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# Management Indicator Species Evaluation

## Buffalo Trail, Crooked Creek, School House, Three Ponds, & Neville Creek Prescribed Fire Projects

Land Between The Lakes National Recreation Area  
Trigg County, Kentucky & Stewart County, Tennessee

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## I. Introduction

This Management Indicator Species (MIS) Evaluation is intended to evaluate the effects of prescribed burning on MIS and their essential habitat conditions. The project areas are Buffalo Trail, Crooked Creek, Three Ponds, School House, and Neville Creek on the USDA Forest Service Land Between The Lakes National Recreation Area (LBL). The Buffalo Trail project area is 2,532 acres in Stewart County, Tennessee, and is bounded to the east by the Trace, to the west and north by the North/South Trail, and to the south by Forest Service Road (FSR) 211. The Crooked Creek project area is 1,548 acres in Trigg County, Kentucky, and is bounded to the west by the Trace, to the east by FSR 153/148, to the north by FSR 134, and to the south by the EBP perimeter and US Hwy 68/80. The Three Ponds project area is 235 acres in Trigg County, Kentucky, on a peninsula on Lake Barkley north and east of FSR 203 and 366, respectively. The School House project area is 578 acres in Trigg County, Kentucky, in the area surrounded by Forest Service Road (FSR) 342 and FSR 165. The Neville Creek project area is 89 acres in Stewart County, Tennessee, and is located south and west of the Trace, west of the intersection with Neville Bay Road (FSR 214). A detailed location map is available for review at LBL Headquarters Environmental Stewardship Department, in Golden Pond, Kentucky.

### Objectives

Objectives of this MIS Evaluation are to:

- Assess the effects of prescribed fire on 4,982 acres on MIS and their habitats.
- Provide biological input to ensure United States Forest Service (FS) compliance with the National Forest Management Act (NFMA) of 1976 and Forest Service Manual (FSM) 2670. For further information see Forest Service Manual (FSM) section 2672.4.

### Purpose and Need

The focus of these prescribed burns is to support Land Allocation Prescription 1.A. for General Forest areas, and Prescription 1.C. for Oak Grassland Restoration Demonstration Areas (OGRDA), as prescribed in the 2004 Land and Resource Management Plan (Area Plan). The Crooked Creek and Three Ponds areas are within the OGRDA; the School House, Buffalo Trail, and Neville Creek areas are in the General Forest.

The Crooked Creek and Three Ponds areas will be restored to an open, oak grassland structure, in part through these prescribed burns. The Three Ponds area consists of 44 acres of open lands and 191 acres of forest land; it has been burned previously to begin to open up the forest canopy and to maintain the open lands. Both areas will be prescribed burned over time until the desired conditions are achieved (grasslands and open oak woodlands with 10-60% canopy closure). Non-native invasive species (NNIS) on these sites will be managed through burning, both in the forest areas and the open lands, as indicated more extensively in the sections below.

The Buffalo Trail, School House, and Neville Creek project areas have different objectives to result from prescribed burning. The Buffalo Trail burn is designed to minimize the likelihood of a catastrophic wildfire by reducing excess leaf litter accumulation on the forest floor. Additionally, this prescribed fire will begin to create

both open forest structure and woodland structure in these project areas. It will remove shade-tolerant understory trees such as sugar maples, thereby releasing native herbaceous plants and eliminating competition for oak species that are characteristic of this ecosystem. The School House burn is intended to maintain the 46 acres of open lands on the project site by reducing shrub and small tree growth and NNIS. An open lands portion of the School House project area (8 acres) has already been burned previously. The proposed action will also burn woodland surrounding the open land areas. This will create a soft transition between the open lands and surrounding forest, as well as eliminate the need for fireline construction by using existing Forest Service roads. The Neville Creek project area is made up exclusively of open lands. It has been burned several times previously, and the open land character, including the reduction of shrubs and NNIS, has been maintained by this burning, and will continue to be maintained by future burns.

The fires will reduce plant litter on the ground in both the open lands and forested areas and improve habitat for deer and turkeys, and nesting habitat for ground-nesting birds. The fires will also reduce the risk of catastrophic wildfire by reducing fuel loading.

There are a number of laws, regulations and policies that relate to NNIS management on National Forest System lands; for example, the principles of Forest Service Manual (FSM) 2080, which address Noxious Weed Management on National Forest Systems, can be interpreted broadly to accomplish the objectives of Executive Order 13112 for all NNIS plant and animal species. The Goal of the Region 8 NNIS Program in the South is to reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of non-native invasive species across all landscapes and ownerships.

This project will be instrumental in achieving two Area Plan Goals:

*Goal 5... “Use a collaborative approach to maintain and restore: 1) a diversity of plant and animal communities that support viability of associated plants, fish, and wildlife; and, 2) sustainable levels of habitat and wildlife populations to support public demand for wildlife-related recreation” (Area Plan pg. 51).*

*Goal 7... “Enhance dispersed recreational and environmental education opportunities throughout the LBL” (Area Plan pg. 55).*

This action will also support goals and objectives of the 2007 Open Lands Revised Environmental Assessment (OLEA). These goals are for the maintenance of early successional habitats and control of non-native invasive and undesirable species. It calls for the use of prescribed fire as one means of maintaining open lands and controlling non-native invasive species (OLEA 1.3 and 2.1.2).

### **III. Proposed Management Actions**

#### **Summary of Proposed Action**

The proposed FS action is to conduct multiple prescribed burns on 4,982 acres during the life of the 2004 Area Plan. These burns will maintain native grasses, stimulate herbaceous development, and facilitate a reduction in the shrub layer in the surrounding woodlands. Fire crews will use a combination of ground ignition and aerial ignition (by helicopter) to ignite the burn units at Crooked Creek and Buffalo Trail. At the remaining

three project areas, hand crews will use drip torches to conduct interior and perimeter ignition. No fire lines will be constructed in the Crooked Creek, Buffalo Trail, Three Ponds, or School House project areas; instead, existing roads will be used in conjunction with experienced firefighters to manage the fire and the smoke it produces. A disked fire line 1.49 miles long will be constructed for the Neville Creek project area, in addition to several hand line segments totaling 0.025 miles. The remaining portions of the fire line will include the adjacent roads and the Neville Creek streambed (an ephemeral stream).

### **Elements of Prescribed Fire Use**

The prescribed fire process includes:

- Biological Assessment and Evaluation
- NEPA compliance
- National Historic Preservation Act (NHPA) compliance
- Prescribed Fire Plan preparation
- Control line preparation
- Ignition
- Mop-up/Patrol
- Monitoring

### **NEPA/NHPA Compliance**

NEPA/NHPA compliance must occur prior to implementation of any of the proposed actions listed in this document. These NEPA/NHPA compliance actions are administrative in nature, occur in an office setting, will have no effect on listed species, and are not considered in the effects section of this document.

### **Prescribed Fire Plan Preparation**

Planning for these prescribed fires began with completion of a Prescribed Fire Plan (PFP) for each project area, in accordance with the Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide ([www.fs.fed.us/fire/fireuse/rxfire/rxfireguide.pdf](http://www.fs.fed.us/fire/fireuse/rxfire/rxfireguide.pdf)). This template has been standardized across all U.S. Department of the Interior Agencies and the FS. This action is administrative in nature, occurs in an office setting, will have no effect on listed species, and is not considered in the effects section of this document.

