

APPENDIX F

BIODIVERSITY

In January 1993, the Council on Environmental Quality published "Incorporating Biodiversity Considerations into Environmental Impact Analysis under the National Environmental Policy Act." Pages 6-8 of that report outlined eleven general principles intended to help managers and planners identify biodiversity concerns and seek solutions in specific situations as agencies pursue their diverse mandates. The eleven principles (with one additional principle) and how they relate to the Crooked Creek project are:

1. Take a "big picture" or ecosystem view.

The Ozark-Ouachita Highlands Assessment (OOHA) examined the terrestrial resources of the Ozark-Ouachita Highlands as a complete unit, spanning 20 ecological units and encompassing 41,131,900 acres (64,269 square miles). The Ozark-Ouachita Highlands Section is a unique feature of the North American landscape. The Highlands are the only extended area of substantial local relief (high hills and mountains) between the Appalachians and the Rockies.

Prehistoric and Historic Ecological Changes

American Indians influenced vegetation patterns through their use of fire.

European settlers began making dramatic changes to the land commencing in the 1830's through land clearing and the suppression of fire; settlers also had an impact on animals by reducing certain habitats and by over-hunting.

Because people have been a constant influence on plant communities and ecosystems of the Highlands for thousands of years, ideas of "natural" (i.e. not human-influenced) conditions need to be reviewed carefully, even challenged.

Status and Trends of Vegetation

As measured by Advanced Very High-Resolution Radiometer data, oak-hickory forest is the most extensive vegetation type of the Assessment area, covering 15 million acres or 36% of the area. Oak-pine forest is the second most extensive within the region, with 4.4 million acres (11% of the Assessment area).

Non-industrial private forest (NIPF) owners hold 68% of the 22.89 million acres of timberland in the Assessment area; forest industry owns 11%. Thus, private and corporate landowners together hold more than 79% of the timberland. The remaining 21% consists of public timberlands, three-fourths of which are within the national forests.

The abundance of oak in the Ozark-Ouachita Highlands is matched by only two other regions in the United States: the Central Appalachian and Eastern Broadleaf Forest (Continental) Provinces.

The annual net growth of hardwoods and softwoods is more than double the annual removals. Since the 1970's, forested area has increased in five of the six Forest Inventory and Analysis (FIA) survey regions in the Highlands and, in some instances, dramatically.

Silvicultural Practices

Upland hardwood forests consist of relatively shade tolerant species that typically are best suited to even-aged management. Except for one case in Missouri, the few successful examples of uneven-aged management in upland oak forests required aggressive chemical control of competing hardwoods.

Shortleaf pine forests can be managed with a variety of even-aged or uneven-aged methods, but successful regeneration under single-tree selection typically requires chemical and/or mechanical control of competing vegetation. Natural regeneration also depends upon the co-occurrence of good seed crops, suitable seedbeds, and sufficient light.

Clearcutting declined in national forests from 27,729 acres in 1988 to 698 acres in 1996, a 97.5% decline. This decline in clearcutting was the single most significant trend on national forests in the Assessment area.

Reproduction cutting on the national forests using the seed tree method averaged 2,382 acres/year (8.6% of the 1988 clearcutting level) from 1991 through 1996. During the same period, the area harvested using shelterwood method an average 3,157 acres/year (11.4% of the 1988 clearcutting level).

The largest increase of a silvicultural method on the national forests was in the use of the single-tree selection. This increase was due more to single-tree selection being the exact opposite of clearcutting rather than to any particular advantages for either pine or oak-hickory silviculture. Together, the Ozark and Ouachita National Forests applied single-tree selection on an average of 8,916 acres annually from 1991 through 1995.

Herbicide application for site preparation declined on the national forests from 12,705 acres in 1988 to 2,132 acres in 1997, an 83% decline over a 10-year period. Conversely, acres burned in site preparation on the Ouachita National Forest increased from 536 acres in 1989 to 3,137 acres in 1997. Each year, more acres were burned than in the previous year. This trend suggests that the limits to using prescribed fire for site preparation have not yet been reached.

The use of prescribed burning as a tool for managing intermediate stands has increased nearly four-fold over the past 5 years and exceeded 100,000 acres in 1997 (due primarily to actions on the Ouachita National Forest). The Ouachita National Forest has increased the use of prescribed burning to restore shortleaf pine-bluestem grass communities over extensive areas of the western Ouachitas to sustain wildlife habitat diversity and to encourage natural regeneration.

Plant and Animal Populations

Of the 333 plants and animals with viability concerns in the Ozark-Ouachita Highlands, 35 are imperiled (having 20 or fewer known populations) or critically imperiled (5 or fewer known populations). More than half (53%) of the species with viability concerns in the Ozark-Ouachita Highlands are known to occur only on national forest lands; about one-third of these species are known to occur only on private lands.

