United States Department of Agriculture

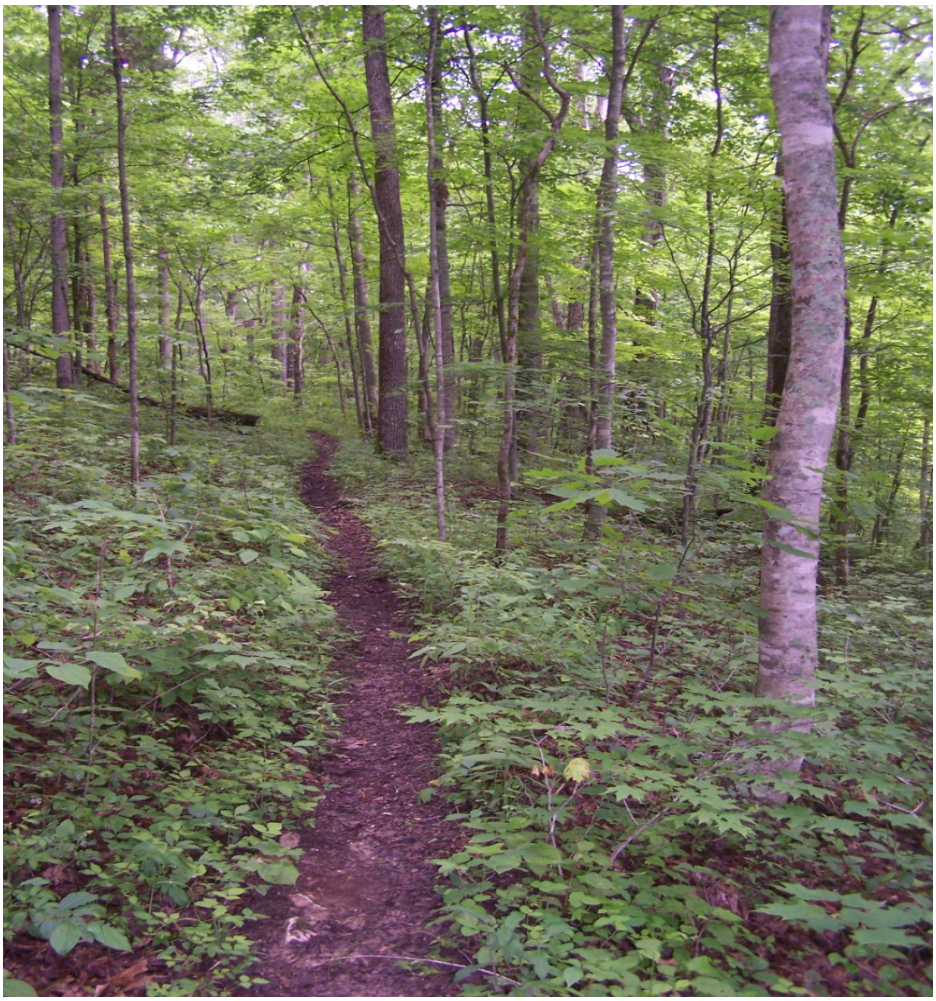
Forest Service

September 2013

Cave Run Nonmotorized Trails Project

Environmental Assessment

Cumberland Ranger District, Daniel Boone National Forest
Bath, Rowan, and Menifee Counties, Kentucky



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Introduction

The Daniel Boone National Forest (Forest) prepared this environmental assessment to analyze different ways of managing nonmotorized trails surrounding Cave Run Lake. In this report we (Forest Service) describe reasons for proposing the project, including alternatives.

The Purpose of the Project and Need for the Project Activities

Project Background

Recreation use and uses have changed on the Daniel Boone National Forest (Forest) over the past twenty years. Trails that were developed and used primarily by hikers have received considerable increased use by equestrians and mountain bikers. Uses occurring on trails that are not designed for those activities ultimately create an unmanageable situation. Our forest managers and our trail users have recognized the escalation in resource damage and trail user conflict along with a simultaneous decline in desired recreation experience. It is clear that we need revised management strategies and actions if we plan to ensure successful management of the Cave Run trail system today and into the future.

We recognized the amount of change in recreation use and demand in the 2004 Land and Resource Management Plan for the Daniel Boone National Forest (Forest Plan) as a management situation warranting consideration. In the Forest Plan we recognize the importance of a quality recreational experience and the increasing demands being put on national forest system lands. The Forest Plan states:

> The Daniel Boone National Forest provides a variety of dispersed and developed recreational opportunities to five million visitors each year. Growth in demand for recreational opportunities is likely to continue and new types of recreation may be introduced. While recreational activities can adversely affect forest resources in various ways, differing recreational activities may create user conflicts or compete for the same resources. One of the issues addressed by Forest Plan revision was the development of an appropriate mix of recreational opportunities that respond to increasing demands and also provide adequate ecosystem protection (Forest Plan p. 1-9).

The Record of Decision for the Revised Land and Resource Management Plan (ROD) reiterates this sentiment:

> The Forest must not only provide for today's consumption and enjoyment, but for those of future generations as well. Citizens from all different points of view want us to quantify the costs and benefits of our management, sure in their hearts that this will prove how important their favorite resource is, and thereby proving their position is the right one. Due to the sheer abundance and variety of opinion in the United States, we in the Forest Service often find ourselves in the midst of controversy. With the passage of new laws and changing values, natural resource issues are becoming more complex as demands for all these resources continue to increase (ROD p. 19-20).

There are approximately 75 miles of designated trails in the Cave Run Lake area on the northern half of the Cumberland Ranger District. This includes a portion of the Sheltowee Trace National Recreation Trail, which crosses through the project area and extends north, nearly to Ohio, and south to Pickett State Park in Tennessee. In addition to the designated trail mileage, there are many miles of undesignated, user-created trails that are very popular with the equestrian community in the area.

We did not design most of the trails in the Cave Run Lake area for the type of use they are receiving today. Many of the trails follow logging roads, and those that we constructed were originally designed in the 1970s as hiking trails, many years before the widespread knowledge and application of sustainable trail design. Initially the trails received moderate hiking and equestrian use, and in the mid-1980s and early 1990s mountain bikes and off-highway vehicles (OHVs) appeared and became very popular. Equestrian use steadily increased as riders from outside the area came to the forest in larger numbers, attracted by the primitive trails and scenic landscape. Mountain bike use continued to grow through the late 1990s as the trails became well known and favored by mountain bikers from across the region. In 1998, the 1986 Forest Plan was amended to restrict OHV use to designated OHV routes and open forest roads (FR). At that time, we removed OHVs from the popular Cave Run trails and constructed a single use OHV trail system (White Sulphur ATV Trail) close by. Hikers, mountain bikers, and equestrians remained as the primary users of the Cave Run nonmotorized trail system.

The Cave Run trail system faces many challenges that are common to other eastern forest trail systems. Multiple uses compete for limited acreage in areas of mixed ownership patterns and high population densities. The trail situation is further complicated by environmental factors such as steep grades, clay-based soils, and wet climate with year-round precipitation. When we combine the “unplanned” trail locations and design with increasingly limited maintenance dollars, the need for skilled and active trail management is evident.

Project Location

The Cave Run Nonmotorized Trails Project area is located on the Cumberland Ranger District around Cave Run Lake in Bath, Rowan, and Menifee Counties, Kentucky (Figure 1), about 7 miles southwest of the city of Morehead. The project area is approximately 75,640 acres in size. This includes 52,500 acres of national forest system land, and 23,140 acres of land in other ownerships. There are approximately 75 miles of existing Forest Service maintained trails on national forest system land within the project area. These miles include about 25 miles of the Sheltowee Trace National Recreation Trail.

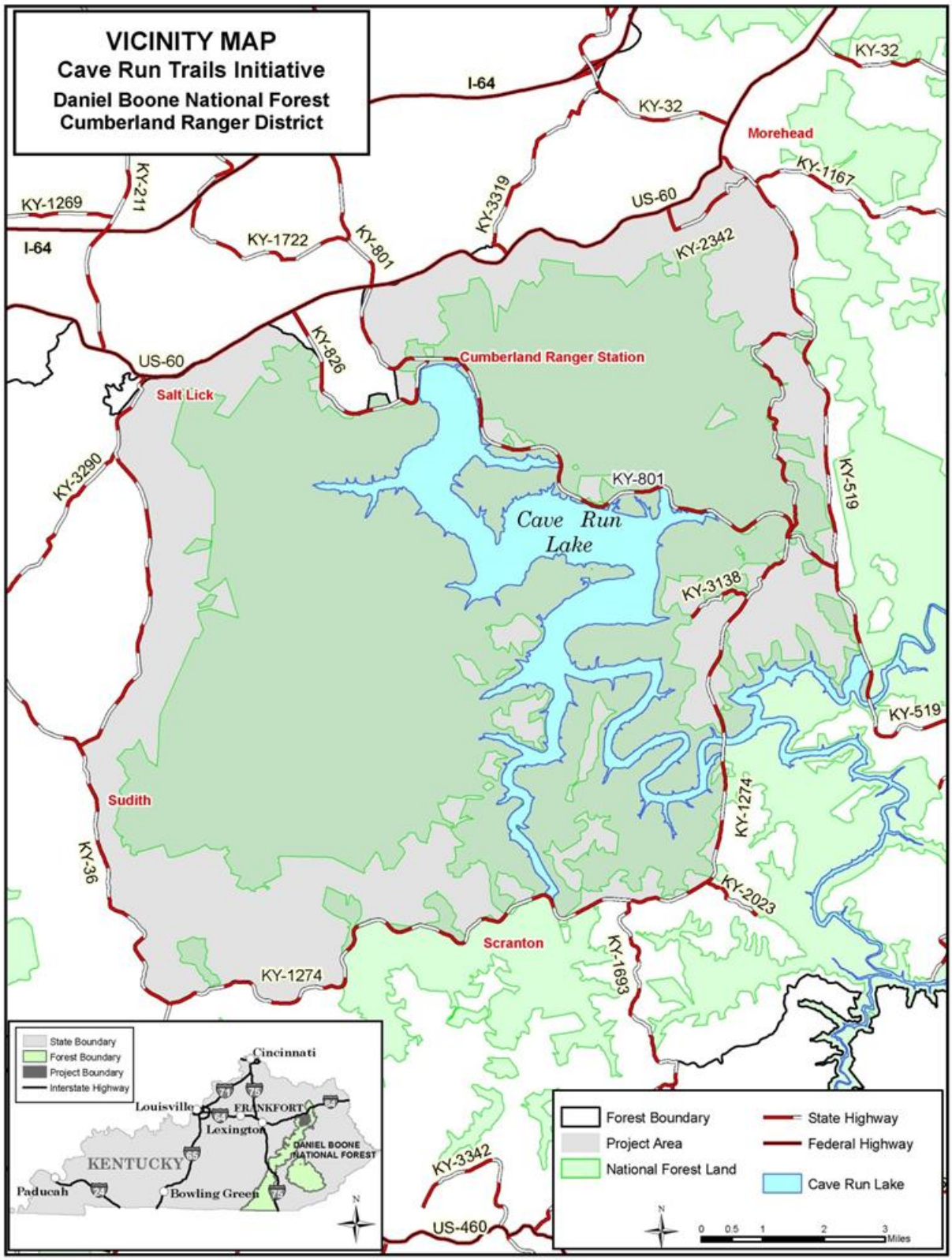

Figure 1. Vicinity map

Management Direction

The Forest Plan provides a programmatic framework regarding allocation of national forest system lands and measures necessary to protect forest resources. It describes how the Daniel Boone National Forest should be managed and what resources should be provided by these lands now and in the future. The final environmental impact statement (FEIS) for the Forest Plan displays forestwide effects of activities such as vegetation management, wildlife management, recreation management, minerals management and other forest resources management. The Forest Plan embodies the provisions of the National Forest Management Act of 1976, its implementing regulations, and other guiding documents.

This project level environmental assessment (EA) is tiered to the FEIS, which includes the Forest Plan. Tiering is in accordance with CEQ regulations (40 CFR 1502.20 and 1508.28), which allows the responsible official to focus on site-specific issues within the scope of a broader plan or analysis that is already approved. The Cave Run Nonmotorized Trails Project is proposed to move the landscape toward goals and objectives described in the Forest Plan. Its scope is confined to addressing the identified issues and site-specific effects of proposed management actions, including alternatives.

The Forest Plan assigns prescription areas to allocations of land with similar resource conditions and corresponding management emphasis (Forest Plan, chapter 3). Each prescription area describes a setting, desired future condition, goals and objectives, and standards for management. Prescription area direction acts collectively with forestwide direction to achieve the forest's desired future condition. Forest Plan prescription areas encompassed in the Cave Run Nonmotorized Trails Project area are summarized in Table 1.

Table 1. Prescription area allocations within the Cave Run Nonmotorized Trails Project area

Prescription Area	Acres in Project Area
Source Water Protection (5.C.)	21,441
Large Reservoirs (3.B.)	6,981
Designated Old Growth (1.I.)	2,600
Habitat Diversity Emphasis (1.K.)	29,204
Significant Bat Caves (1.J.)	2
Riparian Corridor (1.E.)	16,329
Rare Communities (1.G.)	223
Cliffline Community (1.C.)	2,812
Developed Recreation Areas (3.A.)	31

The desired outcome of implementing the proposed project is defined by Forest Plan goals and objectives, which are incorporated in the purpose and need for action, below.

Purpose and Need for Action

This section briefly describes the underlying purpose and need to which we are responding in proposing the alternatives, including the proposed action (40 CFR 1502.13). We compared the existing and the desired conditions and established the need for the project. We determined the desired condition using guidance from the Forest Plan, federal and state laws and regulations, current agency direction, and consideration of the issues and concerns that you expressed.

An assessment of project area trails and resources (Keen et al. 2011) provided an existing condition of the trails and the management situation. Through project scoping and other public participation avenues, you shared important trail attributes that you considered fundamental to your desired experience. We compared these conditions and attributes to Forest Plan goals, objectives and standards, applicable laws, and current policies. Where we found differences between existing conditions- and forest goals and standards and user desires, we identified a need for change.

Project Objectives

The following nine objectives address the purpose of the project. The difference between the existing and desired conditions reflects the need for change, which is encompassed in the project proposal and alternatives.

Provide a nonmotorized trail system to address recreation demand and benefit local communities and the public. (Forest Plan Goals 7, 7.1, 7.3, 12, 12.2, 16, 16.1, 16.2)

Existing Condition

The Cave Run Lake trail system was not developed for the purpose of mountain biking or horseback riding. Trail grades and corridors do not provide proper hydrologic maintenance, and recreation demand has exceeded the carrying capacity of the shared-use trails. Consequently, the trails are no longer able to maintain the condition necessary to produce the desired user experiences being sought. A lack of adequate trailhead parking and up-to-date trail information create a situation where portions of the trail system are overused, and other portions are under-utilized. Business has declined at some local establishments that are supported by trail users as a result of the challenges confronted by management of the Cave Run trail system.

Desired Condition

The trail system offers a sustainable mix of desired uses, valued characteristics, and services providing long-term benefits to local communities and the broader public. The public is satisfied with the recreation surrounding the trail resource and adjustments to markets or facilities and programs are made as needed. The forest is working together with rural communities who rely on forest-generated commerce to implement natural resource solutions to economic, environmental and social challenges. Special use authorizations permitting trails that connect local livery stables, recreation areas and trails to the Forest trail system are administered and up to date. The trail network and facilities address the recreational demand, and additional trail opportunities are provided if necessary.

There is a need to address the recreational needs of trail users and associated benefits to local businesses and communities.

Provide an enjoyable nonmotorized trail user experience through appropriate trail use designation. (Forest Plan Goals 7, 12)

Existing Condition

The Cave Run trail system offers convenient access to a large population base and receives heavy recreation-related visitation. The trail system is currently managed for shared use among pedestrians, bicyclists, and equestrians. Bikers and equestrians exhibit diverging trail needs, limitations, and preferences, and focus on different trail qualities and characteristics.

Trail user satisfaction has declined in the past decade, and mountain biking and hiking use has almost completely diminished. User conflict on the trail system appears to be more a matter of "goal interference" than confrontation or physical conflict. This perception has existed for a number of years and is at the center of the conflict relating to future uses and individual trail designations.

Figure 2. A shared-use trail between Sulphur Branch and Trough Lick Branch drainages.

Desired Condition

Trail users are satisfied with the trail system and supporting facilities. Desired trail attributes are realized and a quality experience can be achieved by all users. Users are encouraged by the delivered experience and take ownership in and responsibility for the care and condition of the trails. Local communities value the environment supported by the recreation resource and realize the long-term economic benefits the multi-use trail system provides.

Many trail users desire a primitive trail experience where trail conditions are less developed and encounters with other users are few. There is however, an expressed need for limited "easy" experience-level trails for novice riders and individuals desiring a less challenging experience. Most users prefer trails specifically designed for the intended use. Trails constructed to appropriate design standards would clearly support user goals and minimize trail use conflicts.

There is a need for specified trail uses where trail user needs, limitations, and preferences can be more closely realized through appropriate design and trail characteristics consistent with the individual use.

Provide a nonmotorized network of trails capable of sustaining the designated use. (Forest Plan Goals 7, 12; Forest Plan Objectives 12.0.A, 12.1.A, 12.1.B, 12.1.C)

Existing Condition

Much of the Cave Run trails system was constructed for light hiking use, or was established through nonmotorized use of former logging roads and skid trails. The existing trail system was not designed to current trail standards, nor intended to sustain horse and mountain biking use. Complex geology and highly erodible soils have resulted in trail placement, such as ridgetop and valley bottom, where water is not easily shed from the trail surface. This condition has led to entrenched trails and pooled water across wide surface areas. This is complicated by the combination of clay soils, seasonal rains, and heavy use. These soils become deeply pocked by hooves where trails traverse wetter locations, and entrained on steeper trail sections, especially with use during wet periods. The results are trail incision and widening and extensive mudhole formation, leading to development of "work-around" trails where existing trails can no longer support use.

Figure 3. A mudhole and "work-arounds" on the Caney loop trail.

Desired Condition

All trails are located, designed, and constructed according to Forest Plan standards, agency direction, and applicable erosion control standards and best management practices. Where trail segments do not currently meet design standards, the enforcement of seasonal restrictions mitigate trail damage during wet seasons and maintain trails in a sustainable condition. The use

capacity of individual trails and surrounding resources are not exceeded, and impacts to the trail tread are minimal and managed efficiently.

To the extent practicable, trails are located outside of riparian corridors. Stream crossings and approaches are hardened appropriately and trail sediment that reaches streams is minimal.

User-created trails not on the trail system are closed and rehabilitated or maintained to system standards. Approximately 20 percent of the existing system trails are brought into compliance and/or maintained each year through expected agency budgets and established partnerships.

There is a need for Cave Run nonmotorized system trails to be able to support the designated use.

Reduce impacts to aquatic and riparian habitat, rare communities, threatened, endangered and sensitive species, cultural resources, and recreation and aesthetic values. (Forest Plan Goals 1, 1.1, 3, 3.2, 5, 6, 6.1, 6.3, 6.5, 7.4, 12.1; Forest Plan Objectives 1.1.A, 6.1.B, 6.3.A, 6.5.A, 12.0.A, 12.1.A, 12.1.B, 12.1.C)

Existing Condition

Existing trail locations were not intended for current uses and did not fully consider impacts to natural resources associated with current trail location and use. For this reason, the trail system traverses sensitive areas and has the ability to affect sensitive plants and wildlife, riparian, cliffline, and rare communities, cultural resources, and aesthetic values.

Portions of the trail system are located in close proximity to rock shelters and caves, across clifflines, and through riparian areas and rare community sites. Several trails in the trail system that parallel drainages have altered stream-courses, and trails and streams have become one and the same. The “natural arch” rock shelter along the Sheltowee Trace is scoured and eroded by trail users. Resource protection measures are needed to assure the health of these habitats and their inhabitants.

Desired Condition

To the extent practicable, trails are located outside of riparian corridors, rare community sites, threatened, endangered, and sensitive species habitats, and archeological sites. Trails are located, designed, and constructed to standards capable of supporting the designated use, and applicable erosion control standards and best management practices are incorporated.

Stream crossings and approaches are hardened appropriately and trail sediment that reaches streams is minimal. Stream channel stability and Cave Run Lake water quality is not being substantially affected by on- or off-trail use. Geological features such as arches, caves, and rock shelters are protected from damage by recreationists. Trail users are staying within the trail tread of designated trails in rare community sites, along clifflines, and in and around bat hibernation, staging, and maternity sites.

There is a need to alleviate or moderate resource damage caused by the Cave Run nonmotorized trail system.

Figure 4. Sensitive rock shelters in close proximity to trails are vulnerable to visitor damage.

Provide adequate trail head parking accommodations. (Forest Plan Goals 7, 12)

Existing Condition

The Stoney Cove trailhead, located at the dam on Cave Run Lake, is widely used and preferred by most trail users. Its close proximity to Interstate 64, the large parking area providing simple ingress/egress for equestrians with larger trailer/vehicle combinations, and the toilet and picnic facilities make this trailhead popular. There are 5 other parking areas utilized by trail visitors in the Cave Run Lake area; three constructed for trail access and two associated with other recreation facilities. Access to the trail system is also available from private land west of the forest boundary. Existing trailhead parking facilities are widely distributed throughout the project area, but many are not preferred due to the lack of amenities and more difficult access.

There is currently little suitable land or available funding to develop or improve trailhead facilities. Suitable options include development of smaller parking areas, focusing trail opportunities out of existing campgrounds, or utilizing adjacent private lands to access the forest trail system.

Desired Condition

Trailheads are adequately distributed to access trails of various experience levels throughout the Cave Run Lake Trails project area. Access to trailheads is readily negotiated by respective trail users, and facilities are well-marked and easy to locate. Trailheads feature adequate space for the

amount of use trails receive, and designated areas provide adequate design and ample room to maneuver vehicles.

There is a need for trailhead facilities that adequately support use of the Cave Run nonmotorized trail system.

Figure 5. The Clear Creek parking area is utilized by fishermen, hikers, bicyclists, and equestrians.

Provide trail loops of various lengths and experience levels. (Forest Plan Goals 7, 12)

Existing Condition

Existing, shorter trail loops originating at trailhead locations are most widely utilized by all user groups. Outside of these shorter loops, opportunities for loop rides on trails diminish, as do varying lengths of loop rides available. The Stoney Cove area and Caney Loop is an important area to all user groups, as it provides the single "easy" experience level trail in the Cave Run trail system. This is an area broadly used by families, beginners, handicapped, and aging persons looking for a less challenging trail experience. Several "out and back" trails around Cave Run Lake are receiving minimal use.

Desired Condition

Loop trails offering a variety of lengths and experience levels are most desired by trail users. The trail system optimizes the number and variety of loop trails accessible from designated trailheads, parking areas, and overnight camping facilities. Campgrounds, picnic areas, and day use areas provide access to shorter routes with interpretive opportunities. Closed and seasonally closed

administrative roads are utilized, where necessary, to complete trail system loops and allow for side-by-side riding. Trails for more experienced riders generally provide longer distances with more varied opportunities and connect to other loops and other areas of the trail system.

There is a need to provide trails of varying lengths, experiences and opportunities for Cave Run nonmotorized trail users.

Figure 6. Several loops have been added to the trail system to enhance the trail users' experience.

Provide easily accessible and understandable information to trail users describing use, availability, accommodations, etiquette, and natural and heritage resources. (Forest Plan Goals 15, 15.1, 15.2, 15.3)

Existing Condition

Designated trails are not well marked, and most users remain on short loops in close proximity to trailheads because they are unfamiliar with the larger trail system. Many signs are outdated, inconsistent, and inaccurate, making travel confusing and contributing to user conflicts. Maps clearly identifying designated trails, uses, directions, and mileages are not readily available or posted at trailheads. Many users are not familiar with trail etiquette, which creates conflicts between users on the trail system.

Desired Condition

Effective signage and maps are the primary means of visitor management and coordination on the trail system where forest personnel or stewardship partners are not present. Kiosks, located at

trailheads, parking areas, and along the trail exhibit large, easily readable maps denoting trail uses, trail name and/or number, experience levels, mileages and/or typical duration, intersections, road systems, places of interest, and a clear symbol marking the visitor's current location. Other information displayed on kiosks include emergency measures, trail closure status information, pack in/pack out and/or leave no trace signage, trail etiquette practices, and volunteer opportunities. Paper maps are readily available at forest visitor centers, campgrounds, and local businesses. Interpretive signing is posted to inform trail users of sensitive and unique resources that need to be protected.

There is a need for the Cave Run nonmotorized trail system to be clearly defined and user-friendly.

Figure 7. Kiosks at trailheads act to disseminate helpful information regarding trails.

Engage the public in cooperative, collaborative efforts that build support in helping to meet the Forest's desired future condition and the public's desired experience. (Forest Plan Goals 14, 14.1, 15.4)

Existing Condition

Currently, there is little evidence of volunteer trail stewardship. User groups appear ready and willing to partnership in trail opportunities from planning to implementing, educating, and enforcing trail management. Volunteers help with maintenance on the Sheltowee Trace, but no other formalized partnerships or agreements are in place to promote and sustainably manage the

larger trail system. Conflicts among users have hampered efforts to unite user groups in trail maintenance and enhancement efforts.

Figure 8. Trail workshops provide education for trail planning, building, and maintenance.

Desired Condition

The public and other agencies and organizations are involved in cooperative and collaborative efforts that build ownership in the trail system. Efforts are made to engage the public in trail planning, expansion, maintenance, and enforcement through cooperative agreements, volunteer opportunities and partnerships. Local businesses are involved in assisting with the distribution of maps and information, which in turn fosters user support to the local economy. Trails are managed so that user group conflicts are minimal, and users' energies are focused on trail improvement and maintenance that is critical to the success of the trail system.

There is a need to incorporate the support and assistance of trail users if the Cave Run nonmotorized trail system is to be maintained, improved, and kept open.

Decision Framework

Based on comments responding to a public review period and the environmental analysis of each alternative, the Forest Supervisor, who is the responsible official for the Cave Run Nonmotorized Trails Project, will decide how to manage the nonmotorized trails within the project area. The responsible official will decide whether to proceed with the modified proposed action, an alternative to the proposed action, or the no-action alternative, and what, if any, forest plan amendments to adopt. The decision will

be in accordance with Forest Plan direction, and will be based on actions the responsible official determines to be appropriate for the resources in this area.

The decision may include:

- Potential improvements and provisions to be made to the Cave Run nonmotorized trail system;
- Designated uses for each trail;
- Restrictions to off-trail horse use in all or parts of the project area through a Forest Plan amendment;
- Project design features and monitoring to be applied to minimize negative effects to resources.

Public Involvement

This section summarizes the opportunities the public has had to be involved in this project. A list of the agencies, organizations, and individuals we contacted during scoping and other public involvement opportunities can be found in the project record. To date, you have been invited to participate in the project in the following ways:

2008 Cave Run Nonmotorized Trails Initiative Process

Although not specifically a part of the NEPA process, the 2008 Cave Run Nonmotorized Trails Initiative (CRTI) became the basis for the initial development of the proposed action. We organized the initiative to bring together various nonmotorized trail users, community members, and others who were interested in reaching agreement on how to manage Cave Run trails. A public meeting resulted in appointing a stakeholder workgroup with representative balance between user groups. The workgroup met from February through August of 2008 to develop a proposal for the trail system. Although the workgroup did not arrive at consensus, they generated valuable information that we used to structure the original proposal. The workgroup was generally unified on issues, desired trail attributes, and general recommendations for trail management. Differences focused on what trails should be designated for individual uses. We incorporated this input into the proposed action that we shared with you in November 2009.