The PFP is broken into 21 elements that are designed to delegate the needed authority for implementing the prescribed fire to a Prescribed Fire Burn Boss (burn boss), and to frame goals and objectives of the prescribed fire. In addition, the PFP contains a prescription for implementation of the prescribed fire as well as its spatial boundaries. A prescription includes a specific set of atmospheric conditions under which the prescribed fire can be ignited. Prescriptions may vary widely depending on the goals and objectives of the prescribed fire. The PFP must comply with Area Plan Standards which apply to allowable fire effects (reference Area Plan Standards on pages 75-82 of the Area Plan). These Standards include, but are not limited to, types of burning done on mesic or alluvial sites,

restrictions on burning in conjunction with pesticide use, erosion control, and water quality protection.

### Control Line Preparation

A primary and critical element of prescribed fire is the presence and quality of control lines, which are barriers to fire spread. If existing barriers are not in place, (natural barriers such as creeks and man-made barriers such as roads) control lines must be constructed. All burns will use existing roads and trails as barriers, except for the Neville Creek area. The Neville Creek project area will require the construction of 1.49 miles of disked control lines and 0.025 miles of hand control lines.

In most cases, existing barriers need little preparation to be sufficient barriers to fire spread; however, some require preparation. Use of existing barriers is the preferred method where feasible (reference the Conservation Measures section of this document). Existing roads (including low-use roads) usually need little preparation, however in the case of seldom used roads there is, on a case-by-case basis, a need to clear the road way of leaf and limb debris in order to provide a fuel break. This clearing is usually conducted by heavy equipment such as road- graders or bull- dozers, and could easily be considered to be standard road maintenance (an activity already considered by KFO in consultation during development of the Area Plan and FEIS), and would have similar effects.

On fire lines, fire crews will consider standing dead snags on or adjacent to the control lines. Snags present a problem for fire crews for two primary reasons. First, snags present a direct hazard to firefighters because of their inherent instability. Second, snags commonly ignite, and if adjacent to control lines, commonly shower embers and burning debris across lines, causing fire control problems. Snags which present a safety problem to firefighters may be felled with chainsaws prior to ignition of the prescribed fire. Another way to reduce firefighter risk and fire control problems is to rake away fuel from the base of snags and flag them to raise firefighter awareness while operating in the vicinity. Raking is the preferred method because it reduces firefighter exposure time to hazardous snags and reduces habitat alteration, and therefore, potential adverse effects to species that utilize snags.

During this phase of prescribed fire implementation, areas such as historic/heritage resources and cemeteries are also protected from fire. This process includes either constructing a hand-line around the area or completely removing all light fuels from the area. The method used largely depends on the size and nature of the area to be protected.

These actions occur in the forest and open lands; they may affect listed species and are considered in the effects section of this document.

### Ignition

Prescribed fire ignition methods vary and depend highly upon fuel type, loading and weather conditions. For the Three Ponds, School House, and Neville Creek fires, LBL personnel on foot will use drip-torches for perimeter ignition. The Crooked Creek and Buffalo Trail project areas will be ignited aurally (by helicopter).

Ignition operations are always designed to provide the highest degree of firefighter and visitor safety while containing the prescribed fire within intended boundaries, and to meet prescribed fire objectives. These actions occur in the forest and open lands; they may affect listed species and are considered in the effects section of this document.

### Mop-up/Patrol

Mop-up and patrol are conducted after every prescribed fire to ensure containment. In general, crews will patrol prescribed fire perimeters for up to three days after ignition. Mop-up standards vary with fuels encountered in a burn unit. Mop-up generally consists of using engines and backpack pumps to apply water to heavy fuels, such as logs, stumps, and snags along control lines to prevent spot fires. In some cases, chainsaws may be used to fell burning snags. Mop-up is usually combined with patrols to insure containment and to monitor problem areas. These actions occur in the forest and open lands; they may affect listed species and are considered in the effects section of this document.

### Monitoring

The PFP includes monitoring requirements specific to this burn. Monitoring occurs in the forest and open lands, but any potential effects from monitoring are relatively benign and discountable, and therefore it is not considered in the effects section of this document.

### Conservation Measures

The Area Plan contains Standards that either directly or indirectly provide protection for the proposed, endangered, threatened (PET), and sensitive species and their habitats on LBL, primarily with respect to soil stability and water quality.

The following Area Plan Standards are specifically intended to manage the way LBL will implement the proposed actions to reduce or eliminate potential adverse effects to species. For convenience, Standards relating directly to the proposed action are listed below. This is not a complete list of all the Standards in the Area Plan. All Area Plan Standards are binding (i.e., they will be applied to all applicable actions), and guide actions on LBL, including these prescribed burns.

- Within the area 25 feet on either side of an ephemeral stream, management activities will maintain the ability of the area to filter sediment from upslope disturbances, provide sediment control within the area, and maintain channel stability downstream. New projects within areas adjacent to ephemeral streams will be designed and mitigated for soil types classified as hydric, highly erodible, or occurring on slopes greater than 30 percent.
- Disturbed soil must be stabilized promptly by mulching, geo-textiles, vegetation, or other approved means.
- All areas requiring re-vegetation for erosion control will be treated within three months following the closeout of the ground disturbing activity. The areas will be considered successfully treated when 85 percent or greater vegetation cover is established within two years of the initial treatment.
- Limit the sum of severely burned and detrimentally compacted, puddled, and displaced land (as defined in the R8 SWCP) to no more than 15 percent of any project or unit area.

- Existing barriers (e.g. streams, lakes, wetlands, roads, and trails) are used whenever possible to reduce the need for fire line construction and to minimize resource impacts. Fire line construction within riparian corridors must be designed in coordination with a resource advisor.
- Areas are not burned under prescription for at least 30 days after herbicide treatment.
- Snags and den trees will not be intentionally felled during vegetation management unless necessary to protect employee or visitor safety, to control insect or disease infestations, or for timber salvage in cases of significant events of tree mortality. In timber salvage cases, a minimum of six snags per acre must be retained. Retained snags may be clumped within salvage areas. Den trees are defined as being a minimum of 10 inches DBH and having a visible cavity.
- When necessary to include deciduous forest communities on mesic and alluvial site types within burning blocks, allow low intensity fires such as backing fires. Direct firing will not be done unless needed to secure control lines and to encourage ecological restoration of native communities such as canebrakes.
- Within General Forest and Oak-Grassland Demonstration Prescription Areas, riparian corridors of native vegetation will be maintained along each side of perennial and intermittent stream courses in order to maintain fluvial and riparian functions. Corridors along perennial streams will be 100 feet measured from bankfull stage. Corridors along intermittent streams will be 50 to 75 feet measured from bankfull stage at a minimum. If a 50-foot corridor is used, a minimum of 20 feet adjacent to management activities must be in a maintained native grass or other suitable vegetative filter strip. The remaining corridor should be in shrubs and trees. Without a native grass or other suitable vegetative filter strip, the minimum corridor along intermittent streams must be 75 feet of natural vegetation.
- The maximum size of an opening created by forest management treatments is 40 acres. These acreage limits do not apply to areas treated as a result of catastrophic conditions such as wildland fire, insect outbreak, or severe storms. Areas managed as open lands or non-forested areas (e.g., rights-of-way and grassy openings) are not subject to this standard and are not included in the calculations of opening size, even when within or adjacent to created openings.
- Temporary openings created by forest management treatments will be separated from each other by a minimum of 330 feet. Such openings may be clustered closer than 330 feet as long as their combined acreage does not exceed the maximum opening size. A forest management area will no longer be considered an opening when the certified re-established stand has reached an age of five years.
- Rare communities are to be protected from detrimental effects associated with management activities and recreational use. Site-specific analysis of proposed management actions and proposed uses identifies any protective or active management practices to enhance the rare community.