Sixteen species in the Ozark-Ouachita Highlands are federally listed as threatened or endangered. Available data for game species in the Highlands show that most populations have increased or remained stable since 1970.

North American Breeding Survey data revealed 21 of 90 species in the Ozark-Ouachita Highlands have declined significantly from 1966 to 1996. Six species showed a significant increase during the same period.

Biological Threats to Forest Resources

The European gypsy moth, a defoliator of hardwood trees, has been found in the Assessment area. The outbreaks have been minor, and eradication has been successful. Scientists expect that a general infestation might reach the Assessment area between 2025 and 2050.

Red imported fire ants are invading the Assessment area from the south and are expected to continue a gradual northward expansion. Eradication is probably impossible.

The southern pine beetle is indigenous to the southern part of the Assessment area. Serious outbreaks will continue to occur. These outbreaks are cyclic and related to stand age and density of pine trees in a stand.

Knapweeds, invasive non-native plants, have been present for several decades on some roadsides in southern Missouri. There are health concerns for humans and livestock related to this plant.

Purple loosestrife, a serious pest in wetlands, is present in the Assessment area and may spread.

The Crooked Creek Analysis Area is within the Meramec River watershed, and the Oak-Pine Hills and Oak-Hickory Hills Land Type Associations, Ozark Highlands Section, Eastern Broadleaf Forest (Continental) Province, Hot Continental Division, and Humid Temperate Domain (Land Type Association is from the Mark Twain Forest Plan and the section, province, division and domain come from the Ecoregions and Subregions of the United States, USDA, 1994). For a description of the Ozark-Ouachita Highlands Section, see pages 17-1 through 17-2 of the Ecological Subregions of The United States: Section Descriptions, WO-WSA, USDA Forest Service, July 1994.

The analysis area is composed of oak-pine forest in various successional stages. Historic and natural disturbance factors include frequent low intensity fires, with infrequent high intensity (or stand replacement) fires; windstorms and tornadoes; insect/disease mortality; occasional summer

drought or late spring frost; ice storms; and flash flooding in intermittent drainages and permanent streams.

OOHA states that people have lived in the Highlands for over 11,000 years; the earliest known inhabitants were the Paleo Indians. There is evidence that people were using the watersheds prior to 8000 BC as a hunting area. For the next 9000 years or so, the area was apparently used off and on by small bands for seasonal hunting and foraging. Caves and rock shelters were used as temporary homes. During the latter part of this time period, base camps may have been set up in river bottoms, from which small hunting/foraging parties spread out over the country. From the Archaic to Woodland times, small garden plots of cultivated plants may have supplemented the basic diet of wild foods. There is evidence that bear, deer, raccoon, rabbits and other small animals were hunted. Because the population was relatively low and use was not concentrated at one site for a long time, there would have been little impact to the environment. The principal prehistoric cultural periods that characterize human occupation of the Highlands prior to European exploration are as follows: Paleo Indian (11,500 BP [years before the present date] to 10,500 BP), Archaic (9,900 BP to 2,000 BP), Woodland (2,000 BP to 1,150 BP), and Mississippi (1,150 BP to AD 1,650). The Spanish expedition of Hernando de Soto (1539-1543) marked the first European exploration of the Highlands. French explorers and fur traders came to the region in the late 1600's.

During most of the Early Historic Period (around 1700 AD), "the semi permanent Osage villages were located in the Western Prairie Region," (west central Missouri) "and no other Indians were utilizing the Southwest Drainage Region...." The Osages "never had permanent villages in the region." As native peoples were pushed westward due to expanding European settlement, some tribes moved through and settled temporarily in Missouri (early 1800's).

The people who moved into the Highlands in the late 18th and early 19th centuries were attracted by opportunities to acquire timberland and by the availability of free open range on unclaimed public land. Land acquisition records indicate that many of the rough upland areas were settled between the 1880's and the 1930's. Traditional uses include small farming or cattle raising; hunting, fishing and trapping; and removal of various kinds of wood products. More uses that are recent include recreational hiking and driving. Most of the original forest cover was completely cut over by the early 1900's. Extensive overgrazing and annual burning followed the logging boom as people tried to make a living through livestock or farming. Most of the forested bottomlands were cleared for production of row crops.

