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Viability Assessment Report For Riparian Habitat Association

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I. Description of Habitat Association

Six distinct habitat types are included in this association. All occur in conjunction with stream corridors. The habitats are related in proximity to a stream, and the function of ground and surface water within the habitats. Three habitat types are found within the stream channel itself: Sand/Gravel/Cobble Bars, Boulder (Scour) Bars, and Stream Banks. The other three are found on a stream floodplain or terrace; these are Eastern River Front Forest, River Floodplain Forest and Canebrakes. Each of the six habitats will be addressed individually. In addition, Swamp, and several grassland types, which may occur in a riparian setting on floodplains or terraces, are described under the Seeps/Swamp Habitat and Grasslands Habitat Associations.

A. Sand/Gravel/Cobble Bars

This habitat type occurs along larger streams and rivers. It occurs on all districts of the Daniel Boone National Forest (DBNF), and probably to some degree, within each of the landtype associations (LTAs) found on the forest. They are most common on streams cut through sandstone dominated areas. It is found at stream's edge just above the normal summer water level to about 6 ft (2 m) above the normal summer water level. As the name implies, it is composed of a combination of sand, gravel or cobble, any combination of which may be dominant at a particular site. Sandstone, shale and coal are the most common rock types, but limestone may be present or even dominant in a few locations. Soils are not developed on these sites, consisting only of sand (0.5-4 in, 1-10 cm deep) or a thin organic duff. Water shapes and maintains these sites. Floods scour live and dead woody vegetation, sand and rock materials off of the bars, and deposit dead woody material, sand and rock materials on the bars. Winter and spring flood events, which scour the bars, are frequent. The sites may pass through several summers in a row without scouring or be scoured multiple times in one summer.

Photosynthesis is the major source of energy for this habitat type. The associated stream brings a variety of organic materials to the sites during the year. Leaf and wood material fall from adjacent and on-site vegetation providing additional energy sources.

When vegetated, the habitat is dominated by herbaceous species. Frequently the species are those associated with prairie flora such as big and little bluestems, false indigo, asters, spiked goat's-rue, and goldenrods. Smartweeds and wild ramie are also common. Woody species found on the bars include poison ivy, shrub dogwood, white pepperbush, and

stunted individuals of sycamore, river birch and red maple. Occasionally a larger individual of sycamore or river birch is found.

B. Boulder (Scour) Bars

This habitat type occurs along larger streams and rivers. It occurs on all districts of the DBNF, and probably to some degree, within each of the LTAs found on the Forest. They are most common on streams cut through sandstone dominated areas. It is found at stream edge just above the normal summer water level to about 6 ft (2 m) above the normal summer water level. Boulder bars often occur in association with sand/gravel/cobble bars, frequently forming a complex gradation of habitats including pockets of sand, gravel and organic matter. In some cases, the boulder bars are immediately adjacent to the stream, and may extend into the stream forming rapids and chutes. Sand/gravel/cobble bars may form on the land side of these boulder bars. In other cases, sand/gravel/cobble bars may be adjacent to the stream, and the boulder bars behind them on the land side. Sandstone is the most common rock type, but limestone may be present or even dominant. Soils are not developed on these sites, consisting only of pockets of sand (1-10 cm, 0.5-4 in deep) or thin organic duff. Water shapes and maintains these sites. Floods scour live and dead woody vegetation, sand and rock materials off of the bars, and deposit dead woody materials, sand and rock materials on the bars. Winter and spring flood events, which scour the bars, are frequent. The sites may pass through several summers in a row without scouring or be scoured multiple times in one summer.

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The vegetation on these sites is sparse, restricted to pockets of sand or gravel, or where a plant is protected in a crevice from the worst of flood events. Most of the vegetation on these sites is dominated by herbaceous species. Frequently the species are those associated with prairie flora such as big and little bluestems, false indigo, asters, spiked goat's-rue, and goldenrods. Smartweeds and wild ramie are also common. Woody species found on the bars include poison ivy, shrub dogwood, white pepperbush, river grape, and stunted individuals of sycamore, river birch and red maple. Occasionally a larger individual of sycamore or river birch is found.

C. Stream Banks

This habitat type occurs along streams and rivers of all sizes. It occurs on all districts of the DBNF, and within each of the LTAs found on the Forest. The best developed, and most distinct, stream banks form on streams of 2nd order and larger. As defined here, it may be found at stream edge just above the normal summer water level to about 10 ft (3 m) above the normal summer water level. The transition from stream to bank may be gradual and nearly level, to abrupt and nearly vertical. Underlying rock may be sandstone, shale, siltstone, or limestone. Soils range from sand to clay with all textures between represented. Water shapes and maintains these sites. Floods scour live and dead woody vegetation, sand and rock materials off of the banks, and deposit dead woody

materials, sand and rock materials on the banks. Erosion can undercut the more vertical banks reshaping them and the habitat they provide, while deposition can build up the more level sites. Winter and spring flood events, which shape the banks, are frequent. The sites may pass through several summers in a row without flooding or be flooded multiple times in one summer.

Photosynthesis is the major source of energy for this habitat type. The associated stream brings a variety of organic materials to the sites during the year. Leaf and wood material fall from adjacent and on-site vegetation providing additional energy sources.

The vegetation on these sites varies widely depending on the stream characteristics and the characteristics of the surrounding area. Along smaller, flatter streams in sandstone areas with mesic forest cover, mosses and liverworts may dominate the stream bank. Along larger streams with higher gradient, but similar forest cover, woody species such as yellowroot, mountain pepperbush, and Carolina allspice may dominate. Steep banks are often unvegetated or they may be covered with herbaceous species such as smartweeds, clearweed, streamside aster, Virginia wild ryegrass and meehania. Woody species such as shrub dogwood, witch hazel, white pepperbush, poison ivy, and steeplejack may also be present. Occasionally trees are present; these may be any of the typical floodplain or mesic forest species. Limestone dominated areas have similar vegetation, but tend to have steeper banks. In open or disturbed areas, invasive species often are the dominants. Commonly found species include potato vine, Japanese knotweed, Japanese honeysuckle, Nepalese browntop, and kudzu. In limestone areas, shrub honeysuckle may also be present.

D. Eastern River Front Forest

This habitat type usually occurs along larger, low gradient streams and rivers. It occurs on all districts of the DBNF, and probably to some degree, within each of the LTAs found on the Forest. It occurs within floodplains, if at all, on slightly elevated ground immediately adjacent to the edge of a stream or river, hence the name 'River Front Forest.' The size of this elevated area varies from 3-16 ft (1-5 m) wide and can be 0.1 to 0.5 mi (0.2 to 0.8 km) long or longer. The habitat type occurs on shale/siltstone, limestone and sandstone/conglomerate rock. Soils are well-drained and usually sandy loams. This habitat type is subject to flooding and sediment deposition/erosion throughout the year. Usually water levels rise and fall quickly, and flooding seldom persists longer than a few days. The well-drained nature of soils present reduces water logging of roots. Streams adjacent to this habitat type are perennial.

Photosynthesis is the major source of energy for this habitat type. Water flow also provides energy to the system. It also brings in large amounts of both inorganic and organic material, including but not limited, to soil, leaves, and wood. Other energy sources come from leaves and branches falling from vegetation at and adjacent to the site.

Trees dominate the vegetation. Species usually found are sycamore and river birch. Slippery elm, hackberry and black cherry are sometimes found. These species tolerate periodic flooding, but benefit from the well-drained soils and slightly higher ground on

which they sit. There usually is not a shrub layer and the herbaceous layer is usually composed of annuals such as clearweed and jewelweed.

E. River Floodplain Forest

This habitat type usually occurs along larger, low gradient streams and rivers. It occurs on all districts of the DBNF, and within each of the LTAs found on the Forest. It occurs on the floodplain, usually on the first terrace, but is not restricted to it. River Floodplain Forest occurs behind (distal to the stream) the Eastern River Front Forest if the latter is present. It may be lower than or higher the Eastern River Front Forest depending on the terrace on which it is located. The floodplain forest can be 16-650 ft (5-200 m) or more wide and can be 0.1 to 1 mi (0.2 to 1.6 km) long or longer. The habitat type occurs on shale/siltstone, limestone and sandstone/conglomerate rock. Soils are a mixture of well drained, and poorly drained, sandy to clayey loams and heavy clays. Many have fragipans and remain more or less water logged throughout the year. This habitat type is subject to flooding and sediment deposition/erosion throughout the year. Water levels rise quickly during floods, but may remain high for days or a week or so after the flood event. Streams along which this habitat type occurs are perennial. A variant of this type occurs along the backwaters of Cave Run Lake, where flooding is in part controlled by the water level in the lake. As a result, the floodwaters may remain high for several weeks.

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Trees dominate the vegetation. Which species are found depends on the soils in a particular area. In areas with well-drained soils, species such as sycamore, river birch, tulip poplar, Ohio buckeye, slippery elm, and black cherry may be encountered. These species tolerate periodic flooding, and benefit from the well-drained, fertile soils, and adequate moisture. In poorly drained areas, sweet gum, black willow, red maple, silver maple, boxelder, and river birch may be found. Shrubs found are often the same on all soil types and include spicebush, shrub dogwood, poison ivy, and witch hazel. Herbaceous species differ somewhat by soil type. On the wetter sites, species such as smartweeds, wild ramie, deertongue, caric sedges, and rushes may be found. On drier sites, an array of species ranging from common spring wildflowers to streamside aster, Virginia wild ryegrass, ironweed, and wingstem may be found.

F. Canebrakes

This habitat type is found across the forest on all districts and probably within all LTAs on the forest. On the forest, it is associated with river floodplains, although it occasionally occurs in depauperate form in upland positions. Floodplain canebrakes are usually dense monocultures whereas upland canebrakes usually are sparse and mixed with other species. Canebrakes may occur on any of the common geologic types found on the forest. Soils are well drained, and often sandy loams. These areas are subject to flooding throughout the year, but water recedes from them quickly.

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The dominant vegetation in canebrakes is cane. Canebrakes are usually composed of just cane without any other species present. The cane is dense providing little growing room or sunlight for any other species. Forest is often along one side of the brake and may somewhat shade it.