Forest Schedule of Proposed Actions and Forest Website

We first listed the proposed action in the Forests' "Schedule of Proposed Actions" beginning January 2010, where it has appeared in each subsequent issue. The proposal was also posted on the forest website.

Project Scoping and Public Open House - November 2009

On November 12, 2009, we distributed a letter providing detailed information on the proposed action. We mailed or emailed the letter to approximately 240 individuals and groups interested in Daniel Boone National Forest projects and the Cave Run Lake trail system. Mailings included federal, state, and local agencies, affected user groups and individuals, tribes, and news media. We asked for responses that included comments and concerns regarding the proposed action.

A public open house, held on November 23, 2009, accompanied the release of the proposed action so that we could answer your questions pertaining to the proposal, and you could express your concerns and desired outcomes for the trail system. All of the comments we received in response to the scoping letter and public open house were documented and can be found in the project record.

Public Open House and Trails Workshop – December 2010

Comments we received in response to the proposed action informed us that more site specific trails information was needed to address the resource and social concerns brought forward during public scoping.

We contracted Trail Dynamics, a professional trail planner/builder, to complete an assessment of the Cave Run Lake trails and provide us with informed recommendations on trail management. The contract included two public workshops, designed to engage and educate everyone interested in the future of the trail system.

We mailed information to all parties described for the November 2009 public scoping and those who had expressed interest in the project, inviting participation in a public open house and two-day workshop the weekend of December 3 through 5, 2010.

Forest Service staff and the project team were available at the Friday evening open house to discuss the reasons we were incorporating the trail assessment, and explain how it would fit into the NEPA process. Saturday and Sunday, Woody Keen of Trail Dynamics presented an interactive workshop to help us all recognize and understand the possibilities for managing the Cave Run trail system. Together, we were able to communicate our concerns and ideas, and explore the capabilities and potential of the Cave Run trails.

Cave Run Trails Workshops – April and May 2011

A second weekend workshop was planned for April, after the trail assessment was completed. The April workshop was not well-attended for several reasons—late notification of the event, inclement weather forecasts, and the "near" government shutdown, all of which caused confusion as to whether or not we would hold the event.

We scheduled an additional public participation opportunity with Woody Keen for May 21 and 22, 2011 in order to encourage continued interaction, which we considered fundamental to the development and success of the future management of the trail system. This workshop was well received and well attended.

The two-day workshop offered participants the opportunity to learn why problems were occurring, how to assess problem areas for sustainability, and how to implement the technical concepts related to repairing, maintaining, and managing sustainable trails. It also provided all of us another chance to share future visions and ideas, and consider opportunities, constraints, and concerns in an atmosphere of mutual cooperation.

Two news articles were reported in the Bath County News, announcing the workshop and describing the project, and relating the details of the workshop and field trip.

Comment Period and Public Meeting - September 2012

The notice of opportunity to comment was published in the Lexington Herald-Leader Newspaper on August 31, 2012. Letters or emails were sent to individuals and groups who had expressed interest in the project, asking for meaningful comments on the prosed action and alternatives prior to a decision being made by the Responsible Official.

A public meeting was held during the comment period to explain the alternatives and how they were developed, and to give attendees the opportunity to ask questions about the alternatives and the decision process. All of the comments we received during the comment period were documented and can be found in the project record.

Issues

We received more than 250 emails and letters and one petition in response to scoping. We read each email and letter and identified individual comments or concerns contained within each one. Many of the comments expressed similar ideas, and several of you offered your own solution or alternative to be considered. Although all comments and concerns are important, some fell outside the scope for consideration in this environmental analysis process. These would include comments that are already part of the proposed action or are addressed through applying the standards in the Forest Plan; comments already decided by law, regulation, or policy; comments beyond the scope of the project; or comments that are speculative or not supported by science. Copies of all letters and emails, along with comments received to date and documentation of how those comments or concerns were addressed, are provided in the project record.

We grouped approximately 650 comments into seventeen public concern statements. The responsible official determined which issues were carried forward and used to form the basis for one or more action alternatives considered, and the resources to be analyzed for effects among alternatives. Concern statements are grouped into four main categories: recreation experience; resource degradation; economic stability; and purpose and need for the project. Table 2 lists the four categories and concern statements within each category.

Table 2. Resource concerns and measures for assessing effects

Concern Statement	Measure
Recreation Experience	
Eliminating the Caney area to horse use will impact equestrian users requiring less challenging trail conditions (i.e., women, children, families, novice riders, riders with physical limitations, and older user groups).	-Miles of “easy” trails available to equestrians
Dividing several existing all-use trails between equestrians and mountain bikers (reducing equestrian trail miles) will decrease trail availability and use by women, who are the majority of horse riders.	-Miles of trails available to equestrians -Percent of total trail miles available compared to previously available
Closing the southern portion of the Sheltowee to horses will impact horse users’ ability to access the natural arch which is an important, traditional destination spot.	-Availability of the natural arch to equestrians
Closing portions of the Sheltowee Trace to bikes will impact bikers’ opportunities for “through” trips on the Sheltowee Trace.	-Miles of Sheltowee Trace open to bike users
Seasonal closure of trails adjoining trailheads restricts access to areas open to all season use.	- Number of trailheads accessing all-season equestrian trails
Proposed blanket seasonal trail closures exclude users preferring “off season” experiences.	-Miles of trail available year-around by use
Proposed shared use trails on steep and narrow trail segments (including 104, 116, portions of 112, 113) will trigger user conflicts and create safety hazards to users.	-Shared use on the steep portions of trails 104, 112, 113, and 116.
Proposed shared use trails are difficult to navigate or impassible to bikes, are littered with equine feces, and provide an unacceptable bike user experience due to trail tread conditions caused by horse use.	-Miles of trail open to bike/hike use only
Resource Degradation	
Fewer miles of equestrian trails and fewer miles of trails open to all season use will result in increased degradation on remaining equestrian trails and trails open year-around due to the resulting increase in use.	-Percent of total trail miles available to equestrians compared to previously available -Miles of all season trails available to equestrians

Concern Statement	Measure
Wet weather causes trail degradation and resource damage throughout the year and wet weather closures need to be considered along with or in addition to seasonal trail closures.	-Precipitation analysis comparisons for seasonal vs. year-round precipitation events
Equestrian trails in low-lying wet areas along Cave Run Lake impact water quality by increasing sedimentation due to eroding soils, and through horse feces washing into the lake.	-Miles of trail in the riparian corridor -Number of stream crossings on trails
Maintaining the section of the Sheltowee Trace between County Road 129 and Forest Road 906A open to horses will exacerbate slumping soils created by horses cutting across the switchbacks and causing increased erosion.	-Miles of trails on slopes greater than 15 percent
Off-trail horse use (cross country riding) promotes unmanageable resource impacts, particularly where new "undesignated" trails become developed.	-Project area acres open to cross country riding
Economic Stability	
Blanket seasonal trail closures will shorten the tourism season and harm many small businesses.	-Employment and labor income response in the local economy from a fixed change in recreation visitation.
Trail closures and restrictions may have negative economic impacts on area businesses dependent on horseback riding and biking occurring in the project area.	-Potential change in recreation use -Employment and labor income response in the local economy from a fixed change in recreation visitation.
Purpose and Need for the Project	
Cross country riding conflicts with the principles of trail designation and required design standards and therefore is not consistent with the purpose and need for the project.	-Project area acres open to cross country riding
Many aspects of the proposed action are not fully developed, do not provide site specific information, and include "wish-list" type actions, which make it difficult to identify specific concerns and to know whether the proposal meets project objectives.	-Descriptive and/or quantitative information on trail proposals

The Alternatives Considered for Management

This section describes and compares the alternatives the responsible official considered be reasonable and to achieve the purpose and need for the project. Here, we define the differences between the proposed alternatives. The information we used to compare the alternatives is based on the purpose and need for the project and the issues that you raised during scoping and public participation.

We developed four alternatives in response to your concerns, including the no-action alternative. We explored many opportunities (Alternatives Considered but Eliminated from Detailed Study) and gave considerable thought to what we, along with partners, might realistically be able to achieve. The alternatives we developed incorporate improvements to existing trails, along with future expansion of the designated trail system. These improvements and expansion opportunities require time, dollars and labor, which may or may not be available to fully accomplish the activities associated with the alternatives.

Following the decision, we would develop a trail management plan to address the priorities for implementing individual tasks or projects associated with the decided activities. The plan would identify required surveys and additional NEPA or other necessary documentation on a year-by-year and project-by-project basis for a five year period. Additional documentation would be dependent on current

regulations and changed environmental conditions. The management plan would be a dynamic plan that would be updated annually over a ten to twenty year period, or until area management is revised.

Measures Common to All of the Action Alternatives

For all of the action alternatives evaluated, we would implement several measures that follow the same basic principles. We outline these common measures below. If there are specific variations of measures that apply to an individual alternative, we provide further detail within that alternative description. These measures would be incorporated as funding becomes available for implementation.

In all of the alternatives analyzed, pedestrians ('hiking') would be allowed on the entire trail system. In this document, we use the terms 'separated use' and 'shared use' to refer to horse use and bike use.

Trail Design Parameters

In order to prevent resource damage in excess of Forest Plan standards, trails we develop through this decision would, at a minimum, meet national trail design parameters (appendix A, C, and D). The current national trail design parameters for equestrian (pack and saddle) use (FSH 2309.18,23.12)(appendix A) were not developed for the prevailing soil, hydrologic, and topographic conditions of the Cave Run Lake project area. Trail Dynamics developed recommended alterations to pack and saddle trail design parameters specifically for Cave Run Lake trails, to further mitigate effects of local conditions (appendix B). To divert water off of trails, refinements to the current pack and saddle design parameters include the use of grade reversals, outsloped treads, and mechanized compaction of soils during construction and maintenance. Recommended parameters also consider trail grade in relation to landscape grade. While large sections of trail within the system fall below maximum grade parameters, many trails have a grade that is half the prevailing hill slope, making it difficult to sustain the current designated use. Where practicable, we would apply the recommended design parameters for pack and saddle use to existing and newly constructed equestrian trails within the Cave Run project area.

We would manage hiking trails and mountain bike trails using national trail design parameters (FSH 2309.18,23.11/23.13), which are sufficient to maintain trail tread in the project area (appendix C and D).

Trail Maintenance and Construction Methods

Trail Construction

Trail design parameters are one of the five fundamental concepts for trail planning and management that the forest service has adopted. Trails designed and managed for horses have different construction parameters than those designed and managed for mountain bikes.

We would construct new equestrian trails in the Cave Run trail system following national design parameters for pack and saddle use (appendix A), and, where reasonable, we would utilize guidelines outlined by Recommended Alterations to Pack and Saddle Trail Design Parameters for Cave Run Lake Trails (appendix B), as discussed above under Trail Design Parameters. We would follow national design parameters for any new mountain bike trails (appendix C), and upgrade hiking trails to meet national hiker/pedestrian design criteria (appendix D). These parameters outline criteria related to trail clearing limits, width, tread, surface type, grade, cross-slope, and turn radius.

Specific trail construction methods mentioned below are described in the Cave Run Trail System: Inventory, Assessment, and Management Plan for the Daniel Boone National Forest (Keen et al. 2011).

Trail Improvement

Meeting Forest Plan standards requires we rehabilitate, reconstruct, and in some cases relocate many of the existing trails. In many places, the current trail system is situated primarily in locations where water management is difficult or impacts to resources are occurring. We would improve existing system trails to facilitate water management, to reduce impacts from recreation use, and to maintain a desirable recreation experience. Existing trails that are being relocated would not be closed until the relocation is completed.

Rolling contours and outsloping are design features we would incorporate to facilitate water movement off the trail. We would use rolling grade dips at 50 to 100 foot intervals on trail slopes, and broader based dips along trail sections with negligible gradient.

High use equestrian and mountain bike trails on clay-based soils would require that we harden the trail tread, especially where soils contact the groundwater table on a seasonal basis. In these areas, we would add rock material to reduce the amount soil exposure, harden the surface, and decrease off-site erosion.

On steeper pitches of higher difficulty mountain bike trails, where drainage dips are not feasible due to fall-line alignment, we would armor the trail tread to prevent water-based erosion and reduce user impacts. In these circumstances, we would construct a downslope keystone using available rock and downed hardwood logs.

We would need to relocate short segments of trail on most existing trails to improve water management and decrease trail incision and sediment deposition or mudhole formation. We would redesign trail sections to incorporate rolling contours and grade reversals. Where trails make a single crossing of a riparian area at too steep a grade or at a location causing sedimentation, we would have to relocate the crossing. We would do this by finding a naturally hardened location, or by hardening the existing crossing and improving upslope water management. Where trails make multiple crossings over a single drainage, we would relocate the route to an area where water management could be best facilitated, ideally one with minimal crossing locations. Where these trails cannot practicably be relocated, we would decommission them or close them on a seasonal basis. Where existing trail impacts have caused resource damage or degradation, we would restore the area.

Trail Closure

A few trails located within the prescribed riparian corridor boundary are below the surrounding landscape grade and either are, or have a high probability of intercepting water drainage and altering natural hydrologic patterns. We would permanently close some trails that are located completely within the riparian corridor as well as those that have multiple stream crossings within short distances. Existing system trails being relocated would not be closed until the relocated trail is constructed. Trail closures vary across alternatives.

Stream and Drainage Crossings

In areas where it is necessary for the trail to cross drains and seeps, a much higher level of design and construction is required. We would incorporate natural armored fords and shallow trail gradients where available, or construct trail bridges or structures. We would employ grade reversals approaching drainage crossings on steep terrain, and use tread hardening on seep crossings and wet locations to minimize mudhole development. For constructed crossings on smaller drainages we would utilize available rock, which would be arranged to facilitate crossing.

We would upgrade stream and drainage crossings to comply with Forest Plan standards as a part of the action alternatives.

Trail Maintenance

We would need to clear the entire trail system annually to remove blown down vegetation and hazard trees from the trail corridor.

We would maintain rolling dips on a consistent basis, especially on equestrian trails where drains tend to lose outslope over time due to accumulating sediment or compaction.

We would need to maintain, regularly and consistently, all aspects of the trail system in order to keep upgraded trails in a sustainable condition. We would need to make significant progress with trail maintenance protocols, timeliness, efficiency, and quality, which we can only do with the help of volunteers and stewardship partners.

Restoration of Closed and Non-Designated Trails, Paths, and Rest Areas

There is no inventory of the non-system, user-created paths within the project area. After analysis and prioritization, we would restore certain non-system paths that are not designated into the trail system, along with closed and relocated routes. Prioritization for path restoration would first consider areas where there is resource damage, and areas where non-designated segments intersect with designated trails. We would also restore existing resting and gathering areas that are not reconstructed for use. All our restoration efforts would emphasize re-establishing natural hydrologic patterns, controlling sedimentation to streams, and returning natural grades. These actions should discourage use and encourage regrowth of natural vegetation. Our restoration methods could include disking compacted soils and planting approved, native vegetation on the sites.

Seasonal Closure and All-Season Trails

Action alternatives (alternatives 2, 3, and 4) include a seasonal closure to horse use on the designated trail system within the project area from December 15 until May 15. This period was selected to reduce undesirable impacts to the trail system and other resources during extended periods of wet conditions. Future monitoring of effects to trails would be done to determine whether changes to closure restrictions are warranted.

A select portion of the equestrian trail system would be available for all season use (not subject to the seasonal closure) when specified trails are improved and/or maintained to meet minimum approved design standards. Potential all-season-use trail miles vary across alternatives (see appendix E, maps 1 and 2), and are evaluated for effects in individual resource analyses. We located the potential all-season trail system based on trailhead availability and trail access, resource protection, and use of routes that are co-located on administrative roads. The all-season system could be accessed by two trailheads located on national forest system lands and two private ranches. We tried to minimize potential all-season trails in riparian areas and areas along stream channels. Roads are available for recreation use year-round, and are not subject to seasonal closures. Gated, durable all-weather roads provide routes that hold up to wet season and freeze/thaw period use and increase the all-season mileage and loop opportunities within the project area.

We would monitor effects to equestrian and mountain bike trails to determine whether additions to seasonal closure restrictions are needed, or whether seasonal closures can be lifted on specified trails.

Gating of the Murder Branch Cave

The need to protect Murder Branch cave was recognized during project planning. Alternatives 2, 3, and 4 would physically close existing trails accessing the cave, restrict cross country equestrian use on

approximately 350 acres surrounding the cave (Appendix E, Map 3), and install a gate at the entrance of the Murder Branch cave.

The Murder Branch cave has documented use by nine species of bats, including the federally endangered bat species (KY Dept. of Fish and Wildlife Resources 2011). Past and on-going use in the Murder Branch drainage is adversely affecting the cave. Prior to Forest Service acquisition of the cave in 2005, ATV trails were developed in the area. Illegal ATV use continues establishment of new trails in the drainage, including several that lead to the cave entrance. Despite the fact the cave is now closed to public access under a Forest Supervisor and Regional Forester order (USDA FS 2012a), field checks have shown a large increase in human traffic into Murder Branch cave (2013 personal communication with Tom Biebighauser). In addition to this illegal access, several user created trails have resulted in erosion and sedimentation into the cave. We are particularly concerned about existing unauthorized public access into the cave due to the increased risk of spreading White Nosed Syndrome (WNS), an illness that has resulted in the mortality of millions of bats in the last five years (USDI FWS 2012c).

Trail Loops

Loop trails offering a variety of lengths and experience levels are the most popular trails. Our trail system objectives help us to optimize the number and variety of loop trails accessible from designated trailheads, parking areas, and overnight camping facilities. Loops providing a beginner or “easy” trail experience include shorter duration rides and incorporate scenic views or interesting destinations where possible. Campgrounds, picnic areas, and day use areas would provide access to shorter routes with interpretive opportunities. We would utilize closed and seasonally closed administrative roads, where necessary, to complete trail system loops and allow for side-by-side riding, which can be desirable for larger groups or less experienced riders. Trails targeting more experienced riders would generally provide longer distances, have varied opportunities, and connect to other loops and other areas of the trail system.

Closure of Roads to Specific Nonmotorized Uses

Each action alternative utilizes permanently and seasonally closed roads to connect trails and create loops. These roads would remain on the forest road system, and not be “designated” trails. So that these roads contribute to the desired trail experience, permitted uses on these roads would correspond to the permitted uses on the surrounding designated trails. This would be accomplished through closure orders enacted by the Forest Supervisor. As an example, where trails are designated to horse and hiking use, the surrounding closed roads creating horse/hiking loops would be closed to bikes. Closure of those roads to specified nonmotorized users would be in effect during the time the roads are closed to public vehicle traffic. Closure of roads to specified uses vary across alternatives, are described in detail in each alternative, and will be evaluated for effects in individual resource analyses.

Special Use Trails

Linkages exist between three local businesses adjacent to the Cave Run trails and the trail system. Under all of the action alternatives, we would require special use permits for trail access to private businesses that are connected to the trail system. The private business owner would be required to apply for and/or keep current a special use permit if they desire a connection to the Cave Run trail system. Permits would be approved following required surveys and proper analysis and documentation. This proposal does not include approval of Special Use Permits for commercial outfitter guide.

Horse Resting Areas

For popular locations where users regularly stop for a break, we would build developed rest areas along designated equestrian trails. These areas would provide hitching posts to limit resource impacts associated

with confining horses in a relatively small area. Rest areas would range from one-tenth to one-third acre in size. The location and size of each rest area would be influenced by natural features along the trails and established historic stops. Where we develop rest areas in previously established locations, we would address and manage the existing impacts. All of the action alternatives would reduce environmental effects by locating rest areas to less environmentally sensitive areas and reducing the area and scope of impact.

Trailheads and Parking Areas

In order to improve access to the designated trail system and distribute use throughout the project area, we would need to improve trailheads and develop new parking areas. New parking areas would be relatively small, graveled areas designed to accommodate between four and eight vehicles, and would include information/education boards. Equestrian parking areas would have room for horse trailers and include a drive-through design. We could also expand existing trailheads or parking areas to incorporate these features.

In each area we would clear brush and small trees, and where necessary, larger trees (10 inches and greater). Earthwork would be needed to remove stumps and level the parking area prior to being surfaced with gravel.

Trail Signage and Information

Effective signage and maps are the primary means of visitor management and coordination on trail systems where forest personnel or stewardship partners are not present. They are the means to a quality recreational experience as well as successful risk management. We would locate kiosks at trailheads, parking areas, and along the trail to exhibit large, easily readable maps denoting trail uses, trail name and/or number, experience levels, mileages and/or typical duration, intersections, road systems, places of interest, and a clear symbol marking the visitor's current location. This information, in conjunction with signage along the trail system, would improve navigation, recreational choices, and risk management for our trail users.

Other information we would display on kiosks includes emergency measures, trail closure status information, pack in/pack out and/or leave no trace signage, trail etiquette practices, and volunteer opportunities.

Paper maps would be sold at forest visitor centers, campgrounds, and local businesses. A trail-way marking system on high-use trails would be accomplished through partnership opportunities.

We would post clear, understandable trail maps on the forest website to improve user experience.

Trail Education and Collaboration

We cannot implement the above measures without a lot of help from groups and individuals outside of the forest service. We would need volunteers from local, state, and regional service groups and user groups in many capacities. User group functions would range from enlisting external monies for trail equipment, improvement, construction, and maps and information, to organizing labor to implement, monitor, maintain, and patrol the trail system. Without these partnerships, trails could deteriorate over time from lack of funding and maintenance, which could ultimately lead to closure.

Our forest staff would be responsible for developing formal agreements between organized equestrian and mountain biking user groups. We would take the lead in managing implementation priorities, setting maintenance protocols, and coordinating essential volunteer training.

Compliance with Road and Area Closures and Trail Designations

The Forest Supervisor would issue an Order for the project area allowing law enforcement to issue citations to trail users who do not comply with road and area closures and trail designations. This effort would increase the chance that all users would have the desired trail experience, and it would also monitor resource protection and trail designation effectiveness.

Priorities for Implementation

Implementing this project would be an ongoing process and likely take many years to achieve the desired trail system. Initially, trails would be designated for specific uses. Trail and trailhead signs would be installed, and maps and web page information would be updated. Seasonal and cross-country horse travel would be restricted to minimize impacts and reduce maintenance. Implementation of the remainder of the activities would be dependent on the availability of funding and forest and volunteer resources over time. The 5.6 miles of existing unauthorized trail in the Murder Branch area would not be designated until the Forest completes archaeological surveys to identify historic properties and Section 106 responsibilities are fulfilled.

The priority for implementation would be in high-use areas that are experiencing elevated resource impacts. Generally, trail improvement would take precedence over new trail construction. We would concurrently restore trails as they are closed or relocated. We would monitor trail and resource conditions on the trail system as improvements are completed, to determine whether we need to adjust seasonal closures, or if we could implement all-season trails. The action alternatives would vary somewhat in how we implement specific trail improvement activities, but the overall intent of resource protection is consistent across all of the action alternatives we are analyzing.

Upon decision, we would seek to develop collaborative opportunities for the public to become engaged in implementation of this decision. The Forest would work in partnership with trail users to further establish priorities for improvements, construction, maintenance, monitoring, and funding sources.

Monitoring

Monitoring is important to ensure that the project is implemented as designed and is effective in accomplishing the desired results. Our monitoring would be designed to collect and maintain accurate information on trail and resource conditions, recreation use, and user satisfaction. This information is essential to maintaining resource protection while providing a quality recreation experience. Monitoring could lead to adaptive management where we would work with our stewardship partners. Adaptive management would allow us to determine acceptable levels of change in physical trail resources and the effectiveness of seasonal closures and all-season trails. It could also identify any maintenance protocols necessary to ensure a specific level of resource management, as well as suitable tools and facilities to service optimal use levels.

Alternatives Considered in Detail

Based on issues and comments received through public input events and requests, we developed alternatives primarily around trail user designations (alternatives 2 through 4). Issues regarding damage to resources included impacts to the existing designated trail system, and impacts resulting from off-trail horse use, or “cross country riding”. Impacts to the designated trail system are addressed within alternative 1 through 4 proposals. Impacts resulting from off-trail horse use are addressed in addition to the action alternatives and within the scope of the action alternative proposals. Environmental effects analysis considers the following three options for off-trail horse use in the project area:

1. Continue to allow off-trail horse use throughout the project area (52,500 acres of national forest system lands).
2. Allow off-trail horse use throughout the project area with the exception of two ecologically sensitive areas (appendix E, map 3). Within these defined areas, riding would be allowed only on the designated trails and on the road system. The two areas include rare community sites in the Caney area, and around the Murder Branch Cave in the Murder Branch area, as shown on map 3. The Forest Plan would be amended to reflect a "closed unless posted open" designation within these two areas.
   - Caney area closure to off-trail horse use: approximately 635 acres
   - Murder Branch Cave area closure to off-trail horse use: approximately 385 acres

   Approximately 51,480 acres of national forest lands within the project area would remain open to off-trail horse use.
3. Allow horse use only on designated trails and on the public road system within the project area. The Forest Plan would be amended to reflect a "closed unless posted open" designation within the project area. All of the 52,500 acre project area would be closed to off-trail horse use.

The responsible official will decide how to manage off-trail horse use within the project area, as described above, *and* whether to proceed with alternative 1, 2, 3, or 4, as described below.

Alternative 1

No Action: Shared Use on the Existing Trail System

Alternative 1 represents the existing condition on the trail system. In other words, we would continue to manage the trail system as it is already being managed. All of the trails would be shared by hikers, equestrians, and mountain bikers. We would not make changes to trail designations, trail locations, or trail maintenance protocols. No trail or resource restoration would be completed. Non-system, user-created trails would not be added to the trail system or restored to native conditions. We would not improve trail facilities or signing beyond current maintenance levels. Trail information would be improved and updated as needs and funding are available. Routine trail maintenance would be implemented as safety concerns arise and as monies become available. The No Action alternative provides a baseline for comparing the action alternatives.

Refer to appendix E – map 4 for a depiction of alternative 1.

Trail Designations

Approximately 74 miles of system trail would remain open to shared use for hiking, biking, and horseback riding under alternative 1. Additionally, about 8 miles[1] of user-created, non-system trail would remain open to nonmotorized users. No new trail mileage and no trail closures would occur under this alternative.

[1] Approximately 8 miles of user-created, non-system trails have been mapped within the Cave Run Nonmotorized Trails project area. There is no current inventory of user-created trails within the project area. It is estimated there are about two times the number of established user-created trail miles in the project area as have been mapped.

Table 3. Alternative 1 activities for the Cave Run Nonmotorized Trails Project system

Alternative 1 – No Action	Units
Designated Trails – Existing Trail System	
Horse/Hike Trails (Miles)	-
Bike/Hike Trails (Miles)	-
Hiking Only Trails (Miles)	1
Mapped Trail Mileage Shared with Roads	~8
All Use Designated Trails (Miles)[a]	74
Total System Trails (Miles)[a]	75
Trail Use – Miles of Designated Trail and Principal Undesignated Paths Currently Used	
Mapped User-created Paths (Miles)	8
All Use Trails (Miles)	82
Total Use (Miles)	83
Seasonal Trail Use	
All Season Trail Use (Miles)	83
Trail Treatments	
Trail Improvement (Miles)	0
New Trail Construction (Miles)	0
Trail Closure (Miles)	0
Trails Considered for Special Use Permits (Miles)	0
Trail Maintenance (Miles)	75
Facilities Treatments	
Horse Resting Site Construction (Number of Sites)	0
Kiosk Construction (Number of Structures)	0
Trailhead Improvement (Number of Sites)	0
Trailhead/Parking Area Construction (Number of Sites)	0

a - This mileage includes the approximate 8 miles of trail shown on roads. Actual *trail* mileage is about 8 miles less.