- Rights of former residents regarding access, burial, decoration, and maintenance of cemeteries will be protected. Access to cemeteries will meet or exceed the type that existed when it became a federal property.
- Protection zones, as specified in the current guidelines for bald eagle habitat management from the US Fish and Wildlife Service (USFWS), will be delineated and maintained around all bald eagle nests and communal roost sites, unless exempted or modified by the USFWS.

LBL has identified an additional conservation measure that will be applied in implementing the proposed actions to further conserve Price's potato bean (*Apios priceana*):

- In planning for implementation of the proposed action, LBL will locate and survey limestone outcrop areas prior to any soil-disturbing activity, and will avoid soil disturbance within 200 feet of the outcrop.

### **Action Areas**

The Buffalo Trail project area is similar in composition to the Crooked Creek area. Prescribed burns in the area will have many of the same objectives as the Crooked Creek area, but the ultimate desired goal is a mature woodland forest structure rather than oak grassland. This forest structure is defined in the Area Plan Final Environmental Impact Statement (FEIS) as, "very open forests with canopy trees averaging greater than 60 years old and 10 to 60 percent of the understory or forest floor receiving direct sunlight. Understories are dominated by grasses and forbs" (p. 95).

The Crooked Creek project area is primarily forested. Prescribed burns in this area will remove excess leaf litter from the ground, and minimize the risk of uncontrollable wildfire in the area. These burns will remove understory, shade-tolerant trees, thereby releasing native herbaceous plants and eliminating competition for oak species characteristic of the desired oak grassland ecosystem. The structure type of an oak grassland is defined in the Area Plan (p. 31-33). Generally, it is an interspersion of grasslands and oak woodlands with 0-60 percent canopy closure. Tree densities vary, and there are gradual transitions throughout the area between grasslands and oak woodlands. In the Crooked Creek area, the burns will begin to open the canopy, allowing more sunlight to reach the forest floor, and beginning the process of forming the gradual transition between grasslands and oak woodlands. The prescribed fires will also reduce numbers of non-native invasive plants, which in conjunction with other management, will make them easier to eliminate from LBL, and allow native species a better opportunity to thrive.

The Three Ponds project area is made up of open lands (44 acres) and forested lands (191 acres). The proposed action is to prescribed burn the area with the objective of maintaining the open lands and beginning to create an oak grassland structure. The prescribed burn will create a wide diversity of wildlife habitat, including those that require early-, mid-, and late-successional habitats. Additionally, the project area will ultimately provide habitat for a unique suite of species adapted to the oak grassland community. The prescribed burn, in conjunction with other management activities, will also help to reduce and eliminate NNIS.

The School House project area is made up of open lands (46 acres) and forested lands (532 acres). The proposed action is to prescribed burn the entire project area. The objectives of this burn are to maintain open lands and create a woodland structure in the forested land. In addition, the prescribed burn will create soft, transitional “edges” between the open lands and woodlands. The mixture of open lands and woodland forest structure, combined with soft, transitional edges, will create a wide diversity of habitat types that will support a large variety of wildlife species. This mixture of lands will be habitat for early-successional, mid-successional, and forest interior species of plants, birds, reptiles, amphibians, and mammals.

The Neville Creek project area is comprised entirely of open lands. The objectives of this prescribed burn are to maintain open lands adjacent to forest land, maintain native warm season grasses and forbs in the open lands, and reduce NNIS in the project area.

### **Ecosystem Overview and Expected Conditions**

LBL is in the Western Mixed Mesophytic forest region, a transition zone between the Eastern Mesophytic forest region and the Western Oak-Hickory forest region (Franklin and Fralish 1994). Approximately 92% of LBL is forested, with mostly second and third growth hardwoods comprised mainly of oak species (Franklin and Fralish 1994). The rest of LBL is comprised of open lands.

The Buffalo Trail project area is similar in composition to the Crooked Creek area, with mixed-age dry-mesic and xeric-dry oak-hickory forest. There is also a small portion of coniferous forest (<100 acres) in the southern end of the site and a small portion of open lands (approximately 125 acres) that are planted in cool season and native warm season grasses. There is a riparian zone (Prior Creek) that runs through the site from northeast to southwest.

The Crooked Creek project area is comprised of mixed-age dry-mesic and xeric-dry oak-hickory forest with shade tolerant species, such as sugar and red maple, in the understory. The oak forest is typical of LBL, and is comprised primarily of white oak (*Quercus alba*), southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), chestnut oak (*Quercus prinus*), black oak (*Quercus velutina*), and pignut hickory (*Carya glabra*). There is a small portion of coniferous forest (<100 acres), and open lands (60 acres) planted in cool season and native warm season grasses. There are two riparian zones in the area: Crooked Creek, running from south to north through the center of the site, and Gilbert Creek, running from north to south near the eastern side of the site. Some NNIS occur there; principally Sericea lespedeza (*Lespedeza cuneata*) and loblolly pine (*Pinus taeda*), followed by Johnson grass (*Sorghum halepense*), tree of heaven (*Ailanthus altissima*), and crab grass (*Digitaria* spp.).

The Three Ponds project area is a peninsula in Lake Barkley. It has rolling topography that ends at bluffs at the lakeshore. It is made up of open lands planted in native warm season grasses, and forest lands. The forest is mixed-age xeric-dry, dry-mesic, and mesic. Two non-native invasive species are known to occur on the site: Johnson grass and Sericea lespedeza.

The School House project area is typical of the oak-hickory forest and open land composition of LBL, and is made up of 8% open lands (46 acres) and 92% forest

(approximately 313 acres of dry-mesic mature oak forest and 219 acres of xeric-dry mature oak forest). The open lands are comprised of cropland (rotation of soybeans and corn; 17 acres), wildlife plantings (approximately 4 acres), and native warm-season grasses (25 acres). There are four streams that run through the project site; all are ephemeral. In addition to the dry-mesic and xeric-dry forest types, there are small portions of mesic forest on the northeast edge of the site. The forest structure is primarily mature closed canopy, but areas to the north and west of the site are mature open canopy, mid-aged, and young. A prescribed fire was conducted on a portion of the native warm season grass fields on the site (8 acres) on 27-Mar-2006. The following non-native invasive species are documented to grow on the site: autumn olive (*Eleagnus umbellata*), multiflora rose (*Rosa multiflora*), Johnson grass, Sericea lespedeza, and Japanese stiltgrass (*Microstegium vimineum*), among others.

The Neville Creek project area is comprised of open lands, which are predominantly native warm season grasses. There is an ephemeral stream that runs through the project site, and makes up part of the control line for the burn area. The following non-native invasive species are documented to grow on the site: Johnson grass, Sericea lespedeza, giant foxtail (*Setaria faberi*), loblolly pine, Chinese yam (*Dioscorea oppositifolia*), multiflora rose, purple morning glory (*Ipomoea purpurea*), and Chinese privet (*Ligustrum sinense*), among others. Several prescribed fires have been conducted on this site.

This proposed action will maintain existing native grasses and forbs within the open lands areas by removal of thatch to stimulate growth of native warm season grasses, and by reducing weedy competition from non-native species found at the sites, including those listed above. The fire will help to reduce woody growth in the open lands and maintain early-successional conditions there. At nearby Fort Campbell Military Reservation, Chester et al. (1997) found that repeated prescribed burns, coupled with mowing, increased the occurrence of native grasses and forbs, and decreased the presence of non-native invasive species over the course of >52 years of prescribed burning that occurred there.