Starting in the mid-1930's, land was acquired by state and federal agencies. Federal lands within the Highlands include over 164,000 acres of lands managed by the National Park Service, over 66,000 acres of national wildlife refuges, about 673,000 acres of lakes managed by the U.S. Army Corps of Engineers, two military bases, and 4.4 million acres of national forests. State lands include 65 State parks, 32 wildlife management areas, 5 State historic sites, 5 conservation areas, and 2 National Guard areas. Protection from annual burning, open range grazing, and indiscriminate logging resulted in re-growth of the oak-hickory/oak-pine forest communities. Shortleaf pine was planted in many abandoned fields. Closure of hunting seasons, protection of habitat, and active programs brought deer, turkey, beaver, otter and grouse among other species, back from the brink of extirpation. Other species (elk, wolves, bison, and red-cockaded

woodpecker) were not so lucky and are now absent from the state. Still other species became extinct (passenger pigeon and Carolina parakeet) in part due to human activities.

Fire suppression in the 1930's and later led to changes in community type and species composition in many areas. Closed-canopy forest replaced open woodland and woody species started growing in glades.

In all of the alternatives, several things will remain the same: The state and county highways and roads will continue to exist. Natural disturbances, such as windstorm, ice storms, frosts, and insects/disease, will continue to affect the analysis area. Fire protection will continue because it is a policy of the Forest Service to protect resources from wildfire and because the proximity of private lands and dwellings makes it imperative. The local economy will continue to rely on wood products, which will be removed from private lands as well as other public lands. Hunting, fishing, trapping and other recreational pursuits will continue.

The action alternatives are intended to use traditional kinds of disturbances (primarily prescribed fire and careful logging) in an environmentally sensitive way to create and maintain natural communities in all their successional stages. Out of this will come a sustainable supply of goods and services.

2. Protect communities and ecosystems.

The Upper and Lower Ozark sections of the Ozarks Natural Division (MDC) have been continuously available for habitation by and evolution of plants, animals and communities since the end of the Paleozoic era (200 million years ago). The great geologic age and physiographic diversity make the Ozarks by far the most biologically diverse area in the state of Missouri and one of the most significant centers of biodiversity in North America. A large percent of biodiversity is found in smaller/rarer communities such as caves, springs, sinkholes, glades, etc.

The oak-hickory/oak-pine forest with all its successional stages is the primary community in the analysis area. There are some stands of mixed oak-pine and shortleaf pine within the analysis area. There are subtle differences in vegetation depending on Ecological Land Type (ELT) (slope and aspect). For instance, broad ridges and southwest slopes are warmer and drier and support more pine and white oak. North slopes are moister and are suitable for a slightly different assemblage of herbaceous plants along with a higher component of hardwood trees. Special habitats within this analysis area include: riparian areas, bottomland hardwood forests, glades, shortleaf pine forest, ponds, old growth, springs, seeps and fens.

The 3.4 management prescription provides "a managed forest which emphasizes wildlife habitat diversity to maintain and enhance populations of native and naturalized vertebrates" (page IV-115 Forest Plan). ELT present in the analysis area include: high flood plains and low terraces with deep well-drained soils (ELT 3), upland intermittent drainages with deep cherty soils (ELT 5 and 6), gently sloping to moderately steep colluvial slopes below ELT 16, 17, 18 (ELT 7), ridgetops with deep cherty soils (ELT 11), ridgetops with deep cherty fragipan soils (ELT 14), south and west slopes with deep soils (ELT 17), north and east slopes with deep soils (ELT 18), and rock outcrop/dolomite glade (ELT 21). Natural vegetative communities are described on

pages IV-14 through IV-17 of the Forest Plan. Communities which exist within the analysis area include: mesic bottomland forest, dry bottomland forest, dry-mesic bottomland forest, mesic forest, dry chert forest, xeric chert forest, dry-mesic chert forest, and dolomite glade.

Alternative 1 would mean that only natural disturbances would occur. All communities present would continue to exist, although the amount of each community type might fluctuate over time. Fire protection would keep wildfires to a minimum. Open woods would only exist where the soil is poor. The oak-hickory-pine communities would continue to grow and mature, with many small openings created by natural mortality of individual trees and some larger openings created by windstorm, ice damage, insect/disease, or other disturbance. A large percent of the area would eventually be in mature and old growth successional stages with a small amount of early successional stages present. Roads would still exist, be maintained, and used.

Open woods (an overstory of medium to large size trees with few midstory trees and abundant ground cover of grasses and forbs) would be recreated and maintained in the two action alternatives, through a combination of commercial harvest and prescribed burns.

Successional stages of the oak-hickory-pine communities would be created several ways. In Alternatives 2 and 3, stand treatments would create early successional stages of oak-pine forest, with openings up to 40 acres. Individual tree selection harvests would create small openings similar to those caused by natural tree mortality. These acres would have some value for early successional species, while at the same time maintaining a largely unbroken canopy of forest preferred by mid-successional species. Designation of old growth has already occurred and would ensure late successional communities would be available into the future.