Alternative 2

The Scoped Proposed Action with Modifications: Shared and Separated Use on the Existing Trail System

Alternative 2 is the original proposed action that was scoped in December 2009, with some minor modifications. In this alternative, we would designate a combination of shared and separated use on the existing trails within the project area. This alternative designates the least amount of separate use trail mileage compared to the other action alternatives.

This alternative would provide individual user groups about 65 percent of the trail mileage currently available to them with about 40 percent of the miles shared between uses. Shared use trails would be improved to equestrian design standards, and separated use trails would be improved or constructed to design standards for the designated use. Trail maintenance and trail improvements within the existing trail tread would be incorporated in alternative activities. This alternative represents the least amount of physical trail modifications, and would require less cost to implement in comparison to the other action alternatives.

We included modifications to the original proposed action based on comments we received from public scoping. This alternative incorporates the following modifications:

- Seasonal trail closures would be implemented for equestrian use from December 15 through May 15 annually.
- All season use for equestrians would be incorporated on a portion of the trail system, contingent on upgrades to approved trail design standards (see Seasonal Closures, p. 24).
- The Murder Branch Cave would be gated to public access.
- Trail 107 and Trail 118 would be designated Shared Use in order to connect bikes to the southern portion of the Sheltowee Trace Recreation Trail.
- Trail 106 would be decommissioned.
- Specific roads would be closed to certain nonmotorized uses.

A point of clarification on the scoped proposed action is also included:

- Special use permits are required for trail access to private businesses that are connected to the trail system. Private business owners are required to apply for and/or keep current a special use permit if they desire a connection to the Cave Run trail system. Special use trails would be improved and maintained to minimum approved design standards by the Special Use permittee. Permits may be approved contingent on required surveys and proper analysis and documentation.

These modifications do not change the scope or intent of the proposed action.

Trail Designations

Approximately 75 miles of system trail would be designated to horse/hike use, bike/hike use, hiking only, or mixed use (horse/bike/hike) under alternative 2. Trail miles by designated use are shown in Table 4 and illustrated on map 5 in appendix E. This would give equestrians a total trail system of 46 miles, and mountain bikers a total trail system of 45 miles if alternative 2 is chosen. No additional trails would be constructed under this alternative.

Road Closures to Horses or Bikes

Specific forest system roads (FR) would be closed to nonmotorized uses that do not conform to the designated use of associated trails. Exclusive use of closed and seasonally closed administrative roads would augment the trail system and mileages available to designated users by creating additional riding opportunities and connecting additional trail loops. Closure orders on those roads would be in effect during the time the roads are closed to public vehicle traffic.

The following forest system roads (or gated portions), used to create horse and hiking loops, would be closed to bike use under alternative 2: 906, 908, 909, 912, 914, 915, 1053, 1054, 1056, and 1074.

The following forest system roads (or gated portions), used to create bike and hiking loops, would be closed to horse use under alternative 2: 1225 between trails 112 and 113, and 1288.

Horse Resting Areas

Approved horse resting areas would be improved at nine locations and constructed at one location along the trail system (appendix E, map 5). We chose these areas because they are currently established resting areas, in locations where users traditionally gather. Rest areas would be confined to about one-half acre in size, and would include permanent hitching facilities. Existing, non-designated resting areas would be

restored to more natural conditions (see Restoration of Non-Designated Trails, Paths, and Rest Areas, p. 24).

A rest area would be constructed on FR 906 for equestrian access to see the arch on the Sheltowee Trace (Trail 100). Benches could also be installed at this location.

The rest area at five-corners (intersection of Trail 112 and FR 1225) would include the addition of a kiosk or sign-board for trail maps and information.

Trailhead and Parking Area Designation/Improvement and /or Construction

This alternative includes the development of two trailhead parking areas. Our plans include improving the Glady trailhead by adding a new overflow parking area to the existing parking lot. This area would be graveled and built to accommodate up to an additional ten truck/trailer combinations.

We would construct a new parking area on County Road 930 by the start of the horse trail to accommodate use of the Murder Branch trails. This lot would be graveled and built to accommodate pull-through traffic for five to eight truck/trailer combinations. Trail maps and signing would also be incorporated at the trailhead.

Refer to appendix E – map 5 for a depiction of alternative 2.

Table 4. Alternative 2 proposed activities for The Cave Run Nonmotorized Trails Project system

Alternative 2 – Shared Use Existing Trail System	Units
Trail Designation – Miles Available After New Trail Construction and Improvements	
Horse/Hike Trails (Miles)	28
Bike/Hike Trails (Miles)	27
Hiking Only Trails (Miles)	2
All Use Trails (Miles)	18
Total System Trails (Miles)	75
Closed and Seasonal System Roads Completing Horse Loops (Miles)	23
Closed and Seasonal System Roads Completing Bike Loops (Miles)	2
Trail Designation – Miles Available on Decision	
Horse/Hike Trails (Miles)	28
Bike/Hike Trails (Miles)	27
Hiking Only Trails (Miles)	2
All Use Trails (Miles)	18
Total System Trails (Miles)	75
Closed and Seasonal System Roads Completing Horse Loops (Miles)	22
Closed and Seasonal System Roads Completing Bike Loops (Miles)	2
Closed and Seasonal System Roads Used for All Use Loops (Miles)	3
Seasonal Trail Use	
Potential All Season Trail Use – Horses (Miles)	8
Potential All Season Trail Use – Bikes (Miles)	27
System Roads Completing All Season Horse Loops (Miles)	9
Trail Treatments	
Trail Improvement (Miles)	75

Alternative 2 – Shared Use Existing Trail System	Units
New Trail Construction (Miles)	-
Trail Closure (Miles)	2
Trails Considered for Special Use Permits (Miles)	1
Trail Maintenance (Miles)	75
Facilities Treatments	
Horse Resting Site Improvement or Construction (Number of Sites)	10
Kiosk Construction (Number of Structures)	1
Trailhead Improvement (Number of Sites)	1
Trailhead/Parking Area Construction (Number of Sites)	1

Alternative 3

Separated Use on a Modified Trail System

In alternative 3 we would designate separated use on a revised and expanded trail system. This alternative optimizes opportunities and recreational experience for the widest range of nonmotorized recreation users. It also minimizes resource impacts, user conflict, and safety concerns.

This alternative would divide the trail system between uses and provide individual user groups about 60 percent of the trail mileage currently available to them. With the exception of about one mile of road, horse/hiking and bike/hiking trail systems would be completely independent of one another. Existing trails would be improved to better facilitate the designated use, and new trail construction would meet minimum design standards for the designated use. User group partnerships and volunteer collaboration would be essential to achieving the designed results, and primary funding would need to be acquired by interests outside the forest service. This alternative incorporates the following actions:

- Seasonal trail closures would be implemented for equestrian use from December 15 through May 15 annually.
- All season use for equestrians would be incorporated on a portion of the trail system, contingent on upgrades to approved trail design standards (see Seasonal Closures, p. 20).
- The Murder Branch Cave would be gated to public access.
- Specific roads would be closed to certain nonmotorized uses.
- Special use permits are required for trail access to private businesses that are connected to the trail system. Private business owners are required to apply for and/or keep current a special use permit if they desire a connection to the Cave Run trail system. Special use trails would be improved and maintained to minimum approved design standards by the Special Use permittee. Permits may be approved contingent on required surveys and proper analysis and documentation.

Trail Designations

Approximately 91 miles of existing and planned system trail would be designated for horse/hike use, bike/hike use, or hiking only use under alternative 3. Potential trail miles by designated use are shown in Table 5, and illustrated on the map in appendix E. This would give equestrians a total potential trail system of 43 miles, and mountain bikers a total potential trail system of 40 miles.

Road Closures to Horses or Bikes

Specific forest system roads (FR) would be closed to nonmotorized uses that do not conform to the designated use of associated trails. Exclusive use of closed and seasonally closed administrative roads would augment the trail system and mileages available to designated users by creating additional riding opportunities and connecting additional trail loops. Closure orders on those roads would be in effect during the time the roads are closed to public vehicle traffic.

The following forest system roads (or gated portions), used to create horse and hiking loops, would be closed to bike use under alternative 3: 906, 908, 909, 912, 914, 915, 1053, 1054, 1056,1062, and 1074.

The following forest system roads (or gated portions), used to create bike and hiking loops, would be closed to horse use under alternative 3: 1225, and 1288.

Horse Resting Areas

Approved horse resting areas would be improved at eight locations and constructed at one location along the trail system (appendix E). We chose the areas for improvement because they are currently established resting areas, in locations where users traditionally gather. Approved areas would be reconstructed in existing locations where practical, or restored where existing locations are too degraded to recover adequately with continued use. Rest areas would be confined to about one-half acre in size, and would include permanent hitching facilities.

A rest area would be constructed on FR 906 for equestrian access to see the arch on the Sheltowee Trace (Trail 100). Benches could also be installed at this location.

The rest area at five-corners (intersection of Trail 112 and FR 1225) would include the addition of a kiosk for trail maps and information.

Trailhead and Parking Area Designation/Improvement and /or Construction

This alternative would include the construction of three trailhead parking areas, improvement of the Glady trailhead, and trailhead designation of an existing parking lot. Our plans include improving the Glady trailhead by adding a new overflow parking area to the existing parking lot. This area would be graveled and built to accommodate up to an additional eight to ten truck/trailer combinations.

We would construct two new parking areas. One would be built on County Road 930 at the beginning of the horse trail to accommodate use of the Murder Branch trails. This lot would be graveled and built to accommodate pull-through traffic for five to eight truck/trailer combinations.

Parking areas to facilitate bike use would be constructed to access new trails at Clay Lick, and existing and new trails northeast of Cave Run Lake off FR 964. These lots would accommodate 4 to 8 vehicles. The Tater Knob fire tower parking area would also be designated for use by mountain bikes, to access the biking trail system to the north of the Tater Knob fire tower.

Refer to appendix E – map 6 for a depiction of alternative 3.

Table 5. Alternative 3 proposed activities for the Cave Run Nonmotorized Trails Project system

Alternative 3 – Separated Use Modified Trail System	Units
Trail Designation – Miles Available After New Trail Construction	
Horse/Hike Trails (Miles)	43
Bike/Hike Trails (Miles)	40
Hiking Only Trails (Miles)	8
All Use Trails (Miles)	0
Total System Trails (Miles)	91
System Roads Completing Horse Loops (Miles)	23
System Roads Completing Bike Loops (Miles)	4
System Roads Completing Shared-Use Loops (Miles)	1
Trail Designation – Miles Available Before New Trail Construction	
Horse/Hike Trails (Miles)	41
Bike/Hike Trails (Miles)	22
Hiking Only Trails (Miles)	8
All Use Trails (Miles)	0
Total System Trails (Miles)	71
System Roads Completing Horse Loops (Miles)	23
System Roads Completing Bike Loops (Miles)	4
System Roads Completing Shared-Use Loops (Miles)	1
Seasonal Trail Use – Miles Available After Trail Improvements and Construction	
Potential All Season Trail Use – Horses (Miles)	10
Potential All Season Trail Use – Bikes (Miles)	40
System Roads Completing All Season Horse Loops (Miles)	9
Trail Treatments	
Trail Improvement (Miles)	71
New Trail Construction (Miles)	20
Trail Closure (Miles)	5
Trails Considered for Special Use Permits (Miles)	~1
Trail Maintenance (Miles)	91
Facilities Treatments	
Horse Resting Site Improvement or Construction (Number of Sites)	9
Kiosk Construction (Number of Structures)	1
Trailhead Improvement (Number of Sites)	1
Trailhead/Parking Area Construction (Number of Sites)	3

Alternative 4

Shared and Separated Use on a Modified Trail System

In alternative 4 we would designate both shared and separated use trails on a revised and expanded trail system. This alternative is similar to alternative 2, but includes new trail construction and proposes less

shared use trail mileage. This alternative connects the two local mountain biking areas and more closely balances mileages between uses with the inclusion of closed and seasonally closed road mileages.

This alternative would provide equestrians about 65 percent of the trail mileage currently available, with about one-quarter of the mileage being shared use. Bikers would have about 75 percent of the current trail mileage available, with about one-fifth of the miles shared between uses. Shared use trails would be improved or constructed to equestrian design standards, and separated use trails would be improved or constructed to design standards for the designated use. User group partnerships and volunteer collaboration would be essential to achieving the designed results, and primary funding would need to be acquired by interests outside the forest service. This alternative incorporates the following actions:

- Seasonal trail closures would be implemented for equestrian use from December 15 through May 15 annually.
- All season use for equestrians would be incorporated on a portion of the trail system, contingent on upgrades to approved trail design standards (see Seasonal Closures, p. 20).
- The Murder Branch Cave would be gated to public access.
- Specific roads would be closed to certain nonmotorized uses.
- Special use permits are required for trail access to private businesses that are connected to the trail system. Private business owners are required to apply for and/or keep current a special use permit if they desire a connection to the Cave Run trail system. Special use trails would be improved and maintained to minimum approved design standards by the Special Use permittee. Permits may be approved contingent on required surveys and proper analysis and documentation.

Trail Designations

Approximately 93 miles of existing and planned system trail would be designated for horse/hike use, bike/hike use, hiking only, or mixed use under alternative 4. Potential trail miles by designated use are shown in Table 6, and illustrated on the map in appendix E. This would give equestrians a total potential trail system of 44 miles, and mountain bikers a total potential trail system of 52 miles.

Road Closures to Horses or Bikes

Specific forest system roads (FR) would be closed to nonmotorized uses that do not conform to the designated use of associated trails. Exclusive use of closed and seasonally closed administrative roads would augment the trail system and mileages available to designated users by creating additional riding opportunities and connecting additional trail loops. Closure orders on those roads would be in effect during the time the roads are closed to public vehicle traffic.

The following forest system roads (or gated portions), used to create horse and hiking loops, would be closed to bike use under alternative 4: 906, 908, 909, 912, 914, 915, 1053, 1054, 1056, and 1074.

The following forest system roads (or gated portions), used to create bike and hiking loops, would be closed to horse use under alternative 4: 1225 between trails 112 and 113, and 1288.

Horse Resting Areas

Resting and gathering areas for alternative 4 would be the same as described for alternative 2. Approved resting areas would be improved or reconstructed at nine locations along the trail system, and constructed at one location (appendix E).

Trailhead and Parking Area Designation/Improvement and /or Construction

Trailhead and parking area designations, improvements, and construction for alternative 4 would be the same as described for alternative 3.

Refer to appendix E – map 7 for a depiction of alternative 4.

Table 6. Alternative 4 proposed activities for the Cave Run Nonmotorized Trails Project system

Alternative 4 – Shared and Separated Use Modified Trail System	Units
Trail Designation – Miles Available After New Trail Construction	
Horse/Hike Trails (Miles)	33
Bike/Hike Trails (Miles)	41
Hiking Only Trails (Miles)	8
All Use Trails (Miles)	11
Total System Trails (Miles)	93
System Roads Completing Horse Loops (Miles)	23
System Roads Completing Bike Loops (Miles)	2
System Roads Used for All Use Loops (Miles)	3
Trail Designation – Miles Available Before New Trail Construction	
Horse/Hike Trails (Miles)	29
Bike/Hike Trails (Miles)	25
Hiking Only Trails (Miles)	8
All Use Trails (Miles)	11
Total System Trails (Miles)	73
System Roads Completing Horse Loops (Miles)	23
System Roads Completing Bike Loops (Miles)	2
System Roads Completing Shared-Use Loops (Miles)	3
Seasonal Trail Use – Potential Trail System	
Potential All Season Trail Use – Horses (Miles)	10
Potential All Season Trail Use – Bikes (Miles)	41
System Roads Completing All Season Horse Loops (Miles)	9
Trail Treatments	
Trail Improvement (Miles)	73
New Trail Construction (Miles)	20
Trail Closure (Miles)	3
Trails Considered for Special Use Permits (Miles)	~1
Trail Maintenance (Miles)	93
Facilities Treatments	
Horse Resting Site Improvement or Construction (Number of Sites)	10
Kiosk Construction (Number of Structures)	1
Trailhead Improvement (Number of Sites)	1
Trailhead/Parking Area Construction (Number of Sites)	3

Design Features and Monitoring Common to All Action Alternatives

Design features are part of the action alternatives. They were developed in response to comments on the proposal and for consistency with Forest Plan direction.

Heritage Resources

H-1: The Forest would ensure that archaeological surveys to identify historic properties are completed in accordance with 36CFR 800.4(b)(2) and the Memorandum of Agreement between Kentucky State Historic Preservation Office (SHPO) and Daniel Boone National Forest (Kentucky SHPO 2013) prior to the implementation of the various parts of the project.

Wildlife and Botanical Resources

WL-1: Recreational activities inside caves will not be promoted except for designated recreational caves. Public information concerning location and access to non-recreational caves will be limited. (DB-REC-1)

WL-2: No tree cutting would occur within 2.5 miles of any Indiana bat maternity colony from May 1 through August 15. A tree that is an immediate threat to human safety may be cut during this time). (DB-WLF-8*)

WL-3: Suitable Indiana bat roost trees more than five miles from significant Indiana bat hibernaculum may only be felled from October 15 through March 31. If tree removal occurs at other times, the trees must be evaluated for current Indiana bat use, according to the U.S. Fish and Wildlife Service protocol. (DB-WLF-9)

WL-4: Suitable Indiana bat roost trees within five miles of a significant Indiana bat hibernaculum may only be felled from November 16 through March 15. If removal occurs at other times, the trees must be evaluated for current Indiana bat use, according to the U.S. Fish and Wildlife Service protocol. (DB-WLF-10)

WL-5: No trees may be cut within five miles of known significant Indiana bat hibernacula between September 1 and December 1. (DB-WLF-12)

WL-6: Hazard trees (dead or alive) considered to be an immediate threat to human safety may be removed at any time. This supersedes all other standards. (DB-VEG-1)

WL-7: Where caves exist outside Cliffline Community Prescription Area a minimum zone of 200 feet is to be maintained around openings to caves and mines suitable for supporting cave-associated species, as well as any associated sinkholes and cave collapse areas, except for designated recreational caves. Prohibited activities within this protective area include use of motorized wheeled or tracked equipment (except on existing roads and trails), mechanical site preparation, recreation site construction, tractor-constructed fire lines for prescribed fire, herbicide application, and construction of new roads, skid trails, or log landings. Vegetation in this buffer zone may be managed only to improve habitat for PETS or Conservation species. (DB-WLF-13)

WL-8: Management activities will not concentrate public use in the vicinity of clifflines, if such is detrimental to PETS species or habitat for Conservation species. (DB-1.C-WLF-2)

WL-9: Build no new trails in Rare Community Sites. (DB-1.G-Rec-2)

WL-10: Do not concentrate public use in Rare Community sites. (DB-1.G-Rec-3)

WL-11: New roads, trails and temporary landings are permitted in rare community management zones as long as surface runoff from roads, ruts, trails, and landings is not concentrated into streams within the defined watershed, but rather dispersed across the site. (DB-1.G-ENG-Wet-1)

WL-12: Do not permit management activities in seep/streamhead/swamp rare communities that are likely to decrease, primarily though changes to the hydrologic balance, the likelihood of maintaining the viability of species that have uncertain prospects for continued viability. Hydrologic changes include those caused by changes in canopy vegetation. (DB-1.G-ENG-WET-2)

WL-13: Snags greater than six inches DBH and equal to or greater than 10 feet in height will only be removed between October 15 and March 31 unless they are a threat to human safety. (BMP-1)

WL-14: New trails will not be designated within 200 feet of caves. Existing user-created paths not included in the action alternatives within the 200 ft. buffer will be closed and rehabilitated. (BMP 2)

WL-15: All clifflines near existing and proposed trail crossings have been surveyed. Changes of more than 200 to 300 ft. to the existing or proposed trail locations, where they cross clifflines, will need to be surveyed prior to implementation. (BMP 3)

WL-16: Recreational or trail construction and maintenance activities will not occur within 330 feet of active eagle nests during the nesting season. (BMP 4)(USDI FWS 2007b)

WL-17: The Clear Creek population of Running Buffalo Clover will be monitored annually to ensure that the existing population is not adversely affected by any increases in equestrian use. (BMP5)

WL-18: Design and layout of new trail construction or trail maintenance within the streamhead seep prescription area will be coordinated with the Forest botanist and hydrologist. (BMP 6)

WL-19: If a butternut tree is found, the tree will be assessed to determine whether it has been affected by butternut canker. No butternut trees will be removed unless they show clear evidence of canker. (BMP 7)

WL-20: Prior to any new disturbance associated with trail or parking lot construction/relocation, a habitat suitability assessment will be conducted for running buffalo clover. Suitable running buffalo clover habitat will be surveyed by a qualified biologist for the presence or absence of plants. Suitable habitat includes closed canopy forest along roads or trails, or open canopy sites where there is a source of limestone. If plants are documented, a Forest Service biologist or ecologist will be contacted, who will identify appropriate buffers or avoidance and minimization measures necessary to ensure that the population is maintained. Impacts to new and existing running buffalo clover populations will be avoided/ minimized where possible. If impacts to new or existing populations cannot be avoided/minimized, formal consultation with USFWS will be initiated. (BMP8)

WL-21: To ensure that the gate installed on Murder Branch Cave is “bat friendly”, USFWS will provide technical assistance and approval of the final gate design and construction period. (BMP 9)

WL-22: Best Management Practices including erosion and sedimentation control measures (i.e. silt barriers) will be implemented during new trail and parking lot construction where determined necessary to minimize effects to water quality. Additionally all new trail construction across streams should be done during periods of low flow. (BMP 10)

WL-23: To ensure that project area streams are maintained and that effects to streams and water quality are within those anticipated, streams are routinely monitored on an annual basis to evaluate impacts from

management actions such as trail crossings. Streams within the project area are part of this monitoring strategy. (BMP 11)

Hydrology and Soils Resources

HS-1: Allow no new designated OHV, horse, or bicycle trails within the scoured ephemeral stream zone except at designated crossings or where the trail location requires some encroachment, for example, to accommodate steep terrain. (DB-REC-7)

HS-2: No new trails for off-highway vehicles, bicycles, horses, and other non-pedestrian modes of transportation are to be constructed within the [1.E] area (Riparian Corridor), except to approach and cross at designated sites, or where the trail location requires some encroachment (e.g. to accommodate steep slopes). (1.E-REC-1)

HS-3: In riparian corridor, do not allow overnight tethering or corralling of horses or other livestock within 100 feet of stream courses or 300 feet of other water bodies. Maintain exiting corral sites to limit impacts to water quality and riparian corridors. (1.E-REC-2)

HS-4: Any trail construction (in Riparian Corridor) must be accomplished in accordance with relevant state Best Management Practices12 or Forest Service regional/national direction for erosion control (e.g., USFS Region 8 Trails South13). (1.E-REC-3)

HS-5: New nonmotorized trail construction (in Riparian Corridor) is allowed to improve existing trail configuration and improve access to streams, lakes and the riparian corridor. (1.E-REC-6)

HS-6: Motorized and nonmotorized trail reconstruction and relocation within riparian corridor are allowed to reduce impacts to riparian and aquatic resources. (1.E-REC-7)

HS-7: New roads, trails, and temporary landings are permitted in rare community management zones (Forest Plan Figure 3 - 2) as long as surface water runoff from roads, ruts, trails, and landings is not concentrated into streams within the defined watershed, but rather dispersed across a wide area. (1.G-ENG-WET-1)

Recreation Resources

R-1: Notify the recreating public if there would be area road and trail closures due to nonmotorized recreation maintenance activities in the project area. Public notification can be provided at interpretive panels and/or on the Forest web page.

R-2: Place interpretative panels at trailheads or recreation sites to aid in public education of trail closures and/or maintenance during project activities.

Alternatives Considered but Eliminated from Detailed Study

There were several alternative ideas suggested by both the project team and the public that were not carried forward for detailed study. The responsible official made this determination based on the fact that some of the suggestions were outside of the area or scale we were considering for the project, some of them did not meet the purpose and need for the project, and some of them were incorporated into aspects of the alternatives that we analyzed. These suggested alternatives are listed below and include the reasons for not considering them in detail.

Designate the Cave Run Trails for Horse Use and Create a New Trail System for Mountain Bikes North of US Highway 60

Part of the purpose and need for the project is to reduce user conflict and provide an enjoyable riding experience. Our objective is to provide this experience within the project area in the footprint of the existing Cave Run Nonmotorized trail system. Creating a new trail system north of Highway 60 is outside the area of project consideration.

Develop a Trail System around Cave Run Lake that Incorporates Private Camps to Enhance Economic Development

The economic impact to local businesses is an important consideration in our decision for management of the Cave Run trail system. Although the project area does encompass the entire Cave Run Lake, developing an "around the lake" trail would necessitate significant time and coordination with both private and government entities at varying levels. This may be a valuable long-term strategy for local economies and the forest, but would not address the immediate needs of the Cave Run trail system and users as described in the purpose and need for the project. Developing a trail around the lake is outside the scope of project consideration.

Charge Fees for the Use of the Trail System

We considered an alternative that would include charging fees for use of the Cave Run trail system, where monies could be used to maintain and improve the designated trails. We did not develop this as part of an alternative for this decision because Forest Service policy authorizes the charging of fees only for use of a designated trail system. Until new designations are implemented and a sustainable trail system is operational, a decision on use fees is untimely. We may revisit the option to charge fees for use of the trails after the trail system is re-designated and an implementation and monitoring plan is in operation.

Designate the Length of the Sheltowee Trace National Recreation Trail Open to Hiking, Horses, and Bikes

Several users expressed the desire to be able to ride the length of the Sheltowee Trace within the project area. The project team agreed that while it would be nice to facilitate "through" travel, the Sheltowee Trace National Recreation Trail Management Plan recognizes that sections of the trail system would not accommodate a full range of dispersed recreation uses. Based on resource capability and social compatibility, some uses would need to be restricted on individual segments. We did not develop this suggestion due to physical conditions of the trail, resource damage resulting from use of portions of the trail or user-created spurs bypassing the trail, and safety concerns for users.

Figure 9. Cliffline along the Sheltowee Trace National Recreation trail cannot sustain some trail uses.

Alternate Days between Horse Use and Bike Use on the Cave Run Trail System

This management technique is used and works well on some nonmotorized trail systems in the eastern United States. We explored the possibilities for use on the Cave Run trail system, or portions of the system as a way to reduce user conflict and increase user safety.

Various feedback from Cave Run trail users indicates user conflict on the trails is related more to trail condition than physical encounters. Alternating days between horse and bike use would not change the physical condition of the trail or resolve the issue. Trails that are not properly located or adequately designed would continue to degrade and negatively influence surrounding resources and the desired user experience. We concluded this alternative would not meet the purpose and need for the project and did not carry it forward for analysis.

