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Viability Assessment Report For Dry-Xeric Mixed Pine-Oak Habitat Association

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I. Description of Habitat Association

The Dry-Xeric Mixed Pine-Oak Habitat Association occurs throughout the Daniel Boone National Forest (DBNF). It is fairly well proportioned across the forest with the exception of the Redbird district, which contains few acres of this association. While more evenly distributed from south to north than other pine and mixed pine-hardwood associations, the majority of this association does occur on the southern portions of the forest. The London, Somerset and Stearns districts contain approximately 66 percent of the total acres found on the forest. This habitat association can be found in several land type associations (LTAs) but it is most common in the Southern Cliff (221Hc003), Rockcastle Hills (221Hc005), London-Corbin Plain (221Hc006) and Big South Fork Plateau (221Hc004). It is also relatively common in the Central Cliff (221Hb002), London-Corbin Plain Transition (221Hc007) and along the Northern Escarpment (221Hb004) LTAs (USDA Forest Service, 1997a).

On the DBNF this habitat association is typical of dry, sandstone ridgetops, along margins of sandstone clifflines and on the upper portions of southwesterly facing slopes. This habitat association typically occurs on broad to narrow ridge tops or slopes with a southerly or westerly exposure (SAMAB, 1996). Most sites are sandstone or shale-based and on acidic soils, primarily on sites with moisture or nutrient deficiencies. Xeric site conditions may exist due to: (1) low precipitation, (2) limited moisture absorption/retention because of exposed bedrock, steep slopes, coarse-textured soils, rocky solids, or shallow soils and/or (3) elevated evapotranspiration rates on southern-facing slopes (USDA Forest Service, 1997). Because lack of precipitation is not normally a factor on the DBNF, these xeric conditions are likely the result of items 2 and/or 3. Rocky south facing slopes and ridgetops with shallow soils and/or exposed rock are common attributes of xeric sites on the DBNF. Xeric sites are often associated with high landscape positions (Jones, 1988).

This association is a mix of yellow pine and hardwood species. Depending on the site conditions and past disturbance history, yellow pine species will comprise 31 to 69 percent of the dominant overstory. The ratio of pine and hardwood species is largely a product of past disturbance regimes. The presence of hardwoods dominating many mixed stands is likely due to the absence of a historic disturbance regime and changes in land use on the forest in the past 75 to 100 years. Whereas past disturbance caused by Native American burning, frequent wildfires, and historic use of these sites for farming, grazing, or heavy timber harvest may have encouraged the regeneration of shade-intolerant oaks and pines, more recent events such as the suppression of fires and succession of grazed and farmed areas to mature forest has favored shade-tolerant hardwoods other than oaks.

Overstory species that commonly occur in this habitat association include: Virginia pine, pitch pine, shortleaf pine, scarlet oak, chestnut oak, black oak, post oak, pignut hickory, and blackgum (and historically, American chestnut). Other species that may be found in the overstory or as midstory include: sourwood, red maple, sassafras, and eastern red cedar. Most shrubs are typically ericaceous and lowbush blueberry, huckleberry, and deerberry are particularly fond of xeric conditions (SAMAB, 1996; Jones, 1988).

II. Current Status of the Habitat Association on the Daniel Boone National Forest

Prior to the 2000-2001 southern pine beetle (SPB) epidemic, the DBNF had approximately 29,353 acres of forest area that was considered in the Dry-Xeric Mixed Pine-Oak Habitat Association (USDA Forest Service, 1998). This represented over 4 percent of the total forested area on the DBNF. However, assuming that approximately 75 to 90 percent of the pine component has been killed as a result of the SPB epidemic, it is more likely that < 1 percent of the total forested area on the DBNF is now in this habitat association. In 1998, approximately 54 percent (15,749 acres) of this was greater than 70 years old. The age class less than 30 years old comprised approximately 12 percent (3,623 acres) of this association.

The pine-hardwood group Virginia pine-scarlet oak typically dominates this habitat association on the DBNF. However, in 1998, over 74 percent of the acres classed in this association were typed as hardwood-pine. Today, it is likely that much more than 74 percent (due to the recent pine mortality) is likely to fall within hardwood-pine forest types.

Most of the mixed pine-oak stands that fall within this habitat association contain little or no advanced oak or pine regeneration in the midstory or understory. This is likely a result of fire-suppression and other disturbances that would allow adequate light to reach the understory layer and stimulate oak and pine regeneration. As a result, the midstory layer of these stands is composed of high densities of species such as dogwood, sourwood, and red maple. The understories of these stands are generally completely shaded and contain shade-tolerant shrubs and herbaceous plants.

On the southern portion of the forest where this association occurred in major quantities, or graded into other pine dominated associations, it was typically included in management strategies for the endangered red-cockaded woodpecker (RCW). Mature Virginia pine-oak stands, were considered suitable foraging areas. Virginia Pine is not considered well suited for nesting habitat but is utilized in that regard. Much of this association occurs in sites that are low in timber productivity due to site nutrient deficiencies. These sites would not normally be targeted for timber production.

The devastation from the SPB epidemic has caused the loss of the yellow pine component in many of these formerly mixed pine-oak stands and will transform formerly mixed stands to sites dominated by hardwoods. Today, most of these sites would not be classified as mixed forest types because they do not contain at least 30 percent live yellow pine. This habitat association currently consists primarily of young regeneration areas not yet impacted by the SPB and small, scattered areas of mature to mid-age mixed pine-hardwood stands that are quickly being transformed into hardwood-dominated areas.

III. Management Needs: Recommendations for the Conservation of Habitat to Ensure Species Viability

A. Purpose and Need for Management of Dry-Xeric Pine-oak Communities

Recognition and management of mixed pine-hardwood types can produce a number of benefits. Since the DBNF occurs within the range of several hardwood and yellow pine species, many sites on the forest are well-suited to providing conditions conducive to growing healthy stands of both yellow pine and desirable hardwoods. As a result, many sites in the forest have likely been historically composed of a mix of pine and hardwood species. This in-stand diversity of tree species composition, which provides a mix of conifers and deciduous hardwoods, has resulted in a high diversity of plants and animals within these stands. Many of these wildlife and plant species (including those in Attachment A) find suitable conditions within these stands because they are attracted to either the yellow pine or the deciduous hardwood component of these stands, or in many cases, to the disturbance regime (often, fire) that often maintains the mixed pine-oak stand composition.

Within the Dry-Xeric Mixed Pine-Oak Habitat Association, the following conditions are needed to ensure persistence of some species identified in Attachment A:

Acidic substrate	Elevations above 2300'	Leaf Litter	Open Canopy	Snags > 6" dbh
Burrows, Holes, and Tunnels	Dry Conditions	Mature Forest	Open Midstory/Understory	Trees with Cavities
Dense Shrub Understory	Periodic burning	Mid-age Forest	Riparian Areas	Water nearby
Downed Logs	Large Decadent Trees	Open (Little or no Shade)	Rocky areas	Large tracts of suitable habitat
Good Drainage	Minimal forest edge/Interior Habitat	Moist Conditions	Sandy Soils	
Upland Areas	Old Growth Conditions	Shrub/Sapling Conditions	Trees > 20" dbh	

Many of these conditions (such as sandy soils, slope, drainage) are factors of geology and topography and not normally influenced by standard forest management activities. Where forest management activities may influence these conditions, however, standards and guidelines are presented in this analysis to ensure that these conditions continue to be present within the Dry-Xeric Mixed Pine-Oak Habitat Association in order to ensure the persistence of species identified in Attachment A.