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

To date, there has been no systematic survey for any of the riparian habitats on the DBNF. However, cooperative rare species inventories conducted between 1987 and 1993 (USDA Forest Service et al., 1988-1994) identified many locations for sand/gravel/cobble bars and boulder bars, and a few locations for river floodplain forest. Project species surveys have identified others. Data on known locations are not yet organized in spatial or tabular databases. About 25 locations for bars with rare plants on them are known, all from the Cumberland River drainage. Another two sites are known for River Floodplain Forest with unusual vegetation, both from the Cumberland River drainage. Several canebrakes are recorded from the northern end of the Forest, but others exist. Eastern River Front Forest is present on, and dispersed across, the DBNF. Stream bank habitat is present across the forest. The extent of all of these habitats is unknown. The following information is available. Around 5540 mi (8900 km) of stream, from 2nd to 9th order, are present on the DBNF. Of this, about 2714 mi (4370 km) is 3rd order or higher, which are likely to have a stream bank with habitat distinct from the surrounding land. Sand/gravel/cobble and boulder bars usually form along streams of 4th order or higher, of which there are about 751 mi (1210 km) on the DBNF. River Front Forest, River Floodplain Forest and Canebrakes are usually associated with 3rd order or higher streams, of which there are about 1394 mi (2240 km) on the DBNF (USDA Forest Service, 2001a). Land within the proclamation boundary, but not within DBNF ownership, includes about 6,000 miles (9650 km) of stream.

Stream miles present today are unlikely much changed from the miles present 200-300 years ago. The condition of the streams and associated habitats probably has changed. Land clearing over the last 200 years removed forest and canebrake vegetation from along larger streams to open land for cultivation. Some of this removed forest has grown back, but little of the cane has. Sand/gravel/cobble and boulder bars are in part a function of erosional processes. Changes in vegetation along streams directly or indirectly would have altered some of the bars, possibly removing some and creating others. Stream bank conditions have changed over the last 200-300 years as a result of natural processes and cultural influences such as clearing, farming, and the build of roads. Today there are fewer miles of wooded stream bank than were present 200-300 years ago, but more exist now on the DBNF than during the early 1900s. Between about 1900 and 1930, most of the land now comprising the DBNF was cut over and burned. This undoubtedly had an effect on these habitats.

A riparian management area (RMA) has been identified for the DBNF using GIS (USDA Forest Service 2001). This model does not identify which habitat type is present, but rather if

a particular piece of ground falls within the riparian zone. The model assigns 33 ft (10 m) to either side of 2nd order streams, 66 ft (20 m) to either side of streams 3rd order or greater, and includes all calculated riparian area to the 100 year floodplain (based on 10 m digital elevation model or DEM) of any size stream if greater than the model minimum. The model does not calculate a riparian zone for 1st order streams. Within the proclamation boundary, the model calculates 612,148 ac (247,729 ha) of riparian management area. Of this, 159,412 ac (64,512 ha) is on National Forest. As 60,349 ac (24,422 ha) of this total are accounted for by the minimum 33 ft and 66 ft zones, 99,063 ac (40,090 ha) represents the additional 100 year floodplain area outside these zones as calculated by DEM. It is in this area, the area of widest floodplain development, that Eastern River Front Forest, River Floodplain Forest, and Canebrakes are most well developed.

While much of the Cumberland Plateau is still wooded, including riparian areas, the land comprising the DBNF is more likely to maintain intact riparian habitats than other lands. The need for flat land in the business and private sectors encourages the clearing and draining of floodplain and terrace lands. Management on the DBNF is expected to clear or drain little, if any, riparian habitat.

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

The management goal for the riparian habitat association is to maintain or improve the physical, chemical and biological conditions that will result in continued functioning of the riparian system, and in a high likelihood that species within this association will persist on the forest over the planning period. (FLRMP, IV: 69,79, in part, Aquatic Assessment, p 48)

The strategy to accomplish this goal focuses on maintaining zones of limited disturbance within the habitat association. Additional standards and guidelines are also recommended when other protective measures are needed to insure the viability of a particular species associated with this habitat association.

The desired future condition of this habitat association is a generally undisturbed area within and adjacent to the riparian zone along streams, in which biological systems composed of native species, and the occasional desirable non-native species contribute to the health and natural function of riparian and aquatic systems. (Aquatic Assessment, p 49)

1. Habitat Association General Direction and Standards and Guidelines (S&G)

A. Management activities are restricted within the riparian zone

- Riparian zones forest-wide will be managed to retain a zone of generally forested and generally undisturbed (by management) ground between the stream or lake and the extent of the riparian zone (see GIS model for this area).
 - *Rationale: With rare exception, riparian zones in the east are dominated by forest vegetation. Riparian and aquatic systems evolved with forested vegetation.*

- Except on a site-specific basis, and where necessary for habitat requirements of PETS or other species at risk, areas of bare soil on stream banks and in the riparian zone will be vegetated to native or other noninvasive species, as funding and personnel allow. (Aq. Ass., p 49, in part)
 - *Rationale: While sediment derived from erosion is natural, the amount is dependent on inherent characteristics of the riparian and stream system. Alterations in vegetation or other characteristics change erosional and sedimentation rates. Some bare ground in riparian systems is natural, and species have evolved to make use of this.*
- On a site-specific basis, activities including vegetation management, can be permitted when the objective is to improve habitat conditions for PETS species.
 - *Rationale: Management activities are sometimes necessary to maintain or enhance individual species habitats.*
- Activities such as rights-of-way, foot trails, and scenic vistas may be permitted in the riparian zone as long as they do not negatively impact PETS species, their potential habitat, or degrade riparian function to an unacceptable degree. (FLRMP, IV:41,129; in part)
 - *Rationale: Limited use of the riparian zone may not affect species viability on a site-specific basis. New rights-of-way are permitted when a cleared corridor is not required.*
- Trails for motorized vehicles, horses, bicycles and other non-pedestrian means of transportation are not permitted in the riparian zone except at designated crossings and where, legal, on system roads. (Aq. Ass., p 58)
 - *Rationale: These kinds of trails have great potential to increase erosion in the riparian area and increase sediment in streams. They also increase the likelihood of invasive exotics introductions.*
- Existing system roads within the riparian zone will be analyzed for their continued need. If needed and if possible, roads will be moved out of the riparian zone and the old road put to bed with native or other non-invasive species. If needed and the current location is the only possible one, roads will be brought to, and maintained at, a standard commensurate with their use AND protection of the riparian and aquatic systems. (FLRMP, IV:30-32, 44; in part)
 - *Rationale: Roads disrupt hydrology of riparian and other systems. Minimizing the number of roads within the riparian zones improves the health and function of the system. When roads are necessary within the riparian zone, their construction and maintenance will be such as to prevent damage to the riparian zone or stream/lake.*

- New roads will be constructed outside of the riparian area, with the exception of necessary stream crossings. Crossings are to be at right angles to the stream and placed to provide the least disturbance to stream bank and channel while minimizing erosional potential. Approaches to crossings will be hardened to reduce or prevent erosion. (FLRMP, Amend. 7; in part)
 - *Rationale: Roads disrupt hydrology of riparian and other systems. Roads will at times cross streams. When they do, the placement and design of crossings should reduce or eliminate erosion of approaches and stream banks.*
- Nonforest vegetation openings are permitted within the riparian zone, but only when the habitat is needed for PETS or other species at risk. Where possible, these areas should be combined with other uses to minimize the amount of nonforest area in the riparian zone.
 - *Rationale: PETS and other species at risk may require habitat conditions not currently present. Nonforest condition is natural in riparian areas, but is of limited extent. Where other uses of the habitat do not harm the species, combining uses maintains more of the riparian zone in forest cover.*
- Manipulation of vegetative cover in the riparian area is not permitted within 5 ft of a stream or lake bank, except for the control of invasive exotic plants. When invasive species are treated, other vegetative cover will be immediately promoted if soil is exposed. Exceptions are also permitted for occasional low intensity backing fires, and single tree cutting, generally from the midstory, in seeps and wetlands that are part of a stream system. (FLRMP, Amend 7; in part)
 - *Rationale: The vegetation immediately adjacent to the bank is vital to maintain bank integrity. Invasive species on and near banks, however, rapidly take over native vegetation changing riparian characteristics. Some PETS or other species at risk require higher light conditions than may be found in some seeps or wetlands.*
- Remove invasive species from sites occupied by PETS species with as little interruption to PETS species as possible. As funding and personnel allow, remove invasive weeds from other areas within riparian zones.
 - *Rationale: Invasive species can rapidly spread in riparian zones, aided by flowing water. These species have great potential to modify and render marginal, habitat for PETS species.*
- Rehabilitate riparian habitat where it is degraded to improve riparian function when such action is expected to provide for conditions better than existing. Limit use of vehicles to the minimum needed to accomplish the project. (Aq. Ass., p. 49; in part)

- *Rationale: Management can improve riparian function when it is degraded. However, such activities must have a reasonable chance of improving conditions, and must not in and of themselves cause degradation.*
- Existing nonforest vegetation will be surveyed and analyzed for composition and structure. Areas of native vegetation will not be altered except as needed for management of PETS or other species at risk. Areas of nonnative vegetation, especially those with invasive species, may be converted to forest, other grassland types or other appropriate habitat.
 - *Rationale: Nonforest vegetation in riparian areas of the east is generally uncommon. If composed of native species, these areas should be maintained as rare communities, and habitat for PETS species or other species at risk.*
- Canebrakes will be encouraged on appropriate existing openings in riparian areas when the openings are not needed for PETS or other species at risk.
 - *Rationale: Canebrakes are part of the native vegetation found on the riparian system. This habitat type is extremely limited on the forest, but was once more common.*
- Prescribed fire is permitted in riparian areas as long as it is low intensity and short duration fires. Exceptions can be made for canebrake and other grassland management when site-specific analysis shows, with or without mitigation, impacts no greater than from low intensity, short duration fires would occur on the adjacent aquatic systems. (FLRMP, Amend 7; in part)
 - *Rationale: Fire was, under most circumstances an infrequent, and low intensity occurrence in riparian areas. Areas of cane and other grasslands, however, burned with some increased frequency and intensity.*
- Fire control lines will not be built in the RMA unless connecting to a stream or lake as part of landscape burns or wildfire control. Except in cases of wildfire, all such lines will be constructed by hand. Any exposed mineral soil is to be seeded with native or other non-invasive species within a week of burning or fire control. Water bars and other water control devices are to be used to prevent concentration of water and energy in a few areas. (FLRMP, Amend 7; in part)
 - *Rationale: Fire breaks utilizing streams and lakes increase efficiency in large scale burning. Crossing riparian areas is necessary to complete the line. Hand lines are less damaging to the riparian system than tractor lines, but still need rehabilitation to prevent damage to the system.*
- Snags should be maintained at 3-5 per 1.0 mile of riparian zone length. Snags should be at least 12" dbh, and if available, at least one should be 20" or greater dbh. Create snags by girdling where needed,

- *Rationale: Snags are important habitat requirements for many species using riparian habitat. Fully functional riparian zones would include snags. Creating snags also creates canopy gaps, which promote localized dense shrubby areas, another habitat component required by many riparian zone species.*
- Salvage of dead and dying trees may occur in riparian zones for maintaining health or improving habitat of the riparian areas long as other S&Gs are met and the over all function of the riparian zone, and viability of species at risk are not compromised by such action. (Aq. Ass., 58; in part)
 - *Rationale: High density of dead and dying trees may contribute to other resource problems in the riparian zone. Removal of some of this material is acceptable if in the process other damage does not occur.*
- Corridors for cable logging in areas adjacent to riparian zones will cross the riparian zone only after consultation with and approval by, DBNF biologists AND hydrologists. Full suspension is required when yarding logs across perennial and intermittent streams. (Aq. Ass., p 58; in part)
 - *Rationale: On a site-specific basis, a cable logging path, properly rehabilitated, may not cause serious harm to the riparian or aquatic system. Both biotic and abiotic concerns are to be considered.*
- Trees may be singly selected for cutting to provide CWD for stream or lake habitat improvement. Trees are to be moved to and placed in streams or lakes without vehicular support, if at all possible. (Aq. Ass., p 58; in part)
 - *Rationale: Large dead wood in streams and lakes is important to stream and lake health. Placement of this material may improve habitat both in the stream or lake and in the riparian zone for species at risk, but should be done without causing damage to the zone or stream or lake in the process.*
- Large dead wood (6" and up dbh) will be left in the riparian zone during salvage or other management activities potentially removing this material. (Aq. Ass., 50; in part)
 - *Rationale: Large dead wood in streams is important to stream health. The natural source for this material is primarily from riparian zones.*
- Drilling pads and production facilities for oil, gas, or mineral extraction are located outside of the riparian zone. Removal of mineral materials from the riparian zone or stream channel is prohibited. (Aq. Ass., 58)
 - *Rationale: These facilities have great potential for serious and immediate harm to both riparian zones and streams. Removal of mineral materials from either riparian zones or streams can cause dramatic hydrologic changes in*

the stream, and damage to downstream property, resources and species at risk.

