grazing, as well as logging, prospecting, mining and transportation corridors were the significant disturbances within the Lusk Creek watershed. Settlement began within the watershed shortly after the General Land Office Surveyors laid out the townships and ranges in 1807 (Illinois Public Domain Land Tract Sales Database). At the time of the original survey, there were already three roads extending across the watershed. Two of the roads extended from Golconda on the Ohio River to Kaskaskia on the Mississippi river, south of St. Louis, MO (Meyer 1976: 152-153; Walsh 1948:iv). Large numbers of people and freight crossed the Lusk Creek watershed on these roads (Rohrbaugh 1978: 357). One of these roads also guided travelers and freight toward Cape Girardeau, MO (McCorvie et al 1989:235; Meyer 1976a:153).

In 1818, 99 percent of the heads of households in Illinois were white Euro-American farmers of Scotch-Irish descent from the backcountry of the Southeast (Buck 1967; McCorvie and Wagner 2001:16; Meyer 1976a:151; 1976b:42). Farming was the largest single economic opportunity, and as expected, there are large numbers of farmsteads located within this watershed. The lands within the watershed that were purchased earliest were those immediately adjacent to the Lusk Creek and those near the confluence of the creek and the Ohio River (Nelson 1981:39, 43). The remainder of the watershed was purchase after 1850 (Illinois Public Domain Land Tract Sales Database). Selling price ranged from \$1.25 to .13 per hectare (Schroeder 1968:21). Much of the land sold for the lower price—indicating it was recognized as not being of the same quality of agricultural land as land that sold for a higher price.

Although not all the watershed has been inventoried for heritage resources, a minimum of ninety-nine historic-era farmsteads located on National Forest System land have been documented. These farmsteads represent a number of historic disturbances within the Lusk Creek watershed, and include free- roaming hogs in the woods surrounding the farms (Allen 1949:22; Hill et al 1987:69). During the early nineteenth century farmers routinely set their hogs loose in the woods to fatten on the nut mast. The rooting and cross-country foraging of these nearly feral pigs might have caused considerable damage to the natural vegetation and soil cover of the woodlands.

These ninety-nine known farmstead sites also represent large amounts of native timberlands that were cleared for farming during the nineteenth century. The thin soiled ridge tops cleared of the natural soil-holding vegetation eroded rapidly (McCorvie 1994). Agricultural fields sewn in row crops guided the runoff through the rows and off the ridges into the rocky intermittent streams and on down to the larger creeks. Although the ridge tops fields were quickly depleted of their natural fertility, farming within the watershed did not decline until the 1930s. In addition, when the Great Depression struck southern Illinois, many farmers increased logging activity in their wood lots to augment their income, but process was so low that the effort was pointless (Soady 1965:6). At this time much of the land was purchased by the federal government and actively

managed to remove it from agricultural production. In areas of private ownership, farming, often on inappropriate landforms, continues.

During the late nineteenth century, logging became a commercial endeavor (Hill et al 1989:56). Previously logging was simply a way to remove the natural vegetation cover from the landscape in order to facilitate agricultural activities. Logging, or removing the original timber resources also altered vegetation and soil properties. Commercial logging of the forest for railroad ties and mine timbers escalated soil loss. Both logging and farming alters hydrologic and geomorphic processes. The effects are generally increased soil water and overland flow, which can result in accelerated erosion. Agriculture, logging and other vegetation-disturbing activities occurred across a landscape of complex topography, diverse vegetation and areas of previous (prehistoric) disturbance. It is likely that they adversely affected the Lusk Creek watershed. As a result of denuding the landscape, erosion increased, removing the natural fertility from the ridge top and increased the soil entering creeks within the watershed.

Later, mining operations along Lusk Creek contributed to the turbidity of the creek, and disturb the wetlands adjacent to Lusk Creek. Not only did the mines impact the wetlands, the area around the mine opening was extensively altered by the construction a two-story frame hotel, general store and several houses (Allen 1949:57). The Empire Spar Mine was opened during the Civil War to mine lead for the war effort. Later, known as the “Old Lead Diggins” lead, iron oxide, clay, and fluorspar were mined (Sneed 1977: 151).