B. Desired Future Condition

AGE CLASS

To provide for the greatest diversity and meet requirements of all species listed in Attachment A, a variety of age classes within this habitat association is recommended. The conditions represented by these various age classes provide important habitat conditions for the species listed in Attachment A. For example, maintaining a component

of this habitat association in the 0 to 10 year old age class would provide for species that require patches of bare ground, thickets, briars, vines and forbs, whereas, a 10 to 30 year old component would better serve species that require taller, more dense, woody, shrubby early successional habitat. Species that simply require brushy conditions, regardless of stem density or type would be provided by both the 0 to 10 year and 10 to 30 year component of this habitat association. Species that only prefer a component of this habitat association in a forested condition that is dominated by trees of varying heights and densities but do not require older trees for mast production and cavities or snags would need a component of this habitat association greater than 20 years of age. Species most dependent upon mature stands that provide cavity trees, large snags, and production of acorns and pine seed would be best provided for by maintaining a component of this habitat association greater than 80 years of age.

However, it is also recognized that the DBNF is currently well below the desired levels of 20 plus year old mixed forest types and has an unbalanced age class distribution of mixed forest types as a result of the SPB epidemic. The desired age class distribution is based upon the viability needs of all the species in Attachment A and would ensure persistence of all these species within the dry-xeric pine-oak community (assuming other recommendations made in this analysis are implemented). However, because of the SPB epidemic, it will be impossible to achieve this desired age class distribution within the next planning period. The age class distribution over the next planning period is more likely to reflect an increase in the 0 to 10 year old age class and a decrease in the 20 plus year old age class for this habitat association. **As a result, the age class distribution expected over the next planning period is not likely to provide for short term persistence of all these species on the DBNF, particularly those species that require large tracts of mature pine-dominated forest.**

Desired age class distribution of dry-xeric pine-oak habitat:

Desired Successional Class	percent desired in pine-hardwood forest types*	percent desired in hardwood-pine forest types*
Forest 0-10 years of age	~3 percent (1998-pre SPB levels)	~5 percent (1998 levels-pre SPB)
Forest 0-30 years of age	~12 percent (1998-pre SPB levels)	~13 percent (1998-pre SPB levels)
Forest 20-80 years of age	~82 percent (1998-pre SPB levels)	~48 percent (1998-pre SPB levels)
Forest 80 plus years of age	~14 percent (1998-pre SPB levels)	~43 percent (1998-pre SPB levels)

*Rationale for using 1998 levels: Monitoring of some species that are identified in Appendix A (primarily birds) immediately before, during and after 1998 did not reveal any significant declines of these species during that time period, therefore, it is assumed that age class distributions that existed during that time period were adequate in ensuring persistence of these species on the forest and within this Habitat Association.

This desired age class distribution will provide for the following habitat conditions within the Dry-Xeric Mixed Pine-Oak Habitat Association: Dense shrub understory, large decadent trees, mature forest, mid-age forest, old growth conditions, shrub/sapling conditions, and trees > 20” dbh.

OVERSTORY

The overall landscape composition of the DBNF is based upon many influences. Based upon existing forest structure and needs of species identified in Attachment A, the desired forest composition of dry-xeric pine-oak habitat is as follows:

Desired level of DBNF that will be in a dry-xeric pine-hardwood forest type	1.1 percent 1998 1 percent likely in 2001 (-3.5 percent) 1-3 percent desired
Desired level of DBNF that will be in a dry-xeric hardwood pine forest type	3.3 percent 1998 < 1 percent likely in 2001 (plus 3.5 percent) 2-4 percent desired
Total desired level of DBNF that will be in a dry-xeric pine-oak Habitat Association	4.4 percent in 1998 < 1 percent likely in 2001 2-4 percent desired

These desired levels are based upon the assumption that the recommendations outlined in this analysis are implemented. Implementation of these recommendations will help assure persistence of the species identified in Attachment A.

MIDSTORY AND UNDERSTORY

It is desired that mixed pine-oak stands be somewhat self-sustaining. This will require the use of techniques, primarily burning and thinning, that will encourage advanced pine and oak regeneration in the understory and create a somewhat open midstory. The use of these techniques will likely create a midstory that contains species such as dogwood, sourwood, sassafras and blackgum and an understory of sedges, grasses, grapes, bracken fern, ericaceous shrubs such as huckleberries and blueberries, and mountain laurel. In the less xeric pine-oak sites, the midstory and understory would be expected to be less open and likely to contain more shade-tolerant species such as red maple with an understory dominated more by deciduous shrubs and herbaceous plants.

General Strategy to be Used to Meet Desired Future Conditions (DFC):

The general strategy that should be taken to achieve the Desired Future Condition is to implement future management that will favor oak in existing or historical hardwood-pine stands and pine in existing or historical pine-hardwood stands. This may lead to some stands becoming >70 percent hardwood or pine and being reclassified as upland hardwood forest types or southern yellow pine types rather than “mixed” forest types. An exception to this will likely occur in cases where existing and historical hardwood-pine sites are contiguous with areas being managed for species that require large tracts of pine forest. Where the latter occurs, many of these hardwood-pine sites may be managed towards pine-hardwood types (50-69 percent pine) or will maintain their hardwood-pine classification.

C. Habitat Association General Direction and Standards and Guidelines

Forest-wide

General Direction: Create healthy dry-xeric pine-oak communities.

- Emphasize prescribed fire use in mixed forest types.
 - *Rationale: Extensive research has shown that both the pine and oak components of pine-oak stands respond favorably to somewhat open conditions created by burning and the reduction of less fire tolerant woody competition. Open conditions created by burning also benefit species identified in Attachment A that require an open midstory/ understory, or are fire dependent/enhanced, and helps maintain an ericaceous and/or forb grass condition in the understory.*
- Implement periodic maintenance burns, including during the growing season to control undesirable woody vegetation in mixed forest types. (RCW FEIS).
 - *Rationale: Growing season burns will likely be the most effective in reducing undesirable hardwood stem density in the understory.*
- Consider restoration of American chestnut in sites that lend themselves to this objective.
 - *Rationale: American chestnut was historically a species dominant in the overstory of this Habitat Association.*
- Provide downed logs and large woody debris on the forest floor where this may be limited naturally.
 - *Rationale: Some species require the presence of down logs on the forest floor within this habitat association and where the presence of down logs is not provided due to natural events or as a result of forest management activities, there should be an attempt made at restoring this habitat condition.*

General Direction: Maintain or restore shortleaf or pitch pine dominance within existing and historical pine-hardwood stands. Maintain Virginia pine dominance on pine-hardwood sites that are less suitable for shortleaf or pitch pine.

- *Rationale: Ensuring a pine dominance in pine-hardwood stands will contribute to the overall availability of yellow pine across the landscape in levels that will provide for the persistence of species that are restricted or dependent upon the presence of stands of pines and other conifers. Shortleaf and pitch pines are the desirable pine species because they are longer lived than Virginia pine and can provided habitat for species associated with the dry-xeric pine-oak community over a longer period of time than Virginia pine-oak sites may provide. However, often Virginia pine is the only pine species that does well on xeric sites and so, in some cases, this species will be preferred.*