Build Alternatives Based on the Three Levels of Development Trail Assessment Recommendations

The Cave Run Trail System: Inventory, Assessment, and Management Plan (Keen et al. 2011) completed specifically for the Cave Run trail system, presented recommendations for the general trail system, for specific existing trails, and for a potential future trail system. The potential trail system recommendations were presented at three levels, intended to improve and build on the existing trail system in three stages as monies would become available. Level 1 represented a basic plan for a sustainable trail system utilizing

primarily existing trails in the project area, and level 3 represented an enhanced trail system providing additional mileage and national destination quality to mountain bikers and equestrians.

The trail assessment was initiated to take a hard look at the existing trails and to recommend "fixes" to improve those trails. Recommended new trail locations were based on map information only. Through field review of many of these "conceptual" trails, we encountered challenges in finding areas that would adequately support sustainable trails. Due to the unique soils and geology in the Cave Run area, side slopes, which are where trails are generally built to maintain suitable water management, are highly vulnerable to slope instability and slumping. For this reason, we could not use the recommendations for the potential future trail system, as suggested in the assessment document. The majority of the document addresses the existing trail system and improvements to bring the trails closer to a sustainable condition, which are incorporated in project proposals.

Apply Year-Around Wet Weather Closures

Year-around wet weather closures were considered in lieu of or in addition to seasonal trail closures. We reviewed National Oceanic and Atmospheric Administration (NOAA) precipitation data and U.S. Geological Survey historic streamflow data to determine average monthly precipitation and average peak flows throughout the year in the Cave Run Lake area. Data shows precipitation is fairly evenly distributed throughout the year, but with higher rates during spring and early-summer. Detailed hydrologic analysis shows that the combination of longer (5 to 10 days) precipitation events and lower evaporation rates occurring in the winter months allow soils and trails to stay wet for extended periods. Freeze-thaw cycles also contribute to trail degradation during this time of year. Summer precipitation is characterized by single, short (1-day), heavier events, when rainfall readily infiltrates soils and evaporation rates are high. Average monthly streamflow is at its lowest rates between the months of June and October.

In addition to precipitation and streamflow data, we considered the challenges of disseminating clear and understandable wet weather closure information and enforcing trail closures during peak-recreation season and quick onset rain events. In view of the precipitation data and analysis, and our desire to manage an effective trail system, we decided not to incorporate year-around wet weather closures at this time. Monitoring of trail conditions may indicate the need for future modifications to management of the Cave Run trail system, and we would consider options at that time.

Eliminate Horse and Bike Use in the Cave Run Lake Area

Cave Run Lake trails were "created" primarily in the 1970's and were not intended to support horse and bike use. Current trail alignments on ridgetops, in drainage bottoms, and on fall lines between, do not support water management; sediment deposition and mudhole formation have become inherent problems. This has led to resource impacts and user conflicts on the trail system. Through assessing the trails for proper alignment and location, we determined that due to the unique local geology, many areas are highly vulnerable to slope instability and slumping and are not capable of sustaining high use or high impact trails. The seasonal wet weather and year-around high intensity rainfall events exacerbate the problems.

Current and projected agency funding for recreation projects, staff, and equipment is not nearly sufficient to cover the annual trail maintenance of a 75 mile trail system, even without the unique problems and challenges the Cave Run trails present. Current staff is currently stretched thin with "risk management" responsibilities and other improvements that are needed in order to keep the trails maintained and open.

For these reasons, we considered an alternative to close the Cave Run trails to horse and bike use.

Excluding horses and bikes from the Cave Run Trail system would not meet Forest Plan or project goals and objectives, and would not meet the purpose and need for the project. Trail users are concerned and

passionate about the future of the Cave Run Lake trails. Many trail users have frequented the Cave Run Lake area for many years, and there is a recognized connection and "sense of place" for these users. Forest management is interested in the opportunities to build partnerships and let users take "ownership" in sustaining the trail system they desire.

Non-Designation and Closure of Murder Branch Area Trails

Murder Branch area trail is a user-created trail that is not currently a part of the designated trail system. The approximately 5.5 miles of trail connects to County Road 930 on one end, and F R 1074 on the other end, making an approximate 10 mile loop ride. The trail is well established and has been widely used by equestrians for many years. Although it is not designated as a national forest system trail, trail users consider it a part of the Cave Run Lake trail system.

We deliberated the addition of the Murder Branch trail to the designated trail system and identified several problems. First, we don't have the funding or personnel to adequately maintain the existing designated trails. The additional designation of mileage would add to our maintenance and risk management responsibilities. Secondly, the trail is located in an area of extensive cliffline community. The trail parallels the cliffline and is in close proximity to numerous rock shelters and significant bat habitat. Making the trail "official" could expose sensitive area resources to further impacts resulting from additional recreation use.

We included designation of the Murder Branch trail in the action alternatives based on project objectives. Our intent is to provide a fulfilling trail experience that addresses recreation demand and reduces impacts to resources. A further objective is to engage trail advocates in collaborative efforts to improve and maintain the trail system. The Murder Branch trail is well established, both physically and socially. To close the trail to public use would be as difficult or more difficult than to incorporate the trail into the system. Adding the trail to the system would provide the public the opportunity for ownership and education in the unique and valuable resources the trail highlights. A partnership with the equestrian community would be particularly important for the future sustainability of this new loop as well as cooperation in voluntarily minimizing or even fully preventing cross country horse travel in the trail area.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternate. Table 7 compares trail and road mileages and facilities improvements where different outputs can be distinguished quantitatively among alternatives. Table 8 gives a general account of how each alternative considers the project objectives listed on pages 9 through 17. Table 9 shows how each alternative addresses the project issues listed on pages 20 and 21. Table 10 shows how the alternatives address other resource effects described in the environmental effects section of the document.

Table 7. Comparison of trail miles by alternative for the Cave Run Nonmotorized Trails Project

	Alternative 1				Alternative 2				Alternative 3				Alternative 4			
	Hike Only	**Horse /Hike**	**Bike/ Hike**	**Share Use**	**Hike Only**	**Horse/ Hike**	**Bike/ Hike**	**Share Use**	**Hike Only**	**Horse/ Hike**	**Bike/ Hike**	**Share Use**	**Hike Only**	**Horse/ Hike**	**Bike/ Hike**	**Share Use**
Miles Existing Designated Trail[a]	1	n/a	n/a	74	2	28	27	18	8	41	22	0	8	29	25	11
Miles of New Trail Construction	0	0	0	0	0	0	0	0	0	2	18	0	0	4	16	0
Total Potential Trail Miles	1	n/a	n/a	66	2	28	27	18	8	43	40	0	8	33	41	11
Miles of Road Completing Trail Loops	n/a	n/a	n/a	8	n/a	22	2	3	n/a	23	4	1	n/a	23	2	3
Total Miles – Trail and Roads	1	n/a	n/a	74	2	50	29	21	8	66	44	1	8	56	43	14

a - This mileage does not include user-created trails that are not a part of the designated trail system

Table 8. Summary comparison of how alternatives address the purpose and need for the Cave Run Nonmotorized Trails Project

Project Objectives	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Provide a trail system to address recreation demand and benefit local communities and the public.	Trails are not in the condition necessary to produce the desired user experiences being sought. Local businesses supported by trail users have declined.	Addressed through: +Improved trail conditions +Sustainable use, +Effective distribution of use, +Upgraded accessibility, +Clear trail information	Addressed through: +Additional trails +Improved trail conditions +Sustainable use, +Effective distribution of use, +Upgraded accessibility, +Clear trail information	Same as alternative 3
Provide an enjoyable nonmotorized trail user experience through appropriate trail use designation	The existing trail system does not consider diverging trail needs, limitations, and preferences desired by different user groups.	Addressed through: +Designation of both single use and shared use trails +Improvement of trails to appropriate design standards	Addressed through: +Designation of all single use trails +Improvement and construction of trails to appropriate design standards +New trails designed for the intended use	Addressed through: +Designation of both single use and shared use trails +Improvement and construction of trails to appropriate design standards +New trails designed for the intended use
Provide a nonmotorized network of trails capable of sustaining the designated use	The existing trail system was not intended for horse and mountain biking use, and was not designed to standards to support these uses.	Addressed through: +Improvement of trails to appropriate design standards + Seasonal restrictions to mitigate trail damage during wet seasons	Addressed through: +Improvement and construction of trails to appropriate design standards + Seasonal restrictions to mitigate trail damage during wet seasons	Same as alternative 3
Reduce impacts to aquatic and riparian habitat, rare communities, threatened, endangered and sensitive species, cultural resources, and recreation and aesthetic values	The existing trail system traverses sensitive areas and has the ability to affect sensitive plants and wildlife, riparian, cliffline, and rare communities, cultural resources, and aesthetic values.	Addressed through: +Trails are improved using applicable erosion control standards and best management practices + Stream crossings are hardened appropriately to reduce trail sediment + Trail users stay on designated trails in rare community sites, along clifflines, and in and around bat hibernation, staging, and maternity sites	Addressed through: +Trails are improved and constructed using applicable erosion control standards and best management practices + Stream crossings are hardened appropriately to reduce trail sediment + Trail users stay on designated trails in rare community sites, along clifflines, and in and around bat hibernation, staging, and maternity sites	Same as alternative 3

Project Objectives	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Provide adequate trail-head parking accommodations	The existing trailhead parking facilities cover a wide distribution within the project area, but many are not preferred due to the lack of amenities, adequate space, and difficult access.	Addressed through: +One existing parking area would be expanded +One new parking area would be constructed	Addressed through: +One existing parking area would be expanded +Three new parking areas would be constructed	Same as alternative 3
Provide trail loops of various lengths and experience levels.	Existing, shorter trail loops at trailhead locations are most utilized by all user groups. Outside of these, opportunities for loop rides and varying lengths of loop rides diminish. Caney Loop is important to all user groups, as it provides an "easy" experience level trail with easy access.	+Caney Loop is designated bike/hike only +Murder Branch trail is designated horse/hike only +Hog Pen trail is removed from the trail system	+Caney Loop is designated horse/hike only +Murder Branch trail is designated horse/hike only +Hog Pen trail is removed from the trail system +Two new short horse loops added near the White Sulphur trailhead +New bike trail loops and trailheads added in 2 locations	+Caney Loop is designated bike/hike only +Murder Branch trail is designated horse/hike only +Hog Pen trail is removed from the trail system +Two new short horse loops added near the White Sulphur trailhead +New bike trail loops and trailheads added in 2 locations +New shared-use trail along Zilpo Hwy creates new horse and bike loop
Provide easily accessible and understandable information to trail users	Trail signs, maps, and information boards need to be replaced and updated. Most trail users remain on short loops close to trailheads because trail maps are not posted and trail signage is outdated. Trail etiquette is not posted, which adds to user conflicts on the trails.	Includes measures to: +Post trail signing with large, easily readable maps, trail uses, trail name and/or number, experience levels, mileages, intersections, roads, places of interest, and current location. + Update and locate kiosks with the above plus trail closure, emergency, etiquette, pack in/pack out, and volunteer information.	Same as alternative 2	Same as alternative 2

Project Objectives	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Engage the public in cooperative, collaborative efforts that build support in helping to meet the Forest's desired future condition and the public's desired experience	No formalized partnerships or agreements are in place to promote and further the trail system. Conflicts among users have hampered efforts to unite user groups in trail maintenance and enhancement efforts.	Includes measures to: +Develop agreements to involve equestrian and mountain biking user groups in trail planning, expansion, maintenance and enforcement +Unite and focus partners on trail improvement and maintenance to build ownership in the trails and reduce user conflict.	Same as alternative 2	Same as alternative 2

Table 9. Summary comparison of how alternatives address Cave Run Nonmotorized Trails Project issues

Project Issues	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Miles of "easy" trails available to equestrians	12.4 Miles Includes use of all of Caney Loop	6.7 Miles	12.4 Miles Includes use of all of Caney Loop	6.7 Miles
Percent of total trail miles available compared to previously available (all trail miles proposed are available to hikers)	All original trail miles available to all uses	Equestrian: 69% of trails; 95% trails and roads completing trails	Equestrian: 64% of trails; 88% trails and roads completing trails	Equestrian: 66% of trails; 93% trails and roads completing trails
		Bikes: 67% of trails; 67% trails and roads completing trails	Bikes: 60% of trails; 60% trails and roads completing trails	Bikes: 75% of trails; 77% trails and roads completing trails
Equestrian access to the natural arch	Direct horse access to the arch	View arch from new rest area off of FR 906	Same as alternative 2	Same as alternative 2
Miles of Sheltowee Trace open to bike users	Approximately 25 miles. Through bike access on the Sheltowee Trace	Approximately 20 miles. Bike access on the Sheltowee Trace east of County Rd 801 and south to tie into the 113 trail. Bike trail re-connects at Clear Creek area to run the length of the Sheltowee south.	Approximately 6 miles. Bike access on the Sheltowee Trace east of County Rd 801	Approximately 11 miles. Bike access on the Sheltowee Trace east of County Rd 801 and south to tie into the 113 trail.
Number of trailheads accessing all-season equestrian trails	Five trailheads accessing all trails	Two trailheads accessing all-season equestrian trails	Two trailheads accessing all-season equestrian trails	Two trailheads accessing all-season equestrian trails
Miles of trail available year-around by use	Trail system open year-around to all uses	8 trail miles and 9 road miles of all-season trail system open to horses	10 trail miles and 9 road miles of all-season trail system open to horses	10 trail miles and 9 road miles of all-season trail system open to horses
		75 miles of trail open year-around to bikes	40 trail miles and 5 road miles of all-season trail system open to bikes	40 trail miles and 5 road miles of all-season trail system open to bikes
Shared use on the steep portions of trails 104, 112, 113, and 116.	Shared use on all steep and narrow trails	Horse use only on trails 104 and 116; Shared use on steep portions of 112, 113.	Separated use on all steep and narrow trails: Horse use only on trail 116; Bike use only on trails 104, 112, 113	Horse use only on trail 116; Shared use on trails 104, 112, 113
Miles of trail open to bike/hike use only	No trails bike/hike only;	27 miles bike/hike only use; Shared use of about 25% of	40 miles bike/hike only use;	41 miles bike/hike only use; Shared use of about 12% of

Project Issues	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	Shared use of all trails	the trails	No shared use trails	the trails
Percent of total trail miles available to equestrians compared to previously available	All of original trail miles available	69% of original t rail mileage available to horses; 95% of trails and roads completing trails available to horses	64% of original t rail mileage available to horses; 88% of trails and roads completing trails available to horses	66% of original t rail mileage available to horses; 93% of trails and roads completing trails available to horses
Precipitation analysis comparisons for seasonal vs. year-round precipitation events (see Hydrologic and Soil Resources portion of this document)	Voluntary wet-season closure at Caney Loop trails only	Equestrian trail closure on a portion of the trail system from December 15 to May 15; no wet weather closures proposed	Same as alternative 2	Same as alternative 2
Miles of equestrian trail in riparian corridor (RCPA)	5 miles of trail within RCPA; All of original lakeside trail miles available	4.5 miles of trail within RCPA; About 40% of original lakeside trail miles available to horses	3.9 miles of trail within RCPA; About 40% of original lakeside trail miles available to horses	4 miles of trail within RCPA; About 25% of original lakeside trail miles available to horses
Number of trail-stream crossings	73	68	58	60
Miles of trails on slopes greater than 15 percent	6.8 miles; All uses on Sheltowee switchbacks	6.8 miles; All uses on Sheltowee switchbacks	11.8 miles; Horse/hike use only on Sheltowee switchbacks	11.8 miles; Horse/hike use only on Sheltowee switchbacks
Project area acres open to cross country riding	Off trail horse use throughout the project area =52,500 acres	Three options for off trail horse use 1) entire project area =52,500 acres; 2) project area except within two sensitive areas =51,480 acres; or 3) none of project area open except designated trails	Same as alternative 2	Same as alternative 2
Employment and labor income response in the local economy from a fixed change in recreation visitation.	Data and models estimate that area horseback riding and area mountain biking each contributes approximately 6.4 jobs and $137,000 annually to the three project area counties.	Effects of current use constitute less than a tenth of one percent of employment in recreation related sectors. As a result, small decreases in horseback riding use would have small economic effects on the project area.	Same as alternative 2	Same as alternative 2

Table 10. Summary comparison of other resource effects for the Cave Run Nonmotorized Trails Project

Resource Measures	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Potential effects to biological resources in the Caney area	Existing use and impacts to streamhead seeps and trail erosion continue.	Reduced equestrian use, trail improvements and cross-country restrictions would reduce trail related impacts to streamhead seeps.	Existing impacts would be reduced due to trail improvements, equestrian cross-country restrictions and seasonal restrictions. Impacts to streamhead seeps would be reduced.	Reduced equestrian use, trail improvements and cross-country restrictions would reduce trail related impacts to streamhead seeps.
Potential effects to biological resources in the Murder Branch area	Use and existing impacts to the Murder Branch cave would continue	Equestrian cross country restriction, improved trail standards, and treatments on existing user trails near Murder Branch Cave would reduce sedimentation into the cave and from the trail system. Access into the cave and potential impacts to cave dwelling species would be eliminated.	Same as alternative 2	Same as alternative 2
Potential effects to biological resources in the Cave Run Lake area	Impacts to Trough Lick Branch and Boardinghouse Branch would continue.	The trail along Trough Lick Branch bottom (Hog Pen) would be decommissioned and stream, riparian and soil and water impacts reduced. While the trail that runs along Boardinghouse Branch would continue to be used, trail improvements would reduce soil and water impacts.	Trails along Trough Lick Branch and Boardinghouse Branch would be moved out of riparian areas. Approximately 1.8 miles of trail in the Graveyard Branch drainage and above Cave Run lake would be eliminated and off-road stream crossings reduced. These changes combined with trail improvements and equestrian seasonal restrictions would reduce stream, riparian and water quality impacts.	Trails along Trough Lick Branch and Boardinghouse Branch would be moved and stream crossings reduced. These changes combined with trail improvements and equestrian seasonal restrictions would reduce stream, riparian and water quality impacts. Potential soil and water impacts would be greater than alterative 3 due to maintaining Graveyard Branch trail more equestrian miles.
Potential effects to biological resources in the Scott Creek and Wilson Hill area	No change	No change	Approximately 1,000 acres of remote habitat affected by 16 miles of bike/hike trail construction. Increased trail use throughout much of the year.	Same as alternative 3

Resource Measures	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Potential to promote non-native invasive plant species (NNIPS) through habitat changes or species introductions	Alternative 1 does not address trail location, condition or existing resource degradation, thus would continue to promote the spread of NNIPS	Alternative 2 would reduce or mitigate long-term NNIPS spread and establishment through: +Trail improvement and reduced resource degradation. +Seasonal closures to preclude trail use during periods of prolonged moisture. Alternative 2 would enhance NNIPS spread and establishment through: +Improvement of 1 and construction of 3 new trailheads	Alternative 3 would reduce long-term NNIPS spread and establishment as listed in alternative 2. Alternative 3 would enhance short and long-term NNIPS spread and establishment through: +Construction of 20 miles of new trail +Improvement of 1 and construction of 3 new trailheads	Same as alternative 3
Potential for off-trail horse use alternatives to promote NNIPS	Cross country horse travel throughout the project area increases the likelihood for the spread and establishment of NNIPS on the landscape.	+Allowing horse use only on designated trails and roads within the project area greatly reduces the potential for spread of NNIPS on the landscape. +Closing the Caney and Murder Branch areas to off-trail horse travel would moderate the spread of NNIPS, but not to the extent of prohibiting cross country horse travel within the entire project area.	Same as alternative 2	Same as alternative 2
Potential for off- trail horse use to affect soil and water resources.	Cross country horse travel throughout the project area would continue the potential of erosion and sedimentation and the likelihood of concentrated irreversible trail effects throughout the project area, and open user-created trail opportunities to other recreation users.	Allowing horse use only on designated trails and roads within the project area would limit erosion and sedimentation potential to the designated trail system. +Closing the Caney and Murder Branch areas to off-trail horse travel would limit erosion and sedimentation potential in these sensitive areas.	Same as alternative 2	Same as alternative 2

Resource Measures	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Cumulative Watershed Effects	Percent of affected watersheds impacted ranges from 0 to 4.4. These percentages are significantly below the 25 percent threshold established by research (Grant et al. 2008 and Bosch and Hewlett 1982).	No change to cumulative watershed impacts	Same as alternative 2	Same as alternative 2
Potential for unauthorized excavation or looting of archeological resources	Existing sites and rockshelters in close proximity to trails remain unrecorded and unprotected, and the current rate of degradation and unauthorized excavation would continue.	Proposed activities could increase disturbance to archaeological materials through exposure of resources that results in unauthorized excavation or looting. Procedures outlined in the MOA would ensure impacts to archeological resources are mitigated.	Same as alternative 2	Same as alternative 2
Potential for off- trail horse use to affect archeological resources.	Off-trail horse use puts rockshelters at any location in the project area at risk from looting, vandalism, and inadvertent impacts from camping.	The reduction of off-trail horse use in the project area would reduce impacts to cultural resources by reducing the area that could be disturbed by direct impacts of horse use, or exposed to added visibility and loss or destruction from looters.	Same as alternative 2	Same as alternative 2
Recreation experience	Considerable negative impact to the quality of a biker's recreation experience. Overall positive impact on horse riding recreation.	Trail miles decline but overall positive impact on the quality of the biker's experience due to less shared use and implementation of trail design standards. Generally negative impact on horse riders due to quantity of available trails, access to easy trails, and seasonal access to trails.	Trail miles decline but overall positive impact on the quality of the biker's experience due to no shared use. Mixed impact on horse use; quantity of trails decreases, off-season access to trails decreases, access to easy trails and Caney area remains the same.	Bike use same as alternative 3 effects. Horse use same as alternative 2 effects.

Resource Measures	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Economics	Economic effects of visit estimates for the sum of biking and horseback riding constitute less than a tenth of one percent of employment in recreation related sectors (see analysis of Economics and Environmental Justice).	Some increases in bike use would have small economic effects on the project area and regional analysis area. Some decreases in horseback riding use would have small economic effects on the project area and regional analysis area.	Same as alternative 2	Same as alternative 2

Environmental Impacts of the Proposed Action and Alternatives

This section summarizes the biological, physical, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. The level of analysis is commensurate with the amount of information necessary to understand the significance of effects of the actions. The EA describes the impacts of the proposed action and alternatives in terms of context and intensity as described in the definition of 'significantly' at 40 CFR 1508.27" (36 CFR 220.7(b)(3)(iii)).

The effects discussions presented in this section are summaries of information from the interdisciplinary (ID) team resource specialists. Specialist reports used in preparation of this EA include the Wildlife Report and Biological Assessment and Evaluation (Reitz 2012), Non-native Invasive Plant Species Report (Taylor 2012), Hydrology and Soils Report (Arias 2012), Recreation Report (Morrissey 2012), Economics and Environmental Justice Assessment (Eichman 2012), and Cultural Resources Report (Adams 2012); these specialist reports are incorporated into this EA by reference. The summaries focus on resource issues and project purpose and need goals disclosed in the "Purpose of the Project and Need for the Project Activities" section of this document. Comments from scoping pertained to recreation experience, resource degradation, economic stability, and the purpose and need for the project. Comments are addressed through the design of the proposed action (project design features), or through general effects analysis disclosed throughout this section. This section also presents the scientific and analytical basis for comparison of the alternatives.

Biological Resources

Wildlife distribution and use is determined by both site specific and landscape level conditions. In this section, a multi-scale analysis is presented that looks at changes in habitat conditions resulting from the alternative activities in specific areas proposed for treatment as well as landscape considerations such as the availability of habitat within and adjacent to the project area. Also presented is a discussion summarizing the effects analysis for species listed under the Endangered Species Act, sensitive species as identified by the Regional Forester of the Forest Service's Southern Region and conservation species and management indicator species (MIS) as identified by the Forest Plan. More information can be found in the Biological Assessment, Biological Evaluation, and Wildlife Report included in the project record.

The project area is predominately forested, except for agricultural and developed private land along its boundaries. Forest over 50 years of age is predominant, and Forest Plan designated old growth attainment prescription area occurs on over 2,600 acres in the northwest portion of the project area. Of the forested habitat, approximately half is oak or mixed oak/pine pine that occurs on upper slopes and ridgetops, whereas mixed mesophytic communities occur on lower slopes and drainage bottoms. Old growth habitat occurs largely as oak and mixed oak/pine.

Table 11. Existing habitat conditions in the Cave Run Nonmotorized Trails Project area

Habitat	Project Area	
	Units	%
Forest Communities [a, b](acres)		
Dry mesic mixed pine/oak	2,162	4
Dry mesic oak	16,645	32
Dry xeric mixed pine/oak	3,251	6
Dry xeric oak	3,865	7
Mixed mesophytic	13,669	26
Yellow and white pine	648	1
Total Forest	40,235	77
Non-Forest (acres)		
Grass/forb	511	1
Shrub	426	1
Roads/Remote Habitat[d]		
Road Miles	222	NA
Road Density (mi/sq. mile)	0.70	NA
Acres over ¼ mile from a road	26,893	36
Riparian/Aquatic[d]		
Reservoir (acres)	6,711	9
Standing Water (acres)	63	<1
NWI Wetlands (acres)	116	<1
Riparian Habitat (acres)	23,299	31
Stream Miles	278	NA
Stream Density (mi/sq. mile)	2.3	NA
Cliffline (miles)	100	NA
Cliffline Zone (acres)[c]	3,781	5
Caves (sites)	20	NA
Significant Bat Habitat (acres)	256	<1

a - Data not available on private land and approximately 4,300 acres of national forest system land.
b – percent of national forest system lands
c – includes 100 ft. from the top of the cliffline and 200 ft. from the bottom
d – all ownerships

Forest prescription areas are displayed in Appendix E, Map 8. Habitat diversity, reservoir and riparian habitat make up over 90 percent of the project area. Streamhead seeps, a Forest rare community occurs to the west of the dam in what is referred to as “the Caney Area”. The Caney area is an important area to all trail user groups and is used by families, beginners, and others looking for a less challenging trail experience. All of this rare community occurs within ¼ mile of existing trails. As a result and considering the entire forest is currently open to cross country trail use, the potential exists for existing trail use to adversely affect this rare community.

The project area also contains approximately 100 miles of cliffline and twenty caves. Significant bat caves occur in the Murder Branch area (national forest system land) in the southeast corner of the project area and in the head of the Morgan Fork drainage along the northeast boundary. Nine bat species including two federally endangered species (Indiana and Virginia big-eared bat) and one sensitive species

(Rafinesque big-eared bat) have been documented from the cave during the fall/winter months from the Murder Branch Cave (KY Dept. of Fish and Wildlife 2011, personal communication with Tom Biebighauser). The Murder Branch cave was identified as a priority four hibernacula for the Indiana bat in the revised recovery plan (USFWS 2007). While no wintering Indiana bats have been documented in the last 10 years, the temperature and climate conditions within the cave provide habitat for a wide diversity of bat species.

While highways surround most of the project area, road density is relatedly low and approximately a third of the area occurs as more remote habitat greater than ¼ mile from an existing road. The largest blocks occur around Cave Run Lake, which is utilized by nesting bald eagles, and in the Pioneer weapons area in the northeast portion of the project area.

Wildlife Habitat and Distribution

Trail Construction

Affected Environment

New trail construction is proposed under alternatives 3 and 4.With the exception of the new trail in the Caney area, it is anticipated that some tree removal would be necessary during new trail construction. Horse/hike and shared trails would be approximately four to five feet in width and it is estimated that up to approximately 150 trees per mile of trail could be removed. Bike/hike trails would be two to three feet in width and could involve removal of up to 100 trees per mile of trail. Based on past experience, removal of larger trees is avoided whenever possible and it is expected that most trees removed would be small in diameter than 12 inches.