Step 4. Description of Reference Conditions

10.4.1) Impacts of Prehistoric Native American Activities

Native Americans have inhabited southern Illinois since about 10,000 B.C. From 10,000 B.C. to approximately 1500 A.D., prehistoric Native Americans occupied or utilized every available environment, including well timbered uplands, rock shelters located where stream bottoms meet rocky escarpments, riparian areas, and floodplains. The earliest prehistoric cultures, the Paleo-Indian (12,000-9,000 B.C.) and Early Archaic (9,000-6,000 B.C.) are relatively infrequently occurring. Evidence from sites in other parts of the state indicate that these ice-age hunters followed seasonal or annual rounds, moving as much as 480-640 km (300-400mi.) between southern Illinois, northern Illinois, western Illinois, and eastern Indiana (Kohldehoff and Walthall 2001:3). Although there are no sites in southern Illinois, a large number of spear points associated with that culture have been recovered from various contexts. Dalton sites are typically more frequently occurring than Paleo-Indian sites (Kohldehoff and Walthall 2001:4). They explored and used the landscapes, and its various resources, with greater intensity than the previous inhabitants.

Middle (6,000-3,000 B.C.) and Late Archaic (3,000-1,000 B.C.) time periods were marked by a considerable growth in population (Jeffries 1987:34, 83; Wiant 2001:5). A more sedentary way of life was characteristic by the Late Archaic time period, but seasonal movements were still necessary. Because of larger populations, these movements became more restricted on the landscape. Archaeological data indicate a marked increase in plant resource utilization (Jeffries 1987: 66-68; Wiant 2001:5-6).

Early and Middle Woodland (1,000 B.C.-400 A.D.) peoples were semi-sedentary exploiting a variety of resources as food. The remains of deer, bear, raccoon, rabbit, opossum, squirrel, fox, beaver, wild cat, muskrat, turkey, mussels and both drum and bass fish bones have been recovered from archaeological sites dating to this time period (Wagner and Butler 1999). Ceramic vessels of this time period are very thick-walled and were decorated with cord and fabric impressions. There are examples of Hopewellian burial mound ceremonialism along both the Ohio and Mississippi River valleys (Farnsworth 2001: 8). Plant resource utilization continued to expand suggesting that during this time period, the Native Americans were actively “cultivating” such wild plants as lambs quarter (*chenopodium*), sump weed, erect knotweed, and may grass, among others (Wiant 2001:6).

The Late Woodland Cultural Period (A.D. 400-900) is characterized by an intensive exploitation of local resources, supplemented by a variety of cultigens, including corn and squash. One special feature of the Shawnee Hills is the Late Woodland stone forts. These ten sites are scattered across the region on the margins of the most rugged terrain of the Shawnee Hills (Butler 2001:23). Most contain few artifacts. Although popularly viewed as forts, refuges, or even buffalo corrals or “pounds” they may represent the remains of a special ceremonial or social sites, or as the name implies, protective fortifications.

The Mississippian period (A.D. 900-1600) is represented by a large number of complex earthen mound centers along the Ohio and Mississippi Rivers (Butler 2001:23). These large population centers reached their zenith ca. 1250, after which the population melted away to occupy smaller local centers. There is also a movement into the interior backcountry as evidenced by the occupation at Millstone Bluff, a Mississippian village located on an isolated hilltop on the upper Bay Creek drainage (Butler:23). Mississippian culture was characterized by an increased dependency on agriculture as a subsistence strategy and increased social and economic stratification. Agriculture in this rich floodplain environment fueled this population growth. Maize, being the primary crop, constituted approximately 50 percent of the diet (Griffen 1990:8). Maize was grown in small garden plots. Smaller hamlets and farmsteads had garden plots located adjacent to each individual household. This pattern of garden location remained relatively constant through the early historic period: “every dwelling-house has a small field pretty close to it” (Williams 1974:435 in Hatley 1989:228). Hamlets and individual farmsteads were located on even smaller tributaries of these major drainages. Nearly all settlement, including villages and individual farmsteads, occurred on the floodplains, on low ridges, sand dunes or natural levees, or on the bluffs overlooking the river (Griffen 1990:8; Smith 1978:198). Individual farmsteads were likely occupied year-round, and functioned as horticultural production units as well as resource extraction sites (Muller 1978:284). Hamlets (small villages of 8-15 houses) also appear to have been largely centers of farming, hunting and gatherings activities (Muller 1978:285).