- Where pine-hardwood stands are considered not adequately stocked to maintain a >50 percent pine overstory dominance, implement management that will increase the pine stocking in the understory using a variety of methods such as controlled burning, planting, releasing advanced regeneration, and other methods that may be applicable.
 - *Rationale: Stands that contain less than 50 percent pine overstory would not be considered pine-hardwood forest types. It is important to maintain a pine dominance in some of these mixed stands in order to provide for species that require contiguous pine habitat and for species that are restricted to pines for foraging purposes (such as red-cockaded woodpecker). Periodic burning will produce a better seedbed for pine regeneration and limit competition from species that are less tolerant of burning than pines. Also improves habitat for fire-tolerant/enhanced species. If burns are conducted prior to pine seed dispersal, there is a greater chance that seed will fall on a site where it can successfully sprout and remain viable. If burning cannot occur during this time, then burns should focus on limiting the amount of non-desirable sprouts within the pine-hardwood stands in order to maintain pine dominance in these sites. Once pine stocking levels in the understory become adequate, controlled burning should be curtailed to allow pine seedlings time to grow. Once pine stocking in the understory reaches the desired level to maintain a >50 percent pine dominance, burning should be curtailed so that young seedlings have a chance to grow without being killed back by other burns. Pine regeneration generally needs to be released from hardwood competition, especially in mixed sites.*
- Conduct site prep activities that will provide the best results for desired pine regeneration such as implementing spring to early summer felling of non-desirable residuals that are > 5 feet tall and allowing felled residuals to be allowed to dry until early to mid-July before burning (Phillips and Abercrombie, 1987). Consider use of herbicides or low intensity burning treatments to release pine seedlings.
 - *Rationale: Site prep at this time will coincide with timing for better site prep burns and follow-up planting. Allowing residuals to “cure” for a few months will improve the effectiveness of a follow-up site prep burn. Studies show that burning after July 1 has the greatest effectiveness on preparing a site for planting that following winter and maximizes the consumption of residual slash on the ground that could impede planting efforts and successful pine regeneration. By planting after the burn, planting is easier to do and the seedlings have less competition from other species. Also, planting in the winter and early spring is the best time for seedlings to get established. Following planting, some sites may need follow-up treatments to ensure that pine seedlings are not out-competed by less desirable species.*
- A variety of regeneration methods may be used to restore or regenerate pine-hardwood forest types, the most appropriate of which is to be determined by site-specific objectives and needs.

- *Rationale: Regeneration of some pine-hardwood forest types will provide habitat for those species that require early successional forest as well as interior forest edge conditions.*
- Unless Virginia pine is the only native yellow pine species likely to dominate a site, all healthy shortleaf and pitch pines should be retained during stand restoration activities, unless their density is greater than 70 square feet of basal area (BA), in which case the desired trees should be thinned to improve pine regeneration in the understory and improve the health of the stand. (RCW FEIS)
 - *Rationale: "Restoration" implies that a shortleaf and pitch pine composition will be restored to the site. If there is already a component of this desired species in the stand, it should be retained, where it may provide a natural seed source, etc., unless its retention hampers further restoration of the site to a desired pine-hardwood type*
- Maintain a pine BA of 40-110 square feet, depending on site and stand condition and site objectives
 - *Rationale: Depending upon objectives for the site, the BA may be relatively low (40-50 BA if the site is managed as a pine-oak barrens, for instance) or it may be relatively high (80-110 BA if the site is being managed to provide dense conifer cover, or is in regeneration and densely stocked). An average BA of 40-110 (around 70 BA) would be desired in the majority of pine-hardwood sites. A range of basal areas will also provide stands with a variety of shade conditions across the landscape.*

General Direction: Maintain or restore an oak component within existing and historical hardwood-pine stands.

- *Rationale: Maintaining an oak component in these stands will ensure persistence of those plant and animal species that require the hardwood component of a mixed forest type, particularly oak, as well as species that require leaf litter on the forest floor.*
- A variety of regeneration methods and site prep techniques may be used to restore or regenerate desired oak species while maintaining a mixed pine-oak composition, the most appropriate of which is to be determined by site-specific objectives and needs.
 - *Rationale: Regeneration of some hardwood-pine forest types will provide habitat for those species that require early successional forest as well as interior forest edge conditions.*
- 1. Even-aged management is generally the preferred regeneration method for regenerating oaks in mixed forest types.
 - *Rationale: Studies indicate that oaks require high amounts of sunlight for successful regeneration, and these conditions are best provided in even age*

management areas. Even-aged management will provide habitat for species that require larger stands (generally >10 acres) of early successional forest habitat and for species that occupy areas with dense shrub understories .

- a) **Clearcutting** is the preferred method where advanced oak regeneration is present (Thompson and Dessecker, 1992).
 - *Rationale: Studies have shown that clearcutting on mesic hardwood-dominated sites often accelerates the site towards a mixed mesophytic community because more mesic sites generally have less advanced oak regeneration in the understory than drier sites. Drier sites generally have a greater accumulation of natural oak reproduction in the understory, which is favored by clearcutting.*
 - b) **Shelterwoods** are preferred where advanced oak regeneration is not present (Thompson and Dessecker, 1992).
 - *Rationale: Shelterwoods are more useful on mesic sites that have less advanced oak regeneration in the understory because it controls stand density near the end of rotation when oak reproduction needs to accumulate.*
2. Uneven age management may be considered where even aged management does not meet site objectives.
- *Rationale: Implementing uneven aged management may allow for regeneration of pine-oak sites while still maintaining some of the overstory and some of the attributes of mature stands. Generally, however, uneven aged management does not provide many of the attributes of early successional habitat. Uneven-aged management may provide for species that will persist in small areas (generally < 2 acres) of early successional forest or for species that require some overstory trees with an early successional, dense, shrubby understory.*
- a) **Group selection** cuts may be used providing that group selection cut openings are at least 1/10 of an acre in size (depending upon amount of advanced oak regeneration on site) (Thompson and Dessecker, 1992).
 - *Rationale: Creating openings will provide necessary light to facilitate growth of advanced oak reproduction in these sites as long as openings fall within 1/10 – 1/2 acre in size. Larger openings should be referred to as patch cuts or clearcuts.*
3. Controlled burning should be timed for early fall immediately preceding acorn seed dispersal from the overstory. Otherwise, burns should be conducted at times when maximum bud and sprout mortality of non-desirable hardwoods will occur.

- *Rationale: If burns are conducted prior to acorn dispersal, there is a greater chance that acorns will fall on a site where it can successfully sprout and remain viable. If burning cannot occur during this time, then burns should focus on limiting the amount of non-desirable sprouts within the hardwood-pine stands in order to maintain oak dominance in these sites.*
4. Retain some mature oaks in regeneration stands to sustain acorn production.
 - *Rationale: Retaining mature oaks in regeneration stands will provide for species that feed on acorns and prefer mature oaks in a very sparse, open canopy condition and will also provide a natural seed source for oak regeneration.*
 5. Reduce competition from non-desirable hardwood species thru a variety of methods such as controlled burning and/or herbicide use. This may be especially necessary on sites that have a Site Index > 70 for black oak (Schlesinger, 1993).
 - *Rationale: On hardwood-pine sites with higher site indices, there may be sufficient competition from other hardwood species to out compete the more desirable oak species. Burning, overstory release and herbicide use have all been shown to retard the development of competing non-oak saplings. Release, particularly overstory release, should be conducted when oak seedlings are at least 4.5 feet tall (Schlesinger 1993). Studies show that oaks of less than 4.5 feet tall generally are not big enough to out compete other nondesirable hardwood saplings in a site.*

General Direction: Provide large cavity trees and snags in mature dry-xeric pine-oak communities.

- *Rationale: For some species identified in Appendix A, the presence of large cavity trees and snags in the dry-xeric pine-oak community is necessary for their persistence within that community.*
- Establish rotation ages that will ensure that mature, heartrotted, and large diameter yellow pines and oaks are provided on the landscape.
 - *Rationale: By increasing the rotation age, a supply of old, decadent, heartrotted pines and oaks should be available for species that require these kinds of trees for nesting, foraging or perching. This standard will maintain the presence of large decadent trees and trees with cavities on the landscape.*
 - Existing pine and pine-hardwood stands of desirable pine type will not be regenerated until they reach rotation age, but thinnings may occur in these stands. If regeneration of pine and pine-hardwood types is necessary to help achieve a balanced age class, regeneration may occur, but not in the oldest 1/3 of pine and pine-hardwood stands.