- Impoundments are generally prohibited, but may be approved, by both the fisheries biologist and hydrologist on a site-specific basis.
 - *Rationale: Impoundments have high likelihood of disrupting both riparian zones and aquatic systems and their function. On a site-specific basis, analysis may show acceptable changes in either or both systems.*
- Protective measures such as informational signing, posting sites closed and/or barrier construction may be applied to sites that are receiving resource damage through inadvertent human activity.
 - *Rationale: Human use of site-specific areas may need to be modified or restricted.*
- Riparian areas identified for disposal in land adjustments will be analyzed for their contribution to watershed health, habitat for species at risk, and potential for new use to degrade either. (FLRMP, IV:43; in part)
 - *Rationale: Healthy riparian areas are essential to maintain healthy aquatic habitat. Forest Service management of riparian areas compared to reasonably expected management in other ownership is necessary as part of the decision process.*
- Camping and fire building will be prohibited in riparian areas, except at developed recreation sites and other designated sites. (Aq. Ass., p 58; in part)
 - *Rationale: Camping in specific areas may serve to invite unwanted, inadvertent use of areas important to maintaining species viability.*
- Recreational developments are permitted in riparian zones as long as they do not cause unacceptable resource damage. If rehabilitation will correct the problems, sites may remain open. Otherwise, they are to be closed. (Aq. Ass., p 58)
 - *Rationale: Riparian zones offer numerous recreational opportunities. As long as riparian and associated stream or lake resource values are not appreciably compromised, access to the areas are permitted.*
- Management activities concentrating public use in the vicinity of sensitive riparian areas would be avoided if detrimental impacts were likely to occur.
 - *Rationale: Site-specific activities need to be evaluated to determine the level of potential inadvertent human impacts to species associated with this habitat association.*

B. Protect or enhance habitat for PETS species.

- Manipulation of existing forest cover adjacent to riparian zones is expected. During timber harvest or other activities, provide for irregular boundaries between the riparian zone and the edge of project area. Feathered edges with varying BA should be created.
 - *Rationale: Abrupt changes in habitat can create barriers for many species. Gradual changes are less likely to do so. This also helps maintain a corridor between the riparian area and upland habitat.*
- Potentially disturbing activities in this area will be mitigated or eliminated, and habitat improvements (such as waterholes) prescribed to enhance suitability will have minimal effect on the riparian system.
 - *Rationale: Existing activities should be evaluated to determine effects and habitat improvement needs that may need to be added on a site-specific basis should also consider effects.*
- Sites providing potential (undocumented) habitat for PETS or other species at risk will be managed according to guidelines established for the riparian zone.
 - *Rationale: Many specific habitat features likely remain undetected or unreachable in the riparian zone. These sites may or may not contain populations of PETS or other species at risk. The riparian zone will provide a protection zone for all riparian-associated habitat features such as seeps and wetlands on the forest.*
- Acquire private lands from willing sellers with known PETS species riparian sites or riparian sites including potential habitat for PETS species. (FLRMP, IV:79-80; in part)
 - *Rationale: Riparian habitat, especially that supporting PETS species, is critical to maintain the health of riparian systems and adjacent streams. Federal ownership of riparian areas and streams better enables cooperating agencies to management for these systems.*

Protect, maintain and enhance Indiana bat roosting, foraging and maternity habitat in the general forest area. (Unless otherwise noted, the standards and guidelines are current Forest Plan direction.)

- Tree cutting activities, involving currently suitable or potential roost trees, will not be conducted within two and one half miles of an Indiana bat maternity colony between 1 May and 15 August.
 - *Rationale: Female Indiana bats frequently forage up to 2 ½ miles from their maternity colony site. Tree cutting activity in this area during the maternity*

period decreases their chance to successfully raise their young. (USFWS current best available knowledge)

- Generally, currently suitable roost trees (SHNS EA, Chapter VII) may be removed between 1 Dec and 15 March. If removal occurs at other times, trees must be evaluated for bat use by a trained observer the evening prior to tree removal.
 - *Rationale: During the 1 Dec to 15 March time period Indiana bats are in hibernation and will not be routinely roosting under the bark of trees. At other times of the year Indiana bats may be utilizing specific currently suitable roost trees.*
- Every effort will be made to retain existing snags within project areas except where they would interfere with the project purpose and need.
 - *Rationale: Snags provide important habitat conditions for roosting Indiana bats and should be retained if at all possible within project areas. Snags should not be intentionally felled in these areas. It is also recognized that the purpose and need of some projects will preclude leaving any snags within the immediate project area.*
- Snags that are considered to be an immediate threat to human safety may be removed at any time.
 - *Rationale: While it is recognized that the removal could occur during the Indiana bat roosting season, the safety of humans is of paramount importance.*
- Snags identified as hazards but not immediate threats to human safety will only be removed during the hibernation season (December 1 - March 15).
 - *Rationale: Snags within project areas that are designated for removal should be removed at a time when this activity does not present a threat to roosting Indiana bats.*
- Some snags may be removed as incidental loss associated with project activities such as skid trails, log landings and roads, etc. The accidental felling of a snag, that is 9 inches or greater dbh, is reportable to the Forest T&E biologist and the USFWS.
 - *Rationale: It is recognized that some inadvertent loss of snags will occur. The accidental felling a snag 9 inches or greater dbh is by definition not part of the analysis of the proposed action. Thus, these trees should be reported, as described above, in order to fully determine annual effects on the Indiana bat roosting/foraging habitat.*
- Prescribed burning will not occur in areas of Indiana bat roosting habitat between 1 May and 15 August.

- *Rationale: During the maternity season non-volant juvenile Indiana bats roosting under tree bark or in snags may be killed by the heat or smoke associated with prescribed fire. (USFWS current best available knowledge)*

Maintain and enhance roosting and foraging habitat during projects designed to manage overstory vegetation. (Unless otherwise noted, the standards and guidelines are current Forest Plan direction.)

- No snags will be intentionally felled within project areas associated with timber management. Within these areas at least three snags per acre need to be over 9 inches in dbh.
 - *Rationale: Snags are important as Indiana bat roosting habitat and should be retained in timber sale areas.*
- Live trees within a regeneration project area will be girdled if the existing density of standing dead trees does not meet the three per acre standard.
 - *Rationale: If the area does not contain at least three, 9 inch dbh or greater snag per acre, additional trees will be killed to provide this needed habitat component.*
- Retain live trees adjacent to 1/3 of all snags over 12 inches dbh to provide partial shading.
 - *Rationale: A variety of microclimate conditions are needed by roosting Indiana bats, especially during the maternity season. By providing shade on some of the large snags a variety conditions will be maintained within the project area.*
- Retain a minimum of 10 to 15 square feet basal area of potential roost trees (where available: see Table 1, DN, SHNS Amendment) of a minimum size of 9 inches dbh per acre, on a stand average. Larger trees are preferred.
 - *Rationale: Retaining trees within the project area provides suitable habitat of foraging and future roosting habitat for Indiana bats. Trees do not need to be retained on a uniform distribution basis, but rather should occur on a stand average basis to maximize the ecological potential of the site.*
- Retain all shagbark, shellbark and red hickories that are at least pole size (6 inch dbh) or greater.
 - *Rationale: These species of hickory trees possess outstanding exfoliating bark characteristics and are highly desirable as roost sites by Indiana bats.*
- Retain all immediate roost trees regardless of size (SHNS EA, Chapter 7). These trees must be physically identified prior to project initiation. Should these trees be felled during project activity the Forest T & E Biologist and the USFWS shall be contacted.

- *Rationale: Immediate roost trees provide the necessary characteristics to be used as roost sites by Indiana bats. These trees are marked prior to project initiation because they are difficult to recognize and marking will insure that they are retained during the duration of the project.*
- Design boundaries of harvested area shall be irregular in shape.
 - *Rationale: Irregular boundaries provide additional linear area for Indiana bats to forage within a project area. Standing trees, utilized for overhead cover and roosting are immediately adjacent to open foraging areas.*
- Distribute some of the leave trees in clumps or strips containing 50 square feet of basal area per acre or 1/2 the density of the original stand whichever is greatest in order to provide travel/foraging habitat corridors.
 - *Rationale: Indiana bats travel and forage in areas where understory vegetation does not inhibit their flight path. Retaining overhead cover in clumps and strips will provide travel corridors and foraging areas not otherwise available in timber sale areas.*
- Some snags may be removed as incidental loss associated with project activities such as skid trails, log landings and roads, etc. The accidental felling of a snag, that is 9 inches or greater dbh, is reportable to the Forest T&E biologist and the USFWS.
 - *Rationale: It is recognized that some inadvertent loss of snags will occur. The accidental felling a snag 9 inches or greater dbh is by definition not part of the analysis of the proposed action. Thus, these trees should be reported, as described above, in order to fully determine annual effects on the Indiana bat roosting/foraging habitat.*

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

- Maintain an inventory of riparian areas with spatial and tabular attributes including but not limited to, location, size, type of habitat, condition, and the presence of any species at risk. (High Priority)
 - *Rationale: An inventory of riparian habitat provides information on which to base management decisions, track yearly and plan period maintenance accomplishments, and estimate habitat suitable for various species at risk.*
- Monitor MAR and other reporting systems to help determine accomplishments for each year and the planning period. (High Priority)
 - *Rationale: MAR and other reporting systems will be filled out yearly. Use data as reported to help verify inventory.*