3. Minimize fragmentation. Promote the natural pattern and connectivity of habitats.

The analysis area is approximately 50% National Forest System land intermixed with large areas of private land. The National forest land is approximately 96% forested and approximately 88% of the private land is forested. The forested areas are composed of several forest types in varying successional stages. Approximately 12% of the private land in the analysis area is grazed, cultivated, or residential land. Overall, approximately 84% of the analysis area is forested.

Adjacent lands include additional National Forest System lands all around the analysis area. Adjacent private lands are in all directions also.

Many county roads cross the analysis area. A possible barrier to movement between sections of the analysis area is Highway 32.

Principle #1 discusses how human actions have changed the landscape over time.

The pattern created by natural disturbances is probably a combination of a large number of small openings created by death of individual trees or small groups of trees, scattered natural openings where soil is poor, and a few large openings in the canopy created by windstorm or wildfire.

Canopy closure probably varied from moderate to heavy depending on the soil type, weather

conditions, and other disturbance factors. There were probably open woods on most ridgetops and south- and west-facing slopes, more dense woods on north- and east-facing slopes, and bottomland hardwoods in the riparian corridors. The forest probably had a naturally occurring variety of age classes, sizes and species distribution. The actions proposed in Alternatives 2 and 3 are designed to minimize adverse impact from insects and disease on forest vegetation and to imitate this variety of age classes, sizes and species distribution. No permanent changes in land use are planned (i.e., the forest areas will remain forested), and there would not be any conversion of one species to another.

Permanent openings on National Forest System Land (within the analysis area) are limited to approximately 900 acres of open field and small brushy openings. Open woods would be created through cutting and prescribed burning of approximately 9,600 acres in Alternatives 2 and 3.

Temporary openings of several sizes would be created through timber stand treatments in Alternatives 2 and 3. Regeneration harvest of up to 40 acres would be created by even-aged cutting methods. Many small openings would be created through single-tree selection. All these openings would consist of regenerating oak, hickory, pine and associated trees; i.e., small fruiting trees such as dogwood; shrubs and vines such as blackberry and greenbrier; and annual and perennial forbs and grasses. As the regenerating trees grow, the lower vegetation would slowly be shaded out and eventually the opening would cease to exist. These temporary openings reduce the amount of continuous forest canopy (but are still part of the forest community) and provide early successional habitat for a short period (up to 10 years).

Temporary edges would be created where even-aged harvest adjoins mature forest. These temporary edges would be young forest against immature or mature forest and would last for about 10-20 years (or until the new regenerating stand grows tall enough to function as immature forest). There would be no new permanent edges created.

Current old growth designations have already been done in all alternatives and were selected, as much as possible, to create blocks of continuous old growth habitat and provide travelways along drainages. In Alternative 1, the entire area would continue to grow older since no vegetation manipulation would be done.

Prescribed fire proposed in Alternatives 2 and 3 would help to reduce fuel loading and to increase the amount of grasses and forbs on the forest floor.

The OOHA report states that the Assessment area has grown rapidly in recent decades and continues to do so. Between 1970 and 1996, its population increased 48%, while Missouri grew by 15%, and the Nation grew by 31%. Recent (1990-96) population growth seems to be most strongly associated with metropolitan status, presence on national forests lands, and high rates of in-migration. In-migration of new residents contributed nearly 80% of the estimated population growth in the Assessment area as a whole and 83 to 98% of the estimated growth in groups of nonmetropolitan counties containing lands of one or more of the Highlands' national forests.

Private land uses are likely to remain much the same as in the past 10 years (homes,

outbuildings, pastures, hayfields, and small woodlots). If timber prices remain high, it is likely that cutting on private land will continue or increase in amount and intensity. It is also possible that additional woodland would be cut and/or bulldozed to create permanent pasture.

4. Promote native species. Avoid introducing non-native species.

Natural vegetative communities are described on pages IV-14 through IV-17 of the Forest Plan. Communities and management areas, which exist within the analysis area, are described in #2 above. Perpetuation of a healthy and diverse oak-hickory/oak-pine/pine forest community is one of the primary goals for this analysis area.

There would be no intentional introduction of non-native species in any alternative. In addition, there would be no management of native species on inappropriate sites in any of the alternatives. The oak-hickory-pine communities and their successional stages would be maintained in the action alternatives. The temporary openings created through even-aged management in Alternatives 2 or 3 would create opportunities for naturalized non-native annual and perennial plants such as ox-eye daisy, Queen Anne's lace, and foxtail. However, native annual and perennial plants would also be found in those areas.