There are many other important Mississippian-era sites mound sites in southern Illinois, including the Linn and Hale sites, and Dogtooth Bend, as well as other craft specialization sites such as the Great Slat Springs and Dillow’s Ridge, where the prehistoric occupants mined chert and manufactured large chip-stone bifacially worked tools such as knives and hoes.

In short, from roughly 10,000 B.C. to 700 A.D. prehistoric populations were non-agricultural; their subsistence activities relied entirely on hunting and gathering activities. There can be little doubt, however, that late prehistoric Native Americans utilized fire in horticultural-related activities (McCorvie 1994). Beginning about 700-900 A.D. maize became a staple part of many prehistoric Native American's diet (Griffen 1990:6). The cultivation of corn along with other Native American cultigens lead to a more stable and sedentary lifestyle of many prehistoric groups, most notably the Mississippians. It would appear from archaeological, ethnographical and historical references that the majority of horticultural fields or gardens were located in close proximity to the domestic areas as identified by the presence of a house structure. This placement saved time and effort in tending and protecting the crops.

The majority of prehistoric and historic groups practiced swidden horticulture, meaning that the fields were rotated periodically and allowed to lie fallow or totally abandoned in favor of newer, more fertile ground. It also resulted in a more "open" look to the prehistoric and historic villages and farmsteads described by so many historical accounts. New fields were cleared by ringing, cutting and burning the trees, while planting crops amidst the dying trees and stumps. The fields were also burned periodically to clear the old fields for planting. From the discussion above it is important to note that: (1) gardens were burned; (2) gardens were located near the settlements; (3) settlements were generally located in the floodplains of major drainages where soils suitable for cultivation were present; therefore the areas immediately surrounding the towns, villages and farmsteads of late prehistoric peoples would have been the only areas managed by fire for horticultural reasons. Although there are indications of scattered Native American villages as late as the early 1500s, Mississippian occupations in the region appear to have all but disappeared by A.D. 1450 (Butler 2001:23). The region was apparently uninhabited except for sporadic incursions by distant groups such as the Shawnee, who began crossing the area during the early 1700s (Butler 2001:23).

10.4.2) Impacts of Historic American Activities

In the early years of American settlement (1790-1830), southern Illinois was preferred over more northerly areas because it was well timbered and offered a variety of resources for food and other necessary materials. Immigrants for the backcountry of Virginia, the Carolinas, Kentucky and Tennessee appear to have been attracted to familiar landscapes. In 1818, 75 percent of the inhabitants of southern Illinois were from these southern states and had traveled there via natural migrations routes (Meyer 1976a:151; 1976b:42). Historic Native American groups such as the Shawnee and Illinois continued to use the area, however, government officials negotiated a series of treaties with various Native American groups in which tribes relinquished their land in return for trade goods, money and new lands west of the Mississippi River (Bogess 1968:71-78; Grover 115:84-105).

Settlers of southern ancestry constructed their homes, barns, and outbuildings of hewn logs, a pattern that persisted into the twentieth century (Caraway 1986:3-5; McCorvie and Wagner 2001:16; McCorvie et al 1989:17, 166-182; Meyer 1975: 54-58). Even today in southern Illinois, it is not unusual to see the remains of old log structures located next to remnants of the early road systems. Farms in southern Illinois were diversified and included not only row crops

such as corn and wheat, but also orchards, livestock and sometimes nontraditional crops such as tobacco and cotton.