In some circumstances, prescribed burning has been shown to increase the occurrence of non-native invasive species, particularly Kentucky 31 tall fescue (*Festuca arundinacea*; Madison et al. 2001, Rhoades et al. 2002) and Sericea lespedeza (Harper et al. 2007). Studies demonstrating positive impacts of fire on non-native species, however, were often short-term or focused on management with fire alone (rather than using other management techniques in conjunction with fire). Research on long-term effects of fire in this region shows that overall, native communities benefit from fire to the exclusion or reduction of non-native species (e.g., McCarty 2002, Chester et al. 1997), and managing lands with fire in conjunction with other management techniques effectively controls many non-native species (Harper et al. 2007).

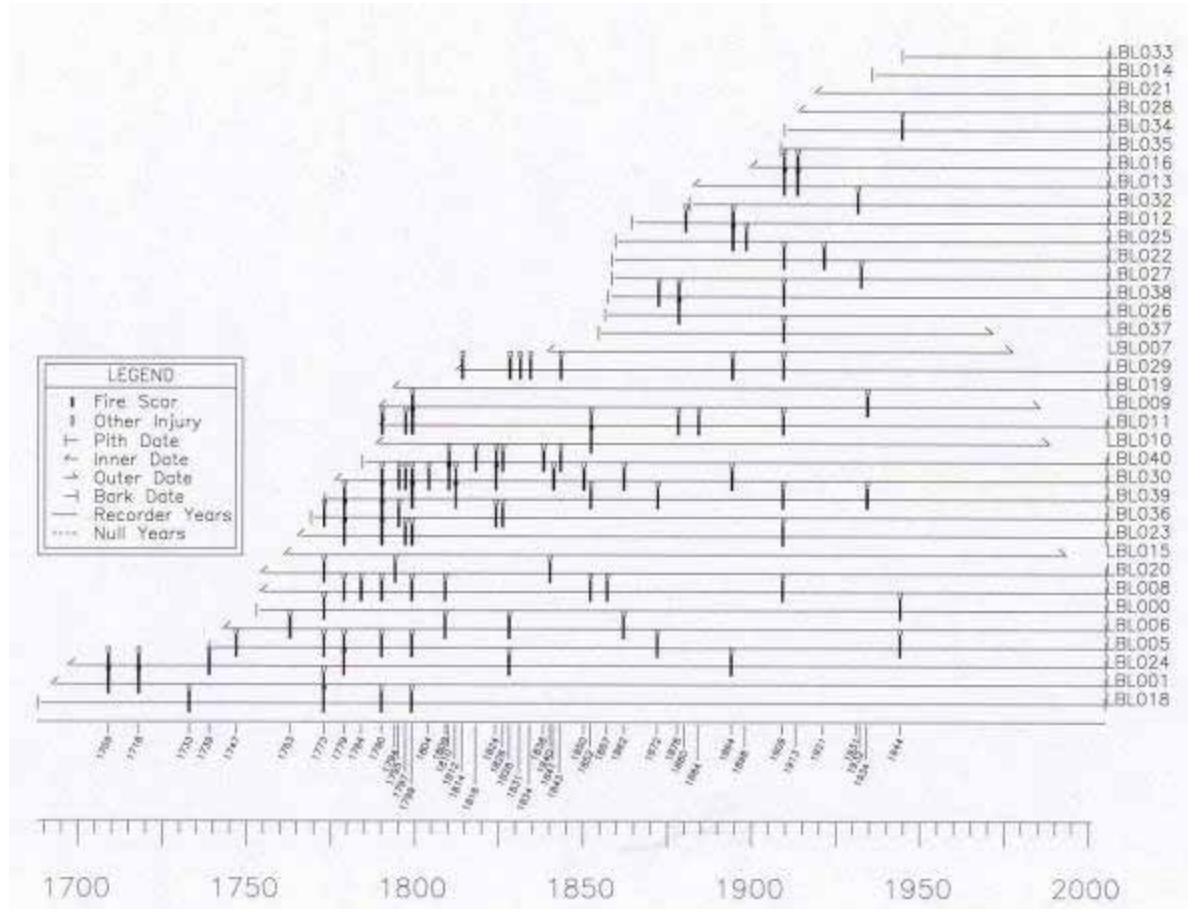
In addition to maintaining the open lands, prescribed burning will create a softened transitional zone between the open lands and oak-hickory forest at the School House site. The creation of this transition zone will eliminate hard edges and create more habitat diversity (both structural and composition), which will in turn support a wider diversity of wildlife. A soft transition zone also reduces stress on forest interior animals by lowering the risk of predation and nest parasitism commonly associated with hard edges

(KDFWR 2003). Prescribed fire reduces competition for light and water among species of grasses and forbs by reducing the number of tree saplings, sprouts, and shrubs. This increases plant diversity, increasing herbaceous biomass and growth of species of conservation concern (McCarty 2002).

This action will also reduce plant litter on the ground. Excessive plant litter has been found to retard the growth of native open lands plants and diminish the quality of habitat for some early- and mid-successional wildlife species (MO Conservation Commission 1980). Fire will improve habitat for mammals such as white-tailed deer, woodchucks, cottontail rabbits, and others which depend on a variety of plants for forage, including both grasses and forbs (Johnson et al. 1995; Barash 1989; Chapman and Flux 1990). Fire will also improve nesting habitat for ground-nesting birds within the open lands areas, including bobwhite quail, Bachman's sparrows, and blue-winged warblers (Main and Richardson 2002). Removing excess plant litter will enable new grasses and forbs to grow in the transition zone, where the canopy will be more open.

In general, the Western Highlands Rim (Interior Low Plateau Eco-region) is suffering from effects of nearly a century of fire exclusion (Franklin and Fralish 1994). On LBL fire exclusion began 60 years ago, when local landowners stopped using fire (Figure 1; Guyette et al. 2008); aboriginal use of fire was documented as early as AD 1568 (Pardo 1569).

The result of fire exclusion is succession and densification of the forest canopy (Apfelbaum and Haney 1987). While it is possible to regard this as desirable for some species of wildlife, in fact, the reverse is true. Closed canopy forest on dry site types is very rarely suitable habitat for forest interior species and lacks herbaceous ground cover and scattered shrub components desirable to a host of declining open forest and woodland/savanna wildlife species. It is more realistic to view the forest on LBL not as a resource to be protected from the anthropogenic disturbance of wildland fire, but rather as a fire-mediated ecosystem suffering from fire exclusion (Abrams 2006; Artman et al. 2005; Brawn et al. 2001; Davis et al. 2000; Delcourt and Delcourt 1997; Deselm 1994; Engstrom 2000; Guyette et al. 2002a; Guyette et al. 2002b; Hamel and Buckner 1998; Hicks 2000; Homoya 1994; Kilgore 1976; Loewenstein and Davidson 2002; Ruffner 2006; Shumway et al. 2001; Van Lear et al. 2000; Van Lear and Waltrop 1993; Williams 2001). By some accounts, oak woodlands and savannas have declined by 99% and are one of the most imperiled communities in North America (McCauley and Raveill 2002).



**Figure 1.** Fire history diagram for a post oak site on Land Between The Lakes NRA. Dark vertical lines represent fire scars while horizontal lines represent the rings of a tree. The bottom line is the date each fire scar was made (from Guyette et al. 2008). Note the relatively frequent occurrence of fire at LBL (average one fire every six years) until 1944, when all fire scars ceased to be found.

Prior to fire exclusion, oak forests existed in a constantly shifting pattern of savanna, woodland, open-oak forest, and oak forest in both a spatial and temporal sense (Abrams 1992; Agee, Unpublished; Delcourt et al. 1999; Denevan 1992; Frost 1998; Franklin et al. 2002; Guyette and Dey 2000; Leach 1994; McCauley and Raveill 2002).