5. Protect rare and ecologically important species.

Effects of the three proposed alternatives upon twelve federally-listed species were evaluated in a Biological Assessment/Evaluation (BAE) prepared for this analysis (Appendix E). The BAE determined that Alternative 1 would either have “no effect” or would “not likely adversely affect” any of the twelve listed species, including Indiana bat. It determined that Alternatives 2 and 3 would have “no effects” upon six species and “are not likely to adversely affect” five other species. The BAE determined that Alternatives 2 and 3 “may adversely affect” the Indiana bat. However, none of the effects disclosed in the BAE for the Indiana bat would be beyond those previously evaluated at a programmatic level on the Mark Twain National Forest with the US Fish and Wildlife Service (US Forest Service 1998; US Fish and Wildlife Service 1999).

Effects of the three proposed alternatives upon Regional Forester’s Sensitive Species (RFSS) and other Species of Concern were evaluated in a BAE prepared for this analysis (Appendix E). The BAE determined that Alternative 1 would have “no impact” upon any RFSS or Species of Concern. It determined that Alternatives 2 and 3 would have “no impact” upon RFSS or Species of Concern using primarily streams/river habitats, a beneficial impact for species using primarily open/grassland and glade habitats, and that Alternatives 2 and 3 “may impact individuals or habitat but will not likely contribute to a trend towards federal listing or loss of population viability” for RFSS or Species of Concern that are using seep/fen habitats.

In March 2001, the Forest Service completed a Supplemental Information Report (SIR) regarding information on plethodontid (lungless salamanders). The report was revised in May 2001. The report was made in response to public concern about recent articles describing the decline of these species and effects of silvicultural treatments on salamander populations. The SIR concludes that the 1986 Forest Plan addressed habitat needs for these species and acknowledged the importance of mature/over-mature forest with dead, downed, and rotten

woody debris. The Forest Plan requires a certain percent of the Forest be maintained in mature and old growth forest, and protects special habitats such as springs, seeps, fens, fishless ponds, caves, and glades that may harbor salamander species. The Missouri Forest Ecosystem Project (MOFEP) is conducting inventory and monitoring of herptofauna (including salamanders) in the Ozarks. The results of MOFEP are being carefully reviewed for their applicability to projects on this district. The May 21, 2001, SIR is hereby incorporated by reference.

There is concern that populations of neotropical migrant bird species (many of which nest within the Forest boundaries) have been declining over the last decade. Suspected causes are loss of wintering habitat and fragmentation of breeding habitat. Studies of several species have been initiated to better determine causes of population declines.

Missouri has established a Neotropical Bird Working Group composed of experts from the Missouri Department of Conservation, Mark Twain National Forest, North Central Forest Experiment Station, and the University of Missouri. The Missouri Working Group is a part of the national Partners in Flight (PIF) effort and was created to evaluate threats to these species in Missouri and develop a list of species of concern for Missouri. The group has drafted this list, which is ranked according to the threats to the species in Missouri, the United States, and throughout their range. Results of this preliminary list show the top three birds of concern in Missouri are: Swainson's warbler (riparian/cane), Bachman's sparrow (glades/savannas/open pine woods), and dickcissel (openland).

Species included on the list of concern occur in all habitat types from openland to brushy areas to woodlands to mature woodland to riparian. Initial evidence indicates the species with lowest numbers are associated with floodplain, tall grass prairie, and shrub habitat, not upland forest habitat. Floodplain and shrub habitats are available in the analysis area. Temporary brushy openings of varying sizes would be created through even-aged and uneven-aged regeneration harvest. The work of this group highlights the fact that breeding habitat for neotropical migratory birds includes all successional stages and all types of habitat and is not only large areas of unbroken woodland.

PIF completed the Bird Conservation Plan for the Ozark-Ouachitas (Physiographic Region 19) in August 2000. This report states, "Therefore, maintaining the forested landscapes needed to support source populations of forest birds is probably the single most important contribution that the physiographic area can make to the conservation of non-game birds." And "...active restoration and management of those habitats" (i.e., pine savannas and bottomland hardwood forests) "across their range is warranted." PIF also state that grass-shrub or early successional forest species "can be provided for by idling agricultural lands, even-aged timber management, or restoration of glade and savanna habitats....Acreage needs of early successional species must be balanced with the needs of mature forest species also in need of conservation attention." To summarize, "In general, recommendations focus on maintaining the region's largely forested landscapes and large blocks of forest to keep source populations intact, restoring landscapes or blocks where potential currently exists, and balancing forest age classes within those areas so that the needs of species requiring a variety of successional stages all can be met."