Using the above assumptions, proposed trail construction would result in removal of up to approximately 90 trees under alternative 2, 2,090 trees under alternative 3, and 2,290 trees under alternative 4.

The following is a brief summary of the six areas proposed for new trail construction and the general habitat conditions:

Caney

The Caney area includes 223 acres of the streamhead seep rare community (USDA FS 2004a p. 3-17). Streamhead seeps are naturally occurring wetlands associated with low-order streams and as the name implies, most often occur in or near the heads of streams. Vegetation is dominated by herbaceous species with sphagnum moss and these sites are sensitive to changes in water flow, especially changes in surface flow. As a result and because they provide habitat for many rare or uncommon plants, invertebrates and wildlife species, the Forest Plan includes specific direction that is designed to maintain the integrity of these sites.

Approximately 1.8 miles of existing trail traverses the Rare Community prescription area and this trail poses risks to this rare community due to possible changes in surface or sub-surface flows.

Currently, with off-trail horse use permitted throughout the project area, there is potential for existing and future user-created trails to adversely affect the streamhead seep community.

Scott Creek

Ten miles of hike/bike trail construction are proposed to connect to the existing 109 trail (Big Limestone) and create four loop trails on ridegtops above Scott Creek. These trails would traverse the habitat diversity emphasis prescription area, a few headwaters of intermittent streams and are proposed to

provide biking/hiking trails where horse use is not permitted. Oak is the dominant forest type on the plateaus and mixed mesophytic predominates in the drainages.

Hog Pen

Over a mile of existing trail currently runs up the Trough Creek bottom, as well as a riparian bottom to the east. This portion of the trail is referred to as the "Hog Pen" and consists of predominantly horse trail use that is currently resulting in erosion and sedimentation, as well as impacts to the stream channel and riparian vegetation. Approximately one-half mile of user-created trail are proposed to be added to the trail system in upland habitat to accommodate horse use in this area and reduce stream and riparian impacts. This section of trail traverses mature oak forest.

White Sulphur

Approximately two miles of new trail are proposed on ridgetops and upper slopes above White Sulphur Creek to create a loop trail that connects to an existing user-created trail. This section would accommodate horse/hike use. It traverses the habitat diversity prescription area and some riparian habitat (intermittent headwaters), mature oak, oak/pine and mixed mesophytic forest.

Pioneer Weapons

A total of approximately 2.3 miles of trail in two sections are proposed here on ridgetops and upper slope positions above Buck Creek in the Pioneer Weapons Area. One section would replace an existing trail that runs up the entire Boardinghouse drainage and one section would serve as a connecter to the Zilpo/Tater Knob trail. This trail section traverses the habitat diversity prescription area and crosses predominantly mature oak forest. There are no unique or sensitive wildlife habitats in this area.

Wilson Hill

Approximately six miles of trail are proposed on ridgetops and upper slope positions on Wilson Hill, which is a large peninsula on the east bank of Cave Run Reservoir. Like the Scott Creek area, it is being proposed to provide separate hike/bike trails. It would traverse the habitat diversity emphasis prescription area and a variety of mature forest communities. Due to its proximity to Cave Run Lake, this area provides suitable bald eagle habitat and much of the trail is within ¼ mile of suitable eagle forging/roost habitat.

Direct and Indirect Effects of Trail Construction

Because trail construction would result in removal of some live and dead trees, direct effects in the form of mortality or avoidance of the site during construction could occur. With implementation of project design features, removal of trees greater than or equal to five inches in diameter would not be permitted during the breeding season for most species (April 1st to October 15th). As a result, while the possibility exists, the likelihood of mortality or reduced reproduction is greatly reduced and direct effects would consist primarily of short-term disturbance during construction (see also trail use discussion below).

Because some trees would be removed, there is potential for new trail construction to open up the canopy and increase fragmentation. It is expected that most trees removed would be smaller in diameter (midstory trees) and that removal would be scattered. As a result, the canopy over the trail corridor would be largely maintained. Understory vegetation and structure would also be modified and potential exists for some fragmentation effects such as increased predation or parasitism, although this would vary by species. For example, in his evaluation of nature trails in Illinois, Hickman (1990) found no difference between the lands containing surfaced (wood chip or gravel) trails (7 to 10 feet wide), than lands without trails for 29 of the 33 species evaluated. Four species, including the three edge species brown-headed cowbird, blue jay and American Robin, and the area sensitive species Acadian flycatcher, preferred territories closer to

the trails. He further suggested that that trails could result in fragmentation related effects such as increased predation and parasitism, as well as reduced reproductive success for area sensitive neo-tropical migrants (Hickman 1990).

When evaluating potential effects of fragmentation, landscape characteristics such as the amount of intact forested and non-forested habitat need to be considered. For example, while nest parasitism is a well-documented edge-related effect in more fragmented landscapes, monitoring in predominantly forested areas such as the Cave Run area indicate that brood parasitism may not occur or would be reduced (deCalesta 1998, Giocomo and Brittingham 1998). Edge effects also vary spatially and brood parasitism by the brown headed cowbird is most prevalent in the first 150 feet from a forest edge, but drops off significantly beyond that distance (Kentucky Department of Natural Resources 2012). Similarly, in his review of research on nest predation, Paton (1993) noted that nest success was little affected by predators more than 150 feet from a forest edge.

While it is possible that modification of the understory vegetation and establishment of the trail surface would increase songbird predation or parasitism, effects would be restricted to the immediate trail corridor (within 150 feet) (KY DNR 2012, Paton 1993). Also, due to the predominantly forested nature of the project area and considering the canopy would be largely maintained, the potential for fragmentation effects would be reduced (deCalesta 1998, Giocomo and Brittingham 1998).

The trail surface may also create a barrier to some species including reptiles and amphibians (Bolton 2002). While no new construction is proposed near preferred breeding habitat (i.e. wetlands or streams), movement or use of upland areas that are utilized for dispersal or foraging could be affected.

Approximately 0.4 miles of new trail construction are proposed along a user created trail in the Caney area to reduce existing impacts. This trail construction increases the likelihood that invasive non-native plants, in particular Japanese stiltgrass, would be introduced to streamhead seeps. In order to ensure that integrity of streamhead seeps are maintained, design feature W-17 would be implemented, requiring coordination with a hydrologist and botanist for trail work in this area.

Alternatives 2, 3, and 4 could restrict cross country equestrian use on approximately 650 acres within and adjacent to the Caney rare community prescription area, reducing the potential for deleterious effects to streamhead seeps due to off-trail use.

Other Construction and Development Associated with the Trail System

Affected Environment and Direct and Indirect Effects

Parking Area Development

Up to four parking areas would be constructed, including a two acre parking area along County Road 930 to accommodate use in the Murder Branch area, and approximately one acre of overflow parking at the Glady Trailhead. Alternatives 3 and 4 also propose two possible parking lots including one to access new bike trails at Clay Lick (Wilson Hill area) and one to accommodate new and existing trails northeast of Cave Run Lake off of FR 964 in the Scott Creek area. These bike/hike lots would accommodate four to eight vehicles and would be approximately one acre in size.

Treatment would remove trees and vegetation and there would be a long-term reduction in forest habitat on up to five acres at the four sites. Effects also include possible mortality to less mobile species and avoidance of the site during construction, although the likelihood of mortality is reduced with implementation of project design features that restrict removal to the fall and winter months.

Horse Resting Areas

Up to nine existing horse resting areas would be improved and one new site would be constructed. These areas may affect up to one half acre each and include establishing permanent hitching posts. There would also be a kiosk established at the five corners resting area.

While no trees would be removed, understory vegetation would be affected including a reduction in herbaceous vegetation on portions of the site. Unlike the parking areas, horse resting areas occur away from existing roads or developed sites. Additionally, because it is likely these areas would have more concentrated use, as well as possible foot traffic off the trail corridor, it is expected that there would be some long-term avoidance of these areas by species sensitive to disturbance.

Roads used to Complete Trail Loops

Affected Environment

Natural Arch

Horse use is proposed to be moved off the arch trail (Carrington Rock Trail) due to erosion concerns near the arch and on the steep sideslope coming out of Clear Creek. Two miles of existing road would be used to accommodate displaced horse use. The road traverses mature oak/mixed mesophytic forest and would reduce approximately 0.4 miles of horse use along existing cliffline.

Clear Creek

In order to complete additional horse/hike trail and loops, approximately seven miles of road would be utilized, including almost three miles along Clear Creek, three miles connecting Clear Creek to the Leatherwood system and approximately one mile up Glady Hollow. This road system traverses mostly mature mixed mesophytic forest with smaller inclusions of oak and pine. It also traverses approximately 3 miles of the riparian prescription area and 0.2 miles of cliffline.

Boardinghouse

This includes approximately 0.5 miles of road proposed to accommodate horse/hike use displaced by moving the trail system out of the Boardinghouse Branch bottom.

Murder Branch

Approximately four miles of road in the Murder Branch area is proposed to create a loop trail. The road is currently being used for this function.

Direct and Indirect Effects of Roads Used to Complete Trail Loops

All affected roads are currently open to public access and are being used by equestrians. It is not anticipated that trail use would create impacts to wildlife over what are currently occurring as a result of the existing road corridor and use. This action would not alter habitat conditions, although some disturbance, mortality and fragmentation related effects resulting from the existing corridor would continue to occur. In some cases, road use would reduce impacts associated with cross country travel or off-road trail.

Trail Maintenance

Affected Environment

Trail system alternatives include a mix of trails and roads, although the amount of off-road trail and road varies by alternative. Trail maintenance, which only includes activities that keep the trail open and reduce

hazards, would occur on75 miles of trail under alternatives 1 and 2, 91 miles under alternative 3 and 93 miles under alternative 4. Activities along the entire system would include removal of trees that have blown down across the trail, as well as removal of hazard trees. In addition, on off-road trails, some rolling dips would be maintained as necessary, particularly where trails collect and drain sediment along equestrian trails.

Direct and Indirect Effects of Trail Maintenance

Direct effects of trail maintenance on wildlife include possible mortality, if hazard trees removed were being utilized for nesting or roosting or mortality associated with any drainage work completed. However, due to the widespread availability of suitable habitat and localized nature of any maintenance work, the likelihood of mortality (due to hazard tree removal) is reduced and would not be expected to affect local populations or the abundance or diversity of wildlife. Similarly, because habitat would continue to be available adjacent to the trail corridor, avoidance of the area during maintenance would be short-term (a few days) and use of the area by wildlife would be maintained.

Indirect effects include a localized reduction in habitat for snag dependent species due to hazard tree removal. Potential impacts depend largely on the continued availability of habitat. Table 12 displays the availability of dead trees across the Forest, as well as within the three counties that are included within the project area (Bath, Menifee and Rowan counties). While the removal of either live or dead trees associated with trail maintenance would reduce habitat on a localized basis, considering the widespread availability of both snags and live trees in a variety of size classes, adequate habitat exists to accommodate any animals displaced due to hazard tree removal and effects would be short-term (one year) in nature.

Table 12. Forest and project area live and dead tree summary*

Size Class	Forest-wide	Project Area Counties
	Trees/acre	
Dead Trees		
>=5 inches d.b.h.	18.1	24.9
>=11 inches d.b.h.	5.3	9.8
>=17inches d.b.h.	1.2	2.5
Live Trees		
>=5 inches d.b.h.	234	200
>=11 inches d.b.h.	78	82
>=17inches d.b.h.	23	27

* based on forested acreage and FIA data from 2005 to 2011

Trail Use

Non-motorized trail use would occur on 75 miles of trail under alternatives 1 and 2, 91 miles under alternative 3 and 93 miles under alternative 4. Potential effects to wildlife from trail use could include direct effects such as mortality due to trampling, behavioral avoidance of the area, or changes in habitat.

Affected Environment

Table 13 summarizes the habitats traversed under the different alternatives, as well as the habitat conditions around the immediate trail area (150 feet from trail), or those lands that may be affected by

increased predation or brood parasitism (KY Department of Natural Resources 2012, Paton 1993). Table 14 displays lands within 660 feet of a trail, or the trail area of influence. This area identifies lands in which some level of disturbance to wildlife may occur, although the likelihood of disturbance varies by species and the availability of suitable habitat. This area is based on Taylor and Knight (2003) who found that some wildlife species exhibited an alert and flight response to trail use of up to 660 feet.

Table 13. Alternative trail system habitat summary

Prescription Area/Landcover	Trail System (Miles)				150 ft. Trail Corridor[1] (Acres)			
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 1	Alt 2	Alt 3	Alt 4
Total Area	NA	NA	NA	NA	3,100	3,397	3,970	4,068
Prescription Area								
Cliffline[2]	3.2	3.4	3.3	3.3	127	134	135	135
Habitat Diversity	39.7	44.6	62.5	64.1	1,595	1,772	2,391	2,449
Old Growth	8.5	8.5	8.5	8.5	297	297	297	297
Rare Community	1.8	1.8	1.8	1.8	60	60	60	60
Riparian[3]	32.7	36.3	33.0	34.4	1,074	1,180	1,119	1,171
Large Reservoir	0	0	0	0	11	16	12	15
Sig. Bat Habitat	0	0	0	0	0	0	0	0
Landcover								
Forest[4]	83	91	106	108	2,856	3,097	3,660	3,741
Grass/Forb[4]	2	3	3	3	44	57	60	61
Open Water[4]	4	5	7	7	34	39	29	38
Oak[5]	38	41	50	52	1,318	1,407	1,694	1,763
Oak/Pine[5]	13	14	14	14	430	465	482	489
Mixed Mesophytic[5]	25	29	33	34	862	1,001	1,166	1,183
Conifer[5]	4	4	4	4	132	138	129	129
Streams								
Stream Crossings (No. of crossings)	73	68	58	60	NA	NA	NA	NA
Stream Buffer[6]	5	4.5	3.9	4	270	300	267	274

1 --lands within 150 ft. of trail
2 – includes lands within 100 ft. from the cliffline top and 200 ft. from the cliffline bottom
3 – includes riparian prescription area and land within 300 ft. of Cave Run lake
4- based on GAP data
5 – based on Forest stand data
6 – based on a 50 ft. intermittent and 100 ft. buffer

Table 14. Alternative area of influence summary[2]

Habitat/Landcover	Alt 1		Alt 2		Alt 3		Alt 4	
	Ac	%[1]	Ac.	%[1]	Ac	%[1]	Ac	%[1]
Cliffline	650	23	712	25	720	25	720	25
Habitat Diversity	6,451	23	6,890	28	8,101	28	8247	29
Old Growth	955	37	955	37	955	37	955	37
Rare Community	191	86	191	86	191	86	191	86
Riparian[3]	3,089	16	3,438	18	3,574	19	3708	19
Sig. Bat Habitat	15	13	15	13	15	13	15	13
Forest[4]	10,063	25	10,792	27	12,119	30	12,308	30
Grass/Forb[4]	177	19	210	22	223	24	227	24
Open Water[4]	490	7	537	8	513	7	570	8
Stream Miles	37.9 mi	20	43.1 mi	23	46.3 mi	25	47.1 mi	25
Oak[5]	4,821	20	5,108	22	5,724	23	5,874	23
Oak/Pine[5]	1,389	23	1,514	25	,1613	28	1,628	29
Mixed Mesophytic[5]	3,138	22	3,498	24	3,816	27	3,863	27
Conifer[5]	341	53	357	55	335	52	335	52
Remote Lands	3,920	24	3,902	24	4,794	30	4,941	31

1 – percent of total project area habitat, landcover or community
2 -- area of influence includes lands within 660 ft. of a trail
3 – includes riparian prescription area and land within 300 ft. of Cave Run lake
4 -- based on GAP data
5 – based on Forest stand data

Terrestrial Effects of Trail Use

Direct effects to wildlife from trail use could include effects to individuals such as behavioral avoidance of an area, increased stress, and associated effects to foraging and reproduction or mortality due to trampling. However, effects vary depending on individual species sensitivity as well as the amount and type of use. For example, animals may notice but not move away from humans on a frequently used trail, reducing the impacts to wildlife (Marion and Wimpy 2007). Also Wisdom et al (2004) found that elk were most disturbed by mountain bikes and least disturbed by hikers and equestrians, whereas the same study found that deer did not respond differently to different users. Similarly, by comparing alert distance, flight distance and distance avoided, Taylor and Knight (2003) found that wildlife did not respond differently to mountain biking versus hiking. They also suggested that the availability of cover affected the flight response and deer only moved to the nearest cover before stopping, suggesting that the increased availability of cover would result in a decrease in response. Finally, the area of influence on a trail did not differ between mountain biking and hiking and suggest that wildlife do not differentiate between hikers and bikers, but are instead reacting to a moving human on the trail, regardless of the person's activity (Taylor and Knight 2003).

In their literature review of effects of recreation on birds, Bennett and Zuelke (1999) concluded that that disturbance from recreation activities have at least temporary effects on behavior and movement of birds within a habitat or localized area. However they found no biological justification for managing mountain biking any differently than hiking, in terms of wildlife response. Also Burger (1986 in Bennet and Zuelke 1999) found that people on horseback did not seem to threaten birds even though they moved rapidly. Birds flushed only to avoid trampling. He suggested that birds perceived the horse and not the person riding it. However, effects may vary depending on the amount of trail use (Bennet and Zuelke 1999).

The type and speed of activity also affected the wildlife response, and trail use that creates more noise or movement caused birds to flush more than users who move slowly and appear less threatening (Burger 1981, 1986, Burger t al 1995, Knight and Cole 1995a in Bennett and Zuleke 1999). Generally foraging time decreased when people were present and with increased noise levels and once disturbed, birds moved off the trail until visitors left the area (Burger and Gochfeld 1998 in Bennett and Zuleke 1999). Effects would be short-term in nature if suitable habitat is available to accommodate displaced birds, whereas long-term effects could occur if individuals were displaced into less suitable habitat.

Existing research indicates that the wildlife response is much greater to users who move off the trail (Taylor and Knight 2003, Kasworm and Monley 1990, in Marion and Wimpy 2007). Consequently, cross country trail use would be expected to result in greater impacts to wildlife including both short and long-term disturbance.

While the direct effects from trail use are similar between the different users, indirect effects, or changes in habitat can vary greatly between uses. For example, hiking and biking trails are narrower and generally have less change in understory or mid-story vegetation. Conversely horse trails are wider, destroy more cover and create more bare ground than hikers (The Nature Conservancy 2000). Consequently, horse trails would be expected to create a larger barrier to less mobile species, including reptiles and amphibians. Similarly, trails used by both horses and people were found to be somewhat deeper than those used by hikers alone (The Nature Conservancy 2000) and shared trails would be expected to result in somewhat greater impacts than either hiking or biking trails alone. Finally, it is assumed that increased trail use would result in increased impacts including trail width (The Nature Conservancy 2000).

All trail use is expected to result in short-term disturbance to wildlife. Some species may habituate to trail disturbance and would either not be disturbed or return immediately after the disturbance (Hockin et al 1992, Burger et al 1995, Madsen 1995, Fox and Madsen 1997 In Bennett and Zuelke 1999, Boyle and Samson 1985, Marion and Wimpy 2007). Long-term impacts may occur to more sensitive species if use is frequent enough to permanently displace these species and/or if suitable habitat is not available to accommodate displaced species (Boyle and Samson 1985, Hickman 1990, Bennet and Zuelke 1999. Any cross country trail use would be expected to result in greater disturbance to wildlife, and horse trails and shared trails would have greater impacts to reptiles, amphibians and less mobile species, and result in larger changes to understory vegetation and habitat.

The following is a discussion of each of the alternatives considered including a summary of the changes that might affect terrestrial or aquatic species, and a brief discussion of the habitat affected and a summary of the effects to the Caney and Murder Branch areas, which are considered the most sensitive habitats affected. Alternative effects are also discussed in the wildlife, aquatic and plant species effects sections.

Alternative 1

The information presented in Table 13 and Table 14 help to identify the habitats most affected by the existing trail system. For example, approximately 23 percent of the existing cliffline habitat is within the 660 foot trail area of influence. Similarly, between 16 and 23 percent of the available habitat diversity and riparian prescription areas, and 19 to 23 percent of existing non-forest, remote habitat, and oak, oak/pine and mixed mesophytic communities fall within the trail area of influence. Potential disturbance related effects discussed above are most likely to occur in this area. Conversely, 77 to 86 percent of these habitats would be unaffected. Also, unaffected habitat is well distributed across the landscape and within all affected drainages. A greater amount (53 percent) of conifer habitat (yellow pine, white pine and hemlock) falls within the trail area of influence because the system traverses several pine plantations.

Possible disturbance related effects described above would be most likely to occur within the trail area of influence, although this would vary somewhat by species and the amount of use. For example, the likelihood of long-term effects associated with trail use would be greater along more heavily used portions of the trail system, such as the Caney area or trails in the vicinity of the White Sulphur horse camp. Conversely, use of much of the trail system would be intermittent with reduced impacts to wildlife.

Almost 90 percent of the trail system occurs as shared use, as well as off-road use. Also there is no restriction to cross country travel. As a result and considering shared use trails tend to have greater impacts to wildlife (Nature Conservancy 2000,) and that the wildlife response is greater to users who move off the trail (Taylor and Knight 2003, Kasworm and Monley 1990, *in* Marion and Wimpy 2007), effects to wildlife including avoidance of the trail corridor would be greatest under this alternative. However, considering the availability of unaffected habitats and available cover immediately adjacent to the trail corridor, effects would be largely short-term in nature (Burger and Gochfeld 1998 *in* Bennett and Zuleke 1999) and many species would likely habituate to the trail use or return immediately after the disturbance (Taylor and Knight (2003, Hockin et al 1992, Burger et al 1995, Madsen 1995, Fox and Madsen 1997 *in* Bennett and Zuelke 1999, Boyle and Samson 1985, Marion and Wimpy 2007). Long-term effects could occur to species such as the Northern goshawk, which are sensitive to human disturbance.

It is expected that trail use would have at least temporary effects on breeding birds (Bennett and Zuelke 1999) and the likelihood of increased predation or parasitism is highest within 150 feet of a trail (KY DNR 2012, Paton 1993) or on approximately 3,100 acres under this alternative. However, impacts would be reduced due to the predominantly forested nature of the project area which reduces fragmentation effects (deCalesta 1998, Giocomo and Brittingham 1998). As a result and considering that most birds would not be attracted to the trail corridor (Hickman 1990) the potential of increased predation or parasitism is reduced.

The Murder Branch area includes approximately 13 miles of user created trails, including six miles of cross country trail and seven miles of trails on existing roads. This area contains significant bat habitat (Murder Branch Cave), two caves (Fuget and Combs), and approximately 40 percent of the total cliffline habitat along the trail system. All cliffline within ¼ mile of these trails, as well as the Fuget and Combs caves have been surveyed and, while no bats have been documented from these sites, the Murder Branch cave has had documented use by five species since 2002, including the little brown bat, big brown bat, northern long-eared bat, tri-colored bat and the Rafinesque big-eared bat (Regionally Sensitive Species) (KY Dept. of Fish and Wildlife Resources 2011).

While a Forest Supervisor Order restricts entry into the Murder Branch cave (USDA FS 2012a), illegal access is occurring (2010 Personal communication with Tom Biebiehauser). Also, erosion from past off highway vehicle (OHV) use in the Murder Branch drainage has resulted in sedimentation into the cave. Existing public access into the cave is of particular concern, due to the increased risk of spreading White Nosed Syndrome (WNS), a fungus that has resulted in the mortality of millions of bats in the last five years (USDI FWS 2012c). Under alternative 1, the Murder Branch cave would not be gated nor would cross country travel be restricted. As a result, it is expected that illegal use, as well as sedimentation into the Murder Branch cave would continue.

A number of factors affect potential impacts to wildlife in the Caney area ,including continued shared use on the entire trail system, continued cross country use and continued erosion and sedimentation from sub-standard trails. As a result, potential impacts to the streamhead seep community would be greatest under this alternative.

Alternative 2

While the total miles of trail are similar to alternative 1, off road trail use would be reduced. So while the amount of habitat affected is increased due to the addition of a short spur in the Zilpo recreation area and movement of equestrian trail to roads in the Clear Creek drainage, potential impacts to off-road trails are actually reduced. As a result and considering that completing the trail system on existing open roads would not alter disturbance already associated with the road, there would be little change in disturbance related effects from those of alternative 1.

While the total miles of trail are similar to alternative 1, because the miles of shared and equestrian use are reduced, disturbance to wildlife, as well as impacts to vegetation and the trail surface would be reduced (The Nature Conservancy 2000).

While there is no change in the miles of trail in the Caney area, equestrians would no longer use the lower loop along Cave Run Lake and impacts to understory vegetation and the trail surface would be reduced. Also because equestrian cross country trail use would be restricted, impacts to streamhead seeps and associated wildlife and plant community would be reduced. As a result, alternatives 2 and 4 would result in the fewest impacts to the Caney area.

Impacts to the Murder Branch cave would be reduced under this alternative due to equestrian cross country restrictions around the cave, treatments along existing trails to discourage future use, and gating of the cave entrance.

Alternative 3

This alternative would add the same roads as that of alternative 2, as well as three new sections (2 and one-half miles) of bike/hike roads. In addition, 16 miles of new bike/hike trail would be added in the Scotts Creek and Wilson Hill areas described above. These changes would increase slightly (2 percent) the amount of cliffline and forested habitat affected, whereas old growth, rare community and significant bat habitat affected would be unchanged from that of alternatives 1 and 2. New bike/hike trail under this alternative would increase the amount of remote habitat affected by approximately 20 percent from that of alternatives 1 and 2, whereas 70 percent of project area remote habitat would continue to be unaffected.

Most new trail construction is associated with bike/hike use. While more remote lands east of the lake would be affected, due to the small trail footprint (2 to 3 feet wide) and widespread availability of unaffected habitat, effects to wildlife habitat would be reduced and adequate habitat exists to accommodate any animals displaced by the trail.

Use along the Cave Run reservoir would continue, although horse use would be eliminated from all areas except the White Sulphur loop. While impacts to vegetation and the trail surface would be reduced due to the likelihood that bike use in this area would increase, it is expected that disturbance to wildlife would be relatively unchanged.

Like alternative 1, all of the trails in the Caney area would be open to equestrian use, although trail improvements would reduce soil and water related impacts. Also, like alternative 2, restriction of cross country equestrian travel and improved trail standards would reduce impacts to wetlands and streamhead seep communities.

Activities and effects in the Murder Branch area would be similar to those of alternative 2.

Alternative 4

Road miles under this alternative are the same as those of alternative 3. Off-road trail miles are also similar, except that this alternative adds a mile of new trail in the Pioneer Weapons area and adds back

trail along Cave Run Lake. As a result, it increases the amount of habitat diversity, riparian and remote habitat affected from that of alternative 3. Cliffline, old growth, rare community and significant bat habitat affected is the same as that of alternatives 2 and 3.

Disturbance related effects would be similar to those described under alternative 3.

Like alternative 2, horse use along the lower trail and equestrian cross country travel in the Caney area would be eliminated, reducing trail erosion and potential impacts to the streamhead seep community.

Proposed activities and effects in the Murder Branch area would be the same as alternatives 2 and 3.