- Conduct systematic inventories of all uncommon or rare forested or non-forested riparian habitat on the Forest. (High Priority)
 - *Rationale: This increases known information for riparian habitat and the species that use them. The information improves management of riparian areas and the species using them.*
- Monitor riparian areas for resource degradation related to recreational activities. (High Priority)
 -
- Monitor riparian areas for invasive exotic species, primarily plants, which may compromise habitat conditions. (High Priority)
 - *Rationale: Invasive exotics can spread quickly, taking over and rendering unusable or marginal riparian habitat, as well as choking out plants at risk.*

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Attachment A.**Species List: Riparian Habitat Association**

Class	Common Name/ Species
ANIMALS	
Birds	Wood Duck/ <i>Aix sponsa</i> Cerulean Warbler/ <i>Dendroica caerulea</i> Acadian Flycatcher/ <i>Empidonax virescens</i> Bald Eagle/ <i>Haliaeetus leucocephalus</i> Wood Thrush/ <i>Hylocichla mustelina</i> Swainson's Warbler/ <i>Limnithlypis swainsonii</i> Hooded Merganser/ <i>Lophodytes cucullatus</i> Kentucky Warbler/ <i>Oporornis formosus</i> Eastern Towhee/ <i>Pipilo erythrophthalmus</i> Pied-billed Grebe/ <i>Podilymbus podiceps</i> Prothonotary Warbler/ <i>Protonotaria citrea</i> Louisiana Waterthrush/ <i>Seiurus motacilla</i> Hooded Warbler/ <i>Wilsonia citrina</i>
Insects	Cliff Caddisfly/ <i>Manophylax butleri</i>
Mammals	Beaver/ <i>Castor canadensis</i> Gray Bat/ <i>Myotis grisescens</i> Eastern Small-footed Bat/ <i>Myotis leibii</i> Indiana Bat/ <i>Myotis sodalis</i> River Otter/ <i>Lutra (Lontra) canadensis</i> Southeastern Myotis/ <i>Myotis austroriparius</i>
Reptiles	Northern Coal Skink/ <i>Eumeces anthracinus anthracinus</i> Eastern Ribbon Snake/ <i>Thamnophis sauritus sauritus</i>
PLANTS	
Dicots	Running Serviceberry/ <i>Amelanchier stolonifera</i> Rockcastle Aster/ <i>Aster saxicastellii</i> Spreading False Foxglove/ <i>Aureolaria patula</i> False Indigo/ <i>Baptisia australis</i> var. <i>australis</i> Prairie Redroot/ <i>Ceanothus herbaceus</i> American Golden-saxifrage/ <i>Chrysoplenium americanum</i> Sweet-fern/ <i>Comptonia peregrina</i> Cumberland Rosemary/ <i>Conradina verticillata</i>

07/15/2003

Goldenseal/ *Hydrastis canadensis*
American Water-pennywort/ *Hydrocotyle americana*
Vetchling Peavine/ *Lathyrus palustris*
Smooth Veiny Peavine/ *Lathyrus venosus*
Lesquereux's Bladder-pod/ *Lesquerella globosa*
Nuttall's Lobelia/ *Lobelia nuttallii*
Barbara's Buttons/ *Marshallia grandiflora*
Carolina Anglepod/ *Matelea carolinensis*
Mock Orange/ *Philadelphus inodorus*
Hoary Mock Orange/ *Philadelphus pubescens* var. *pubescens*
Nodding Rattlesnake-root/ *Prenanthes crepidinea*
Rock Scullcap/ *Scutellaria saxatilis*
Short-stem Ragwort/ *Senecio pauperculus*
Southern Oconee bells/ *Shortia galacifolia* var. *galacifolia*
Riverbar Goldenrod/ *Solidago spathulata*
Virginia Spiraea/ *Spiraea virginiana*
Big-flowered Snowbell/ *Styrax grandiflorus*
Synandra/ *Synandra hispidula*
Spiked Hoary-pea/ *Tephrosia spicata*
Slippery Elm/ *Ulmus rubra*
New York Ironweed/ *Vernonia noveboracensis*
Sand Grape/ *Vitis rupestris*
Toothache-tree/ *Zanthoxylum americana*

Gymnosperms Northern White Cedar/ *Thuja occidentalis*

Liverworts Liverwort/ *Jubula pensylvanica*
Liverwort/ *Trichocolea tomentella*

Monocots Cane/*Arundinaria gigantea*
Caric Sedge/ *Carex seorsa*
Loesel's Twayblade/ *Liparis loeselii*
Clubspur Orchid/ *Platanthera clavellata*
White Fringeless Orchid/ *Platanthera integrilabia*
Small Purple-fringed Orchid/ *Platanthera psycodes*
Shining Ladies'-tresses/ *Spiranthes lucida*
Yellow-eyed Grass/ *Xyris tortula*

Mosses Sword Moss/ *Bryoxiphium norvegicum*
Closter's Water Hypnum/ *Hygrohypnum closteri*
Moss/ *Mnium hornum*
Moss/ *Syrrhopodon texanus*

Attachment B.

Riparian Species/Habitat Relationships with References

ANIMALS

Birds

Wood Duck – *Aix sponsa* – These birds live around a variety of aquatic habitats that have cavities available for nesting. Swamps, wooded streams, lakes, ponds, reservoirs, and marshes provide suitable habitat. Nesting is in live or dead trees, within cavities, hollow limbs, and even abandoned pileated woodpecker holes. Trees utilized are usually near or above water—often in sycamore and maples (Mengel 1965). Artificial nest boxes are widely used. Birds forage in shallow water for aquatic plants, insects, and small fish. In the winter, wood ducks often eat acorns. The wood duck would be likely to be found utilizing the forest immediately adjacent to rivers, larger streams, lakes, and permanent ponds for nesting.

Cerulean Warbler – *Dendroica caerulea* – 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, monitoring data suggest that breeding territories in the Cumberland Mountains tend to have fewer canopy trees and greater shrub coverage than those elsewhere. The birds are rarely found in tracts less than 250 hectares, whereas maximum population densities occur in tracts greater than 3000 ha (1997). Hamel gives a minimum tracts size of 1750 ha (1992). Loss of bottomland hardwood and forest fragmentation has resulted in decreased numbers of this species. The cerulean warbler would be attracted to the bottomland hardwood forest and natural edge frequently associated with riparian areas.

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 observed male birds in alders and willows in a marshy, Laurel County meadow (1965). Most of the breeding population frequents elevations above 2500 feet. The least flycatcher would likely be particularly attracted to the marshy backwater areas created by larger rivers and streams, especially where dense woody shrubs are present.

Acadian Flycatcher – *Empidonax virescens* – This species is usually found near water generally near a stream course or some small waterway (Hamel, 1992). It generally uses an open, moderate understory for feeding in a stand with tall trees and closed canopy (DeGraaf et. al., 1991). It is associated with forested tracts at least 37 hectares (91.4 acres) in size (Hamel, 1992). DBNF monitoring data indicates that the greatest number of occurrences for this species were in mesophytic-cove habitats greater than 80 years

old. Acadian flycatchers would be expected to nest and forage in riparian areas that consist of streams with an overhanging canopy and dense shade (L.Perry, pers. obs.).

Bald Eagle – *Haliaeetus leucocephalus* – This federally listed species is dependent on aquatic habitat, primarily river floodplains, lakes, and natural and human-built reservoirs. It utilizes both standing and flowing fresh water sources (and salt water, in coastal areas) that have large trees suitable for nesting, perching and roosting. Suitable trees are at least 20” dbh in size and usually growing near the water (Hamel, 1992). In Kentucky, the birds have nested and wintered around wetland/floodplain habitats and reservoirs resulting from the impoundment of rivers (e.g., Laurel River Lake on the DBNF). Wintering birds are known to occur on major impoundments on the DBNF. Records of attempted nesting exist for Laurel River Lake although no active nests are currently known to exist. The bald eagle would be attracted to the forest along large rivers for nesting and wintering.

Worm-eating Warbler – *Helmitheros vermivorus* – Worm-eating warblers inhabit moist, shady forest on moderate to steep slopes. In eastern Kentucky, the birds are common on deeply shaded slopes in mixed mesophytic woods and moist ravines (Mengel 1965). They are usually found in fairly mature deciduous or mixed forest with a dense understory, preferably of rhododendron and mountain laurel, but will also use younger forest and forest edge. Nesting is typically on sloping ground among leaf litter, while foraging is carried out on the ground or among understory vegetation. Although the species occurs in dissected woodland, it avoids isolated tracts (Palmer-Ball, 1996). Hamel lists the minimum necessary tract size as 370 ha (1992). The worm-eating warbler would be particularly attracted to the steep, hardwood-dominated slopes often found adjacent to streams and rivers.

Wood Thrush – *Hylocichla mustelina* – The Wood thrush is found in a wide variety of forest types, provided a well-developed understory is present. Moderately shaded, deciduous and mixed stands of mature trees with a dense shrub and/or sapling understory are typical habitat, particularly when occurring on moist sites. The species frequently occurs in riparian habitat, rich hardwood and bottomland forests being favored; however, drier sites may be used, so long they have the relatively dense shrub layer. Nesting is in shrubs, vines, and small trees. Although the species will tolerate some fragmentation of habitat, it is most common in extensive forest and requires a minimum tract size of 3 hectares (Hamel 1992). The wood thrush is particularly attracted to the shaded, moist and often dense conditions found along stream corridors and riverbanks.

Swainson’s Warbler – *Limnothlypis swainsonii* – This forest interior species is found within tracts of moist, extensive forest that have dense understory. Hemlock ravines, having dense growths of rhododendron and laurel, and bottomland forest, with a well-developed understory and/or thickets of small trees, are favored locations. Dense cane breaks are also used. On the DBNF, this bird is often observed in damp, shady hemlock ravines with an understory of rhododendron, near small streams (L.Perry, pers. obs.). The Swainson’s warbler is particularly attracted to the shaded, moist, and often dense, conditions found along stream corridors and riverbanks.

Hooded Merganser – *Lophodytes cucullatus* – This species of waterfowl requires wooded areas with clear water streams, rivers, swamps, ponds, and lakes with cavity trees present (DeGraaf et. al., 1991). Usually forages in freshwater situations such as swamps, ponds or lakes (Hamel, 1992). This species is seldom found far from floodplain situations and usually requires a good stand of fairly mature forest nearby for nest sites (Palmer-Ball, 1996). They require cavities for nesting and may utilize artificial cavities originally constructed for wood ducks (Bellrose, 1980). The hooded merganser would be particularly attracted to the backwater areas of rivers and larger streams, where it can occasionally be found foraging and nesting.