Fire affects Western Highlands Rim ecosystems primarily by having a thinning effect on the forest canopy and mid-story, as well as removing accumulated leaf litter. The effects of fire in once-burned forest stands are evidenced by a general reduction in the shrub layer and some thinning of the understory. In often-burned forest stands, a well developed herb layer is present, along with abundant sunny spots and a generally open canopy structure (Figure 2; Hutchinson and Sutherland 2000; Hutchinson and Dickinson 2006; Pierce 1994). This augmented herb layer contributes greatly to carbon sequestration by producing high levels of primary productivity and biomass (McCarty 2002).

Fire functions as a chemical decomposition agent for forest biomass. Nutrients are rapidly released when biomass is burned (Liechty et al. 2005; Neary et al. 2005). A large amount of this nutrient release is absorbed by soil and is readily available for plant use. In fire-mediated ecosystems, fire replaces biological decomposers as the primary agent of nutrient recycling (Boerner and Brinkman 2003; Hubbard et al. 2004; McQuattie et al. 2004). Nitrogen, a primary limiting factor for plant growth, is generally more readily available in fire-mediated habitats, and annual biomass gain is generally higher, despite noticeable nitrogen losses due to volatilization when biomass is burned (Boerner 2000;

McGuire et al. 1995). In heavy rain events, a portion of the rapid nutrient release is expected to be leached from the soil and may runoff into streams. Most studies have shown that stream nutrient enrichment from prescribed fire has no lasting impact on stream organisms, but as a worst case will simply have a temporary minor impact on stream water quality (Clinton et al. 2003; Elliot and Vose 2005; Feminella 2000; Minshall 2003; Minshall et al. 2001; Vose et al. 2005).



**Figure 2.** An example of ecosystem response to a moderate intensity prescribed fire conducted in the spring of 2007 (photo taken on LBL in the spring of 2008).

Burning in forests raises concerns about global climate changes, specifically about changes in the forests' carbon sequestration rate. Global climate change may be exacerbated by forest fires, if allowed to burn frequently and out of control over large areas. The extensively burned forest areas no longer sequester carbon at the same rate as pre-fire, and over large scales, this may cause changes in the atmosphere that affect climate change. Carbon stocks that had been stored within the biomass of the forest are released into the atmosphere as a result of fire (Birdsey et al. 2006). However, unlike large wildfires, prescribed burns are low-intensity and cover only small areas at a time. They do not result in large-scale tree death, as wildfires sometimes do. On the contrary, research indicates that regular, periodic prescribed burning results in a reduction of risk of catastrophic wildfire occurrence (Fernandes and Botelho 2003). The short-term loss of biomass resulting from a fire may be offset by the burned area's increased ability to produce herbaceous biomass (e.g., McCarty 2002). Additionally, mature, old-growth forests sequester carbon at a lower rate than younger forests, and therefore management activities such as prescribed fire that maintain a variety of forest ages may increase the ability of forest tracts to sequester carbon (Pacala et al. 2007). Management actions (such as prescribed burning) that improve the resilience of forests to climate-induced disturbances such as catastrophic wildfire, may help sustain the current strength of the carbon sequestration ability of U.S. forests (Birdsey et al. 2007). In fire-mediated ecosystems, carbon sequestration generally equals or exceeds sequestration in unburned systems (Liechty et al. 2005). Finally, at a global or national scale, the short-term

reduction in carbon stocks and sequestration rates of the proposed burn project are imperceptibly small, as are the potential long-term benefits.

### **Area Plan Desired Conditions, Goals, and Objectives**

Land Allocation Prescriptions form the backbone of the Area Plan. In the Area Plan, the land allocations, their management emphases, and desired condition are described using management prescriptions. Area Plan Goals, which directly support Land Allocation Prescriptions, are concise statements that begin to focus the picture of how LBL will look in the future. When taken as a whole, Area Plan Goals constitute the desired conditions for LBL.

This project will help to achieve Area Plan Goals 5 and 7, as delineated on pg. 3 of this document. Area Plan Objectives form the time-specific or measurable, planned results that will help meet the Area Wide Goals. This project will help to achieve the following Area Plan Objectives on 4,982 acres of LBL:

- OBJ5a: In mature oak forests, provide open forest structure on approximately 19,000 acres by the end of the first decade with a long-term objective of 31,000 acres.
- OBJ5b: In mature oak forests, provide woodland structure on approximately 6,000 acres by the end of the first decade with a long-term objective of 30,000 acres.
- OBJ5i: Maintain approximately 10,600 acres in open lands – cultivated and grassland cover types – to support game species, early successional species, and watchable wildlife.
- OBJ5j: Restore and maintain fire regimes and fire return intervals in fire dependent communities by prescribed burning an average of approximately 10,000 acres per year by the end of the first decade, with a long-term objective of 21,000 acres per year on average. Some acres will incur repeat fire application during the planning period.

This project will meet Goal 7 by creating opportunities for dispersed recreation for visitors to LBL, in part by allowing them to visualize the management activities underway that help to maintain open lands and create woodland areas. Additionally, the maintenance of open lands will facilitate viewing of wildlife species such as white-tailed deer, turkey, and eastern bluebirds. Woodland structure in the general forest areas also enables easier viewing of wildlife.

The proposed action is designed and intended to implement Area Plan Goals 5 and 7, to meet the Objectives listed above, and to provide habitat for species associated with the following habitats, as listed in the FEIS:

- Upland Forest
- Xeric and Dry Grassland and Woodland
- Forest Opening

- Xeric and Dry Open Forest
- Interior Forest
- Regenerating Forest
- Den Tree
- Mesic Forest
- Mesic Closed Canopy Forest
- Mesic Forest Opening
- Snag

#### **IV. Species Considered and Species Evaluated**

Twelve species were considered in the Area Plan as management indicator species (MIS) on the NRA (Table 2); one is a federally-listed threatened species (*Aplos priceana*) and has already been assessed in the section above. Of these, all 12 species were selected as potentially affected by this project, since the proposed actions could affect habitat types for each of these species.

MIS will continue to be monitored at the plan level as identified in the Area Plan for Objectives #5a, 5b, 5i, and 5j (pg. 53-54), and monitoring summary pages 106-109.

Table 2. Management Indicator Species at the Land Between the Lakes NRA.		
Note: MIS may appear under more than one resource/habitat category.		
Life form	Scientific name	Common name
<b>Threatened and Endangered Species Recovery</b>		
Plant	<i>Apios priceana</i>	Price's potato bean
<b>Snags within forests</b>		
Bird	<i>Dryocopus pileatus</i>	Pileated woodpecker
<b>Snags within open areas</b>		
Bird	<i>Sialia sialis</i>	Eastern bluebird
<b>Mature forest within riparian areas</b>		
Bird	<i>Empidonax virescens</i>	Acadian flycatcher
<b>Oak woodlands</b>		
Bird	<i>Dendroica discolor</i>	Prairie warbler
<b>Mature open oak forest</b>		
Bird	<i>Myiarchus crinitus</i>	Great-crested flycatcher
<b>Mesophytic and riparian forests with complex canopy structure and mature forest interior</b>		
Bird	<i>Hylocichla mustelina</i>	Wood thrush
<b>Grassland</b>		
Bird	<i>Sternella magna</i>	Eastern meadowlark
Bird	<i>Colinus virginianus</i>	Northern bobwhite quail
<b>All forest type regeneration</b>		
Bird	<i>Icteria virens</i>	Yellow-breasted chat
<b>Demand non-game species (wildlife viewing)</b>		
Bird	<i>Sialia sialis</i>	Eastern bluebird
<b>Demand game species (hunting)</b>		
Bird	<i>Colinus virginianus</i>	Northern bobwhite quail
Bird	<i>Meleagris gallopavo</i>	Eastern wild turkey
Mammal	<i>Odocoileus virginianus</i>	White-tailed deer

### Pileated woodpecker

The pileated woodpecker was selected as an indicator species to changes in snags within forests, which are used by other species such as barred owls, screech owls, great horned owls, fox squirrels, gray squirrels, and southeastern five-lined skinks. It requires large cavity trees for nesting and foraging. Its abundance is correlated with abundant large dead trees and fallen logs (Hamel et al. 1992). This species has been selected to indicate the effects of management activities on forests with a desired abundance of snags (Area Plan 2004). Its usefulness as an indicator species is limited by its wide ranging habits, which cause it to be documented in forest types that are not ideal for it.