Aquatic Effects of Trail Use

Effects on aquatic resources include direct effects to streams and wetlands from trail use, as well as sedimentation and reduced water quality. This section summarizes effect on streams, water quality and the aquatic resource by alternative. More detailed information on soil and water effects can be found in the project hydrology and soils report (Arias 2013).

Alternative 1

Under this alternative trail standards would not be improved, almost all trails would be shared by hikers, equestrians, and mountain bikers, and cross country use would continue to occur across the project area.

Existing trails under this alternative have 73 stream crossings and 5 miles fall within 50 feet of an intermittent stream or 100 feet of a perennial stream. Trails under this alternative have the greatest number of off-road stream crossings, contain more off-road miles close to streams, and has all trails open to use year-round. Because trails were not designed to accommodate existing use, effects include continued degradation of lands affected by the trail corridor including soil disturbance and erosion, with the greatest effects occurring on equestrian trails. As a result and considering that trail conditions would not be improved, and that equestrian use would continue to occur on all but one mile of trail, potential impacts to water quality, streams and the aquatic resource would be greatest under this alternative.

Alternative 2

Existing trails under this alternative have 68 stream crossings and 4.5 miles fall within 50 feet of an intermittent stream or 100 feet of a perennial stream. While the total miles of trail is the same as that of alternative 1, there are a number of actions that would reduce effects to water quality, streams and aquatic habitat, including; 1) trails would be improved and brought up to a standard that would accommodate anticipated use while reducing erosion and impacts to water quality, 2) the existing trail that runs along lower Trough Lick Branch would be decommissioned which would reduce stream and riparian impacts in this drainage, 3) five stream crossings would be eliminated, 4) horse use on steep, narrow sections of trail in the Clear Creek drainage would be moved to roads which would reduce erosion in this drainage, and 5) impacts to wetlands, streams and streamhead seeps could be reduced in the Caney and Murder branch drainages due to equestrian cross country restrictions. While short-term sedimentation would occur during parking lot construction and trail maintenance, sedimentation and water quality impacts from the existing trail system would be reduced over the long-term (Arias 2013). Also, while on-going use would continue to impact streams, trail crossings would be improved to accommodate use and reduce water quality and stream impacts.

Alternative 3

A total of 20 miles of new trail and up to five acres parking lot construction would occur under this alternative, which would result in short-term sedimentation during construction, as well as impacts associated with use. While a new crossing would occur in the headwaters of an intermittent stream, trails

would largely occur in upland areas. As a result and considering that all new trails would be constructed to a standard that accommodates use, potential water quality impacts would be reduced. Also because several trails are proposed to move trail use out of stream bottoms, existing impacts in Trough Lick Branch, Boardinghouse Branch, Leatherwood Creek and Graveyard Branch would be reduced.

Existing trails under this alternative have 58 stream crossings and 3.9 miles fall within 50 feet of an intermittent stream or 100 feet of a perennial stream. Like alternative 2, proposed actions would improve trail standards, reduce equestrian use, seasonally close trails during wet periods, decommission the existing trail in lower Trough Lick Branch, move trails to roads in the Clear Creek drainage and restrict cross country use in the Caney drainage. In addition, the existing trail that runs along Boardinghouse Branch would be moved, and approximately 1.8 miles of trails along Cave Run Lake in the Graveyard Branch drainage would be eliminated. This alternative has the least amount of equestrian use and fewest stream crossings. As a result, implementation would result in the fewest impacts to streams, water quality and aquatic communities.

Alternative 4

A total of 20 miles of new trail and up to five acres parking lot construction would occur under this alternative, which would result in short-term sedimentation during construction, as well as impacts associated with use. Like alternative 3, while a new crossing would occur in the headwaters of an intermittent stream, new trails would largely occur in upland areas. As a result and considering that all new trails would be constructed to a standard that accommodates use, potential water quality effects would be reduced. Also because several trails are proposed to move trail use out of stream bottoms, existing impacts in Trough Lick Branch, Boardinghouse Branch and Leatherwood Creek and would be reduced.

Existing trails under this alternative have 60 stream crossings and 4.0 miles fall within 50 feet of an intermittent stream or 100 feet of a perennial stream. Like alternative 2, proposed actions would improve trail standards, reduce equestrian use, seasonally close trails during wet periods, decommission the existing trail in lower Trough Lick Branch, move trails to roads in the Clear Creek drainage and restrict cross country use in the Caney drainage. Like alternative 3, the trail in Boardinghouse Branch would be moved out of the bottom, although the trail in the Graveyard Branch drainage along Cave Run Lake would be maintained under this alternative. As a result and because more miles of shared use and equestrian trails would occur under this alternative, the potential for water quality and stream impacts are somewhat higher than that of alternative 3. However; due to improved trail standards, trail re-location out of Trough Creek and Boardinghouse Branch and off steep slopes in the Clear Creek drainage, and with seasonal and cross country equestrian closure trail closures, implementation of this alternative would reduce existing impacts to streams, water quality and aquatic communities.

Cumulative Effects of Proposed Activities on Biological Resources

A list of past, on-going and future activities can be found in the project file.

Activities that are most likely to have cumulative effects are those that might result in long-term changes to wildlife habitats such as timber harvest, timber stand improvement work, and wildfire. Recent wildfire and on-going and reasonably foreseeable future activities that are expected to occur under all alternatives during the analysis period (2013-2028) are displayed in Table 15.

Table 15. Cumulative effect summary of past, present, and reasonably foreseeable future activities

Activity	Amount	
	Acres	Percent
Timber Harvest	101	0.1
Timber Stand Improvement	1,559	2.1
Roadside Salvage	422	0.6
Wildfire	1,359	1.8
Invasive Weed Treatment	[1]	
Road Maintenance	[2]	
Total	3,442	4.6

1 – occurs at scattered locations and treatment size varies considerably
2 – maintenance along existing roads across the project area

Cumulative Effects of the Proposed Activities and Timber Harvest

A total of 101 acres in three units occurs in the northeast corner of the analysis area in the headwaters of Ramey Creek, with the closest cutting unit occurring approximately 0.9 miles southeast of the existing trail system. Treatment includes a sanitation salvage harvest to remove severely damaged trees. Effects to wildlife include possible mortality of less mobile individuals, as well as avoidance of the site during treatment. Additionally habitat would be reduced for species that utilize snags and downed woody debris. However, because Forest Plan standards and guidelines (USDA FS 2004a) would retain snags on all harvest sites and due to the small amount of habitat affected and widespread availability of dead trees, effects to wildlife and wildlife habitat are reduced.

Cumulative Effects of the Proposed Activities and Timber Stand Improvement

Ongoing and future timber stand improvement (TSI) work will occur on 1,559 acres during the analysis period. This treatment includes removing trees five inches in diameter of less and occurs at scattered locations across the southern half of the analysis area. Approximately 430 acres of TSI work occurs within the existing trail area of influence under all alternatives, with most of this occurring in the Murder Branch area. Treatment may result in possible mortality to less mobile species, although with implementation of Forest Plan standards, tree removal is restricted to the fall and winter months. As a result, the likelihood of mortality is reduced and effects include largely avoidance of the site during or following treatment. Effects to habitat include a reduction of understory and mid-story woody vegetation on the site, which would reduce habitat for species which prefer dense understory conditions and improve habitat for species that prefer the open understory conditions created by treatment.

Cumulative Effects of the Proposed Activities and Roadside Salvage

This treatment involves removal of dead and dying trees along existing roads and will occur on 422 acres across the analysis area. Approximately 175 acres occur within the area of influence of existing roads that also serve as part of the trail system. Because of the reduction in standing and future downed woody debris, treatment would be expected to reduce habitat for snag dependent species. Based on the availability of dead trees across the landscape, habitat for species that prefer or require dead wood would continue to be available.

Cumulative Effects of the Proposed Activities and Wildfire

A total of 1,359 acres of wildfire have occurred within the analysis area since 2005 and of this, 363 acres occurred within the trail area of influence. Effects of wildfire vary depending on the intensity of burning. Because almost 90 percent of the wildfire occurred during the spring (April) when wetter site conditions

would reduce burning intensity, effects to understory vegetation and wildlife were reduced somewhat. Many species respond to fire in adaptive manners that minimize mortality (Means and Campbell 1981), whereas large mammals move away from the fire (USDA FS 2000). Upland game birds, raptors and many smaller birds are attracted to fires due to increased foraging opportunities (USDA FS 2000). Consequently when mortality does occur, it is usually negligible at the population level (Lyon et al. 1978) and is not expected to adversely affect local populations for any species.

Effects from the low to moderate intensity burning would also include a reduction in woody vegetation and an increase in herbaceous vegetation (Bowles and Jacobs 2007). This reduction in woody vegetation and pockets of overstory mortality would result in more open understory conditions. Generally this is expected to improve habitat for species that prefer or require forested habitat with a grass/forb understory and decrease habitat for species that utilize understory shrubs or low woody cover.

Cumulative Effects of the Proposed Activities and Non-Native Invasive Weed Treatments

Non-native invasive plant species (NNIPS) treatment would occur at scattered locations across the project area including; the Zilpo campground, Scott Creek wildlife viewing area, Twin Knobs campground, Caney roads and fields, shoreline trail east of Twin Knob, Ranger District office and work center, Slabcamp restoration, and along a number of existing roads. Treatment involves use of herbicides or mechanical/hand treatment in sensitive areas. With implementation of mitigation measures incorporated into treatments, effects to wildlife include primarily short-term (one year) behavioral avoidance during treatment, as well as reduced likelihood that invasive species would encroach into adjacent native vegetation. There are no long-term effects to wildlife or wildlife habitat anticipated.

Cumulative Effects of the Proposed Activities and Road Maintenance

Activities including re-surfacing, ditchline repair and maintenance, culvert replacement and right-of-way maintenance will occur on many of the existing roads within the project area. It is expected that all activities will occur within the existing ROW and effects include possible mortality to less mobile species and short-term (up to one season) avoidance of the road during treatment. Treatment would also result in short-term increases in sedimentation for some activities, whereas maintaining road surface and drainage would reduce long-term sedimentation associated with roads.

In summary, while there could be a long-term reduction in habitat for species sensitive to human disturbance from new trail corridors (alternatives 3 and 4), most effects are short-term in nature, habitat conditions would be largely maintained, and unaffected habitat would continue to be available along the trail corridors as well as across the landscape. There would be some changes in wildlife habitat and associated changes in wildlife movements, considering that much of the disturbance from on-going and future activities is short-term in nature, that habitat would be reduced for some species and improved for others, and that over approximately 70 percent of the analysis area would be unaffected, there are no significant cumulative effects to wildlife anticipated under any alternative.

Table 16. Summary of effects of proposed activities on biological resources by area by alternative

Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Caney	Existing use and Impacts to streamhead seeps and trail erosion will continue. Cross country use would continue. Overall use would be unchanged.	Horse use from the lower loop will be eliminated and bike/hike use would increase. Equestrian use would be restricted during wet conditions. Overall trail use would be unchanged. Reduced equestrian use, trail improvements and cross country restrictions would reduce trail related impacts to streamhead seeps.	Bike use would be eliminated and horse use would be maintained on the entire system. Existing impacts would be reduced due to trail improvements, equestrian cross country restrictions and seasonal restrictions. Impacts to streamhead seeps would be reduced. Overall trail use would be largely unchanged.	Horse use from the lower loop will be eliminated and bike/hike use would increase. Equestrian use would be restricted during wet conditions. Overall trail use would be unchanged. Reduced equestrian use, trail improvements and cross country restrictions would reduce trail related impacts to streamhead seeps.
Murder Branch	Use and existing impacts to the Murder Branch cave would continue.	Existing horse hike use would increase due to trail improvements and reduced system horse trail. The Equestrian cross country restriction, improved trail standards, and treatments on existing user trails near Murder Branch Cave would reduce sedimentation into the cave and from the trail system. Access into the cave and potential impacts to cave dwelling species would be eliminated.		
Cave Run Lake	Existing use would continue. Impacts to Trough Lick Branch and Boardinghouse Branch would continue.	The trail along Trough Lick Branch bottom (hog pen) would be decommissioned and stream, riparian and soil and water impacts reduced. Equestrian use around Cave Run Lake would be reduced. While the trail that runs along Boardinghouse Branch would continue to be used, trail improvements would reduce soil and water impacts. Overall use would be largely unchanged, although shared use would be reduced.	Approximately 1.3 miles of new construction would be implemented to allow complete separation of uses. Trails along Trough Lick Branch and Boardinghouse Branch would be moved. Approximately 1.8 miles of trail in the Graveyard Branch drainage and above Cave Run lake would be eliminated and off-road stream crossings reduced. These changes combined with trail improvements and equestrian seasonal restrictions would reduce stream, riparian and water quality impacts.	Approximately 1.3 miles of new construction would be implemented to allow separation of use, with some shared use. Trails along Trough Lick Branch and Boardinghouse Branch would be moved and stream crossings reduced. These changes combined with trail improvements and equestrian seasonal restrictions would reduce stream, riparian and water quality impacts. Potential soil and water impacts would be greater than alterative 3 due to maintaining Graveyard Branch trail more equestrian miles.
Natural Arch	Erosion and trail impacts on portions of the arch trail would continue. No change in cliffline habitat. Use would be unchanged.	Horse use would be reduced on 3.5 miles of trail and moved to existing roads. As a result and due to improved trail standards, impacts from trail use to the natural arch would be reduced. No change in cliffline affected. Overall trail use would be maintained		
White Sulphur	Erosion in the hog pen area and ridge above White Sulphur Branch would continue. Overall use would be unchanged.	Bike use would be eliminated. A total of 0.6 miles of new construction would occur to accommodate use being displaced by decommissioning the trail in Trough Lick Branch. This combined with trail improvements and equestrian seasonal restrictions would reduce stream, riparian and water quality impacts.	Bike use would be eliminated. Approximately 2.6 miles of new construction would be implemented in order to eliminate trail in the hog pen area and to establish trail north of white Sulphur branch. Equestrian use would decline initially. Soil and water impacts would be reduced due to trail improvements, decommissioning of the Trough Lick Branch trail and equestrian use restrictions during wet periods.	
Leatherwood	Erosion associated with the user created trail would continue.	Trail improvements and seasonal equestrian restrictions would reduce soil and water impacts. No change in cliffline affected		
Scott Creek & Wilson Hill	Not affected by the trail system		16 miles of bike/hike trail would be constructed. Approximately 1,000 acres of remote habitat affected. Increased trail use throughout much of the year.	

Wildlife, Aquatic and Plant Species

This section described the affected environment for each of the species evaluated in detail and the effects to each species resulting from implementation of the alternatives. Management indicator and conservation species with similar habitat requirements are discussed together.

The species that occur or are likely or possible based on available suitable habitat within or near the Cave Run Trails Nonmotorized Project are listed in Table 17 and Table 18.

Table 17. Summary of threatened, endangered, sensitive, and conservation species analyzed

Species Common Name	Latin Name
Threatened and Endangered Species	
Mammals	
Gray Bat (E)	*Myotis grisescens*
Indiana Bat (E)	*Myotis sodalis*
Virginia Big-eared Bat (E)	*Plecotus townsendii virginianus*
Mussels	
Snuffbox (E)	*Epioblasma triquetra*
Sheepnose (E)	*Plethobasus cyphyus*
Plants	
Running Buffalo Clover (E)	*Trifolium stoloniferum*
Sensitive Species	
Mammals	
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*
Eastern small-footed bat	*Myotis leibii*
Birds	
Bald Eagle	*Haliaeetus leucocephalus*
Appalachian Bewick's wren	*Thryomanes bewickii altus*
Fish	
Eastern sand darter	*Ammocrypta pellucida*
Tippecanoe darter	*Etheostoma tippecanoe*
Northern madtom	*Noturus stigmosus*
Mussels	
Long-solid	*Fusconaia subrotunda subrotunda*
Salamander mussel	*Simpsonaias ambigua*
Invertebrates	
Cliffline caddisfly	*Manophylax butleri*
Vascular Plants	
Small spreading pogonia	*Cleistes bifaria*
Kentucky Lady's slipper	*Cypripedium kentuckiense*
French's shooting star	*Dodecatheon frenchii*
Butternut	*Juglans cinerea*
Sweet pinesap	*Monotropsis odorata*
Hairy skullcap	*Scutellaria saxatilis*
Rock skullcap	*Scutellaria saxatilis*

Species Common Name	Latin Name
Little Mountain meadowrue	*Thalictrum mirabile*
Cutleaved meadow parsnip	*Thaspium pinnatifidum*
Vascular Plants	
Closter's brook-hypnum	*Plagiochila sullivantii closteri*
Sullivant's leafy liverwort	*Plagiochila sullivantii var sullivantii*
Agoyan cataract moss	*Scopelophila cataractae*
Conservation Species	
Birds	
Common raven	*Corvus corax*
Chuck-wills-widow	*Caprimulgus carolinensis*
Red-breasted nuthatch	*Sitta canadensis*
Swainson's Warbler	*Limnothlypis swainsonii*
Warbling vireo	*Vireo gilvus*
Reptiles and Amphibians	
Northern scarlet snake	*Cemophora coccinea copei*
Corn snake	*Elaphe guttata guttata*
Scarlet kingsnake	*Lampropeltis tiangulum elapsoides*
Northern coal skink	*Eumeces anthracinus anthracinus*
Gastropods	
Early hairstreak	*Erora laeta*
Invertebrates	
Six banded long horned beetle	*Dryobius sexnotatus*
Osmunda borer Moth	*Papaipema speciosissima*
Aquatic	
Gilt darter	*Percina evides*

Threatened, Endangered and Sensitive Species

Threatened, endangered and sensitive species are evaluated in the project Biological Assessment and Evaluation (Reitz 2013), located in the project record. Threatened, endangered and sensitive (TES) species evaluated in detail in this analysis include TES species that have been recently documented within the area, as well as species that have not been documented but have suitable habitat within the project area. Species evaluated in detail are summarized in Table 17.

Gray Bat

The gray bat was previously known from the southern portion of the Cumberland Ranger District from two summer records of single individuals, approximately 25 miles southwest of the project area. While the project area contains limestone caves utilized by this species, gray bats have not been found to use these caves. Past mist net sampling on the district has not documented use. However, potentially suitable foraging habitat and suitable limestone caves are present. There is potential for the gray bat to occur within the project area and be affected by proposed activities.

Direct and Indirect Effects

While the project area contains potentially suitable limestone caves, suitable habitat within ¼ mile of the trail system has been surveyed and no gray bat caves have been documented. As a result, there are no effects to roosting, hibernating or swarming gray bats anticipated under any alternative.

There are no direct effects to foraging gray bats anticipated from trail use. While some tree removal would occur in alternatives 2, 3, and 4, the overstory would be largely unchanged and no tree removal would occur within riparian habitat, so foraging habitat would be largely unchanged. As a result, and considering that removal of trees greater than five inches in diameter would occur while bats are at their hibernacula, there are no direct or indirect effects to gray bats anticipated under any action alternative.

Indiana Bat

Suitable roosting and foraging habitat and potential maternity habitat for the Indiana bat occur throughout the Daniel Boone National Forest. Roost tree monitoring on the Forest in 1996 indicated that the majority of roost trees used by Indiana bats during the autumn months were located in stands greater than 50 years of age with relatively closed canopies, in natural canopy gaps, and in sites that had received a prescribed burn (USDA-FS 2003a). Summer maternity colonies, consisting of females and their young have been documented on national forest system lands on three sites on the Cumberland Ranger District.

The entire project area is considered occupied Indiana bat habitat and includes Indiana bat swarming, roost and foraging habitat, as well as possible maternity roost habitat. The Murder Branch Cave is located on national forest system lands in the southeast corner of the project area. Nine bat species including two federally endangered species (Indiana and Virginia big-eared bat) and one sensitive species (Rafinesque big-eared bat have been documented from the cave during the fall and winter months. While hibernating Indiana bats have not been recently documented from the Murder Branch Cave (KY Dept. of Fish and Wildlife Resources 2011), this cave was considered a priority four hibernacula at the time the Indiana bat recovery plan was revised (USFWS 2007a).

Direct and Indirect Effects to Roosting Bats

Alternative 1

Direct effects to roosting bats could occur from any activity that result in removal of occupied roosts or an activity that causes a bat to alter its normal behavior pattern and flush from its roost, making it more susceptible to predation. Indirect effects occur if suitable roosting, foraging or swarming habitat is modified to a level where the availability of suitable habitat is reduced. Because there is no removal of suitable roost trees, there would be no change in the availability of roosting, foraging or swarming habitat under this alternative.

Trail use and maintenance would continue to occur on 75 miles of trail. Of this, 67 miles occur as off-road trail, and approximately six miles occur in swarming habitat. As a resul,t there is potential for a roosting bat to be disturbed, although potential effects would vary depending on the level of use. More heavily used portions of the trail such as the Caney area and sections of trail around the White Sulfur campground would be more likely to result in increased levels of use and associated disturbance. However, use along these trails has been on-going for many years and it is unlikely that maternity roosts or roosts that would be sensitive to disturbance and utilized for more than one season would be established along these sections of trail. Much of the trail system receives reduced levels of use and overall, it is not expected that trail use would change under this alternative. The likelihood that a bat would be affected by trail use is also reduced due to the widespread availability of suitable roost trees available in the area.

Alternative 2

Effects of trail use under this alternative would be similar to those described under alternative 1, although it could reduce the likelihood that roosting bats in the Caney and Murder Branch areas would be affected by cross country trail use. It is not anticipated that trail use under this alternative would result in levels of disturbance that would result in Indiana bat mortality.

While there is no new trail construction proposed, suitable roost trees would be removed on approximately three acres due to parking lot construction. While effects include possible mortality if a tree to be removed contained a roosting bat, with implementation of project design features restricting removal to when the bats are in hibernation, there are no anticipated direct effects or mortality to roosting bats from tree removal.

Indirect effects or changes in habitat would result due to the of approximately five hundred suitable roost trees under this alternative. Because removal would occur while bats are in hibernation, there would be no direct mortality. While there would be a reduction in three acres of forest, over 42,000 acres of suitable foraging and roost habitat would be unaffected, and there would only be a two acre reduction in forested swarming habitat. Considering the availability of live and dead trees, there would be little change in roost tree availability. Tree removal does not discourage Indiana bats from using dead trees nearby as roosts, and in fact, may make them more attractive by opening up the forest canopy allowing more sunlight to hit the tree making it warmer and thermally more stable (USDI FWS 1996). It is not anticipated that treatments would reduce Indiana bat roosting, foraging or swarming habitat to level that would result in Indiana bat mortality.

Alternatives 3 and 4

Much of the proposed new trail construction occurs in areas with more closed canopy conditions and most of the forested habitat affected does not contain the more open canopy conditions preferred for roosting and foraging (Romme et al 1995). Tree removal would be scattered across the project area and would occur over a five to ten year period, resulting in little annual change in roost tree availability. Because bike trails would only be two to three feet wide, there would be no tree removal over much of the trail and would involve cutting only a few trees at any location. Anticipated removal would come from smaller diameter (<10 inches) understory and mid-story trees. Collectively, new trail construction would result in little change in the overstory or the availability of roost habitat.

Trees would be removed due to proposed parking lot construction. New trail construction could result in removal of up to 2,450 trees. Implementation of project design features would restrict tree removal to when bats are in hibernation, thus no mortality to roosting bats anticipated.

While parking lot construction would reduce forest by five acres, sites are located adjacent to and within existing road corridors. As a result, construction would not result in further fragmentation of forested habitat.

Direct and Indirect Effects to Foraging Bats

All Alternatives

Because bats forage between sunset and sunrise, there are no direct effects to foraging bats from trail use anticipated. Additionally, because the closed canopy conditions that predominate across the project area provide less preferred habitat (USFWS 2004a p. 26), the selective removal of trees associated with new trail construction would open up the understory and mid-story, and foraging habitat may be somewhat improved (Romme et al 1995, USFWS 1996, USDA FS 2004a, Calahan 1993 *In* USFWS 2007c,). This is especially true in the dense mixed mesophytic or cove forest that provides more marginal habitat

conditions (USFWS 2007a p. 80) and characterizes much of the new Scott Creek trail. As a result and due to the small amount of forested habitat affected, available Indiana bat foraging habitat would be essentially unchanged.

Direct and Indirect Effects to Hibernating Bats

Alternative 1

Cross country horse use around the Murder Branch cave would continue to occur and the cave would not be gated under this alternative. A serious cause of Indiana bat decline has been human disturbance of hibernating bats and humans passing near hibernating Indiana bats can cause arousal, depleting a bat's fat reserves resulting in mortality. Direct mortality from vandalism has also been reported (USDA FWS 2004a p. 20). In addition to these threats, illegal access into the cave increases the risk that White Nose Syndrome would be introduced. Continued illegal access increases the likelihood that mortality to hibernating bats could occur.

Alternatives 2, 3, and 4

All alternatives would install a gate on the entrance of the Murder Branch cave. Also, equestrian cross-country travel around the cave could be eliminated. Collectively for these reasons, there are no impacts to hibernating bats anticipated.

Cumulative Effects

Anticipated cumulative effects are discussed under the treatment effect section and include TSI, wildfire, sanitation salvage harvest, roadside salvage. Effects include possible mortality to roosting bat during treatment, as well as indirect effects to habitat. All harvest and TSI work would comply with Forest Plan standards and guidelines and anticipated effects would be consistent with those considered in the revised Forest BO (USFWS 2007a). As result, potential direct mortality is reduced.

Past, present, and reasonably foreseeable activities would affect Indiana bat habitat and remove potential roost trees. While the availability of roost trees would be reduced on approximately 525 acres receiving a sanitation harvest, because live trees would largely be retained through implementation of Forest Plan snag standards (USDA FS 2004a), all sites would continue to provide suitable roost trees. Fire and TSI work (approximately 2,900 acres) would reduce primarily small diameter trees, and overstory and large diameter trees and snags would be largely retained. Consequently, affected sites would continue to provide suitable foraging and roost habitat.

Up to approximately 3,200 acres (14 percent) of existing roosting and foraging habitat would be affected by proposed actions and ongoing/future activities. Harvest and reforestation treatments would be consistent with the Forest revised BO (USFWS 2007a). Approximately 85 percent of the existing roosting and foraging habitat would be unaffected by management actions. Cumulative effects are not anticipated under any alternative.

The status of WNS in Kentucky was considered through a Forest-wide evaluation (USDA-FS 2008a, USDA-FS 2011). Potential impacts and the need to re-initiate consultation with the U.S. Fish and Wildlife Service (USFWS) were evaluated. Although WNS has been recently documented in Kentucky, because the Murder Branch cave entrance would be gated in alternatives 2, 3, and 4, illegal access would be eliminated and the threat of WNS reduced. Conversely, because illegal access into the cave would continue under alternative 1, WNS could be more readily spread due to disturbance to hibernating bats.

Virginia Big-Eared Bat

This species is known from about 90 locations within the Forest proclamation boundary and is a year-round resident on the northern half of the Daniel Boone National Forest. Nearly all of the records represent single individuals or small groups that have been encountered in caves and sandstone rock shelters. To date, five maternity colonies have been found on the Forest. The Virginia big-eared bat has been documented at three locations within the project area, including the Murder Branch area (Tom Biebiehauser personal communication).

Preferred habitat includes forested land adjacent to clifflines. Since the cliffline prescription area includes lands within 100 ft. of the top of the cliffline and 200 ft. from the bottom, the cliffline prescription area is considered preferred habitat, which occur on approximately 1,600 acres within the project area.