Kentucky Warbler – *Oporornis formosus* – Kentucky Warblers are most frequent in moist, shady, deciduous and mixed (with pine or hemlock) forest types with dense, shrubby understories. However, in Eastern KY they occur in virtually all habitat associations except the most xeric pine and pine-oak communities, and may even invade them (Mengel 1965). Mature stands are required, though some younger stands and shrubby woodland borders are used, as well. These ground-nesting birds forage in understory vegetation, leaf litter, and soil. Unlike several other ground-nesting warblers, the Kentucky occurs regularly in bottomland forests... apparently nesting successfully despite periodic flooding (Palmer-Ball, 1996). The Kentucky warbler is particularly attracted to the shaded, moist, and often dense, conditions found along stream corridors and riverbanks.

Prothonotary Warbler – *Protonotaria citrea* – This species is found in standing water habitats within areas of extensive forest (Hamel, 1992). When birds are seen, they are almost always near water. Swamps, riparian corridors, bottomland/floodplains, willow thickets around lakes and ponds, and reservoir margins that contain snags at least 6" dbh provide potential habitat for these cavity-nesters. Somewhat open swamps with scattered dead stumps or dead trees with cavities are favored nesting sites. The prothonotary warbler would be attracted to the forested areas along large slow moving streams and rivers for nesting and foraging.

American Woodcock – *Scolopax minor* – This species typically requires moist woodlands in early stages of succession. It may use open fields, cultivated land, pastures and clearings at least ¼ acre in size (DeGraaf et. al., 1991). It generally requires poorly drained soils with an abundance of earthworms for feeding, nearby fields or small forest openings for courtship and roost site (DeGraaf et. al., 1991) and is largely absent from extensive areas of mature forest (Palmer-Ball, 1996). The presences of edge habitat and a high shrub stem density may be important for nest site selection in some areas (NatureServe, 2001). Appears to be partial to sheltered wet thickets along meandering streams (Barbour et. al., 1973). American woodcocks would be attracted to the marshy backwater areas of rivers and larger streams, especially where a dense cover of shrubs, grasses and vines is present.

Ovenbird – *Seiurus aurocapillus* – Mature and second growth forest conditions are utilized, on dry to moderately moist sites with light to moderate understory. Birds 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 observed nests on logging

roads and under small logs, sheltered by ferns, on steep, mesophytic slopes (1965); however, Baker and Lacki note that birds are more abundant in non-harvested than in harvested areas (1997). 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). The ovenbird is commonly found on the steep slope adjacent to rivers and streams.

Louisiana Waterthrush – *Seiurus motacilla* – This forest interior breeding bird frequents rather steep, wooded slopes in riparian areas: especially the banks of rocky, rushing streams. Nests are usually near the water--commonly in crevices at the base of rocks under bank overhangs in heavily shaded areas (Mengel 1965). On the DBNF, the birds are nearly always found where a dense understory of rhododendron or other shrubs shades the stream (L. Perry, pers. obs.). Hamel gives the minimum tract size necessary for the species as 875 ha (1992). The Louisiana waterthrush would utilize the edges of small streams for nesting and foraging habitat.

Yellow-throated Vireo – *Vireo flavifrons* – Extensive tracts of relatively mature woodland are necessary for this interior breeding bird. Large, deciduous trees within a variety of forest types, including mixed mesophytic cove, pine-oak, and oak hickory upland forest, are favored. Isolated or much-dissected tracts are avoided; however, the bird will tolerate a certain amount of disturbance (from fire, selective logging) without being dramatically affected (Palmer-Ball, 1996). Rather, activities that serve to result in a fairly open midstory/understory can be beneficial, as the birds frequent trees within relatively open settings. Yellow-throated vireos on the DBNF are often observed in hardwoods within mixed pine-hardwood stands that have been burned or had midstory reduction (L.Perry, pers. obs.). The yellow-throated vireo would be expected to be attracted to the hardwood-dominated areas along streams and river floodplains.

Mammals

Beaver – *Castor canadensis* – is a year-round resident of the river floodplain forest habitat association on the DBNF. They are closely associated with water, normally ranging within about 500 feet of 2nd to 4th order streams. Another important element in beaver habitat is the availability of food, usually fairly young, tender tree species associated with the riparian zones. Young seral stage tree vegetation within 500 feet of creeks and rivers provides an abundant food source. Activities that favor young deciduous growth, such as timber harvest or to some extent prescribed fire, will usually benefit beavers. The diet of the beaver changes throughout the year. From fall to spring beavers rely mainly on woody vegetation although they will use this food throughout the year. During the summer beavers eat a variety of foods including; pondweeds, duckweeds, pond lilies, algae and fleshy rootstocks of many other species, as well as a wide variety of upland or riparian herbaceous plants. Beavers alter stream habitats by their dam construction and create other unique habitats for both terrestrial and aquatic species. Lotic streams are altered to become more lentic systems. Beaver dams provide a shifting mosaic of environmental conditions within stream corridors. Additionally, beavers add much needed large woody debris to stream systems thereby aiding many aquatic organisms which require this habitat component.

River Otter – *Lutra (Lontra) canadensis* – Once thought to be extirpated from the DBNF, river otters have recently been reintroduced to selected areas on the forest. River otters are now established in a few locations within the river floodplain habitat association. As their name would imply, this species is closely associated with stream habitat. A forested riparian corridor is essential to maintaining good river otter habitat. River otter food habits include about 50% fish with the remainder made up of frogs, crayfish, insects and various other animals including small birds and mammals. Home ranges are linear along stream courses and may be many miles long. Den sites that may also be used for rearing young are near water and may be hollow logs, abandoned beaver lodges, the burrow of another animal or spaces under root wads or rocky overhangs.

Southeastern Myotis – *Myotis austroriparius* – The Southeastern myotis rarely occurs on the DBNF which is considered to be on the very edge of the species range. This species utilizes limestone caves for hibernation and is difficult to detect because of its habit of wedging itself far back in cracks and crevices in the ceilings and walls of caves. The Southeastern myotis roosts almost exclusively in caves during the winter and some cave use occurs in the summer. These bats also use hollow trees as summer and maternity roosts. Foraging areas are usually over riparian habitat bordering streams, lakes and ponds. Aquatic insects such as small beetles, moths and mosquitoes form the basis of the food species for the Southeastern myotis.

Gray Bat – *Myotis grisescens* – No large hibernating, bachelor or maternity colonies of gray bats are currently known to exist on the DBNF. Gray bats have been observed in small numbers in caves and in riparian forest areas at several locations on the forest. Gray bats roost in limestone caves year-round, but seasonally they may utilize different caves during the summer and winter. They may migrate between caves or sometimes can be considered as residents of a relatively small area. Gray bats feed almost exclusively over water in riparian forest areas. Emerging aquatic insects such as beetles, moths, mayflies, stoneflies and caddisflies make up the bulk of their diet.

Eastern Small-footed Bat – *Myotis leibii* – The eastern small-footed bat likely occurs in forested areas throughout the DBNF. Foraging habitat is often associated with riparian areas, but may occur elsewhere in the forest or forest edge. Summer roosting habitat includes caves, under rocks, bridges (in expansion joints), hollow trees and under exfoliating bark. Food habits are thought to be almost exclusively flying insects associated with riparian habitats. Reproducing females have been found in Eastern Kentucky, but the species is believed to be most common on the DBNF during the winter. Winter hibernation often occurs in relatively cold areas of low humidity just within the entrance of caves or mines. Thus, the eastern small-footed bat may be vulnerable to freezing in severe winters and to human disturbance. The species also hibernates in rock shelters and in fissures within clifflines.

Indiana Bat – *Myotis sodalis* – The DBNF is known to support both winter and summer colonies of the Indiana bat. During the non-hibernation season Indiana bats are likely to occur throughout the DBNF. Some males periodically roost in caves during the summer,

but most, along with females, roost under exfoliating bark or in hollow cavities in a variety of dead and alive trees. Roost trees with some sun exposure seem to be preferred because they are warmer. Indiana bats forage for insects in a wide variety of forest habitats ranging from riparian corridors to upland oak to higher elevation ridgetops. Forest canopy ranges from relatively closed to fairly open and Indiana bats sometimes forage in and near grass areas at the forest edge. An open forest understory enhances the bats ability to navigate within the forest stands. Available water in the form of shallow waterholes or ponds enhances general habitat suitability and utilization. Maternity populations are known to exist on the DBNF. Female Indiana bats are known to use multiple roost trees during the lactation period and may forage and roost up to 2 ½ miles from their primary roost trees. During the winter Indiana bats hibernate in several cool/cold limestone caves on the DBNF. These bats gather in large clusters on cave ceiling and need protection from human disturbance during this time of year. Significant hibernation caves occur on the Stanton, London and Somerset Ranger Districts. Hibernation caves are most often, but not always, associated with limestone clifflines. Maintaining forest canopy around hibernation caves helps maintain microclimate conditions and provides nearby roosting and foraging habitat, particularly during the fall swarming season.

Reptiles

Northern Coal Skink – *Eumeces anthracinus anthracinus* – The Appalachian population of this subspecies extends into eastern KY, while a disjunct population occurs in the west-central part of the State. Suitable habitat includes damp forests of oak, oak-poplar, oak-hickory-pine, and mixed pine-hardwood with moist soils, abundant leaf litter, logs, and/or loose stones; humid wooded or rocky hillsides; rocky bluffs; and similar areas near water sources, such as streams, springs, swamps, and bogs. These skinks seek the cover of rocks, logs, stumps, brush, and rock slabs. When pursued, they will take refuge in shallow water, hiding under rocks at the bottom. Various rocky areas in which they have been found include: on limestone ledges; in dry leaves beneath rock ledges; beneath flat slabs of sandstone; under rocks in sunlit forest openings and in grassy cut over areas in hardwoods; and under rocks in the slope of a road cut through a mixed forest (VA Dept. of Game and Inland Fisheries 2001). Use of fire to maintain grassy openings within forested stands is of benefit to this species. Coal Skinks feed primarily on insects and spiders.

Eastern Ribbon Snake – *Thamnophis sauritus sauritus* – This is a semiaquatic species almost always found close to the shallow water of bogs, marshes, swamps, ponds, streams, and weedy lake shorelines. Other low, wet places in which it is encountered include meadows and grassy roadside ditches. Occupied areas tend to be open, but with an abundance of ground cover, such as grasses and sedges, and bushes in which the snakes can sun themselves. These snakes often climb into low vegetation, although rarely more than 4 feet off the ground (Barbour 1971). When startled, they swim on the surface of the water. Deep water is normally avoided, and fleeing Ribbon Snakes skirt the shore, threading their way through vegetation and getting lost from sight with amazing rapidity (Conant and Collins 1991). Their diet consists of small fish and amphibians.

PLANTS

Dicots

Running Serviceberry – *Amelanchier stolonifera* – is montane Appalachian species that is found in rocky and sandy soil in dry, open hardwood forest. The only Kentucky record is from the DBNF area. It is located on rocky soils on a limestone ridge in dry open oak-cedar forest.