- *Rationale: By retaining the oldest 1/3 of pine and pine-hardwood stands, species that require mature pine-dominated forest and older, mature pines should be provided for.*
- Provide artificial cavities and nest boxes for species that may be limited by cavity availability.
 - *Rationale: Artificial cavities and nest boxes can provide nesting and roosting habitat for species that may be limited by the unavailability of snags and den trees within the dry-xeric pine-oak communities.*
- Retain existing snags in project areas except where they would interfere with project purpose and need.
 1. No snags will be intentionally felled within project areas associated with timber management.
 - *Rationale: This will insure that deliberate attempts to reduce the snag component within timber management areas will not occur.*
 2. Within project areas, at least three snags per acre at least 9" dbh will be retained.
 - *Rationale: This will help insure that larger diameter snags >6" dbh will be provided in project areas that fall within dry-xeric pine-oak forest types.*
 3. Live trees will be girdled if the existing density of standing dead trees does not meet this standard.
 - *Rationale: This will provide suitable snags in areas where snag availability may be limited.*
 4. Snags considered to be immediate threats to human safety may be removed anytime. Those identified as immediate hazards should be removed during the Indiana bat hibernation season.
 - *Rationale: This will protect species that may be using snags for breeding purposes.*

LONDON, SOMERSET AND STEARNS

General Direction: Provide contiguous pine-dominated habitat for forest-interior pine-dependent species on the London, Somerset and Stearns Districts.

- *Rationale: Some species require large tracts of contiguous interior pine dominated habitat. Habitat requirements for these species would be best met on the London, Somerset and Stearns District because the southern part of the forest provides the greatest numbers of sites suitable for restoration and/or maintenance of the dry-xeric pine oak community.*

- Emphasize pine management in existing and/or historical hardwood-pine stands that are on the south end of the forest and are determined to be important links necessary for maintaining continuity of large tracts of contiguous pine dominated habitat.
 - *Rationale: Where habitat for species requiring contiguous pine dominated habitat in large tracts, the conversion of hardwood-pine sites to pine-hardwood sites should be considered since often, these hardwood-pine sites are located adjacent to pine dominated stands and contain suitable site characteristics that make them suitable for either pine or hardwood dominance.*
- Limit regeneration patch sizes in pine and pine-hardwood forest types:
 - *Rationale: Patch size on the south end of the forest within pine dominated forest types should be limited because the south end of the forest offers the best and only potential for providing habitat for species that require large tracts of interior mature pine dominated forest.*
 1. Regeneration patch size for *restoration* of pine or pine-hardwood forest types will not exceed 40
 - *Rationale: It is understood that for restoration purposes, there will be a need to accelerate regeneration of these forest types and increasing patch size is one method of doing that.*
 2. Regeneration within pine or pine-hardwood forest types for *non-restoration* purposes will not exceed 25 acres (RCW FEIS and current FLMP)
 - *Rationale: Limiting patch size will help maintain the continuity of mature pine-hardwood forest types.*
- Avoid creation of permanent or temporary barriers that inhibit or prevent movement of forest-interior pine-dependent species between areas of activity.
 - *Rationale: The creation of permanent and temporary barriers on the south end of the forest within pine dominated forest types should be limited because the south end of the forest offers the best and only potential for providing habitat for species that require large tracts of mature pine dominated forest and habitat for these species could be fragmented by the unlimited creation of permanent or temporary barriers.*
- Provide some overstory pine habitat within regeneration areas.
 - *Rationale: Because the south end of the forest offers the best and only potential for providing habitat for species that require large tracts of mature pine dominated forest, the retention of some pine habitat within the overstory of regeneration areas may provide for a mature pine component within these stands and mitigate the potentially fragmenting effects to mature pine dominated habitat*

that could occur were no mature pine overstory retained. This standard will also provide an open forest canopy condition within this habitat association.

- Regeneration areas where contiguous habitat for forest-interior pine-dependent species may be limited will retain 40 square feet of pine BA when it is available.
 - *Rationale: Maintaining a 40 BA of pine will maintain attributes of a mature pine-hardwood stand while also allowing stand regeneration.*
 1. Trees retained should be selected in the following order:
 - relict trees,
 - other potential cavity trees,
 - *Rationale: Retention of these trees will ensure that trees most likely to develop heart-rot and provide habitat for cavity dependent species are provided.*
 - other trees > 10” that represent the best seed producers (RCW FEIS)
 - *Rationale: Retention of these trees will provide the best natural seed source for the stand to be regenerated.*

IV. Management Needs: Monitoring and Inventory to Ensure Species Viability

There are basically no species listed in Attachment A that would fail to persist on the DBNF if the Dry-Xeric Pine-Oak Habitat Association was not maintained on the Forest, as long as Southern Yellow Pine and Dry-Xeric Oak Habitat Associations are provided. Because the DBNF is a hardwood-dominated forest overall, those species identified in Attachment A that are attracted to the hardwood component of dry-xeric pine-oak habitats would not likely be greatly affected by loss of this habitat association on the Forest. However, the presence of pine and open, fire-maintained habitat is a more limiting factor on the DBNF and many species would persist in much lower numbers on the DBNF if the sites recommended in this analysis for pine-hardwood management were converted to hardwood-dominated systems or were not maintained by some level of burning. For this reason, it is recommended that species that are most dependent upon the pine and fire component of this habitat association be monitored. Those species are:

Pine warbler, Red-cockaded woodpecker, Pitch pine

The two bird species are currently being monitored on an annual basis through the DBNF's implementation of the Southern National Forests' Migratory and Regional Landbird Conservation Strategy, as well as thru the use of roadside point counts and it is recommended that this monitoring be given high priority and allowed to continue to ensure our awareness of persistence of these species. Currently, the DBNF monitors the presence of pitch pine and other tree species in its ongoing CISC and it is recommended that this be given high priority and continue on a regular basis.

The condition of the dry-xeric pine-oak community should also be monitored by including attributes such as midstory density, understory description and condition, and a past history of stand treatments as part of the regular field inventory of stands. Conduct field inventories to gain data on a number of stand/site attributes such as soil conditions, slope, aspect, dominant and codominant stem densities, midstory and understory composition, and estimation of site quality. Utilize existing databases such as CISC, Forest Inventory, as well as GIS spatial data, aerial photographs, historical land use patterns, etc. Utilize Forest Service Ecological Classification System descriptions of Landtypes and Landtype Phases, which are based largely upon material outlined by Smalley (1983; 1984; 1986). Prior to making decisions that affect stand composition of individual sites on the forest, this information should be gathered to provide guidance as to what management decisions would be best for restoring or maintaining a dry-xeric pine oak community on a particular site, or in some cases, to justify management of the site for some other habitat association. This stand inventory monitoring would be given high priority.

Monitoring should also be conducted the summer following burning to determine natural pine and oak stocking as a result of burning activities. This monitoring may be given medium priority but will reveal whether or not the burn reached the objective of improving pine or oak viability in the site or had a negative effect upon the stand and its desired condition.

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Attachment A.