The most recent research by North Central Forest Experiment Station suggests the type of

landscape that surrounds an area has much to do with what effects occur on neotropical migrant songbirds. This research has shown that landscapes which are fragmented by large blocks of agriculture (pastures and crops) or human development (subdivisions, shopping malls, towns, businesses, etc) and have only a small proportion of forest, such as southern Illinois, show the greatest negative impacts on neotropical songbirds from cowbirds and possibly other nest predators.

On the other hand, landscapes that are primarily forest with only a small proportion of permanent agriculture or human development, such as the analysis area, show very little negative effects from cowbirds and possibly other nest predators. Detrimental effects appear to be more a result of conversion of forest to permanent non-forest uses rather than a result of manipulation of forest vegetation to create various successional states. Research is continuing to accumulate more data and refine these conclusions. There would be no conversion of forest to permanent non-forest uses in any alternative.

Other research recently conducted in southern Indiana suggests that brood success for some neotropical migrant birds is less when they nest adjacent to forest openings of any kind (clearcuts or permanent openings). The reasons for this are cowbirds' parasitism and nest predation. These results are, as stated in the paper, not statistically significant for any of the species but are significant for others. The question remains, are these results related to decreased populations of the species studied or are the increased parasitism/predation rates not significant in terms of population fluctuations. Because there are neotropical migrant species which prefer the type of brushy habitat created by even-age management, a combination of careful placement of even-age management harvest and of larger blocks of forest interior/old growth should provide habitat for all of the native Missouri migrants, as required by the Forest Plan. Old growth design was made considering size and placement to maximize contiguous area of native over-mature forest.

A comparison of data from 2 years of bird monitoring (1992 and 1993) from managed versus unmanaged areas of the Mark Twain National Forest shows that most neotropical migrants which might be considered "forest interior" species can be found in similar frequency in both the managed and unmanaged areas. The managed area includes plots adjacent to clearcuts of various ages and sizes, as well as commercial thinning. The unmanaged area is within Wilderness, where only natural disturbance occurs. Only one species was found in the unmanaged (worm-eating warbler), but not in the managed. Two species (black and white warbler and Kentucky warbler) were found only in the managed plots, but not in the unmanaged. The remaining nine species were found in the managed plots at the same or higher frequency than the unmanaged, with one exception. The summer tanager was found more frequently in the unmanaged than managed. While 2 years of data is not enough to conclusively prove any hypothesis, it does suggest that manipulation of forest cover to provide different successional stages does not preclude use by "forest interior" neotropical migrant birds.

It also appears from recent research, but is not yet proven, that areas such as the analysis area have greater bird reproduction than mortality; therefore, these areas might have surplus birds to move to areas which have greater mortality than reproduction (such as southern Illinois). Research is also continuing to determine whether birds from southern Missouri actually move to

southern Illinois.

Alternative 1 would provide an abundance of mature to old growth oak/hickory/pine forest. However, much of the analysis area is less than 1 mile from private lands with permanent agricultural openings. This could limit the suitability of this habitat for those species that require larger blocks of forest interior. The primary method to develop shrub habitat is to conduct even-age management harvest; and since none of this would occur, shrub habitat would be very scarce. Even on private land, most of the open habitat is in grazed fescue pasture with very little shrub development. These neotropical migrants who depend on this habitat for breeding (e.g., blue-winged warbler, white-eyed vireo, prairie warbler, yellow-breasted chat, etc.) would find very little suitable habitat on National Forest within the analysis area. There would be no fragmentation of forestland by non-forest land uses and only natural fragmentation of forest types, communities, age-classes and successional stages.

Alternatives 2 and 3 would have several large blocks of old growth forest, areas of single-tree and group selection harvest creating small openings in the canopy, and areas of shrubby habitat created through even-age regeneration harvest. Single-tree selection harvests and areas of no treatment would create a variety of canopy closures from light to moderate to dense. This, in turn, would allow a wide variation in amounts and types of ground flora available throughout the analysis area. This would provide suitable habitat for a wide variety of neotropical migrant species, although numbers of each species might be lower or higher than in other alternatives due to the amount of each habitat available. Mature forest species would be lower, "gap" species would be slightly higher and shrub species would be slightly higher.

In Alternatives 2 and 3, there would be no fragmentation of forestland by non-forest land uses, only fragmentation of forest types or communities, and some fragmentation of forest age-classes and successional stages. The differing age-classes and successional stages would leave the forest matrix intact and would continue to provide the mosaic of age-classes and successional stages common in the area for the past 20-30 years.