There is currently suitable habitat for this species in the Crooked Creek, Buffalo Trail, School House, and Three Ponds project areas.

## **Effects**

### **Alternative 1 – No action**

This alternative would eventually result in mixed-age forests with trees in varying stages of decay. There would be fewer large trees overall, but large trees that are currently existing will begin to senesce and decay over time, as they are replaced by maturing trees of shade-tolerant species. This alternative is likely to benefit this species, both directly and indirectly, as forests age and disturbances are minimized. Cumulatively, this alternative would benefit this species since more maturing, senescing forests will be created than with many other management activities such as open lands management and oak grassland restoration.

### **Alternative 2 – Proposed Action**

This alternative would result in open woodlands, open lands, and oak grasslands, which would be less desirable for pileated woodpeckers, although this species would likely continue to occupy the project areas. Snags would continue to be created in the process of prescribed burning (as described in the BAE for this project), so habitat would still remain. Other species that prefer snags, such as the squirrels and skink listed above, would still have suitable habitat. Directly, pileated woodpeckers may be impacted by this alternative if they are nesting in snags at the time of the burn. Cumulatively, this action combined with other actions leading to creation and maintenance of open lands, woodlands, and open forest structure, may limit habitat for this species and other similar species. However, the number of acres planned by the Area Plan to be converted to woodland and open forest structure (66,400) is small when compared with the number planned for mature forests (123,000), so this species is not likely to be limited overall. Additionally, although this species may be most benefited by no action, habitat created by the proposed action(s) may be important for some portions of the pileated woodpeckers life cycle; some benefits will be realized.

## **Eastern bluebird**

The eastern bluebird was selected as an indicator species to changes in snags within and adjacent to open conditions, which are used by other species such as red-headed woodpeckers, fox squirrels, gray squirrels, Indiana bats, Eastern pipistrelle bats, bald eagles, and five-lined skinks. Eastern bluebirds are also important for wildlife viewing opportunities on the NRA. These birds prefer habitats with scattered hardwoods and grasslands, with snags for nesting. They frequent grassy areas including meadows, pastures, roadsides, utility corridors, and cultivated lands. They are secondary cavity nesters, and are limited by the number of snags and cavity trees within or adjacent to grassy areas. Eastern bluebirds eat invertebrates and small fruits.

Surveys indicate that populations and nesting success of bluebirds are stable throughout the NRA (OLEA p. 75).

## **Effects**

### **Alternative 1 – No Action**

Under the No Action Alternative, open land habitat would remain, since it is managed through prescriptions in the OLEA, such as mowing. Forest openings and open forest

conditions would be minimized in the project areas; these are important for this species. There would be no direct adverse effect to this species; however, current forest openings in the Three Ponds project areas that have resulted from prior burns would be lost as forest succession occurred. Cumulatively, this action would have little effect on this species, since prescriptions in the Area Plan FEIS, the OLEA, and the Prior Creek EA will continue to provide habitat for this species on the NRA.

### **Alternative 2 – Proposed Action**

The Proposed Action Alternative would increase suitable habitat for Eastern bluebirds by creating forest openings and open forest conditions. Additionally, existing open lands habitat in the project areas would be maintained. Directly, individual birds may be adversely affected by this alternative if it occurs during the nesting season, when nests may be exposed to smoke and fire. Cumulatively, this alternative will improve and increase habitat for Eastern bluebirds when combined with other management activities such as open lands maintenance and timber harvests which maintain and create open lands, woodlands, and oak savannas, as prescribed under the Area Plan FEIS, the OLEA, and the Prior Creek EA.

### **Acadian flycatcher**

The Acadian flycatcher was selected as an indicator species to changes in mature forests with riparian areas, which are used by other species such as gray bats, woodland voles, Louisiana waterthrushes, coal skinks, pygmy rattlesnakes, green treefrogs, red-spotted newts, and zigzag salamanders. It requires mature forests with a high, heavily-shaded canopy and an open understory, especially in riparian zones (NatureServe 2008a). This species prefers oak, gum, and cypress trees, typically found in mesic or hydric areas. It generally requires large patches of undisturbed forest (NatureServe 2008a).

There currently are patches of suitable habitat in the Crooked Creek and Buffalo Trail project areas, although overall, these areas are more xeric and dry than what is preferred by this species.

### **Effects**

#### **Alternative 1 – No Action**

This alternative would have a direct and indirect beneficial effect on this species, particularly on the Crooked Creek and Buffalo Trail project areas where there are riparian corridors. These riparian corridors are marginally suitable for this species within the project areas, since the creek stretches in those areas are only ephemeral. Allowing the forest to mature and shade out understory vegetation along these riparian corridors would provide suitable habitat for this species over time. Cumulatively, this alternative would have beneficial effects on this species as the project areas, along with the core areas on the NRA, develop into mature, old-growth forest, providing habitat islands for Acadian flycatchers. Core areas make up approximately 25% of the NRA (over 35,000 acres), and are primarily managed with minimal disturbance of existing habitat.

#### **Alternative 2 – Proposed Action**

The proposed action is not likely to have a direct adverse effect on this species. However, this alternative may lead to small losses of suitable habitat for this species, as closed forest canopy in the Crooked Creek and Buffalo Trail riparian areas is lost to woodland and open forest structures. Suitable habitat for this species would not be created in the project areas as the canopy is opened up and more dense herbaceous vegetation grows in the understory. Cumulatively, this action is not likely to adversely affect this species, because the existing potential habitat areas are marginal, and any declines in habitat there would be negligible compared to the total habitat area on the NRA. The core areas on the NRA will remain intact, and make up a much larger portion of suitable habitat than the project areas. The number of acres planned by the Area Plan to be converted to woodland and open forest structure (66,400) is small when compared with the number planned for mature forests (123,000). Overall, populations of this species are not likely to be significantly reduced, since the project areas currently contain only substandard habitat for this species.

### **Prairie warbler**

The prairie warbler was selected as an indicator species of oak woodlands, which are used by other species such as blue-winged warblers, Indiana bats, evening bats, ground skinks, kingsnakes, timber rattlesnakes, tiger salamanders, and American toads. This species nests on the NRA in shrubs or thickets and needs only small patches of habitat for breeding (NatureServe 2008*b*). Key habitat is found in open areas with poor soil, and offers shrubby areas for nesting (Area Plan 2004). All five project areas currently contain small patches of suitable habitat for this species.