The population of southern Illinois peaked in 1900, and thereafter began to decline (McCorvie: 1994:29). This was due in part to the cultivation of the highly erodable soils located on the ridge tops across the region. Prices for unsold public lands in southern Illinois had been reduced in price to 12 ½ cents per acre in the early 1850s! This led to the cultivation of large tracts of marginal land that might not have been subjected to the plow had the land not been so drastically reduced in price. This price reduction led directly to the formation of the Shawnee National Forest in the 1930s (McCorvie 1994:30). The natural fertility of the soil had been so reduced by the turn of the century that agricultural production declined and continued to decline until the State of Illinois requested the federal government to purchase the land and begin the restoration of the timber resources originally present.

Step 5. Synthesis and Interpretation

10.5.1) Impacts of Prehistoric Native American Activities

In sum, prehistoric disturbances have probably significantly altered the Lusk Creek watershed. From 10,000 B.C. to 700 A.D. prehistoric populations were non-agricultural; their subsistence activities entirely hunting and gathering activities. It is unknown how these early prehistoric activities affected the watershed. However, beginning about 700-900 A.D. maize became a staple part of many prehistoric Native American's diet. The cultivation of corn along with other Native American cultigens led to a more stable and sedentary lifestyle for many prehistoric groups, most notably the Mississippians. By 1,000 A.D. population numbers had risen to levels that left significant imprints on the landscape. The larger population numbers required more housing, fuel, and food, suggesting an increase in the level of resource depletion near their settlements. In addition, prehistoric Native Americans practiced swidden agriculture in which fire plays a significant role.

There can be little doubt that these late prehistoric Native American populations had a significant impact on the environment. Timber harvesting for 1.) habitation construction, 2.) fuel and 3.) field clearing for agriculture denuded the areas around their settlement. Native American use of fire in field clearing probably increased the amount of soil erosion.

10.5.2) Impacts of Historic American Activities

The great majority of the earliest settlers in southern Illinois and the Lusk Creek watershed were from the backcountry of the Carolinas, Tennessee, and Kentucky. They were also directed to southern Illinois via natural immigration corridors such as the Tennessee and Cumberland Rivers (Meyer 1976a). These early farmers had a dependence upon wood-oriented technology (McCorvie et al 1989; Newton 1974:143-154). Housing, furniture, tools, farm implements, fencing, and wagons or sleds were all manufactured from wood. Tools such as wooden plows, harrows, cultivators, rakes, forks, shovels, ox yokes, and many domestic items were self designed and constructed. Initially, farms were located along slopes of the Shawnee Hills. This choice provided farmers with productive agricultural land access to forested uplands necessary

for the wood-oriented technology of the Upper South. The wooded uplands also provided forage for livestock such as hogs that were allowed to roam free and fatten on nut mast (Moffat 1987:249).

Harvesting timber for log house construction, rooting livestock, clearing the land for agriculture and row crops, and later timber harvests for mine supports and railroad ties all lead to adverse impacts on the vegetation of the watershed. Removing the vegetation through field clearing, allowed the thin layer of fertile soil to be removed from the ridge tops through erosion. These activities also increased the volume of run-off entering the watershed perhaps causing additional scouring of the creek bottoms. The increased rate of erosion also probably increased the turbidity of the water in the creeks within the watershed.

Step 6. Opportunities

10.6.1) Prehistoric Native American

The IDNR has embarked upon a research project that will culminate in the nomination of several prehistoric Late Woodland stone forts to the National Register of Historic Places. This is a good opportunity for the Shawnee National Forest to strengthen its partnership with IDNR and pursue a mutually beneficial research consortium with SIUC to attempt reconstruct the lifeways of the Late Woodland people who built these hill top stone forts. It is a good opportunity to combine financial resources and jointly nominate all the stone forts located on public lands (Shawnee National Forest and IDNR) to the National Register of Historic Places

In addition, it would be beneficial for the Heritage Program of the Shawnee National Forest to continue its working partnership with SIU in documenting the Mississippian culture and occupation in the Shawnee Hills. Because of the opening of the interpretive trail at Millstone Bluff near Glendale, IL, the public has become interested in learning more about Mississippian lifeways in southern Illinois. The Forest has sponsored a number of public outreach programs, entitled Passport in Time, Millstone Bluff that operated along side the SIU archaeological field school. This is a program that has been shown to be very beneficial in enabling the Shawnee National Forest and SIU to uncover more hidden history at archaeological sites like Millstone Bluff. These excavations contribute information for interpretive purposes as well as in environmental reconstruction.