Rockcastle Aster – *Aster saxicastellii* – inhabits open cobble/boulder bars along free-flowing rivers. 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.

Spreading False Foxglove – *Aureolaria patula* – is a calciphile and occurs in association with limestone. On the DBNF, it occurs in rocky mixed oak-hardwood forest, usually in areas with an open canopy and a sparse midstory. It also occurs in tree gaps. Soils are usually thin. Most of the DBNF sites are on slopes above larger streams or rivers.

False Indigo – *Baptisia australis* var. *australis* – is prairie and Appalachian provinces species. It grows in open warm season grassland or in open forest (usually yellow pine or yellow pine-oak) with a sparse midstory and a grass-forb ground layer. On the DBNF and in Kentucky, the species is only known from riverine cobble/boulder bars. A prairie-like flora, which includes warm season grass species, develops on these bars. Frequent scouring by high water and flood events keeps most trees and shrubs off of the bars and maintains them in an open condition.

Brook Saxifrage – *Boykinia acontifolia* – is found throughout its range associated with stream banks. It grows on continually wet, sandy or rocky banks just above summer water levels. It is usually found in moderate shade.

Sweetshrub – *Calycanthus floridanus* (generic) – occurs as var. *glaucus* on the DBNF. Species-habitat relationships are described for that that variety below.

Sweetshrub or Carolina Allspice – *Calycanthus floridus* var. *glaucus* – is a southern species found in a variety of habitats, but usually along waterways. It often grows in large colonies. On the DBNF is found on stream terraces which are well-drained and seldom subject to flooding. The overstory is usually open and composed of mixed oak-hardwoods, sometimes with southern yellow pine. One site occurs on the upper portions of a toe slope in oak forest.

Prairie Redroot – *Ceanothus herbaceous* – is a midwestern species associated with rocky soils in grasslands and along streams. The Kentucky records occur in the DBNF area, where it occurs only on boulder and cobble bars associated with larger streams. The habitat is open and is maintained open by periodic scouring during flood events.

American Golden-saxifrage – *Chrysoplenium americanum* – is a northern species found on mud or moist soil at the edge of seasonal ponds and stream banks, or wet sandstone

cliffs. It occurs singly or as small clumps of plants. On the DBNF, it is known from a few locations, all from stream banks or sandstone cliffs. The plant requires moist conditions and is usually in the shade of other vegetation.

Throughout most of its range, sweet fern – *Comptonia peregrina* – is associated with open, sterile, sandy ground where it forms dense, low thickets. In this habitat, fires probably helped maintain the habitat. On the DBNF, 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.

Cumberland Rosemary – *Conradina verticillata* – inhabits open cobble/boulder bars along free-flowing rivers. 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. Scouring also helps to spread pieces of the shrub, which when broken and carried downstream to suitable habitat, often root and establish new populations. Currently, this species does not occur on the DBNF, but habitat for the species may occur on some streams within the Cumberland River drainage.

Goldenseal – *Hydrastis Canadensis* – grows in a variety of habitats ranging from well-drained floodplain to mesic cove forest. On the DBNF, it is known from floodplain sites, mixed mesophytic forest, and drier hardwood forest on limestone. It usually occurs in clusters of not more than a few dozen plants, but a few sites have been found with 1000s of plants. The species is a moderate calciphile and does best in well drained soils with ample available moisture. Shade is usually moderate, and the largest colonies have little or no midstory.

American Water-pennywort – *Hydrocotyle Americana* – is a northern species that extends south along the Appalachian Mountains. It grows on usually damp sandy soil, often along streams. On the DBNF, it occurs in only one area, on the sandy floodplain of a stream. The overstory is oak-yellow pine and the midstory is sparse.

Butternut or White Walnut – *Juglans cinerea* – is distributed from southern Ontario to the southern Appalachians. In the northern portions of the range, the species is usually found on well-drained floodplains, either in open areas or as part of a forest canopy. To the south, the species also occurs in rich, mesic hollows. As young trees, they are intolerant, require high light. On the DBNF, it is found in both habitat types, but most trees are infected with butternut canker.

Vetchling Peavine – *Lathyrus palustris* – is found on the coastal plain and in the mountains of eastern North America. It is typically found in or at the edge of floodplain forest, swamps, wet meadows or streamside fields, and riverbanks. On the DBNF, this species occurs on terrace forest of larger streams.

Smooth Veiny Peavine – *Lathyrus venosus* – is widespread in eastern North America. It is often found in open dry forest, but may also be found in moist mesic or terrace forest,

and sometimes on stream banks. On the DBNF, it is found in dry-mesic oak and mixed mesophytic forest, often near gaps or other areas of higher light levels.

Short's bladderpod – *Lesquerella globosa* – is found on limestone or calcareous glades, talus slopes in open woods, or rock cuts. The species requires open conditions, including bare soil. It is not known from the DBNF, but is present nearby. Habitat for the species occurs on the forest along the western edge of ownership.

Nuttall's Lobelia – *Lobelia nuttallii* – is a coastal plain species with stations inland along the southern Appalachian Plateaus. The species is found in open sandy swamps, wet yellow pine savannas, and wetlands. On the DBNF, it is known from wet meadows and wet warm season grassland.

Marshallia grandiflora – This species inhabits open cobble/boulder bars along free-flowing rivers. 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. Currently this species is not known from the DBNF, but habitat for it may exist on some streams within the Cumberland River drainage.

Carolina Anglepod – *Matelea carolinensis* – is a coastal plain species with range extensions along the southern Appalachian Plateaus. It grows in moist, open forest, either yellow pine or hardwood, and in sandy old fields and waste areas. On the DBNF, the single station is on a sandy roadside adjacent to open yellow pine-oak forest.

Mock Orange – *Philadelphus inodorus* var. *grandiflorus* (per Medley, 1993) – is an Appalachian provinces species. It is found along stream banks, on moist soil in open forest, and on cliffs. On the DBNF, the species is found on limestone cliffs and glades.

Hoary Mock Orange – *Philadelphus pubescens* var. *pubescens* – is a southern Appalachian and Ozarkian species. Medley (1993) rejects this species for the forest area, suggesting *P. pubescens* var. *intectus* as more likely. Even this variety is uncertain for the DBNF area. The DBNF area record (Pulaski County) is an uncertain identification. If present, the species occurs on limestone cliffs and glades.

Nodding Rattlesnake-root – *Prenanthes crepidinea* – is northern midwest species with disjunct populations to the south. It is found in moist, usually floodplain forest. On the DBNF, all locations are from open, mesic, terrace forest, mixed mesophytic forest, or the transition between them. The plants flower best in open conditions such as forest edge, but occur as vegetative plants in heavier shade.

Rock Scullcap – *Scutellaria saxatilis* – is an Appalachian Mountains species. Its habitat is forested hillside, moist cliffs, and low forest. On the DBNF, it is found in rocky, mesic forest, usually over sandstone.

Short-stem Ragwort – *Senecio pauperculus* – is northern US and Canada species with range extensions southward along the Appalachian provinces. It is commonly found in bogs and wet meadows. On the DBNF, the species is found on boulder/cobble bars of

Cumberland River drainage streams. In this habitat, moisture levels may be maintained, and habitat it maintained in an open condition.

Southern Oconee Bells – *Shortia galacifolia* var. *galacifolia* – is narrow endemic of the southern Appalachian Mountains. It grows in rich woods on stream banks. The only Kentucky record, an introduction in to the Red River Gorge Geological Area (DBNF) is maintaining itself in similar habitat.

Riverbar Goldenrod – *Solidago spathulata* (as spp. *randii* var. *racemosa* per Cronquist 1980; as *S. simplex* ssp. *randi*, two vars. per Medley 1993) – is found on boulder and cobble bars along large streams and rivers. In Kentucky, the taxon is present only in the DBNF area where it is found on sandstone boulder/cobble bars along larger streams and rivers of the Cumberland River drainage.

Virginia Spiraea – *Spiraea virginiana* – inhabits two habitat types within riparian areas. On the Daniel Boone NF, the species occurs on both cobble/boulder bars and on streambanks. These habitats are generally open with limited overstory. In both cases, the actual areas inhabited are subject to scouring (or were prior to dam construction) during high water events. Scouring prevents or retards the establishment of trees in these habitats helping to maintain the open condition. Scouring also helps to spread pieces of the shrub, which when broken and carried downstream to suitable habitat, often root and establish new populations.

Big-flowered Snowbell – *Styrax grandiflorus* – is southern Appalachian Mountains and southeastern coastal plain species. It commonly grows in mixed or deciduous forest in upland locations. There is at least one reliable record for the species in Kentucky from the DBNF area (McCreary County). Here is growing in mixed mesophytic forest on a north aspect above the Cumberland River.

Synandra – *Synandra hispidula* – is more or less distributed along the Ohio River basin and the eastern Cumberland and Tennessee River basins. It is generally found in rich woods, often on limestone or on base rich soils. On the DBNF, most sites are on limestone along intermittent, upland streams, rich lower slopes in mixed mesophytic woods, or on rarely flooded stream terraces in mesophytic forest.

Spiked Hoary-pea – *Tephrosia spicata* – 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 DBNF, 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.

Slippery Elm – *Ulmus rubra* – is widespread in eastern and central North America. It is found typically in moist woods such as floodplain forest. On the DBNF, the species is commonly found in floodplain forest, at forest edge along roadsides, and often in mesic hardwood forest on limestone or base rich soils.

New York Ironweed – *Vernonia noveboracensis* – is a coastal plain species with scattered interior stations. It is found in open floodplain forest, roadside ditches, marshes,

and other wet places. On the DBNF, the species is found in streamhead wetlands and occasionally in roadside ditches. A canopy may be present, but if so, the midstory and shrub layers are sparse.

Sand Grape – *Vitis rupestris* – is found along the Appalachian and Ozarkian Mountains. It occurs along rivers in boulder and cobble bars. The more western populations are often on limestone bedrock and occur on streams which infrequently flood. The more eastern populations, including those on the DBNF, are often on sandstone along rivers, which flood and scour any time of year. The scouring keeps most woody vegetation from establishing on the bars and maintains the sites in open condition.

Toothache-tree – *Zanthoxylum Americana* – is found in much of northern North America south to the Gulf coastal plain. It grows in moist forest and forest edges. On the DBNF, it is infrequent but locally abundant on limestone outcrops in open dry-mesic forest or along roadsides.

Liverworts

Liverwort – *Jubula pensylvanica* – is found throughout eastern North America. It grows in clean, low flow water where it is attached to sandstone rocks and cobble. These sites are in heavy shade. It grows in similar sites on DBNF as well as on saturated sand in sandstone rockshelters.