Direct and Indirect Effects

All Alternatives

A total of 3.2 to 3.4 miles of trail traverse the cliffline prescription area under the alternatives considered. Approximately eight percent of the suitable habitat falls within 150 feet of an existing or proposed trail. Cliffline habitat within one-quarter mile of existing and proposed trails has been surveyed and no Virginia big-eared bat hibernacula have been identified. Implementation of project design features further reduce the likelihood that a bat would be disturbed and adversely affected by trail use.

There is no new trail or parking lot construction proposed within or adjacent to clifflines under any alternative. As a result suitable Virginia big-eared bat foraging and roost habitat would be unchanged.

Cumulative Effects

Cumulative activities within the cliffline prescription area include 50 acres of recent wildfire, four acres of salvage harvest and 67 acres of TSI work. Nearly 90 percent of the preferred habitat (cliffline prescription area) would be unaffected. TSI work and wildfire would reduce understory vegetation including smaller diameter trees. Virginia big-eared bat foraging habitat would be essentially unchanged and cumulative effects to this species or its habitat are not anticipated.

Effects described for White Nose Syndrome are the same as those discussed for Indiana bat.

Snuffbox

The snuffbox is usually found in small to medium sized creeks in areas with swift current. Although not documented within the project area, it has been documented in drainages below the project area (KY CWCS 2012). As a result, project activities could affect water quality of suitable habitat.

Direct and Indirect Effects

Alternative 1

Although there are fewer acres of the riparian prescription area directly affected under this alternative, it has the greatest number of off-road stream crossings, contains more off-road trail miles close to streams, and has all trails open to use year-round. Trail conditions would not be improved under alternative 1. Potential impacts to water quality, as well as sedimentation and impacts to stream channels are greatest under this alternative.

Alternatives 2, 3, and 4

While the miles of trail and type of use differ, proposed treatments were designed to reduce sedimentation and water quality impacts.

Alternatives 3 and 4 differ from alternative 2 in that the miles of off-road equestrian use and off-road trails along streams would be reduced further, parking lot construction would increase to five acres and new trail construction would increase by up to 21 miles. While there may be some short-term increases in sedimentation associated with trail and parking lot construction, implementation of project design features would moderate these effects, and sedimentation and water quality impacts from the trail system would be reduced over the long-term. Additionally, improved trail standards would reduce impacts to streams and riparian habitat.

Cumulative Effects

Timber harvest, TSI work and road maintenance could result in short-term increases in sedimentation. Implementation of Forest Plan Standards and Guidelines (USDA FS 2004a) would insure water quality, as well as in-stream conditions would be maintained. Similarly, with implementation of Plan standards and site specific design features, there are no effects to water quality from invasive weed treatment. While recent wildfire would have resulted in localized increases in sedimentation and reduced water quality in some areas immediately following burning, herbaceous vegetation has since become re-established and there are no future impacts to water quality anticipated. Cumulative effects are not anticipated under any action alternative.

Sheepnose

Although it does inhabit medium sized rivers, this mussel generally has been considered a large river species. It may be associated with riffles and gravel/cobble substrates but usually has been reported from deep water (>6 feet) with slight to swift currents and mud, sand or gravel bottoms. It appears capable of surviving in reservoirs and specimens have been found in deep runs of larger rivers (KY CWCS 2012). It has been documented in the Licking River immediately below the Cave Run dam (KYCWCS 2012). The project area is considered suitable occupied habitat for the sheepnose.

Direct, Indirect, and Cumulative Effects

While this species is found in larger rivers than the snuffbox, because habitat and threats are similar, direct, indirect and cumulative effects would be similar to those described for the snuffbox.

Running Buffalo Clover

Running buffalo clover occurs in mesic habitats of partial to filtered sunlight, where there is a prolonged pattern of moderate periodic disturbance. It is most often found in regions underlain with limestone or other calcareous bedrock. The primary threat to running buffalo clover is habitat alteration. Factors that contribute to this threat include natural forest succession and subsequent canopy closure, competition by invasive plant species, permanent habitat loss through development and possibly elimination by large herbivores (USFWS 1989). Suitable habitat on the Cumberland district is present and this species has been documented within the Forest proclamation boundary and is known to occur near Clear Creek Lake along a trail used by horses (David Taylor personal communication). The project area is considered occupied habitat.

Direct and Indirect Effects

All Alternatives

A small population of running buffalo clover occurs in Clear Creek along an equestrian trail. Because this use is maintaining open understory conditions near the population, it is likely existing use is helping to maintain this population (David Taylor personal communication). Trail use is not expected to change under alternative 1, and this species and its habitat would be maintained. For alternatives 2, 3, and 4, implementation of a project design feature requiring monitoring of the Clear Creek population would

ensure that future use does not result in adverse impacts to this species or its habitat. It is not anticipated that trail use under any of the alternatives would adversely affect running buffalo clover.

While there is risk that non-native invasive species (NNIS) would spread into suitable, none of the alternatives propose trail expansion or improvements in this area. On-going and future NNIS treatment in this watershed is expected to help contain NNIS.

Cumulative Effects

Future NNIS treatment would contain or control invasive species and with continued monitoring of this population, there are no cumulative effects anticipated.

Rafinesque's Big-eared Bat

The Rafinesque's big-eared bat is closely tied to ridgetop/cliffline habitat. In the summer on the Forest this species also uses rockshelters associated with sandstone cliffline as both roosting and feeding shelters. Rafinesque's big-eared bats have been found at over 37 locations on the Cumberland Ranger District. Hibernation was documented approximately one half mile from the Murder Branch area and a single bat was documented in the Murder Branch cave in 2002. Two maternity sites are located approximately 1 mile southwest and 1.5 miles northeast of the Murder Branch area. The Cave Run project area is considered occupied habitat for this species.

Direct, Indirect, and Cumulative Effects

Because they forage and roost in similar habitats, direct, indirect and cumulative effects would be similar to those described for the Virginia big-eared bat.

Eastern Small-footed Bat

The eastern small-footed bat likely occurs in forested areas throughout the Forest and has been documented from Bath, Menifee and Rowan counties on the Cumberland Ranger District. Four small-footed bats were captured over woodland ponds on the district in 1995, including two lactating females in Rowan County. Due to the 1995 documentation and considering the availability of summer and winter habitat, the project area is considered occupied habitat for this species.

Direct, Indirect, and Cumulative Effects

Because they forage and roost in similar habitats, direct, indirect and cumulative effects would be similar to those described for the Virginia big-eared bat and Indiana bat. Potential effects to suitable cliffline habitat are discussed under the Virginia big-eared bat. The likelihood that bats roosting within suitable live or dead trees could be affected is discussed under the Indiana bat.

Bald Eagle

Wintering birds are known to occur on major impoundments on the Forest. While this species is relatively selective in its nesting habitat requirements, it forages in a diversity of areas and is likely to be found foraging throughout the general forest, provided that a body of water such as a large river or lake is present. Cave Run Lake provides suitable bald eagle habitat and two bald eagle nests have been documented within the project area. These nests are currently protected by a Forest Supervisor Order that restricts public access into nesting area during the breeding season.

Direct and Indirect Effect

All Alternatives

Because trail use near existing bald eagle nests has been restricted in the past during the nesting season, bald eagles have successfully nested and reproduced at these sites. As a result and with implementation of project design features that restrict trail use near these and any future nests documented within the project area, direct effects to nesting birds would be reduced and there is no loss of reproduction anticipated.

Up to five acres of forested habitat would be removed due to parking lot construction. Proposed trail construction (alternatives 3 and 4) would maintain forested habitat. As a result there will be little change in bald eagle roosting, nesting or foraging habitat under any alternative.

Cumulative Effects

The only past, present and future activities on lands around the reservoir included TSI work and a small amount of roadside salvage. None of these activities would reduce suitable bald eagle habitat and treatments would comply with Forest Plan standards (USDA FS 2004a). As a result there are no cumulative effects anticipated.

Appalachian Berwick's Wren

The Berwick's wren is found in a variety of open areas and can be found in rural farmland, suburban yards and forest clear-cuts (KY Breeding Bird Atlas 1996). The species will nest in both natural and artificial cavities. Although there have been no surveys for this species, the Berwick's wren has not been documented within the three affected counties. However suitable habitat is present and the analysis areas fall within its breeding range (KYCWCS 2012).

Direct, Indirect, and Cumulative Effects

All Alternatives

Because this species has not been recently documented in the project area or eastern Kentucky, and because there would be no change in suitable openland habitat, there are no effects to habitat anticipated. While the possibility exists that trails through openings could affect an individual, no new trails are proposed in suitable habitat and the likelihood of direct effects is remote. Suitable habitat would not be affected by on-going or future activities, and no cumulative effects are anticipated.

Eastern Sand Darter

Due to similarities in habitat, threats, and potential effects, aquatic species including the eastern sand darter, Tippecanoe darter, northern madtom, longsolid and salamander mussel are discussed together.

These five species inhabit sandy areas of small creeks to large rivers. It is most abundant in larger sandy areas of moderate to large streams with currents not strong enough to wash away the sand (Trautman 1981). It is also found frequenting the less turbulent, but clean swept margins of the main current over gravel and sand substrate (USDA-FS 2003b).

The eastern sand darter is found on the Licking River. Although habitat within the Licking River has been reduced due to impoundment and associated sedimentation, reaches of streams with adequate flows provide suitable habitat.

The Tippecanoe darter occurred within a segment of the Licking River that was inundated by Cave Lake. Although documented in Rowan County in 2008, it has not been recently documented within project area drainages.

The northern madtom has not been recently documented within portions of the Licking River affected by Cave Run Lake.

Suitable habitat for the longsolid occurs immediately below Cave Run Lake dam.

The salamander mussel has been found in the Licking River at the mouth of Slate Creek in Bath County (Shuster 1988). A single specimen was collected from Blackwater Creek in the backwaters of Cave Run Lake approximately five miles south of the project area

Direct, Indiretc, and Cululative Effects to Aquatic Species

Effects are the same as discussed in Aquatic Effects of Trail Use, above.

Cliffline Caddisfly

While cliffline caddisfly has been collected from rock surfaces adjacent to streams, most sites on the Daniel Boone National Forest are along sandstone cliffline that is not associated with surface water. The hydrology of these sites are maintained by the shading presence of dense woody vegetation in the adjacent forest (USDA-FS 2003c). Although not known to occur within the project area, no surveys have been conducted.

Direct, Indirect and Cumulative Effects

Between 3.2 miles (alternative 1) and 3.4 miles (alternative 4) of cliffline are traversed by system or user created trails. While the possibility exists that an individual could be affected during trail use, implementation of project design features, and the small amount of habitat affected minimize the likelihood that an individual would be affected.

Kentucky Lady's Slipper

Habitat in Kentucky includes mesic forests on stream floodplains that are annually inundated with water (Center for Plant Conservation (CPC) 2012). Suitable habitat for this species could occur on the bottoms of streams that are periodically in-undated with water, including a number of drainages flowing into Cave Run Lake, portions of the Clear Creek drainage and wetlands associated with streamhead seeps in the Caney area.

Direct, Indirect, and Cumulative Effects

All Alternatives

The existing trail system and use has the potential to impact this species due to increased access and possible collection, as well as impacts to surface or subsurface flow from the trail itself. Because the existing trail was not designed to accommodate existing or anticipated future use, indirect effects to habitat (i.e. altered drainage and flow) would continue under alternative 1. Similarly, the possibility of collection would continue under alternative 1 due to cross country use and use along existing trails in the Caney area and the lower reaches of streams around Cave Run Lake.

Like alternative 1, use along the trail system as well as cross country use though suitable habitat poses a risk for collection under the action alternatives (alternatives 2-4), although cross country closure in the Caney area and improved trail standards would reduce impacts to habitat and help protect any plants established in this drainage. Eliminating use along riparian areas in alternatives 2, 3, and 4 would reduce impacts to suitable habitat. Only 0.4 miles of new construction is proposed within suitable habitat but construction would reduce erosion and impacts from the existing trail. Future trail construction would include plant surveys before any work is completed. No direct effects associated with new construction is anticipated.

Risk of encroachment of NNIS into suitable habitat for this species would be greatest under alternative 1. While the spread of NNIS would continue under all alternatives, due to seasonal closures during wet conditions, reduced stream crossings, improved trail standards, and potential cross country closures in the Caney and Murder Branch drainages, encroachment of NNIS would be reduced in alternatives 2, 3,and 4.

Cumulative Effects

Cumulative effects are the same as those discussed under the Cumulative Effects of Proposed Activities on Biological Resources sections above. While potentially suitable habitat along Cave Run Lake could be affected by future TSI work, all treatment would comply with Plan standards related to the protection of suitable wetland and riparian habitat. No measurable cumulative effects are anticipated.

Small Spreading Pogonia

The small spreading pogonia generally occurs on dry soils, often at road cut or cliff edge, but is also known to occur in wet to moist grassy areas in the open. Large populations are documented from open, moist grassy areas in utility rights-of-way. Most of the small populations are associated with streamhead wetlands, dry cliff edges or road banks of ridge roads. This plant is known from about a dozen sites along ridge roads on the Cumberland Ranger District.

Direct and Indirect Effects

All Alternatives

Both existing and proposed new trails cross suitable habitat for this species. Effects to suitable habitat from the existing system would continue under alternative 1. Effects to existing habitat would also continue under the action alternatives, although trail improvements, seasonal closures, and reduced equestrian use would reduce trail corridor impacts. Surveys would be conducted prior to any new construction and it is not expected that individual plants would be affected. Due to the narrow trail corridor, little habitat would be removed.

Effects of invasive species are discussed above and the spread of NNIS would continue under all alternatives. While the risk of further spread would be unchanged under alternative 1, NNIS would be reduced under alternatives 2, 3, and 4 due to seasonal closures during wet conditions and improved trail standards. Continued cross country use could affect this species or its habitat. Cross-country closures to horses would reduce impacts.

Cumulative Effects

Cumulative effects are the same as those discussed under the Cumulative Effects of Proposed Activities on Biological Resources sections above.

French's Shooting Star

This species is normally found in a very distinctive and limited habitat. Typically, the plants grow in linear colonies in thin sandy soil in shade directly below outer edges of prominently extending and overhanging sandstone ledges. These rock shelters are usually exposed along or near streams and can vary in size (USDA FS 2002). While not documented within the project area (personal communication with David Taylor), it has been documented from Menifee County (KSNPC Rare Plant Database 2012) and suitable habitat is present.

Direct and Indirect Effects

All Alternatives

While the project area contains rock shelters and potentially suitable habitat, few rock shelters are affected by the existing trail and there is no new trail or parking lot construction proposed within suitable habitat. As a result, the likelihood that individual plants would be affected is low.

Effects of invasive species are the same as those discussed under alternative effects above.

Cumulative Effects

Cumulative effects are the same as those discussed under the Cumulative Effects of Proposed Activities on Biological Resources sections above.

Butternut

Butternut is found throughout the Daniel Boone National Forest and is found on moist and rich soils along the banks along larger rivers and on north east facing, moderate to steep slopes. It grows in a number of locations on the Cumberland district, although most trees are infected with the butternut canker.

Direct, Indirect, Cumulative Effects

Project design features that prevent removal of potentially resistant butternut trees would protect butternut trees from disturbance. Similarly, because Forest Plan objectives include maintaining suitable butternut habitat (USDA FS 2004a), it is not expected that proposed harvest or TSI would adversely affect this species and there are no cumulative effects anticipated.

Sweet Pinesap

Sweet pinesap inhabits mixed deciduous or coniferous forests below 4,600 ft. elevation (Flora of North America 2012). In Kentucky it is associated with yellow pine communities, pine/oak heaths and cover forests with a mountain laurel or rhodendron understory (personal communication with David Taylor). It is usually found near sandstone cliffs and while it has not been documented from the project area, suitable habitat exists around clifflines and Cave Run lake (personal communication with David Taylor).

Direct and Indirect Effects

All Alternatives

Trail improvements and seasonal closures would reduce trail corridor impacts in alternatives 2, 3, and 4. New trail construction under these alternatives would increase access and reduce suitable habitat. Surveys would be conducted prior to any new construction and it is not expected that individual plants would be affected. Due to the narrow trail corridor, little habitat would be removed.

Effects of invasive species are the same as those discussed under alternative effects above.

Cumulative effects

Cumulative effects are the same as those discussed under the Cumulative Effects of Proposed Activities on Biological Resources sections above.

Hairy Skullcap

This perennial herb inhabits mesic wooded slopes, often with white oak and yellow poplar (KY State Nature Preserve 2012). It is known from Menifee County along Glady Creek, approximately eight miles

south of the project area (David Taylor personal communication). Threats include disturbance that results in increased erosion or invasive plant infestations (KY State Nature Preserve 2012).

Direct, Indirect, and Cumulative Effects

Because habitat and threats are similar, direct, indirect and cumulative effects would be similar to those described for the sweet pinesap.

Rock Skullcap

Rock skullcap inhabits rocky mixed mesophytic woods, talus slopes and bluffs usually with a sandstone substrate. Threats include disturbance that increase erosion or invasive species. While it has not been recently observed within the three county area within the project area of influence, historic observations occurred in Menifee County (KY State Nature Preserve 2012) and suitable habitat exists around Cave Run lake (personal communication with David Taylor).

Direct, Indirect, and Cumulative Effects

Because habitat and threats are similar, direct, indirect and cumulative effects would be similar to those described for the sweet pinesap.

Little Mountain Meadowrue

This is found in and near permanently damp to wet sandstone rockshelters, often in the spray zone of a waterfall (David Taylor personal communication).

Direct, Indirect, and Cumulative Effects

Because habitat and threats are similar, direct, indirect and cumulative effects would be similar to those described for the French's shooting star.

Cutleaved Meadow Parsnip

A state threatened species, cutleaved meadow parsnip inhabits dry mesic forests with limestone outcroppings. Threats include exotic pest plants and increased access through trail or road construction (KY State Nature Preserve 2012). This species has historical documentation from Menifee county and has been observed more recently in Rowan county, including sites around Cave Run lake (personal communication with David Taylor).

Direct, Indirect, and Cumulative Effects

Because habitat and threats are similar, direct, indirect and cumulative effects would be similar to those described for the sweet pinesap.

Closter's brook-hypnum, Sullivant's leafy liverwort and Agoyan cataract moss

Because of similar habitat requirements and threats, these three non-vascular plants are discussed collectively.

Closter's brook-hypnum is found attached to submerged rocks in streams. It may also be on rocks adjacent to streams. While not documented within the project area, suitable habitat is present.

Sullivant's leafy liverwort is frequently on moist, bryophyte covered boulders or on rockhouse or cliff walls. Habitat includes wet rockhouses and cliff faces (David Taylor personal communication). While not documented within the project area, suitable habitat is present.

Agoyan cataract moss is a species associated with metal containing substrates. It is considered rare in the United States and elsewhere in the world. Habitat includes wet rockhouses and cliff faces. While not documented within the project area, suitable habitat is present.

Direct, Indirect, and Cumulative Effects

Because habitat and threats are similar, direct, indirect and cumulative effects would be similar to those described for the French's shooting star.

Conservation Species

Five conservation species have been recently documented within the three counties that make up the project area and eight species have suitable habitat, but have not been recently documented. These species are evaluated in detail in this assessment. Additionally, while not listed as a conservation species in the Forest Plan, the Osmunda borer moth (*Papaipema speciosissima*), a State endangered species has been documented in the Caney area and will also be evaluated in detail. Conservation species evaluated in detail are displayed in Table 17. The following is a discussion of anticipated effects from proposed alternatives on these species.

Common Raven

This species is typically found at elevations above 3,500 feet, but may occur down to 1,500 feet (USDA-FS 2003b). Raven typically utilize rocky and remote cliffline and are rarely found in areas without rocky outcrops. In Kentucky, they are typically birds of remote places and are rarely seen away from extensively forested portions of the mountains (Palmer- Ball, 1996). While this species is relatively selective in its nesting habitat requirements, it is much less selective in where it forages, and is likely to be found foraging throughout the general forest, regardless of forest type (USDA-FS 2003a).

While common ravens have not been recently document there, the project area is within this species breeding range (Kentucky Fish and Wildlife 2011a) and provides suitable foraging and nest habitat.

Direct and Indirect Effects

All Alternatives

While suitable nest habitat occurs on approximately 3,800 acres of cliffline habitat, more remote lands with rocky outcrops, which might provide preferred nest habitat occur on approximately 1,300 acres. Currently approximately 250 acres of remote cliffline habitat is affected by trail use (alternative 1) and effects include likely avoidance of this area during nesting. Because none of the proposed new trail construction (alternatives 2 through 4) traverses remote cliffline, there would be no change in preferred nest habitat affected under the action alternatives.

Foraging habitat would be affected on approximately 6,900 acres under alternatives 1 and 2, 7,800 acres under alternative 3 and 8,000 acres under alternative 4.

While the possibility exists that a nesting bird could be affected by trail use, because of the small amount of habitat affected and considering use has been on-going in these areas, the likelihood of mortality or reduced nest success is low. Similarly, because of the widespread availability of suitable foraging habitat and considering the intermittent use that characterizes much of the trail, the likelihood that foraging birds be affected is low. Also any disturbance would be short-term in nature and abundant foraging habitat exists to accommodate any displaced birds.

Cumulative Effects

Approximately 50 acres of the cliffline prescription area and preferred nest habitat has been affected by recent wildfire. Future activities include 4 acres of salvage and 67 acres of TSI work, whereas approximately 2,800 acres of foraging habitat would be affected by on-going or future activities. While short-term disturbance to foraging birds could occur during implementation of proposed actions and on-going/future activities, due to the small amount of preferred nest habitat affected and considering that there are no long-term adverse effects from proposed actions anticipated, there are no significant cumulative effects anticipated.

Swainson's Warbler

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 Daniel Boone National Forest, this bird is often observed in damp, shady hemlock ravines with an understory of rhododendron, near small streams (USDA-FS 2007).

While Swainson's Warbler is not recently documented there, the project area is within this species breeding range (Kentucky Fish and Wildlife 2011b) and provides suitable habitat. Preferred habitat is provided on approximately 13,700 acres of mixed mesophytic or hemlock forest.

Direct and Indirect Effects

All Alternatives

Potential direct effects to wildlife are discussed under the Wildlife Habitat and Distribution section and include possible mortality during trail maintenance or new trail construction. Because tree removal would largely occur outside the breeding season and due to the scattered nature of and small amount of understory/mid-story vegetation affected along the trail, the likelihood of mortality is low.

Other direct effects include possible increased nest predation/parasitism within 150 feet of off-road trails and behavioral avoidance within 660 feet. Suitable habitat within 150 feet of an off-road trail corridor occurs on approximately 500 acres under alternatives 1 and 2 and 650 acres under alternative 3 and 670 acres under alternative 4. Disturbance within the trail area of influence could affect approximately 1,900 acres under alternatives 1 and 2 and 2,200 acres under alternatives 3 and 4.

Due to the small amount of habitat affected and considering that many species become habituated to trail use similar to what is anticipated for the Cave Run system (Bennett and Zuelke 1999, Boyle and Samson 1985, Marion and Wimpy 2007), any behavioral avoidance would be short-term in nature. Also nest predation and parasitism are less likely to occur in predominantly forested areas such as the project area (deCalesta 1998, Brittingham 1998). Collectively for these reasons and considering the widespread availability of unaffected habitat, there are no long term effects to foraging, reproduction or use of the project area by this species anticipated.

Cumulative Effects

Potential cumulative effects of timber harvest, TSI and recent wildfire would be expected to reduce dense understory conditions preferred by these species on approximately 1,133 acres, whereas habitat would be largely unaffected by non-native invasive plant species (NNIPS) treatment and roadside salvage. Cumulatively during the analysis period, short-term effects associated with disturbance would occur on up to approximately 3,515 acres of suitable habitat (26 percent of available habitat), whereas long-term effects (reduced habitat and possible increased predation/parasitism) would occur on up to approximately 1,804 acres (13 percent of available habitat). While there would be a reduction in suitable habitat,

considering that over 90 percent of the existing habitat would be maintained and almost 75 percent would be unaffected, there are no cumulative effects anticipated.

Chuck-wills-widow

This species tends to favor mixed oak and pine stands (USDA-FS 2003b). It may occur and breed in general woods and forests that are primarily dry or mesic (USDA-FS 2003b). It appears to be much more common in drier forest, where the understory and midstory levels are relatively open (USDA-FS 2003b). It typically feeds over adjacent fields and clearings (USDA-FS 2003b). Only forested habitats that have developed open understories would be expected to support this species. On the Daniel Boone National Forest, this species is most often found in mixed pine-oak sites.

This species has been recently documented from the analysis area in Rowan County (KY. Dept. of Fish and Wildlife Resources 2011c). It prefers dry mixed oak/pine nest habitat which is widely scattered across approximately 2,400 acres of the project area.

Direct and Indirect Effects

All Alternatives

Suitable habitat within 660 feet of an off-road trail occurs on approximately 1,100 acres under alternatives 1 and 2 and 1,200 acres under alternatives 3 and 4, whereas suitable habitat within 150 feet of an off-road trail occurs on approximately 300 acres under all alternatives. Effects to this species would be similar to those described for the pine warbler and many species become habituated to trail use similar to what is anticipated for the Cave Run system (Bennett and Zuelke 1999, Boyle and Samson 1985, Marion and Wimpy 2007). As a result, any behavioral avoidance would be short-term in nature. Nest predation and parasitism are less likely to occur in predominantly forested areas such as the project area (deCalesta 1998, Brittingham 1998). As a result and considering that suitable habitat would be maintained along the trail corridor and that 77 percent of the suitable habitat would be unaffected, there are no long term effects to foraging, reproduction or use of the project area by this species anticipated.

Cumulative Effects

Potential cumulative effects to habitat would be improved due to recent wildfire on 433 acres, due to the more open understory conditions that would result. Conversely, salvage and TSI work would likely reduce preferred understory conditions on approximately 50 acres. Cumulatively during the analysis period, approximately 1,700 acres or 30 percent of the existing habitat would be affected by proposed actions and on-going/future activities. Considering that habitat would be improved on over 400 acres, and that over 99 percent of the existing habitat would be maintained, there are no effects anticipated.

Red-breasted Nuthatch

Though this nuthatch is dependent on coniferous habitat, its requirements vary considerably between seasons. It generally breeds at elevations above 3,500 feet, in dead spruce or fir trees. Occasionally it will nest in hemlock and, rarely, in pine. Suitable snags (dead trees) are greater than 6”dbh (six inch diameter at breast height) and mature stands are favored. The red-breasted nuthatch prefers to over winter in dense stands of conifers and pine-oak. During this time, the birds are not particular to age class, so much as to stand density. On the Forest, when these birds are encountered in winter, it is almost always while feeding in pines—especially mature Virginia pines having a lot of cones. The red-breasted nuthatch is particularly attracted to white pine forests during the nesting season (USDA-FS 2003b).

While not recently documented, the three county area within the project area of influence is considered within its breeding range (Kentucky Fish and Wildlife 2011d), although nest habitat is limited. Suitable winter habitat is also restricted to a few isolated yellow pine stands.

Direct and Indirect Effects

All Alternatives

Potential effects to this species are discussed under the Wildlife Habitat and Distribution section. While some behavioral avoidance during treatment and trail use is anticipated, considering that existing snags will be largely maintained, that suitable nest trees are widely available across the landscape, that the average nest height is 30 feet high (BNA 2012), that only five acres of preferred white pine habitat would be affected, and that no new trail construction is proposed in pure conifer stands preferred for winter use, the likelihood that nesting birds would be adversely affected is low. However, some short-term disturbance to foraging birds is possible immediately along the trail corridor.