Species List: Dry-Xeric Mixed Pine-Oak

Class	Common Name/ Species
ANIMALS	
Amphibians	Green Salamander/ <i>Aneides aeneus</i>
Birds	Sharp-shinned Hawk/ <i>Accipiter striatus</i> Bachman's Sparrow/ <i>Aimophila aestivalis</i> Chuck-will's Widow/ <i>Caprimulgus carolinensis</i> Eastern Wood-Pewee/ <i>Contopus virens</i> Cerulean Warbler/ <i>Dendroica caerulea</i> Prairie Warbler/ <i>Dendroica discolor</i> Yellow-throated Warbler/ <i>Dendroica dominica</i> Blackburnian Warbler/ <i>Dendroica fusca</i> Pine Warbler/ <i>Dendroica pinus</i> Least Flycatcher/ <i>Empidonax minimus</i> Red-headed Woodpecker/ <i>Melanerpes erythrocephalus</i> Red-cockaded Woodpecker/ <i>Picoides borealis</i> Summer Tanager/ <i>Piranga rubra</i> Ovenbird/ <i>Seiurus aurocapillus</i> Red-breasted Nuthatch/ <i>Sitta canadensis</i>
Reptiles	Eastern Slender Glass Lizard/ <i>Ophisaurus attenuatus longicaudus</i> Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i> Southeastern Crowned Snake/ <i>Tantilla coronata</i>
PLANTS	
Dicots	American Chestnut/ <i>Castanea dentata</i> Allegheny Chinquapin/ <i>Castanea pumila</i> var. <i>pumila</i> Sweet-fern/ <i>Comptonia peregrina</i> Box Huckleberry/ <i>Gaylussacia brachycera</i> Red-disked Sunflower/ <i>Helianthus atrorubens</i> American Cow-wheat/ <i>Melampyrum lineare</i> var. <i>pectinatum</i> American Chaffseed/ <i>Schwalbea americana</i> Spiked Hoary-pea/ <i>Tephrosia spicata</i>
Monocots	Appalachian Spreading Pogonia/ <i>Cleistes bifaria</i> Pink Lady-slipper/ <i>Cypripedium acaule</i> Bearded Skeleton Grass/ <i>Gymnopogon ambiguus</i>
Mosses	Dog Paw Moss, Elegant Moss/ <i>Dicranum scoparium</i>

Attachment B.

Dry Xeric Mixed Pine-Oak Species/Habitat Relationships with References

ANIMALS

Amphibians

Green Salamander – *Aneides aeneus* – The green salamander lives in damp crevices in shaded rock outcrops and ledges. In cove hardwoods, this salamander can be observed under bark and cracks of trees (Gordan, 1967). In the general forested area, the green salamander occurs in mucky, boggy water among decaying leaves and logs around woodland streams and ponds (The Center for Biodiversity Studies, 2001). The green salamander has also been observed in upland pine areas, Virginia pine and white pine-hemlock with mountain laurel occupying the understory. Moist outcrops are required for egg depositing and larval development. (Wilson, 1995).

Birds

Sharp-shinned Hawk – *Accipiter striatus* – During the year, sharp-shinned hawks utilize both hardwoods and conifers and, in general, are most abundant in areas where a mixture of tree types exists. Although they are known to nest in hardwoods, birds in Kentucky seem to prefer evergreens for nesting and over-wintering and would be attracted to the evergreen pines in this habitat association during that period. A large, mature pine is a typical nesting site, provided it is within an extensive tract of forest. Although sharp-shinned hawks are observed (particularly when foraging) in areas having a mix of forested and semi-open habitat, they more frequently occur in forested tracts and are considered forest interior birds (Hamel, 1992).

Bachman's Sparrow – *Aimophila aestivalis* – This species typically requires dense grassy places where scattered trees or saplings are present, usually in pine forests (Hamel, 1992). Historically, it was found in mature to old growth southern pine woodlands subject to frequent growing-season fires (NatureServe, 2001). This provided the grassy undergrowth required by this species. This species formerly inhabited a variety of early successional habitats in Kentucky (Palmer-Ball, 1996). Bachman's sparrow would be particularly attracted to the pine component of the dry-xeric pine-oak forest as well as the open, frequently burned conditions of these forests.

Chuck-will's Widow – *Caprimulgus carolinensis* – This species tends to favor mixed oak and pine stands (DeGraaf et. al., 1991). It may occur and breed in general woods and forests that are primarily dry or mesic (Hamel, 1992). It appears to be much more common in drier forest where the understory and midstory levels are relatively open (Palmer-Ball, 1996). It typically feeds over adjacent fields and clearings (Hamel, 1992). Chuck-will's widow would be particularly attracted dry-xeric and open, frequently burned conditions of the dry-xeric pine-oak forest

Eastern Wood Pewee – *Contopus virens* – This species' preferred habitat is rather open mature woodland in a rather dry situation (Hamel, 1992). This species may be absent from younger, second growth forest where an open midstory has not yet developed. In such habitat they often frequent edges and road or stream corridors (Palmer-Ball, 1996). They typically utilize large deciduous trees for the nest site but may use conifers in mixed forest types. This species may be

found in numbers in most major forest types examined in Kentucky (Mengel, 1965). Eastern wood pewees would be particularly attracted to the hardwood component of the dry-xeric pine-oak forest as well as the open, frequently burned conditions of these forests.

Cerulean Warbler – *Dendroica caerulea* – This species would be primarily attracted to the hardwood component of mixed pine-oak stands. Cerulean warblers depend primarily on extensive tracts of mature, relatively undisturbed, deciduous forest. These birds occur in floodplains and upland sites that have large trees (> 20" dbh) in which to nest. Both nesting and foraging take place in the canopies of hardwoods. Stands are usually somewhat open, with little understory; however, according to Buehler and Nicholson (1997), monitoring data suggest that breeding territories in the Cumberland Mountains tend to have fewer canopy trees and greater shrub coverage than those elsewhere (1997). The birds are rarely found in tracts less than 250 hectares, whereas maximum population densities occur in tracts greater than 3000 ha (Buehler and Nicholson 1997). Hamel gives a minimum tract size of 1750 ha (1992).

Prairie Warbler – *Dendroica discolor* – Prairie warblers occur in semi-open, early successional, and woodland habitats. Mixed forest type, especially those that have been cut-over or burned, with pines and cedars are occupied. Forest edges, clearings, brushy borders, and overgrown fields with scattered saplings or small trees are commonly used. On the Daniel Boone National Forest, the birds are nearly always found in early successional habitat, especially young pine clearcuts, the undergrowth of shelterwood cuts, wood edges, and in stands that have been burned (L. Perry, pers. obs.).

Yellow-throated Warbler – *Dendroica dominica* – In some areas, hardwood-pine is used; however, birds on the Cumberland Plateau show a preference for pine (Mengel 1965) and the pine component of dry-xeric pine-oak forests is attractive to this species. Sites may range from moderately moist to dry/upland, provided the stands are rather open and have large trees (> 20" dbh). On the Daniel Boone National Forest, the birds are frequently observed in mature pine trees, and almost always observed in or near pines; they are frequently seen in stands with open canopies (L. Perry, pers. obs.).

Blackburnian Warbler – *Dendroica fusca* – The blackburnian warbler has a slight preference for forests of hardwoods mixed with hemlocks, spruce and fir (Hamel 1992). On the Daniel Boone National Forest, this species has only been encountered during periods of migration and would not be expected to breed on the Daniel Boone National Forest except in areas where elevations are greater than 3500', of which there are few of. This is a forest interior species of higher elevations, with most of the birds that are recorded in the Cumberland and Southern Appalachians occurring above 3500 feet (Hamel, 1992). A variety of coniferous and mixed forest types are utilized, with deciduous habitat being used to a greater extent in this southern part of the breeding range (DeGraaf et. al., 1991). Extensive tracts of mature forest, with large (> 20" dbh) nesting trees, are required (Hamel, 1992). This species may be particularly attracted to the evergreen pine component of mixed pine-hardwood stands during its migration.