### **Effects**

#### **Alternative 1 – No Action**

This alternative is likely to have no effect on this species directly. Indirectly, this alternative may adversely affect prairie warblers. Open lands management in the form of mowing and tilling results in hard edges free of shrubs between forests and open lands, and eliminates shrubby habitat within open lands. Cumulatively, this action may have adverse effects if combined with a general policy towards no prescribed burning on the NRA; however, other forms of open lands and open forest or woodland management would continue to provide habitat for this species.

#### **Alternative 2 – Proposed Action**

Implementation of the proposed action may adversely affect individuals of this species if it occurs during the nesting season. However, this alternative is likely to benefit this species overall by maintaining and creating open lands and oak grassland conditions over time. Cumulatively, when combined with other management actions that maintain and create open lands and open woodland habitat, such as open lands maintenance and timber harvests, this action is likely to benefit this species.

### **Great-crested Flycatcher**

The great-crested flycatcher was selected as an indicator species of mature open oak forests, which are used by other species such as Indiana bats, evening bats, ground skinks, kingsnakes, Fowler's toads, and marbled salamanders. This species prefers to

forage in the upper reaches of open canopies, and nests in cavity trees or snags. Great crested flycatchers eat insects, including both flying and nonvolant insects. They have longer foraging flights compared with other flycatchers, and they tend to eat larger insects, including moths and cicadas (NatureServe 2008c). For this reason, they prefer open forest canopies which provide tall trees with more open space between trees.

Currently, there is no suitable habitat for this species in any of the project areas. The Three Ponds area, as a result of past burning, has the most suitable habitat; however, many of the trees in this area are not mature enough to provide ideal nesting or foraging trees for great-crested flycatchers.

## **Effects**

### **Alternative 1 – No Action**

Great-crested flycatchers will likely decline in abundance with this alternative, because their preferred habitat type will decline as forest succession occurs and forest canopies in the project areas become more dense. They are not likely to be adversely affected directly, but indirectly they will eventually lose habitat. Cumulatively, this action may have adverse affects if combined with a general policy towards no prescribed burning on the NRA; however, other forms of management for open woodlands, such as habitat thinning as prescribed by the Prior Creek EA, would continue to provide habitat for this species.

### **Alternative 2 – Proposed Action**

This species will benefit from the proposed action on all sites except for Neville Creek, where no suitable habitat occurs. Directly, this species may be adversely affected to prescribed burns that occur during the nesting season, when nests and nestlings in tree cavities may be susceptible to fire and smoke. Indirectly, habitat will be created for this species, as woodland and oak savanna conditions are created over time. Cumulatively, when combined with other management actions that maintain and create woodland and open canopy habitat such as timber harvests, this action is likely to benefit this species.

## **Wood Thrush**

The wood thrush was selected as an indicator species of mesophytic and riparian forests with complex canopy structure and mature forest interiors. This ecosystem type is used by other species such as gray bats, Southeastern myotis bats, woodland voles, cerulean warblers, coal skinks, pygmy rattlesnakes, red-spotted newts, and spotted salamanders. Wood thrushes nest in the mid-canopy and forage on the ground, and they require denser conditions at those two structural levels for protective cover (Lang et al. 2002). They eat insects and small fruits. Wood thrushes have been found to respond well to habitat after a prescribed burn (Lang et al. 2002).

There is currently suitable habitat in the Crooked Creek and Buffalo Trail project areas, and sufficient, though less suitable, habitat in the Three Ponds and School House project areas.

## **Effects**

### **Alternative 1 – No Action**

This alternative would likely have no effect on this species directly. Indirectly, mixed-age forests that would result from forest succession in the project areas would provide improved habitat for this species by improving more complex mid-story structure; however, habitat quality would be reduced by the lack of dense growth in the understory. Cumulatively, this alternative may have a beneficial effect on this species by increasing the number of mixed-age forest stands on the NRA, especially if timber harvests are managed to increase complex understory growth in the project areas.

### **Alternative 2 – Proposed Action**

Alternative 2 is likely to have no effect on this species directly, except that nests and nestlings may be adversely affected by burns that occur during the nesting season. Indirectly, this species may be adversely affected because opening the forest canopy into a woodland or oak-grassland structure would deteriorate habitat for this species in some areas; in other areas, opening up the forest canopy would benefit this species by encouraging understory plant growth. Cumulatively, when combined with other management actions, this action is not likely to adversely affect this species because the number of acres planned by the Area Plan to be converted to woodland and open forest structure (66,400) is small when compared with the number planned for mature forests (123,000).

### **Eastern Meadowlark**

The Eastern meadowlark was selected as an indicator species of grasslands, which are also used by other species such as woodchucks, Northern bobwhite quail, Bewick's wrens, pine snakes, fence lizards, six-lined racerunners, and American toads. This bird nests on the ground and feeds primarily on insects and other invertebrates.

Currently, there are patches of habitat for this species in all five project areas, and the Neville Creek project area is entirely comprised of suitable habitat for this species.

### **Effects**

#### **Alternative 1 – No Action**

This alternative would likely have no direct effect on the Eastern meadowlark. Indirectly, this action may have adverse effects on the Eastern meadowlark since ground nesting conditions will be diminished by a dense leaf litter layer, even if open lands conditions are maintained by mowing and tilling. Nesting and foraging habitat for this species would also diminish as woody succession occurred in some of the open lands on the project areas. Cumulatively, this action may have adverse effects if combined with a general policy towards no prescribed burning on the NRA; however, other forms of open lands management would continue to provide habitat for this species.

#### **Alternative 2 – Proposed Action**

This alternative is not likely to adversely affect this species directly; however, it may have direct adverse effects if burning occurs during or immediately prior to the nesting season. Spring burns may impair habitat quality for the spring nesting season if all available cover (i.e., tall grasses and forbs) is removed, and burns may destroy nests if implemented during the spring and early summer. However, prescribed burning is likely to have indirect beneficial effects because it will maintain suitable open land and

grassland habitat by removing excess leaf litter and woody growth. Cumulatively, when combined with other management actions that maintain and create open lands habitat such as those described in the OLEA, this action may benefit this species.

### **Northern Bobwhite Quail**

The Northern bobwhite quail was also selected as an indicator species of grasslands, which are used by other species such as those listed above under Eastern meadowlark. This species is also a demand game species, and the Area Plan calls for management actions that enhance habitat for these species. Bobwhites are ground nesting birds. Juveniles forage primarily on insects, and adults forage on seeds from legumes, grasses, pine and oak mast, and fruits. This species inhabits croplands, grasslands, and open forests, and is found in higher numbers in small patches of open habitat divided by woody edges. It needs open, bare ground in between clumps of grasses and forbs to facilitate easy movement (especially for the young), since it generally forages by moving along on the ground. This species uses grasslands, croplands, brushy cover, and woodland cover. Bobwhites have been declining in Kentucky and Tennessee, and management efforts are underway throughout these states to increase its numbers.

There are suitable patches of habitat for this species in all five project areas.

### **Effects**

#### **Alternative 1 – No Action**

This alternative would likely have no direct effect on the bobwhite quail. Indirectly, this action will have adverse effects on the bobwhite since ground nesting conditions will be diminished by a dense leaf litter layer, even if open lands conditions are maintained by mowing and tilling. Nesting and foraging habitat for this species would also diminish as woody succession occurred in some of the open lands on the project areas. Cumulatively, this action may have adverse affects if combined with a general policy towards no prescribed burning on the NRA; however, other forms of open lands management would continue to provide habitat for this species.