This liverwort – *Tricocholea tomentella* – occurs on streambanks. On the DBNF, it is found on moist, sandy flats along streams, just above summer water levels. The sites are on low gradient sections of streams in moderate to heavy shade, often under a canopy of hemlock, magnolia and rhododendron. This species is not tolerant of heavy deposition, so stable stream dynamics are essential for its health.

Gymnosperms

Pitch Pine -- *Pinus rigida* – ranges from New England to the Appalachian Mountains. It grows in generally sterile, sandy soil where it competes well against many other woody species. These soils are usually dry, but may be moist. The cones are semi-serotinous, opening following hot fires or occasionally very hot days. Fire also prepares a seedbed advantageous to the light seeds. On the Daniel Boone NF, this species is most commonly found within a few hundred feet of sandstone cliffs. The soils here are sandy, thin and usually dry providing the conditions under which the species competes. These areas also would have been subject to periodic burning, aiding regeneration of the species.

Northern White Cedar – *Thuja occidentalis* – has a northeastern North American distribution with range extensions southward along the Appalachian provinces and other westerly disjunct stations. In its primary range, the species occurs in moist to damp soil, or swamps where it can form dense monotypic forests. On the DBNF, the species is found on limestone cliffs and talus slopes along the Cumberland River and some of its major tributaries. In most case, the plants are associated with karst seeps on the cliffs. One location is on a sandstone boulder in a creek.

Monocots

Caric Sedge – *Carex seorsa* – is a wet forest species with a range over much of the eastern US. It grows in areas that remain wet throughout the year. On the DBNF, it is associated with a few streamhead wetlands and slope seeps. It grows in clumps forming thick to thin mats of vegetation. Shade is usually moderate to light.

Kentucky Lady's-slipper – *Cypripedium kentuckiense* – occurs along streambanks and in river front or floodplain forest. It occurs on DBNF streambanks where silty sand accumulates. These areas are low, usually not more than 6 cm (4 in) above summer water level. Most are open or lightly shaded. The river front and floodplain forest sites are well drained and usually moderately shady. Flowering appears to be best in more open areas. All three habitats are subject to flooding events throughout the year. Flooding may help control competition and helps to maintain fertility on the sites.

Loesel's Twayblade – *Liparis loeselii* – is a northern and midwestern North American species. It is found in wet to damp forest. On the DBNF, it is known from wet seeps on roadsides, a seep at the base of an abandoned limestone quarry, and at the edge of a strip mine pond.

Clubspur Orchid – *Platanthera clavellata* – occurs in a wide variety of habitats across its range. On the DBNF, it occurs in streamhead wetlands, in seeps, on streambanks, and in swamps. It is usually found in mucky soil under moderate to heavy shade. The soil in which it occurs is always damp or wet. This species is an alternative host to the endophyte fungus that is the sole fungal associate for white fringeless orchid (*P. integrilabia*). Maintaining this orchid helps to maintain a diverse stock for the fungal symbiont.

White Fringeless Orchid -- *Platanthera integrilabia* – On the Daniel Boone NF, this species is found in streamhead seeps, or rarely streambanks in the vicinity of streamhead wetlands. This species requires the sterile, constantly wet to moist sandy soil found in this habitat. Water in these seeps is always flowing at least below the surface, and is never stagnant. It is possible that this helps keep the species endophyte fungus associate from damaging the plant. The species almost always grows in mats of *Sphagnum* mosses, but occasionally is associated with leaf litter or a thin layer of organic muck. It is probable *Sphagnum* helps to maintain moisture and soil pH. It is also known to serve as a nursery for seed germination. The canopy associated with these seeps ranges from open to closed. The open conditions encourage butterfly-attracting species such as *Eupatorium fistulosum*, which in turn increase the chances of pollination of the orchid flowers. The closed canopy condition may improve germination and establishment of seedlings.

Small Purple-fringed Orchid – *Platanthera psycodes* – is a northern species with a range extension south along the Appalachian Mountains. It is found in wet meadows and wet, open forest. On the DBNF, there are tentative records for this species from wet stream terraces under high canopy closed forest. The identity of the plants in question is not certain.

Shining Ladies'-tresses – *Spiranthes lucida* – is a northeastern to central US species. It is commonly found in damp forest and marshes, and on wet shores. On the DBNF, the species at all sites is found on open limestone streambanks, often in thin mud.

Yellow-eyed Grass – *Xyris torta* – is a coastal plain and lake state species found in bogs and wet, sandy soil of open yellow pine forest and grasslands. The DBNF records are from streamhead wetlands, slope seeps, and wet warm season grasslands and meadows.

Mosses

Sword Moss – *Bryoxiphium norvegicum* – is a northern species that extends southward through the Appalachian Mountains. It is found on wet to damp sandstone and conglomerate in areas of constant high humidity. On the DBNF it occurs on overhangs and on the ceilings of rockhouses along cliffs where shade is high. It also occurs on boulder overhangs near streams.

Closter's Water Hypnum – *Hygrohypnum closteri* – is an Appalachian species with possible stations in Washington state. The species grows in low flow streams attached to rocks. In Kentucky, the only records are from the Red River Gorge Geological Area (DBNF). Here the species was found in streams, one on limestone, one on sandstone.

Moss – *Mnium hornum* – is found on streambanks and in sandstone or conglomerate rockhouses. On the DBNF, the most common habitat is on sandy streambanks along low gradient sections of streams. These areas are usually under a canopy of hemlock, magnolia and rhododendron. While it may occur with *Tricocholea tomentella*, it appears more tolerant of deposition.

Moss – *Syrrhopodon texanus* – is a coastal plains species with disjunct distribution in the Appalachian and Ozarkian provinces. It commonly occurs on moist rotten logs and stumps, on rock and the bark of trees, especially in low ground. On the DBNF, the species is almost always encountered on the back walls of moist, shaded sandstone or conglomerate rockhouses or cliff faces.

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Attachment C.

Riparian Habitat Association Matrix

Assoc.	Habitats	Modifier	Class	Common/Species	
10-Riparian	Boulder (Scour) Bars	Acidic Substrate	P-DIC	Prairie Redroot/ Ceanothus herbaceus	
		Drainage Good		Cumberland Rosemary/ Conradina verticillata	
					Prairie Redroot/ Ceanothus herbaceus
		Open (Little or No Shade)		Cumberland Rosemary/ Conradina verticillata	
					False Indigo/ Baptisia australis var. australis
					Riverbar Goldenrod/ Solidago spatulata
					Spiked Hoary-pea/ Tephrosia spicata
					Sweet-fern/ Comptonia peregrina
					Virginia Spiraea/ Spiraea virginiana
		Open Forest Canopy			Rockcastle Aster/ Aster saxicastellii
		Sandy Soil			Cumberland Rosemary/ Conradina verticillata
					Rockcastle Aster/ Aster saxicastellii
		Scoured, at least occasionally			Cumberland Rosemary/ Conradina verticillata
				Rockcastle Aster/ Aster saxicastellii	
		Shrub/Sapling Condition		Rockcastle Aster/ Aster saxicastellii	
	Cane Breaks	(none)	BIRD	Eastern Towhee/ Pipilo erythrophthalmus	
		Dense shrub understory		Swainson's Warbler/ Limnothlypis swainsonii	
	Eastern River Front Forest	(none)		Hooded Warbler/ Wilsonia citrina	
				Kentucky warbler/ Oporornis formosus	
				Wood Thrush/ Hylocichla mustelina	
	Forest Interior (Minimal Edge)		Prothonotary warbler/ Protonotaria citrea		
	Mature forest		Kentucky warbler/ Oporornis formosus		
			Wood Thrush/ Hylocichla mustelina		
	Moderate Shade		Wood Thrush/ Hylocichla mustelina		
	Moist		Hooded Warbler/ Wilsonia citrina		
			Kentucky warbler/ Oporornis formosus		
			Wood Thrush/ Hylocichla mustelina		
	Riparian		Wood Duck/ Aix sponsa		
		MAMM	Eastern Small-footed Bat/ Myotis leibii		
		P-DIC	Vetchling Peavine/ Lathyrus palustris		
	Snags > 6" dbh	BIRD	Prothonotary warbler/ Protonotaria citrea		
			Wood Duck/ Aix sponsa		
	Tract Size (Area Sensitive)		Prothonotary warbler/ Protonotaria citrea		
	Tree and Snags (Cavity Nesters)		Prothonotary warbler/ Protonotaria citrea		
			Wood Duck/ Aix sponsa		
	Trees > 20" dbh		Bald Eagle/ Haliaeetus leucocephalus		
	Water (Distance Sensitive)		Bald Eagle/ Haliaeetus leucocephalus		
			Prothonotary warbler/ Protonotaria citrea		

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<u>Assoc.</u>	<u>Habitats</u>	<u>Modifier</u>	<u>Class</u>	<u>Common/Species</u>
				Wood Duck/ Aix sponsa
	Floodplains/Terraces	(none)		Hooded Merganser/ Lophodytes cucullatus
			P-DIC	Smooth Veiny Peavine/ Lathyrus venosus
		Closed Forest Canopy	BIRD	Acadian flycatcher/ Empidonax virescens
		Downed Logs	P-MOS	Moss/ Syrrhodon texanus
		Drainage Good	P-DIC	Butternut/ Juglans cinerea
				Goldenseal/ Hydrastis canadensis
			P-GYM	Pitch Pine/ Pinus rigida
		Fire Tolerant/Enhanced		Pitch Pine/ Pinus rigida
		High Shade	P-LIV	Liverwort/ Trichocolea tomentella
		High/Constant Humidity (Microclimate)		Liverwort/ Trichocolea tomentella
		Large Decadent Trees	BIRD	Cerulean Warbler/ Dendroica caerulea
		Low (wet, i.e. subject to holding water)	P-MON	Least Trillium/ Trillium pusillum var. pusillum
		Mature forest	BIRD	Black-and-white Warbler/ Mniotilta varia
				Cerulean Warbler/ Dendroica caerulea
				Hooded Merganser/ Lophodytes cucullatus
		Mid-age Forest		Black-and-white Warbler/ Mniotilta varia
		Moderate Shade	P-DIC	Smooth Veiny Peavine/ Lathyrus venosus
				Vetchling Peavine/ Lathyrus palustris
		Open Forest Canopy	P-MON	Kentucky Lady's Slipper/ Cypripedium kentuckiense
		Open Midstory/Understory	BIRD	Acadian flycatcher/ Empidonax virescens
		Rich Soil	P-DIC	Goldenseal/ Hydrastis canadensis
		Sandy Soil	P-GYM	Pitch Pine/ Pinus rigida
			P-MON	Kentucky Lady's Slipper/ Cypripedium kentuckiense
		Scoured, at least occasionally		Kentucky Lady's Slipper/ Cypripedium kentuckiense
		Sediment free	P-LIV	Liverwort/ Trichocolea tomentella
		Seep/Constant Water		Liverwort/ Trichocolea tomentella
			P-MOS	Moss/ Syrrhodon texanus
		Slope (hillside, steepness)	BIRD	Black-and-white Warbler/ Mniotilta varia
		Snags > 6" dbh		Wood Duck/ Aix sponsa
		Tract Size (Area Sensitive)		Acadian flycatcher/ Empidonax virescens
		Tree and Snags (Cavity Nesters)		Hooded Merganser/ Lophodytes cucullatus
				Wood Duck/ Aix sponsa
		Trees > 20" dbh		Bald Eagle/ Haliaeetus leucocephalus
		Water (Distance Sensitive)		Bald Eagle/ Haliaeetus leucocephalus
				Hooded Merganser/ Lophodytes cucullatus
				Wood Duck/ Aix sponsa
	River Floodplain Forest	(none)	P-DIC	Nuttall's Lobelia/ Lobelia nuttallii
		Burrows, Holes, Tunnels	MAMM	River Otter/ Lutra (Lontra) canadensis
		Closed Forest Canopy	BIRD	Acadian flycatcher/ Empidonax virescens
		Dense shrub understory		Hooded Warbler/ Wilsonia citrina
				Kentucky warbler/ Oporornis formosus
				Swainson's Warbler/ Limnithlypis swainsonii
		Downed Logs	MAMM	River Otter/ Lutra (Lontra) canadensis