The OOHA project analyzed data from the PIF program, the North American Breeding Bird Survey (NABBS), and the National Audubon Society's Watchlist (NASW). Forty-one (26%) of 157 species of birds that breed within the Assessment area are classified as priority species by PIF. Analysis of the NABBS reveals that 21 of 90 bird species in the Ozark-Ouachita Highlands have significantly declined in abundance during the period 1966-96. Six of the species had significant population increases. Twenty-five of the 90 species on the NASW occur within the Ozark-Ouachita Highlands.

The three lists of birds with management concerns have some species in common but also differ in many ways. The priority species list and the Audubon Watchlist are based on similar criteria but applied at different scales (the Ozark Highlands Plateau and the United States, respectively). These two lists consist of a mix of resident, short-distance and long-distance migrants, but are dominated by neotropical migratory birds. By contrast, the list of species in the region with population declines is a more balanced mix of resident, short-distance and long-distance migrants.

Most bird species, including most species with management concerns in the Assessment area, primarily use forest and shrub/sapling habitats. Some species with management concerns inhabit savannas and glades. Shrub/sapling birds exhibit some of the steepest population declines in the region but, in general, are still more abundant or broadly distributed than some forest birds with management concerns.

Landscape composition and pattern significantly affect the reproductive success and status of forest bird populations in the Assessment area. Productivity, source-sink status of populations and levels of nest predation or brood parasitism are related to landscape patterns in forest cover. Strong regional patterns in the productivity of some songbirds in midwestern forests occur because of the great variation in the amount of forest cover. No single silvicultural practice can be generalized as good or bad for birds. Any silvicultural system will create habitat for some species while degrading habitats for others. Land management for species conservation should consider patterns and practices at both the landscape scale and stand scale. A diversity of forest management practices will meet the habitat needs of songbirds better than any one practice. The mix of practices will largely determine the abundance of individual species.

6. Maintain unique or sensitive environments.

See #2 for information about special communities.

The anticipated effects of each of the three proposed alternatives upon a variety of specialized habitats are disclosed on page 3-84 of the EA.

7. Maintain or mimic natural ecosystem processes.

and

8. Maintain or mimic naturally occurring structural diversity.

See also discussions in #2, #3, and #6 above. Historic and natural disturbance factors include fairly frequent low intensity fires, with infrequent high intensity (or stand replacement) fires; windstorms and tornadoes; occasional summer drought and/or late spring frosts; insect/disease mortality; and flash flooding in intermittent drainages and permanent streams. These disturbances formed a mosaic of successional stages of the oak-hickory/oak-pine forest. Small openings resulting from windthrow, insect/disease, or natural mortality were probably frequent, with larger openings caused by stand-replacement fires, drought, frost and tornadoes were probably infrequent across the landscape. In addition, soil fertility helped determine the species composition and density of vegetation. Poorer soils had less density of tree species and more herbaceous understories, while richer soils had a higher density of tree species along with a varied mid-story of shrubs and small trees and less herbaceous ground cover.

Actions that create the larger stand-replacement openings include even-age harvest techniques of clearcut, seedtree, overstory removal, and shelterwood seedcut. Uneven-age management harvest (either single-tree or group selection) would create the smaller and more numerous openings typical of most natural disturbances. Prescribed burning of selected area would recreate and maintain open woods conditions prevalent on ridges, southwest slopes, and poor soils. Designation of old growth allows formation of the older, late successional stages that have

been lacking since the late 1800's and early 1900's.

Information on many ecosystem processes (such as hydrologic regimes, nutrient flows, and inter-species relationships) is sparse, particularly as relates to the Missouri Ozarks.

Alternative 1 would come the closest to allowing natural processes to operate. There would still be human-caused impacts, but they would be caused by activities other than those proposed in this EA.

Both uneven-age and even-age management would occur in Alternatives 2 and 3, creating openings up to 40 acres. Prescribed burning to encourage growth of herbaceous ground cover would occur in Alternatives 2 and 3. Old growth already designated within the analysis area would be allowed to develop in Alternative 1.

9. Protect genetic diversity.

"To preserve genetic adaptations, species should be maintained in natural habitats across their natural ranges, and plants and animals for reintroduction should be selected from ecologically similar areas as close to the restoration site as feasible" (p. 7, CEQ).

Only natural vegetative disturbances or human-caused wildfires would affect the analysis area in Alternative 1. The area would move toward a higher percent in mature or old growth successional stages with very little in early successional stages. Populations of species adapted to hot, sunny and dry conditions would likely decrease and populations of species adapted to more shady, cool, and somewhat more moist conditions would likely increase. In this case, genetic adaptations would be more difficult for those decreasing populations and easier for those increasing populations.