10.6.2) Historic American

During the course of this analysis, it was determined that a moderate number of African Americans lived in the village of Golconda throughout the nineteenth century. The earliest persons of color to live there were indentured for periods up to sixty or ninety-nine years. Thomas Ferguson, the founder of Sarahville, later changed to Golconda, owned a number of “indentured servants.” However, as early as 1823, slave owners were freeing their “indentured servants” or “slaves” in Pope County (Allen 1949:42-49). At nearby Miller Grove, located in the Hayes Creek watershed, free people of color settled and formed a community complete with school and church (McCorvie and Wagner 2001:17). A number of contemporary civic, tourism and economic development groups are interested in preserving the heritage of southern Illinois.

Heritage tourism in southern Illinois, including the Shawnee National Forest, can be enhanced by working with and through these types of groups to capture additional funds through rural community assistance, humanities council, educational and arts council grants.

Section 11. Lands & Special Uses

Step 1. Characterize the Watershed

11.1) Land Base & Adjustment

The Lusk Creek watershed is located in Pope County, Illinois. Generally, Pope County is scarcely populated and economically depressed.

Step 2. Issue Identification

- 11.2.1) What are the anticipated effects of mineral exploration and development on this watershed during the next decade?
- 11.2.2) What is the effect of past land acquisition activities and what are the highest priority nonfederal land parcels for acquisition by the USA to protect resources within this watershed?
- 11.2.3) Are there any Special Use permits that are harming the resources of the watershed and are there any potential uses that will harm the watershed?
- 11.2.4) What are the agricultural uses that are adversely affecting the watershed?
- 11.2.5) Does the status of federal land within this watershed prohibit actions that would benefit natural resources?

Step 3. & 4. Description of Current and Reference Conditions

11.3.1) Mineral Exploration

Similar to other areas of the Shawnee National Forest, nearly all of the federal land within the Lusk Creek watershed was acquired from private vendors. In many cases, the rights to coal, oil, gas, fluorite and other minerals were outstanding prior to the conveyance involving the United States. Many of these outstanding rights were reserved in perpetuity. In some cases the vendor that conveyed land to the United States reserved the minerals; however, the reservation generally specified an expiration date. Many of these reservations have expired or will be expiring within the next two decades.

Historically, the marketable mineral extracted from the Lusk Creek watershed has been fluorite. Fluorite exploration and development was one of the primary reasons the Illinois Wilderness Act created the East Fork Special Management Area, which delayed wilderness designation for eight

years. No fluorite exploration or development occurred during the eight-year period; consequently the East Fork Special Management Area was incorporated as wilderness. Recently, all mining of this mineral has ceased within this region and the mineral is imported from other nations. Although the subsurface within this watershed is expected to contain significant quantities of fluorite, a market for this mineral is not currently available.

Coal, oil, and gas remain marketable minerals within this region. Within this watershed, the potential for marketable deposits of coal, oil, gas, and other marketable minerals is considered speculative.

Oil and gas leases were offered on a portion of this watershed, however there were no bidders. Currently, the Forest is enjoined by the courts from offering additional oil and gas leases within this watershed or the remainder of the National Forest.

Currently, there is no known mineral exploration or development within this watershed.

11.3.2) Land Adjustments

The priority for land adjustment activity within the Lusk Creek watershed has varied based on the specific management prescriptions adopted in the Forest Plan. None of the federal land within this watershed is listed within the 9.1 (minimum level management) prescription. Land within the 9.1 prescription is generally the most desirable for exchange to private ownership and the least desirable area for acquisition.

The Forest Consolidation Map adopted in the Forest Plan emphasizes consolidation of National Forest land in most of the northern portion of the watershed and provides limited emphasis on consolidation of National Forest land in the southern portion of the watershed. During the period from 1990 to the present, the Forest has implemented this Forest Plan direction. More than 550 acres of private land has been acquired in the northern portion of the watershed (T11S-R6E, Pope County, Illinois). During that same period, the Forest has not acquired land in the southern portion of the watershed (T12 & 13S – R6E, Pope County, Illinois) and has disposed of a 22.25-acre land parcel through exchange.