Pine Warbler – *Dendroica pinus* – Pine warbler habitat consists of open to fairly dense stands of yellow pine and pine-hardwood. Although most numerous in extensive pine stands, the birds will use small stands of pine, as well (Mengel 1965). Suppression of fire has contributed to reduction

of pine in some areas (Palmer-Ball, 1996). Both middle-aged and mature stands are used; however, nesting is usually in mature pines.

Least Flycatcher – *Empidonax minimus* – This is a species of open conditions; it is rarely encountered deep in the forest. Open, deciduous woods (particularly those that have been disturbed by burning or logging), forest edge, fields with scattered large trees, and other habitats that provide early successional conditions are utilized. During spring migration, Mengel (1965) observed male birds in alders and willows in a marshy, Laurel County meadow. Most of the breeding population frequents elevations above 2500 feet. Least flycatchers would be particularly attracted to the hardwood component of the dry-xeric pine-oak forest as well as the open, frequently burned conditions of these forests.

Red-headed Woodpecker – *Melanerpes erythrocephalus* – Semi-open to open habitat with an abundance of large (> 14" dbh), dead trees is preferred for both breeding and wintering purposes. Relatively open, mature woods, swamps, clearings within mixed woodland, forest edges, and places where groves of trees are present, such as park-like settings, are commonly used. On the Daniel Boone National Forest, the birds are often observed in pine-dominated stands that have been frequently burned (L. Perry, pers. obs.). Nesting is in dead trees, or in dead limbs of live trees (Mengel 1965). This species generally avoids mature closed canopy forest during the breeding season (Palmer-Ball, 1996). The open, xeric conditions commonly found in this habitat association would be preferred by this species, as well as the oaks, which are used as a food source for the red-headed woodpecker.

Red-cockaded Woodpecker – *Picoides borealis* – Habitat for this species is generally thought of as being primarily open pine woods. Habitat is generally fairly mature forest with little or no midstory. The birds prefer conditions of minimal understory (Hamel, 1992). It is likely that the red-cockaded woodpecker used forests that were maintained by natural fires (Palmer-Ball, 1996). On the Daniel Boone National Forest this species seems to be attracted to open, frequently burned pine dominated stands where it selects live mature pine trees for nesting (L. Perry, pers. observation). These stands contain cavity trees that typically range in age from 90 to 128 years old and have an average diameter at breast height of 14.2-18.9 inches (Murphy, 1980). Due to southern pine beetle impacts to the primary habitat of this species, all known red-cockaded woodpeckers on the Daniel Boone National Forest were relocated out of state to suitable habitat in other populations.

Summer Tanager – *Piranga rubra* – Relatively dry sites, which tend to produce stands of a semi-open condition, are frequented by this species. Uplands are commonly used, but the birds may occur in a variety of habitats, including bottomlands and wooded residential areas. Forest types range from hardwood to pine-hardwood stands of open to medium density. On the Daniel Boone National Forest, the birds are frequently found in mature, mixed pine stands that have been burned and undergone midstory removal (L. Perry, pers. obs.). Oaks in open woodland or forest edge and often over open spaces such as roads and clearings are often chosen for nesting (Mengel 1965). Wild turkeys would be particularly attracted to the oak component of the dry-xeric pine-oak forest as well as the open conditions of these forests.

Ovenbird – *Seiurus aurocapillus* – Mature and second growth forest conditions are utilized, on dry to moderately moist sites with light to moderate understory. Ovenbirds are more common in

stands with closed canopies and open ground. This is a ground nesting species that forages in the leaf litter or on the soil. Mengel (1965) observed nests on logging roads and under small logs, sheltered by ferns, on steep, mesophytic slopes; however, Baker and Lacki (1997) note that birds are more abundant in non-harvested than in harvested areas. Upland stands and sloping terrain are preferred, but a variety of deciduous and mixed (e.g., pine-oak) forest types are used. This is a forest interior species having a minimum necessary tract size of 15 ha (Hamel, 1992). Ovenbirds would be particularly attracted to the hardwood component of the dry-xeric pine-oak forest as well as the open and somewhat drier conditions of these forests.

Red-breasted Nuthatch – *Sitta canadensis* – Though this nuthatch is dependent on coniferous habitat, its requirements vary considerably between seasons. It generally breeds at elevations above 3500 feet, in dead spruce or fir trees. Occasionally, it will nest in hemlock and, rarely, in pine. Suitable snags (dead trees) are greater than 6" dbh (six inch diameter at breast height). Mature stands are favored. The red-breasted nuthatch prefers to overwinter in dense stands of conifers and pine-oak and would be particularly attracted to the pine component of pine-oak forests during this time. During that time, the birds are not particular to age class so much as to stand density. On the Daniel Boone National Forest, when these birds are encountered in winter, it is almost always while feeding in pines—especially mature Virginia pines having a lot of cones (L. Perry, pers. obs.).

Reptiles

Eastern Slender Glass Lizard – *Ophisaurus attenuatus longicaudus* – This is a species of dry, often sandy, soil conditions. It occurs in relatively open, typically upland, habitats—including Virginia and shortleaf pine and pine-oak stands, forest edges, grassy fields and prairies—which have loose, friable soils. This secretive, legless lizard tends to stay in old rodent burrows and under mats of dead grass and decomposing plants; when it basks in the sun, it is often hidden in tall grass or with only part of its body showing (VA Dept. of Game and Inland Fisheries, 2001). Slender glass lizard diets include insects, spiders, birds' eggs, smaller lizards, and snakes. Prescribed burning and other management practices that help to create open canopy conditions benefit this lizard species.

Northern Pine Snake – *Pituophis melanoleucus melanoleucus* – Pine snakes inhabit dry, sandy pine and pine-oak forest types with open canopies and patchy to dense ground cover. Eastern Kentucky sites are typically upland or ridgetop, whereas, at lower elevations, the snakes utilize pine flatwoods and sandhill areas. Forest openings with scattered areas of well-drained sand and little shrub cover are required for nesting and hibernation sites (NatureServe, 2001). These secretive snakes spend much of their time in burrows, emerging to hunt for small mammals, birds and eggs; they climb trees well. Loose or friable soil is needed, since the snakes excavate their own burrows as well as use those made by small mammals. This species requires a relatively large area in which to forage (Wilson 1995). Management practices, including midstory control and prescribed burning, promote and maintain barrens-like condition (open stands with well-lit, grassy understories) and are necessary to support the species.

Southeastern Crowned Snake – *Tantilla coronata* – The southeastern crowned snake ranges from southcentral Virginia and southern Illinois to the Florida panhandle and eastern Louisiana. This secretive snake is an excellent burrower, spending much of its time concealed in rotting logs,

under bark, stones, leaf litter, pine needles, or burrowed in the soil. The southeastern crowned snake apparently prefers relatively xeric, well-drained soils in pine flatwoods, sandhills and dry hillsides. This snake requires dry habitats with friable soil and sufficient debris for shelter. Females deposit eggs in rotting logs or sawdust piles. The southeastern crowned snake's diet consists of centipedes, spiders, termites, and other small, soft-bodied arthropods. (Wilson, 1995).

PLANTS

Dicots

American Chestnut -- *Castanea dentata* – American chestnut is far less common today than it once was. A fungal disease introduced from Asia in 1904 decimated the species in about 30 years. The species sprouts prolifically and sprouts are still found through its range. American chestnut once dominated much of what is now upland oak forest. On what is now Daniel Boone National Forest land, American chestnut was found on narrow sandstone and conglomerate ridges along the edge of the escarpment and in the Redbird area. It was associated with chestnut oak. Scarlet and black oaks replaced it on these sites. Today on the Daniel Boone National Forest, sprouts are common to scarce on upper slopes and ridges near the escarpment and on portions of the Redbird District. The species grows on acid soils that are generally poor, dry, and located on sites subject to fire. It is believed that fire promoted the species.