There would be no attempt to physically move any plant or animal species from somewhere else into the analysis area in any alternative. However, Alternatives 2 and 3 attempt to maintain the type and amount of disturbance which create a mix of "natural habitats" within the oak-hickory-pine ecosystem as well as minimize adverse impacts from insects and disease on forest vegetation. A range of successional stages would be provided (see discussions in #2, 7, and 8) and non-native species would be discouraged (see discussion under #4). By maintaining the range of successional stages of communities on appropriate sites, genetic variations and the ability to adapt are also maintained.

10. Restore ecosystems, communities, and species.

Species extirpated from Missouri within historic times include: red and gray wolf, cougar, red-cockaded woodpecker, elk, and bison.

The Missouri Department of Conservation is responsible for wildlife populations. They are currently conducting a study to determine feasibility of and public sentiment concerning possible reintroduction of Woodland Elk. No other plans are being made to reintroduce any other species.

Species successfully recovered or reintroduced in the Lower Ozarks from the 1930's until the present include: deer, turkey, beaver, ruffed grouse, and river otter.

Some species that are relatively uncommon in Missouri are naturally moving back into the state. In the past several years, black bear and armadillo sightings have been more frequent in the Lower Ozarks and near the analysis area. It appears that both these species are expanding their ranges by moving into southern Missouri from adjoining states. The Missouri Department of Conservation has a Black Bear Management Plan but has no immediate plans to actively reintroduce bears to the state. They are monitoring bear sightings and responding to situations where bears and people come in conflict. Armadillos make recurring attempts to move north and are usually decimated during extended periods of extremely cold weather. The last several winters in south Missouri have been relatively mild, allowing the expansion of armadillo populations.

Natural communities that have been altered or reduced within historic times in this area include: open woods and old growth. Forests with woodier understory plants have gradually replaced open woods typical of poor soils and/or ridgetops as fire protection kept out frequent low-intensity fires. Old growth forests were almost completely wiped out during the logging boom of the late 1800's and early 1900's.

See #2, 5, 6, 7, and 8 for discussions of how natural communities would be affected by each alternative.

11. Monitor for biodiversity impacts. Acknowledge uncertainty. Be flexible.

Because ecosystems are so complex and the interrelationships so difficult to understand, there is extensive research being done on various aspects of ecosystem composition, structure and function. In Missouri, efforts are underway by the Missouri Department of Conservation, Missouri Department of Natural Resources, United States Geological Survey, USDI National Park Service, USDA Forest Service, the Missouri Universities, and other organizations or private businesses to study many of these subjects. The Missouri Resource Assessment Project (MoRAP) is measuring the effects of forest management on many species of animals and plants. This work is ongoing. The OOHA was a study completed of the Ozark-Ouachita Highlands. It measured the areas from the socio-economic conditions to the terrestrial vegetation and wildlife.

At the present time, there are no studies being done specifically within the analysis area. This area would be available for future research and studies under all alternatives.

Alternatives 2 and 3 all contain provisions for monitoring. In addition, normal contract administration monitors actions carried out under a contract. District staff normally make unscheduled visits to different areas to informally monitor compliance with specifications and the results of various activities.

12. Incorporate human needs.

Several objectives of the Forest Plan incorporate human needs as a part of management of the ecosystem. In particular, the 3.4 Management Prescription mentions as some of its purposes “to provide dispersed recreation opportunities” to provide for moderate to high production of other resources such as timber products, recreation, forage and minerals (Forest Plan, p. IV-115).

These objectives can be met by maintaining traditional uses while providing for changing societal needs within the limits of ecosystem capability.

See discussion under #1 about traditional uses.

Traditional uses such as hunting, fishing, hiking, berry-picking and horseback riding would still be possible under any alternative. Driving for pleasure would still be possible in all alternatives. Game species such as doves, rabbits, quail and deer that prefer early successional habitats would be less abundant in Alternative 1; therefore, hunting success might be lower for these species. Game species such as turkey, raccoon, and squirrel, which prefer mid to late successional habitats, would be more abundant in Alternative 1; thus leading to the possibility of higher hunter satisfaction. Conversely, in Alternatives 2 and 3, early successional species (and hunting success) would be relatively higher and late successional species relatively lower than in Alternative 1.

The existing road system would still exist in all alternatives. However, in Alternative 1 there would be only minor maintenance. Some roads might deteriorate to the point of being drivable only by 4-wheel drive vehicles or ATV's. Reconstruction of existing roads would be done in Alternatives 2 and 3 keeping them drivable by most vehicles.

Wood products removed in Alternatives 2 and 3 would be enough to supply an average large-size local mill for about 2 years. Personal use firewood would be available with a permit in Alternatives 2 and 3. With no commercial cutting in Alternative 1, personal use firewood would be limited to permits to cut hazard trees and possibly downed trees along roads. All alternatives maintain the opportunity to provide goods and services in the future.