The Forest Plan directs, "...acquire only the interest needed to achieve land management objectives." No scenic, conservation or similar easements have been acquired within this watershed.

11.3.3) Special Uses

Road and utility corridor permit dominate the existing special use permits within this watershed. Conditions within these roads and utility corridors vary, however all are acceptable. None of the existing special use permits are having a significant adverse effect on the watershed.

Private land-use trends appear to be conversion of land previously used for agriculture or timber-production purposes to part-time or full-time residential uses. This trend is expected to result in additional requests for road construction or restoration along with request for additional utility

services which will cross National Forest land. All of these anticipated proposals will be analyzed in compliance with the National Environmental Policy Act and no adverse impacts to this watershed are expected from these uses.

The northern portion of this watershed is intensively used for equestrian activities. Customers of several commercial equestrian facilities utilize systems and non- system routes within this area. The issuance of outfitter and guide permits that direct these commercial equestrian activities are expected in the future.

11.3.4) Agricultural Uses

Generally, private land within the floodplains that can be drained is used for crop production and private land at higher elevations is used for pasture or hay production. Crop production is more prevalent in the southern portion of the watershed. Erosive soils are present throughout the watershed, consequently there is potential to generate silt production from all agricultural uses. No-till crop production techniques and rest/rotation pasture use techniques are being implemented by some farmers. These techniques are reducing the potential for extensive erosion.

The trend in private land use appears to be converting land previously used for agricultural and timber production purposes to residential, recreational, and other commercial uses.

Increasing the priority for acquisition of private land due to detrimental agricultural uses has not been identified as a priority.

11.3.5) Land Status and Boundaries

Approximately 95 percent of the federal land within this watershed has Week or Weeks-LWCF status. The remaining land has Clarke-McNary Status. The northern portion of this watershed is much more consolidated than the southern portion; consequently the potential for encroachment from adjacent private landowners is greater in the southern portion of the watershed. Approximately 30 percent of the landlines and corners have been recovered within this watershed. There are no specific limitation on activities other than those listed in the Forest Plan.

Step 6. Opportunities

The information within this report indicates that consolidation of the land base within the Lusk Creek Wilderness would be a high priority as identified in the Forest Plan. The Forest Plan identifies 165.82 ha of private and State of Illinois-owned land within the Lusk Creek Wilderness. State of Illinois land has “Nature Preserve” status and acceptable title cannot be obtained without legislative action. Within the wilderness, private land with acceptable title should be acquired. The second priority private land parcels for acquisition are those parcels within the 8.3 and 8.3 management prescriptions. Land acquisition for general consolidation should be emphasized in the northern portion of the watershed.

A corridor designated as .47 km each side of Lusk Creek is managed as a Candidate Wild and Scenic River Study area, under the 9.2 management prescription. The Wild and Scenic River Study for Lusk Creek is expected at some time in the future and could be incorporated in the Forest Plan revision. Similar studies have identified private land or interest in private land necessary for the management of the stream corridor. Since the Wild and Scenic River Study has not been completed, acquisition of land or interest in land within this corridor does not elevate in priority above that listed in the Forest Plan.

Land exchange activities are receiving detailed scrutiny internally and externally. If disposal of federal land through land exchanges is considered, disposal of isolated parcels in the southern portion of the watershed should be emphasized.

The economic feasibility of mineral exploration and development are considered relatively remote. No oil, gas, or other mineral leases involving the federal mineral estate are expected until completion of the Forest Plan revision. Proposals to explore or develop reserved or outstanding mineral estates are considered unlikely because known mineral deposits are not considered marketable.

Special use permits will continue to be issued when alternative sites on other ownership are not present.

Landlines and property-corner recovery will continue. Encroachments and trespass will be discovered, especially within the southern portion of the watershed where federal ownership is scattered with isolated tracts.

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