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<u>Assoc.</u>	<u>Habitats</u>	<u>Modifier</u>	<u>Class</u>	<u>Common/Species</u>
		Exfoliating bark, (trees dead or alive)	MAMM	Indiana Bat/ Myotis sodalis
				Southeastern myotis/ Myotis austroriparius
		Forest Interior (Minimal Edge)	BIRD	Cerulean Warbler/ Dendroica caerulea
				Prothonotary warbler/ Protonotaria citrea
				Swainson's Warbler/ Limnothlypis swainsonii
		Low (wet, i.e. subject to holding water)	P-MON	Caric Sedge/ Carex seorsa
		Mature forest	BIRD	Cerulean Warbler/ Dendroica caerulea
				Kentucky warbler/ Oporornis formosus
		Moist		Hooded Warbler/ Wilsonia citrina
				Kentucky warbler/ Oporornis formosus
		Open Forest Canopy	MAMM	Indiana Bat/ Myotis sodalis
		Open Midstory/Understory	BIRD	Acadian flycatcher/ Empidonax virescens
				Cerulean Warbler/ Dendroica caerulea
		Regeneration area/early seral	MAMM	Beaver/ Castor canadensis
		Riparian	MAMM	Gray Bat/ Myotis grisescens
				Southeastern myotis/ Myotis austroriparius
			P-DIC	Vetchling Peavine/ Lathyrus palustris
		Snags > 6" dbh	BIRD	Prothonotary warbler/ Protonotaria citrea
				Wood Duck/ Aix sponsa
		Tract Size (Area Sensitive)		Acadian flycatcher/ Empidonax virescens
				Cerulean Warbler/ Dendroica caerulea
				Prothonotary warbler/ Protonotaria citrea
				Swainson's Warbler/ Limnothlypis swainsonii
		Tree and Snags (Cavity Nesters)		Prothonotary warbler/ Protonotaria citrea
				Wood Duck/ Aix sponsa
		Trees > 20" dbh		Bald Eagle/ Haliaeetus leucocephalus
				Cerulean Warbler/ Dendroica caerulea
		Water (Distance Sensitive)		Bald Eagle/ Haliaeetus leucocephalus
				Prothonotary warbler/ Protonotaria citrea
				Wood Duck/ Aix sponsa
			MAMM	Beaver/ Castor canadensis
				River Otter/ Lutra (Lontra) canadensis
	Sand/Gravel/Cobble Bars	Open (Little or No Shade)	P-DIC	Riverbar Goldenrod/ Solidago spathulata
			P-MON	Shining Ladies'-tresses/ Spiranthes lucida
		Riparian	P-DIC	Riverbar Goldenrod/ Solidago spathulata
	Stream Banks	(none)	BIRD	Hooded Merganser/ Lophodytes cucullatus
			P-DIC	American Water-pennywort/ Hydrocotyle americana
				Brook Saxifrage/ Boykinia acontifolia
				Carolina Allspice/ Calycanthus floridanus
				Carolina Anglepod/ Matelea carolinensis
				Mock Orange/ Philadelphus inodorus
				Sand Grape/ Vitis rupestris
				Short-stem Ragwort/ Senecio pauperculus
				Smooth Veiny Peavine/ Lathyrus venosus

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<u>Assoc.</u>	<u>Habitats</u>	<u>Modifier</u>	<u>Class</u>	<u>Common/Species</u>
				Sweetshrub/ <i>Calycanthus floridus</i> var. <i>glaucus</i>
				Toothache-tree/ <i>Zanthoxylum americana</i>
				Virginia Spiraea/ <i>Spiraea virginiana</i>
			P-MON	White Fringeless Orchid/ <i>Platanthera integrilabia</i>
		Basic Substrate	P-GYM	Northern White Cedar/ <i>Thuja occidentalis</i>
			P-MON	Loesel's Twayblade/ <i>Liparis loeselii</i>
				Shining Ladies'-tresses/ <i>Spiranthes lucida</i>
		Cool Temperatures	P-LIV	Liverwort/ <i>Trichocolea tomentella</i>
		Dense shrub understory	BIRD	Louisiana Waterthrush/ <i>Seiurus motacilla</i>
				Swainson's Warbler/ <i>Limnothlypis swainsonii</i>
		Forest Interior (Minimal Edge)		Louisiana Waterthrush/ <i>Seiurus motacilla</i>
				Swainson's Warbler/ <i>Limnothlypis swainsonii</i>
		High Shade		Louisiana Waterthrush/ <i>Seiurus motacilla</i>
				Swainson's Warbler/ <i>Limnothlypis swainsonii</i>
			INSEC	Cliff Caddisfly/ <i>Manophylax butleri</i>
			P-DIC	American Golden-saxifrage/ <i>Chrysopenium americanum</i>
				Brook Saxifrage/ <i>Boykinia acontifolia</i>
				Smooth Veiny Peavine/ <i>Lathyrus venosus</i>
				Southern Oconee bells/ <i>Shortia galacifolia</i> var. <i>galacifolia</i>
			P-LIV	Liverwort/ <i>Trichocolea tomentella</i>
			P-MON	Clubspur Orchid/ <i>Platanthera clavellata</i>
			P-MOS	Sword Moss/ <i>Bryoxiphium norvegicum</i>
		Moderate Shade	P-DIC	American Golden-saxifrage/ <i>Chrysopenium americanum</i>
				Goldenseal/ <i>Hydrastis canadensis</i>
				Rock Scullcap/ <i>Scutellaria saxatilis</i>
				Smooth Veiny Peavine/ <i>Lathyrus venosus</i>
				Spreading False Foxglove/ <i>Aureolaria patula</i>
				Vetchling Peavine/ <i>Lathyrus palustris</i>
			P-MON	Small Purple-fringed Orchid/ <i>Platanthera psycodes</i>
		Moist	BIRD	Swainson's Warbler/ <i>Limnothlypis swainsonii</i>
			INSEC	Cliff Caddisfly/ <i>Manophylax butleri</i>
			P-DIC	American Water-pennywort/ <i>Hydrocotyle americana</i>
				Barbara's Buttons/ <i>Marshallia grandiflora</i>
				New York Ironweed/ <i>Vernonia noveboracensis</i>
				Rock Scullcap/ <i>Scutellaria saxatilis</i>
				Synandra/ <i>Synandra hispidula</i>
				Virginia Spiraea/ <i>Spiraea virginiana</i>
			P-MON	Shining Ladies'-tresses/ <i>Spiranthes lucida</i>
				Yellow-eyed Grass/ <i>Xyris tortula</i>
		Open (Little or No Shade)	P-DIC	Virginia Spiraea/ <i>Spiraea virginiana</i>
			P-MON	Shining Ladies'-tresses/ <i>Spiranthes lucida</i>
		Remote Habitat	P-DIC	Virginia Spiraea/ <i>Spiraea virginiana</i>
		Rich Soil		Nodding Rattlesnake-root/ <i>Prenanthes crepidinea</i>
				Slippery Elm/ <i>Ulmus rubra</i>
				Southern Oconee bells/ <i>Shortia galacifolia</i> var. <i>galacifolia</i>

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<u>Assoc.</u>	<u>Habitats</u>	<u>Modifier</u>	<u>Class</u>	<u>Common/Species</u>
		Riparian	BIRD	Louisiana Waterthrush/ Seiurus motacilla
		Rocky/Rocks		Louisiana Waterthrush/ Seiurus motacilla
			P-DIC	Barbara's Buttons/ Marshallia grandiflora
				Hoary Mock Orange/ Philadelphus pubescens var. pubescens
				Lesquereux's Bladder-pod/ Lesquerella globosa
				Running Serviceberry/ Amelanchier stolonifera
				Slippery Elm/ Ulmus rubra
				Virginia Spiraea/ Spiraea virginiana
			P-GYM	Northern White Cedar/ Thuja occidentalis
			P-MON	Small Purple-fringed Orchid/ Platanthera psycodes
			P-MOS	Sword Moss/ Bryoxiphium norvegicum
		Sandy Soil	P-DIC	Barbara's Buttons/ Marshallia grandiflora
				Big-flowered Snowbell/ Styrax grandiflorus
				Sand Grape/ Vitis rupestris
			P-LIV	Liverwort/ Trichocolea tomentella
			P-MON	Loesel's Twayblade/ Liparis loeselii
		Scoured, at least occasionally	P-DIC	Virginia Spiraea/ Spiraea virginiana
		Seep/Constant Water		American Water-pennywort/ Hydrocotyle americana
			P-LIV	Liverwort/ Jubula pensylvanica
			P-MON	Clubspur Orchid/ Platanthera clavellata
				Small Purple-fringed Orchid/ Platanthera psycodes
			P-MOS	Closter's Water Hypnum/ Hygrohypnum closteri
		Slope (hillside, steepness)	BIRD	Louisiana Waterthrush/ Seiurus motacilla
		Snags > 6" dbh		Wood Duck/ Aix sponsa
		Tract Size (Area Sensitive)		Louisiana Waterthrush/ Seiurus motacilla
				Swainson's Warbler/ Limnothlypis swainsonii
		Tree and Snags (Cavity Nesters)		Hooded Merganser/ Lophodytes cucullatus
				Wood Duck/ Aix sponsa
		Water (Distance Sensitive)		Hooded Merganser/ Lophodytes cucullatus
				Louisiana Waterthrush/ Seiurus motacilla
				Pied-billed Grebe/ Podilymbus podiceps
				Wood Duck/ Aix sponsa
			INSEC	Cliff Caddisfly/ Manophylax butleri