#### **Alternative 2 – Proposed Action**

This alternative may have direct adverse effects on Northern bobwhite quail if burning occurs during or immediately prior to the nesting season. Spring burns may impair habitat quality for the spring nesting season if all available cover (i.e., tall grasses and forbs) is removed, and burns may destroy nests if implemented during the nesting season. However, prescribed burning will have indirect beneficial effects because it will maintain open lands and grasslands that would otherwise undergo succession to woody growth and eventually to forest. Prescribed fire has been described as one of the most effective management tools for bobwhite quail (Snyder 1991). Burning would remove excess litter and vegetation covering the ground, which otherwise impairs movement of bobwhites through their habitat. Cumulatively, when combined with other management actions that maintain and create open lands and woodlands habitats such as those described in the OLEA, the Area Plan FEIS, and the Prior Creek EA, this action is likely to benefit this species over time.

### **Yellow-breasted Chat**

The yellow-breasted chat was selected as an indicator species of regenerating forests, which are also used by other species such as indigo buntings, Northern cardinals, long-tailed weasels, Eastern pipistrelle bats, white-tailed deer, milk snakes, box turtles, and eastern narrowmouth toads. This bird nests in thick brier tangles, vines, shrubs, and woody undergrowth, usually within 5 feet of the ground. It feeds on insects and other invertebrates, and small fruits. It is often found close to water (streams, ponds, swamps) during the nesting season.

## **Effects**

### **Alternative 1 – No Action**

This alternative is not likely to have an effect directly on this species. Indirectly, this alternative would benefit this species in the short term by providing improved habitat conditions in some of the open lands of the project areas; however, over time these areas would undergo succession to a mid- and late-seral stage and would no longer be suitable for yellow-breasted chats. Cumulatively, this action is likely to have no effect over time, if combined with a general policy towards no prescribed burning on the NRA; however, other forms of forest management such as timber harvest where regenerating forest would result in open patches of forest, would continue to provide habitat for this species.

### **Alternative 2 – Proposed Action**

Habitat for yellow-breasted chats would be maintained and enhanced in the open lands areas, in amounts and distributions that would fluctuate with the burn cycles. Habitat is expected to be enhanced in and around the perimeter of the open lands, where shrubby growth would grow the thickest. Areas of the open oak forest and woodland within the project areas would also provide suitable habitat for this species. This species may be adversely impacted directly if prescribed burn implementation occurred during the nesting season. Cumulatively, other management actions that maintain open lands, woodlands, oak grasslands, and open forests, as described in the Area Plan FEIS, the OLEA, and the Prior Creek EA, would provide suitable habitat for this species in conjunction with the proposed actions.

## **Eastern Wild Turkey**

The Eastern wild turkey was selected as an indicator of the effects of management actions on hunting opportunities. This species is adapted to a variety of habitat conditions, and generally requires a combination of conditions to prosper. Specifically, this species depends on hard mast-producing trees such as oaks and hickories for forage during fall and winter. Turkeys nest on the ground in regenerating forests, at the edge of forests and woodlands, and in shrubby areas within grasslands. They often forage in open lands, and take cover in woodlands where they roost in trees at night. They feed on seeds, nuts, fruits, grains, and insects.

There are patches of suitable habitat in all five project areas.

## **Effects**

### **Alternative 1 – No Action**

This alternative will likely have no effect on this species directly. Indirectly, wild turkeys may lose habitat over time, as forest succession occurs in some of the open lands, and

nesting and foraging habitat in open lands, forest edges, and shrubby areas disappear to dense forests; however, this would be offset by other open lands management actions in the project areas. Cumulatively, this action may have adverse affects over time, if combined with a general policy towards no prescribed burning on the NRA; however, other forms of open lands management would continue to provide habitat for this species in the project areas and throughout the NRA.

### **Alternative 2 – Proposed Action**

This alternative may have an adverse effect on individuals if implementation occurs during the nesting season. Indirectly, this alternative will benefit wild turkeys by maintaining existing open land habitat, and by creating more open forest and woodland conditions with forest openings that can be used by turkeys. Turkey habitat would be improved as open forests and woodlands allowed more oaks and hickories to mature to mast-producing age. Oaks and hickories would have more robust canopies as gradual thinning of the canopy occurred; this would increase mast production. Cumulatively, this action combined with other management actions that maintain open lands, woodlands, oak grasslands, and open forests, as described in the OLEA, the FEIS, and the Prior Creek EA, would provide suitable habitat for this species.

### **White-tailed Deer**

The white-tailed deer was selected as an indicator of the effects of management actions on hunting opportunities. White-tailed deer populations are well-established on the NRA. It is the NRA's highest demand game species and among the highest demand wildlife viewing species. Since the 1980s, deer populations have increased substantially in the surrounding privately-owned farm communities outside of the NRA, due to extensive agricultural production. However, since these lands are privately owned, hunting opportunities there are not available to the general public.

Ideal deer forage is made up of a mixture of mast-producing trees such as oak and hickory, shrubs, vines, forbs, grasses, fungi, sedges, and agricultural waste grains. Deer browse primarily in the woods and edges of forests. Regenerating forests provide large amounts of browse for deer. This forest type is shrinking in area on the NRA as forest succession is occurring and forests are maturing.

White-tailed deer populations are monitored primarily through harvest data. Over twenty years of harvest data indicate deer were more prevalent on the NRA during the 1980s (approximately 2000 harvested/year) than they are today (approximately 1100 harvested/year). Habitat changes over time are a primary factor determining numbers of individuals in the population. The NRA's forests have matured, the canopy has grown more closed, and the amount of open lands have decreased; all these factors have led to the decline in area of suitable habitat for this species, and therefore, the decline in the deer population. Currently, there are patches of suitable habitat for white-tailed deer in all five project areas.

### **Effects**

#### **Alternative 1 – No Action**

Although no deer are likely to be directly adversely affected by no action, this alternative would indirectly lead to a decrease in white-tailed deer habitat in the project areas over time. As stated above, forest succession leading to mature, closed canopy forests would diminish suitable habitat area for deer. Additionally, the gradual shift from oak-hickory forest to a shade-tolerant maple-beech forest would lead to a decline in winter forage for deer (i.e., a decline in hard mast such as acorns and hickory nuts). A heavily shaded forest would allow for fewer forbs and grasses to grow on the forest floor, leading to a decline in summer forage for deer. Cumulatively, this action may have adverse effects over time, if combined with a general policy towards no prescribed burning on the NRA; however, other forms of open land, oak grassland, and woodland management would continue to provide habitat for this species in the project areas and the NRA.

### **Alternative 2 – Proposed Action**

Directly, deer are unlikely to be impacted by this alternative, as they are mobile nearly from birth, and are able to leave the project area during implementation of the proposed actions. This alternative would indirectly benefit white-tailed deer. Deer habitat would be improved as open forests and woodlands allowed more oaks and hickories to mature to mast-producing age. Oaks and hickories would have more robust canopies as gradual thinning of the canopy occurred. These forest structures would also allow more light to reach the forest floor, stimulating herbaceous plant growth and providing summer forage for deer. Immediately post-burn, habitat will not be suitable for deer in the project areas, but herbaceous growth would soon provide foraging opportunities. Cumulatively, other management actions that maintain open lands, woodlands, oak grasslands, and open forests, as described in the Area Plan FEIS, the OLEA, and the Prior Creek EA would provide suitable habitat for this species, in conjunction with the proposed actions.

Preparer(s)

PREPARER:

I prepared this MIS Evaluation and made the effects determinations.

---

Name:

Date:

Position:

Land Between The Lakes National Recreation Area

REVIEWER:

I reviewed this MIS Evaluation for and I concur with the documented findings and effects determinations.

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Name:

Date:

Position:

Land Between The Lakes National Recreation Area

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