Allegheny Chinquapin -- *Castanea pumila* var. *pumila* – The Allegheny chinquapin is found in dry upland oak or oak-yellow pine forests. It usually occurs where midstory and shrub layers are sparse, or the canopy is open. The species at least somewhat adapted to fire, sprouting readily after fire. It may respond to fire in the way American chestnut and oaks do.

Sweet Fern – *Comptonia peregrina* – Sweet fern is associated with open, sterile, sandy ground throughout most of its range, where it forms dense, low thickets. In this habitat, fires probably helped maintain the habitat. On the Daniel Boone National Forest, this species inhabits open cobble/boulder bars along free-flowing rivers. The plants are found rooted deep in the crevices between boulders. The cobble/boulder bars are subject to periodic scouring during high water events. Scouring prevents or retards the establishment of trees in these habitats helping to maintain the open condition.

Box Huckleberry -- *Gaylussacia brachycera* – This huckleberry is a central Appalachian species. It occurs in upland yellow pine and yellow pine-oak woods. Yellow pine is present in or adjacent to all sites on the Daniel Boone National Forest. It is also found on sandstone glades and in the upland portions of utility rights-of-way. The species appears to require well-drained, sandy soils. *Gaylussacia* will grow in closed canopy (yellow pine) conditions if the midstory and shrub layers are more or less absent. On the Daniel Boone National Forest, the densest, and apparently the healthiest populations, are found in these sites. It also grows under more open canopy conditions where it is tolerant of thicker midstory and shrub layers. The rhizomes are positioned at the transition between the duff and mineral soil. Fire maintains the general habitat in which it grows. The species is top killed by fire, but does resprout, at least if the duff layer is not removed. Recovery appears to be slower than for other *Gaylussacia* species or *Vaccinium*

species, but with the proper interval and intensity of fire, populations should be maintained while enhancing habitat.

Red-disked Sunflower -- *Helianthus atrorubens* – This sunflower is a southern and prairie species commonly occurring in warm season grassland. It also is found in open yellow pine forest. On the Daniel Boone National Forest, this species is most abundant in warm season grassland. This habitat in powerline rights-of-way holds most of the Daniel Boone National Forest population. Scattered plants and clumps are found in open yellow pine and yellow pine-oak forest. Fire enhances flowering of this species and maintains its habitat.

American Cow-wheat -- *Melampyrum lineare* var. *pectinatum* – American cow wheat has been carried as var. *lineare* on the Daniel Boone National Forest based on a literature citation. Medley (1993) argues against this and places all plants in the Daniel Boone National Forest area in var. *pectinatum*. This is a coastal plain species. It is found in sandy, open yellow pine forest. On the Daniel Boone National Forest, the sole station for the species is from ridgetop dry-xeric oak and oak-yellow pine forest.

American Chaffseed – *Schwalbea americana* – American chaffseed occurs in two general kinds of habitats, wet and dry. In all cases, soils are sandy and somewhat sterile. In wet habitats, the combination of constant water and periodic fire maintain the site in an open condition. The overstory is open as are the midstory and shrub layers beneath it. Generally, wet sites are grassy with few shrubs. Periodic fire helps to maintain the open condition of the sites. It also plays a role in triggering flowering. This habitat type is not known from the Daniel Boone National Forest. Dry habitats likewise are open with a thin overstory and open midstory and shrub layers. These sites are generally a mixture of forbs, grasses, and low shrubs. Some dry habitats are subjected to periodic burns, which help to maintain the open condition. Fire here also helps to trigger flowering. In other dry habitats, the openness is more edaphically controlled. The historic sites on the Daniel Boone National Forest fall into this group. Here, fire would have triggered flowering. Other dry Daniel Boone National Forest sites could, with periodic fire, support *Schwalbea* populations.

Spiked Hoary-pea – *Tephrosia spicata* – Spiked hoary pea is a southern species with a number of more northern stations. It is commonly found in dry to wet, open yellow pine or yellow pine-hardwood forest, roadsides, clearings and fields. On the Daniel Boone National Forest, the species is found on boulder/cobble bars along larger streams and rivers of the Cumberland River drainage. A few sites are known from sandy, sparsely shaded openings on ridges.

Monocots

Appalachian Spreading Pogonia -- *Cleistis bifaria* – The Appalachian spreading pogonia ranges from the Appalachian Plateaus to the Piedmont. It is found in a variety of sites ranging from glades to open forest to warm season grassland to streamhead wetlands. It occurs on well-drained substrates (on hummocks in wetlands) usually in open or partially open conditions. The plants can be single or occur in colonies. On the Daniel Boone National Forest, it is known from glades, streamhead wetlands, seep slopes, and on road cuts in upland oak forest. Fire enhances flowering and total numbers of plants. Fire probably helps to maintain habitat as well.

Pink Lady's-slipper – *Cypripedium acaule* – The pink lady's-slipper occurs in acid forests or wetlands (usually sphagnum bogs) across its range. On the Daniel Boone National Forest, pink lady-slipper is found in upland oak and mixed pine-oak woods, and occasionally on hummocks within seeps and streamhead wetlands. It occurs in light to heavy shade, but does not seem to flower unless in somewhat open conditions. This species responds well to burning. It is not uncommon to find 3 to 4 dozen plants in flower and as many more in vegetation condition following a fire where only a dozen or so were found before. The species is experiencing collection pressure from root diggers. Digging of this species is not permitted on the Daniel Boone National Forest.

Bearded Skeleton Grass – *Gymnopogon ambiguous* – Bearded skeleton grass is a coastal plain species that generally occurs in dry, sandy, open forest. It may also occur in open grassland. On the Daniel Boone National Forest, it occurs in open warm season grassland and open, sandy ground with or without light forest cover.

Mosses

Dog Paw Moss or Elegant moss – *Dicranum scoparium* – This moss is found throughout most of eastern North America. It is relatively common on shaded sandstone boulders, outcrops and cliffs. It also occurs on soil in upland forest. It appears to require moderate shade and acid conditions, but will live in moist to dry environments. The species is often subject to fire and frequently portions of clumps are burned, but not the entire clump. The species is collected for the horticultural industry. It may serve as a refugium for some species during fire events, and act as water reservoir and soil stabilizer following fire.

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Attachment C.

Dry-Xeric Mixed Pine-Oak Habitat Association Matrix

Association	Habitat	Modifier	Class	Common/Species
8-Dry-Xeric Pine-Oak	Dry-Xeric Pine-Oak Forest	(blank)	AMPHI	Green Salamander/ <i>Aneides aeneus</i>
			BIRD	Chuck-will's widow/ <i>Caprimulgus carolinensis</i>
				Eastern wood pewee/ <i>Contopus virens</i>
				Red-cockaded Woodpecker/ <i>Picoides borealis</i>
				Red-breasted Nuthatch/ <i>Sitta canadensis</i>
			P-DIC	American Cow Wheat/ <i>Melampyrum lineare</i> var. <i>pectinatum</i>
			P-MON	Pink Lady-slipper/ <i>Cypripedium acaule</i>
		Acidic Substrate	P-MOS	Dog Paw Moss, Elegant Moss/ <i>Dicranum scoparium</i>
		Burrows, Holes, Tunnels (Secondary Users)	REPT	Eastern Slender Glass Lizard/ <i>Ophisaurus attenuatus longicaudus</i>
				Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i>
		Closed Forest Canopy	BIRD	Ovenbird/ <i>Seiurus aurocapillus</i>
		Dense shrub understory		Ovenbird/ <i>Seiurus aurocapillus</i>
		Downed Logs	REPT	Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i>
				Southeastern Crowned Snake/ <i>Tantilla coronata</i>
		Drainage Good		Eastern Slender Glass Lizard/ <i>Ophisaurus attenuatus longicaudus</i>
				Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i>
		Dry	BIRD	Summer tanager/ <i>Piranga rubra</i>
				Ovenbird/ <i>Seiurus aurocapillus</i>
				Chuck-will's widow/ <i>Caprimulgus carolinensis</i>
			P-DIC	Spiked Hoary-pea/ <i>Tephrosia spicata</i>
			P-MON	Pink Lady-slipper/ <i>Cypripedium acaule</i>
				Bearded Skeleton Grass/ <i>Gymnopogon ambiguus</i>
			REPT	Eastern Slender Glass Lizard/ <i>Ophisaurus attenuatus longicaudus</i>
				Southeastern Crowned Snake/ <i>Tantilla coronata</i>
		Elevation (above 2300 ft)	BIRD	Blackburnian warbler/ <i>Dendroica fusca</i>
				Least flycatcher/ <i>Empidonax minimus</i>
				Red-breasted Nuthatch/ <i>Sitta canadensis</i>
		Fire Dependent		Red-cockaded Woodpecker/ <i>Picoides borealis</i>
		Fire Tolerant/Enhanced		Bachman's Sparrow/ <i>Aimophila aestivalis</i>
				Pine warbler/ <i>Dendroica pinus</i>
				Least flycatcher/ <i>Empidonax minimus</i>
				Red-headed woodpecker/ <i>Melanerpes erythrocephalus</i>
				Red-cockaded Woodpecker/ <i>Picoides borealis</i>
		Forb/Grass Condition		Bachman's Sparrow/ <i>Aimophila aestivalis</i>
		Forest Interior (Minimal Edge)		Sharp-shinned Hawk/ <i>Accipiter striatus</i>
				Cerulean Warbler/ <i>Dendroica caerulea</i>
				Yellow-throated Warbler/ <i>Dendroica dominica</i>

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Association	Habitat	Modifier	Class	Common/Species
				Ovenbird/ <i>Seiurus aurocapillus</i>
		Forest Interior (Minimal Edge)	BIRD	Blackburnian warbler/ <i>Dendroica fusca</i>
		Large Decadent Trees		Sharp-shinned Hawk/ <i>Accipiter striatus</i>
				Eastern wood pewee/ <i>Contopus virens</i>
				Yellow-throated Warbler/ <i>Dendroica dominica</i>
				Red-cockaded Woodpecker/ <i>Picoides borealis</i>
		Leaf Litter		Ovenbird/ <i>Seiurus aurocapillus</i>
			REPT	Eastern Slender Glass Lizard/ <i>Ophisaurus attenuatus longicaudus</i>
				Southeastern Crowned Snake/ <i>Tantilla coronata</i>
		Mature forest	BIRD	Eastern wood pewee/ <i>Contopus virens</i>
				Cerulean Warbler/ <i>Dendroica caerulea</i>
				Yellow-throated Warbler/ <i>Dendroica dominica</i>
				Blackburnian warbler/ <i>Dendroica fusca</i>
				Pine warbler/ <i>Dendroica pinus</i>
				Red-headed woodpecker/ <i>Melanerpes erythrocephalus</i>
				Red-cockaded Woodpecker/ <i>Picoides borealis</i>
				Summer tanager/ <i>Piranga rubra</i>
				Red-breasted Nuthatch/ <i>Sitta canadensis</i>
		Mid-age Forest		Eastern wood pewee/ <i>Contopus virens</i>
				Pine warbler/ <i>Dendroica pinus</i>
		Old Growth Condition		Red-cockaded Woodpecker/ <i>Picoides borealis</i>
		Open (Little or No Shade)	BIRD	Summer tanager/ <i>Piranga rubra</i>
			P-DIC	Purple False Foxglove/ <i>Agalinus decemloba</i>
				Red-disked Sunflower/ <i>Helianthus atrorubens</i>
			P-MOS	Dog Paw Moss, Elegant Moss/ <i>Dicranum scoparium</i>
		Open Forest Canopy	BIRD	Yellow-throated Warbler/ <i>Dendroica dominica</i>
				Pine warbler/ <i>Dendroica pinus</i>
				Least flycatcher/ <i>Empidonax minimus</i>
				Red-headed woodpecker/ <i>Melanerpes erythrocephalus</i>
				Summer tanager/ <i>Piranga rubra</i>
			P-DIC	American Chestnut/ <i>Castanea dentata</i>
				Allegheny Chinquapin/ <i>Castanea pumila</i> var. <i>pumila</i>
				Red-disked Sunflower/ <i>Helianthus atrorubens</i>
			P-MON	Appalachian Spreading Pogonia/ <i>Cleistes bifaria</i>
			REPT	Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i>
				Southeastern Crowned Snake/ <i>Tantilla coronata</i>
		Open Midstory/Understory	BIRD	Bachman's Sparrow/ <i>Aimophila aestivalis</i>
				Chuck-will's widow/ <i>Caprimulgus carolinensis</i>
				Eastern wood pewee/ <i>Contopus virens</i>
				Cerulean Warbler/ <i>Dendroica caerulea</i>
				Red-cockaded Woodpecker/ <i>Picoides borealis</i>
				Summer tanager/ <i>Piranga rubra</i>

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			P-DIC	Box Huckleberry/ <i>Gaylussacia brachycera</i>
			REPT	Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i>
		Riparian	REPT	Eastern Slender Glass Lizard/ <i>Ophisaurus attenuatus longicaudus</i>
		Rocky/Rocks		Southeastern Crowned Snake/ <i>Tantilla coronata</i>
				Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i>
		Sandy Soil	P-DIC	Sweet-fern/ <i>Comptonia peregrina</i>
				American Chaffseed/ <i>Schwalbea americana</i>
			REPT	Northern Pine Snake/ <i>Pituophis melanoleucus melanoleucus</i>
		Shrub/Sapling Condition	BIRD	Prairie warbler/ <i>Dendroica discolor</i>
				Least flycatcher/ <i>Empidonax minimus</i>
				Ovenbird/ <i>Seiurus aurocapillus</i>
		Slope (hillside, steepness)		Ovenbird/ <i>Seiurus aurocapillus</i>
		Snags > 6" dbh		Red-headed woodpecker/ <i>Melanerpes erythrocephalus</i>
		Tract Size (Area Sensitive)		Ovenbird/ <i>Seiurus aurocapillus</i>
				Pine warbler/ <i>Dendroica pinus</i>
				Cerulean Warbler/ <i>Dendroica caerulea</i>
				Yellow-throated Warbler/ <i>Dendroica dominica</i>
		Tree and Snags (Cavity Nesters)		Red-headed woodpecker/ <i>Melanerpes erythrocephalus</i>
				Red-cockaded Woodpecker/ <i>Picoides borealis</i>
		Trees > 20" dbh		Yellow-throated Warbler/ <i>Dendroica dominica</i>
				Blackburnian warbler/ <i>Dendroica fusca</i>
				Red-cockaded Woodpecker/ <i>Picoides borealis</i>
		Trees > 20" dbh	BIRD	Cerulean Warbler/ <i>Dendroica caerulea</i>
		Upland (usually mesic to dry, not subject to holding water)		Yellow-throated Warbler/ <i>Dendroica dominica</i>
				Ovenbird/ <i>Seiurus aurocapillus</i>
			REPT	Eastern Slender Glass Lizard/ <i>Ophisaurus attenuatus longicaudus</i>
		Water (Distance Sensitive)		Southeastern Crowned Snake/ <i>Tantilla coronata</i>