Cumulative Effects

While proposed harvest would reduce the overstory, as well as some potential nest trees on approximately 500 acres, considering the widespread availability of snags and small amount of habitat affected by proposed actions, there are no cumulative effects anticipated.

Warbling Vireo

The warbling vireo is a bird of semi-open and open habitats, with scattered large trees, and it is rarely encountered in extensively forested areas. Consequently, in eastern Kentucky this species is generally found only in cleared bottomland situations. Warbling vireos are sometimes found in naturally occurring habitats, such as riparian zones along larger rivers, but they primarily occur in altered situations. This species was found in less than 3 percent of the priority blocks on the Cumberland Plateau and was not found in the Cumberland Mountains (KY Breeding Bird Atlas). However, the warbling vireo was documented during breeding bird survey routes near the analysis area in Bath County (USGS 2011).

Direct, Indirect and Cumulative Effects

All Alternatives

Effects to this species would be similar to those described for the Acadian flycatcher. Because suitable foraging and nest habitat would be largely unchanged by proposed actions or on-going/future activities and considering disturbance related effects would be short-term in nature, habitat would be maintained and there are no significant cumulative effects anticipated. As a result, the viability of this species would be maintained under all alternatives.

Northern Scarlet Snake

This is a burrowing species that is rarely seen, typically venturing out only at night or after heavy rains. It is usually found under logs, stones, leaf litter, pine needles, or bark; it is occasionally turned up during plowing or excavation work (USDA-FS 2003a, Russell et al 1999). While they have occasionally been found in open fields and residential areas, scarlet snakes primarily occur in woodlands, including pine, hardwood, and mixed forests (FS 2003a) with sandy or other friable, well drained soils that are suitable for burrowing. They are most common in open habitat and benefit from management practices such as periodic burning and selective thinning that retain open canopy, early successional conditions (USDA-FS 2003b). Scarlet Snakes feed on the eggs of other reptiles, and on mice, insects, smaller snakes, lizards, and salamanders (USDA-FS 2003a Appendix B).

While not recently documented, the analysis area is within this species range (Kentucky Fish and Wildlife 2011e) and suitable habitat exists.

Direct and Indirect Effects

All Alternatives

Because this species utilizes both open and forested habitat, suitable habitat would be maintained under all alternatives, except for the three (alternative 2) to five acres (alternatives 3 and 4) of parking lot development. While the possibility that an individual could be harmed during trail use exists, the likelihood is remote because this species forages at night.

Cumulative Effects

Cumulative effects could occur on up to approximately 3,400 acres or six percent of the project area. Because this species is active at night, and considering reptiles can often escape slow moving wildfire (Means and Campbell 1981), the likelihood that an individual would have been directly affected by recent wildfire is low. Also because this species benefits from disturbances similar to those associated with harvest and TSI work, existing habitat would be maintained or improved and there are no cumulative effects anticipated.

Eastern Corn Snake

Although this subspecies occurs in disjunct populations in eastern and west-central Kentucky, corn snakes are much more common in other southeastern States. Typical habitat includes pine and pine-hardwood forests, rocky hillsides, old fields, openings within bottomland hardwoods, and to a lesser extent forested swamps. Open woodland, ranging from uplands to lowlands, with an abundance of rocks and logs for cover is preferred, especially when bordering old or cultivated fields that increase foraging success. Corn snakes are fairly secretive, spending much of their time concealed under surface cover, in stumps, under bark, or in the burrows of other animals. They readily climb trees and enter abandoned houses and barns, in search of prey (USDA-FS 2003a). These snakes are most often encountered along woodland edges, overgrown fencerows, and around farmsteads (USDA-FS 2003a).

This species has been recently documented from the project area, which is considered occupied habitat.

Direct and Indirect Effects

All Alternatives

Like the Northern scarlet snake, because this species utilizes a variety of habitats, and considering the small amount of vegetation removal during new trail construction, existing habitat would be maintained except for the three to five acres of parking lot construction. Due to the small amount of habitat affected by the actual trail corridor, the likelihood of mortality is low. Because this species is active during the day, it is possible that an individual could be harmed as a result of trail use under any alternative.

Cumulative Effects

Cumulative effects are described under the Wildlife Habitat and Distribution alternative effect section and would occur on approximately 3,400 acres or six percent of the project area. While anticipated activities would result in habitat changes described above, all lands affected would continue to provide suitable habitat and there are no cumulative effects anticipated.

Scarlet Kingsnake

This snake's size and ecology vary considerably from those of the Milk Snake (L. triangulum), of which it is considered a sub-species (USDA-FS 2003a). The Scarlet Kingsnake prefers wooded areas, including pine, oak and other hardwoods, and mixed stands. It is typically found under rotting logs and debris, in stumps, and underneath the bark of dead trees. It is apparently a burrower in upland forests with deep

sandy soils. This small species appears to utilize pine snags to a great extent for hibernation and spring activity; management practices should include leaving a certain number of snags in pine habitat (USDA-FS 2003a). The Scarlet Kingsnake is shy and secretive, normally emerging from hiding only at night or after a heavy rain, and is adept at worming its way into small cracks and crevices, either into logs or rocks, or to considerable depths in the ground (USDA-FS 2003a). Its diet includes small snakes and lizards, mice, insects, and earthworms (USDA-FS 2003a).

While not recently documented within Menifee, Rowan or Bath counties, the project area is within its breeding range (Kentucky Fish and Wildlife 2005r) and suitable habitat is present.

Direct, Indirect and Cumulative Effects

All Alternatives

Effects, including the maintenance of local populations would be similar to those described under the eastern corn snake and there are no effects under any alternative that would affect local viability of this species.

Northern Coal Skink

The Appalachian population of this subspecies extends into eastern Kentucky, 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, humid wooded or rocky hillsides and similar areas near water sources. 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. They inhabit various rocky areas and can be found in forest openings and in grassy cut over areas in hardwoods (USDA-FS 2003b). Use of fire to maintain grassy openings within forested stands is of benefit to this species. Coal Skinks feed primarily on insects and spiders (USDA-FS 2003b).

While not recently documented within Bath, Menifee or Rowan counties, the project area is within its breeding range (Kentucky Fish and Wildlife 2005s) and suitable habitat is present.

Direct, Indirect and Cumulative Effects

All Alternatives

Effects, including the maintenance of local populations would be similar to those described under the eastern corn snake and there are no effects under any alternative that would affect local viability of this species.

Six-banded Longhorn Beetle

This species inhabits mature hardwood forests with large, overmature trees (especially elm, maple, and beech used by wood-boring larvae). Feeding continues until after trees die and bark has fallen off. This species has one 1993 documentation from Menifee county (KY nature preserve 2012) and the analysis is considered suitable unoccupied habitat.

Direct, Indirect and Cumulative Effects

All Alternatives

There are no activities under any alternative that would reduce habitat for this species. Because there has not been recent documentation within project area counties, there are no direct effects anticipated. While roadside salvage and sanitation cutting would reduce foraging habitat, considering the widespread

availability of suitable habitat, there are no significant cumulative effects anticipated. Collectively for these reasons, none of the proposed alternatives would affect the local viability of this species.

Early Hairstreak

This species is strongly associated with hardwood and northern hardwood mixed forests. Caterpillars eat the young fruit of American Beech (Fagus grandilolia) and the species is strongly associated with mountainous forests tracks with a beech component. In Kentucky, individuals observations occur most often on flowers in openings (Natureserve 2012), especially on open ridgetops and along dirt roads (Butterflies and Moths of North America 2012), whereas observations in adjacent states include rock outcrops, edges of northern hardwood forests, roads or other exposed soils in extensively forest areas with a beech component (Natureserve 2012). Although rare, this species has been documented in Menefee County (Butterflies and Moths of North America 2012).

Direct, Indirect and Cumulative Effects

All Alternatives

Preferred northern hardwood forest would be unaffected by proposed actions and there are no direct or indirect effects to this species anticipated under any alternative. While nine acres of northern hardwood forest would be affected by TSI work, habitat would be maintained and there are no significant cumulative effects anticipated. As a result, the local viability of this species would be maintained under all alternatives.

Osmunda Borer Moth

A State endangered species, the Osmunda borer moth inhabits seeps and springs supporting cinnamon and royal ferns, which are used as a larval host. This species is highly sought after and many moths can be trapped within one or two nights during the flight season. As a result, illegal collection is considered one of the biggest threats to this species (Personal communication with Ellis Laudermilk 2009).

This species has been documented within streamhead seeps in the Caney area, which includes approximately 200 acres of suitable habitat.

Alternative 1

Direct and Indirect Effects

The Osmunda borer moth (moth) is dependent on cinnamon and royal ferns and the spring/seep habitat that supports them. Consequently any activity that has the potential to affect these species or alter the hydrology of the streamhead seep community has the potential to adversely affect the moth.

Approximately 1.8 miles of existing trail traverse the streamhead seep prescription area. The existing trail system traverses a total of 0.4 miles of the streamhead seep rare community and suitable Osmunda borer moth habitat, although there is a short section of user defined bike trail that runs through this prescription area between the upper and lower loop.

A number of factors affect potential impacts to streamhead seeps and this species under this alternative. For example; 1) trails would not be improved, 2) equestrian use and shared use, which can result in greater soil and water impacts would continue, 3) use during wet periods of the year would continue and 4) equestrian cross country use would continue. Collectively for these reasons, potential impacts to streamhead seep hydrology and Osmunda borer moth habitat are greatest under this alternative.

Trail use also increases the spread of NNIPS. The effect of trail use on NNIPS is described in the project NNIPS report and while all types of use have the potential to increase the spread of invasive species, equestrian use results in the greatest risk (USDA FS 2012a). Because cross country trail use would continue, there is increased risk of spreading NNIPS to off-trail locations, especially those with soft or moist soils (Landsberg et al 2001), increasing the likelihood that NNIPS would adversely affect moth habitat.

Considering that 75 percent of the streamhead seep rare community is greater than 150 feet from a trail, it is unlikely that continued use would alter habitat to a level that would reduce the Forest viability of this species. However, with continued cross country equestrian use, equestrian use during wet periods, and sub-standard trails, it is likely that use associated with this alternative would adversely affect suitable moth habitat. As a result, alternative 1 is not consistent with Forest Plan direction to protect or enhance habitat for endangered, threatened, sensitive, and conservation species in streamhead seep communities (USDA FS 2004a, pp. 212 and 3-23).

Cumulative Effects

Because the moth is largely restricted to the streamhead seep community, cumulative effects are analyzed by looking at ongoing or future cumulative effects that may occur within the Caney drainage. There is no timber harvest or roadside salvage in the Caney drainage and cumulative effects in this area include NNIPS treatment and 14 acres of TSI. Proposed TSI work is over a mile from moth habitat and would not result in direct or indirect effects. Also because NNIPS treatment is designed to reduce or contain invasive species, risks that invasive weeds would spread into this community would be reduced. As a result there are no on-going or future activities that would result in adverse effects to this species or its habitat.

Alternatives 2 to 4

Direct, Indirect and Cumulative Effects

While the total miles of trail in the Caney area and the total miles of trail traversing the streamhead seep community would be the same as alternative 1, the following changes would reduce impacts to the streamhead seep community under all action alternatives; 1), proposed new construction and trail work would bring all trails to a level that accommodate expected use, while reducing soil and water impacts. Also a hydrologist/botanist would be involved during all trail work to ensure streamhead seep hydrology is maintained, 2) equestrian cross country travel would be restricted on approximately 600 acres, and 3) equestrian use during the wet season of the year would be restricted. Collectively for these reasons, it is expected that all action alternatives would maintain streamhead seep hydrology and protect rare communities, including Osmunda borer moth habitat.

In addition to cumulative effects described under alternative 1, proposed actions would reduce impacts to streamhead seeps and Osmunda borer moth habitat. As a result there are no significant cumulative effects anticipated. All alternatives are consistent with Forest Plan direction to protect or enhance habitat for PETS and conservation species in streamhead seep communities (USDA FS 2004, pp. 212 and 3-23).

Gilt Darter

The gilt darter occupies upland rivers in shoal areas with moderate to fast current and a substrate of gravel, sand, and scattered rubble free of vegetation. It’s known to use the riffles and bars of moderate to large streams of moderate gradient with clean sand and gravel substrate. It is also found over substrates of cobble, pebble, and gravel, sand and organic debris (USDA FS 2003a). Increased levels of sedimentation can adversely affect this species (Sutherland 2001).

This species has been documented in the Cave Run watershed (USDA FS 2003a) and suitable habitat exists below the dam.

Alternative 1

Direct and Indirect Effects

Effects to the gilt darter are evaluated by looking at changes to water quality and sedimentation, which may affect gilt darter habitat below Cave Run Lake. Because portions of the Caney drainage flow directly into the Licking River below the dam, potential impacts in this drainage would be more likely to affect this species.

Anticipated effects to water quality and the aquatic resource are discussed under Wildlife Habitat and Distribution above. As described, alternative 1 has the greatest number of off-road stream crossings, contains more off-road trail miles close to streams, and has all trails open to use year-round. As a result and considering that trail conditions would not be improved, potential impacts to water quality, as well as sedimentation are greatest under this alternative.

Cumulative Effects

Anticipated cumulative effects are discussed above and displayed in Table 15. While timber harvest, TSI work and road maintenance could result in short-term increases in sedimentation, with implementation of Forest Plan Standards and Guidelines (USDA FS 2004a), water quality, as well as in-stream conditions would be maintained. Similarly, with implementation of Forest Plan standards and site specific mitigations, there are no effects to water quality from invasive weed treatment. While recent wildfire would have resulted in localized increases in sedimentation and reduced water quality in some areas immediately following burning, herbaceous vegetation has since become re-established and there are no future impacts to water quality anticipated.

Alternatives 2 to 4

Direct, Indirect and Cumulative Effects

Anticipated effects to water quality and the aquatic resource are discussed under Wildlife Habitat and Distribution alternative effect section. While the miles of trail and type of use differ, proposed treatments were designed to reduce sedimentation and water quality impacts. Specifically, the following would be implemented under the action alternatives; 1) seasonal restrictions to equestrian use would lessen impacts to the trail system and associated erosion, 2) miles of off-road equestrian trail and trails along perennial streams would be reduced, 3) the existing trail along the Trough Creek would be decommissioned, reducing impacts from the trail system in this drainage, 4) equestrian off-road trails which result in greater soil and water impacts would be reduced, 5) equestrian cross country closure in the Caney and Murder Branch areas would reduce impacts in these drainages and most importantly, and 6) trails would be improved to a standard that would support expected use, facilitate drainage and reduce erosion and sedimentation.

Alternatives 3 and 4 differ from alternative 2 in that the miles of off-road equestrian use would be reduced further, parking lot construction would increase to five acres and new trail construction would increase by up to 21 miles under these alternatives. While there may be some short-term increases in sedimentation associated with trail and parking lot construction, improved trail standards and trail/use modification identified above would reduce trail erosion, sedimentation and water quality impacts (USDA FS 2012b). Additionally State water quality standards would be met and impacts to streams and riparian habitat reduced.

Cumulative effects would be the same as those described under alternative 1 and there are no on-going or future activities that would result in long-term effects two water quality or the aquatic resource. As a result there are no cumulative effects under any action alternative.

Management Indicator Species

Management indicator species (MIS) are used in concert with other indicators to gauge the effects of management on wildlife and fish. In general, the MIS approach is used to reduce the complexity of discussing all the species on the Forest and MIS represent groups of wildlife associated with similar habitats. Evaluating the effects of management practices on these species and their habitat also displays the effects of alternatives on the ecological communities they represent and helps to ensure that biodiversity is maintained.

Table 18 displays the 15 MIS species on the Daniel Boone National Forest and the habitats they represent, available project area habitat and when available, population trend information. More detailed species specific information is provided below. The selection and rationale for these species are located on pages 3-194 to 3-195 of the Forest Plan FEIS and preferred habitat, threats, and management emphasis are discussed on pages 3-196 to 3-204 of the Forest Plan FEIS (USDA-FS 2004b).

Table 18. Management indicator species and habitat evaluated in detail

Species	Preferred Habitat	DBNF Annual Population Change[1]	Breeding Bird Survey Trend[1]	Project Area Habitat
Closed Canopy Mature Forest Species				
Acadian Flycatcher (*Empidonax virescens)*	Riparian corridor forest > 80 years of age	0.7%	Stable	Suitable habitat exists on approximately 12 percent of the project area and is well distributed
Black-throated green warbler (*Dendroica virens)*	Dense cove forest > 80 years of age	6.8%	Stable	Suitable habitat exists on approximately 12 percent of the project area, with larger blocks in the Murder Branch and Leather wood drainages.
Cerulean Warbler (*Dendroica cerulea)*	Upland hardwood and mixed yellow pine communities > 41 years of age with >60 BA. 70-90 BA preferred.	-4.8%	Negative	Potentially suitable oak habitat occurs on approximately 49 percent of the project area; However preferred nest habitat is determined largely by site conditions.
Woodland & Moderate to Open Canopy Mature Forest Species				
Summer Tanager (*Piranga rubra)*	Drier upland hardwood or mixed hardwood-yellow pine communities > 50 years of age, with 30-60 BA	8.2%	Stable	Preferred forest types greater than 50 years of age occur on approximately 39 percent of the project area. Open canopy stands are widely scattered.
Chipping Sparrow (*Spizella passerine)*	Upland hardwood or mixed hardwood-yellow pine communities > 50 years of age, with <30 BA and a grassy understory.	-3.6%	Stable	Suitable open canopy habitat is widely scattered across the analysis area.

Species	Preferred Habitat	DBNF Annual Population Change[1]	Breeding Bird Survey Trend[1]	Project Area Habitat
Northern Cardinal (*Cardinalis cardinalis)*	Upland hardwood or mixed hardwood-yellow pine communities > 50 years of age with <30 BA and a shrub layer.	5.9%	Stable	
Grassland and Early Successional Species				
Field sparrow (*Spizella pusilla)*	Grasslands, old fields, wooded grasslands, prairie	-0.9%	Negative	Suitable habitat occurs on approximately 950 acres s of open grasslands and woodlands with an herbaceous understory.
Eastern towhee (*Pipilo erythrophthalmus)*	Any forest type <10 years of age	-2.8%	Negative	Suitable seedling habitat is essentially absent and old field/edge habitat exists on less than one percent of the analysis area.
Yellow breasted chat (*Icteria virens)*	Any forest type <20 years of age	-3.6%	Stable	Seedling/sapling habitat exists on approximately four percent of the analysis area.
Predominately Yellow Pine Communities				
Northern Bobwhite (Colinus virginianus)	Woodland and wooded grassland; predominantly mature yellow pine or mixed yellow pine hardwood with 25-50 BA. Predominately grass/forb understory with scattered brush.	-12.4%	Negative	Suitable open canopy habitat containing an herbaceous understory exists at widely scattered locations where mortality has opened up the forest canopy.
Prairie warbler (*Dendroica discolor)*	Yellow pine communities <10 years of age that are recovering from pine beetle infestation (XP, P-O, DMO, DXO)	-13.1%	Negative	Regenerating yellow pine is essentially absent from the analysis area.
Pine warbler (*Dendroica pinus)*	Yellow pine communities >41 years of age with 70-90 BA (XP & P-O)	-7.8%	Positive	Maturing yellow pine or mixed pine/hardwoods occur on approximately 5,000 acres at scattered locations across the project area.
Demand Species				
White-tailed deer (*Odocoileus virginianus)*	Various	Numbers Increasing	NA	Virtually all of the project area provides suitable deer habitat.
Northern Bobwhite (*Colinus virginianus*)	Wooded and wooded grassland and mature yellow pine or mixed yellow pine/hdwd communities with 25-50 BA and a predominately herbaceous layer with scattered brush.	-12.4%	Negative	Very little suitable habitat currently exists and what does occur is in the form of openings/edge in the Caney area and on scattered lands to the east.

Species	Preferred Habitat	DBNF Annual Population Change[1]	Breeding Bird Survey Trend[1]	Project Area Habitat
Aquatic Community				
Macro-invertebrates	Aquatic systems	Stable in the Project Area	NA	Approximately 75 miles of stream habitat occur within the analysis area.

1 – Change between 1992 and 2004 (LaSorte et al 2007)

Acadian Flycatcher and Black-throated Green Warbler

Acadian Flycatcher - Preferred and Project Habitat

This species is usually found near water, generally near a stream course or some small waterway (USDA-FS 2003b). It generally uses an open, moderate understory for feeding in a stand with tall trees and closed canopy (USDA-FS 2003b). It is associated with forested tracts at least 90 acres in size (USDA-FS 2003b). Forest monitoring data indicates that the greatest number of occurrences for this species were in mesophytic-cove habitats greater than 80 years old. The Acadian flycatcher is particularly fond of the shaded, moist coves dominated by hemlocks and adjacent to small streams (USDA-FS 2003a).

Mature mixed mesophytic habitat occurs on approximately 6,000 acres in the project area. While this only makes up approximately eleven percent of National Forest lands within the project area, with the exception of the Caney area and lands immediately south of the lake, suitable habitat is well distributed.

Black-throated Green Warbler - Preferred and Project Area Habitat

The black-throated green warbler nests in a variety of forests, especially where conifers mix with northern hardwoods (Brauning 1992). Historical accounts indicate hemlock is very important for this species and on the Forest the black-throated green warbler is an indicator of mature to late successional mesic deciduous forest, particularly mature cove forest. This warbler feeds in both deciduous and coniferous trees, usually in the middle to upper levels of the canopy. Its nest is usually 20 to 80 feet high, but may be lower (Brauning 1992).

Like the Acadian flycatcher, suitable habitat for this species is fairly widespread in riparian and cove forest scattered throughout the project area. Larger blocks of habitat occur in the Murder Branch and Leatherwood areas.

Direct and Indirect Effects

All Alternatives

Potential direct effects to wildlife are discussed under the Wildlife Habitat and Distribution section and include possible mortality during trail maintenance or new trail construction. Because tree removal (Acadian flycatcher nest habitat) would largely occur outside the breeding season and due to the scattered nature of and small amount of understory/mid-story vegetation affected along the trail (black-throated blue warbler nest habitat), the likelihood of mortality is low.

Other direct effects include possible increased nest predation/parasitism within 150 feet of off-road trails and behavioral avoidance within the trail area of influence. Suitable habitat within 150 feet of an off-road trail corridor occurs on approximately 300 acres under alternatives 1 and 2 and 400 acres under

alternatives 3 and 4, whereas trail use could result in disturbance on approximately 1,000 acres under alternatives 1 and 2 and 1,200 acres under alternatives 3 and 4.

While disturbance may occur on up to 1,185 acres, approximately 82 percent of the project area habitat would be unaffected by any proposed action. Due to the small amount of habitat affected and considering that many species become habituated to trail use similar to what is anticipated for the Cave Run system (Bennett and Zuelke 1999, Boyle and Samson 1985, Marion and Wimpy 2007), and the widespread availability of unaffected habitat, any behavioral avoidance would be short-term in nature. The Acadian flycatcher has been found to prefer territories closer to trails corridors due to more open foraging habitat provided (Hickman 1990). Also, nest predation and parasitism are less likely to occur in predominantly forested areas such as the project area (deCalesta 1998, Brittingham 1998), and seasonal and cross country restrictions on equestrian use under alternatives 2 through 4 would reduce disturbance during the nesting period. Collectively for these reasons and considering the widespread availability of unaffected habitat, there are no long term effects to foraging, reproduction or use of the project area by these species anticipated. As a result local populations and existing distribution and use would be maintained.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the Wildlife Habitat and Distribution alternative effect section. Of the anticipated activities/effects, timber harvest, TSI and recent wildfire would be expected to reduce dense understory conditions preferred by these species on approximately 775 acres, whereas habitat would be largely unaffected by NNIPS treatment and roadside salvage. Cumulatively during the analysis period, effects associated with disturbance would occur on up to approximately 2,000 acres of suitable habitat. Because suitable foraging and nest habitat would be largely unchanged by proposed actions or on-going/future activities, and considering disturbance related effects would be short-term in nature, there are no cumulative effects.

Cerulean Warbler

Preferred and Project Area Habitat

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 in which to nest. Both nesting and foraging take place in the canopies of hardwoods, and in addition to large diameter trees, stands that contain complex vertical structure and more heterogeneous stand conditions are preferred (Hamel 2006). Typically, cerulean warblers choose to place their nest high in the canopy, closer to the outer edge and away from the bole, suggesting that nest trees may have been opened up and experienced full sunlight at some point in time (Hamel and Rosenberg 2006). As a result, on the Forest this species is often found nesting near canopy gaps and typically selects nest sites that contain a pine component. This species nests from May to June (Hamel 2000) and forages and nests in the canopy (Natureserve 2012, Hamel 2000).

The cerulean warbler is selected as the MIS for mid to late successional mesic forests, as well as mesic oak forest communities (USDA-FS 2004a B-26). Because this species utilizes both communities, habitat was evaluated by looking at dry mesic/xeric oak and mixed mesophytic habitat greater than 41 years of age. Preferred habitat currently exists on approximately 48 percent of the project area (National Forest lands). While these mature to late successional forests would provide potentially suitable habitat, because of this species preference for open canopy conditions and complex vertical structure (Hamel 2006), and considering it often nests near canopy gaps, not all of this would be considered suitable nest habitat.

Direct and Indirect Effects

All Alternatives

Proposed treatments would reduce forested habitat by up to five acres and disturbance associated with proposed construction and trail use would occur on up to approximately 4,566 acres of suitable habitat. Potential direct effects to this species are similar to those discussed under the Acadian flycatcher and include short-term behavioral avoidance during new trail construction and maintenance, possible avoidance during trail use or increased nest predation/parasitism associated with the off-road trail corridor. Four (alternatives 1 and 2) to five percent (alternatives 3 and 4) of the suitable cerulean warbler habitat occurs within 150 feet of a trail, whereas 15 (alternatives 1 and 2) to 18 (alternatives 3 and 4) percent occur within 660 feet.

Because this species nests in the canopy and considering that implementation of project design features would restrict tree removal during the breeding season, there is no direct mortality to nesting birds anticipated. Seasonal and cross country restrictions on equestrian use under alternatives 2 through 4 would reduce disturbance during the nesting period. Similarly, because it forages in the upper canopy, the likelihood that foraging birds would be disturbed by trail use is low. As described under alternative effects and the Acadian flycatcher, the likelihood of nest predation/parasitism would be is low. As a result, and due to the widespread availability of unaffected habitat (85 to 88 percent), there are no long term effects to foraging, reproduction or use of the project area by the cerulean warbler anticipated and local populations would be maintained.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the Wildlife Habitat and Distribution alternative effect section. While all anticipated activities would result in short-term disturbance, only activities that affect the overstory canopy would be expected to reduce habitat for this species (i.e. timber harvest and roadside salvage). While wildfire may result in pockets of overstory mortality, this is likely to promote preferred nest site conditions (Hamel and Rosenberg 2006). As a result, anticipated cumulative effects would be largely restricted to short-term disturbance. Because over 75 percent of the suitable habitat would be unaffected by the proposed actions and on-going/future activities, and considering nesting and foraging habitat would be largely unchanged, there are no cumulative effects anticipated.

Ovenbird

The ovenbird is a ground nesting species that forages in the leaf litter or on the soil, with birds being more common in stands with closed canopies and open ground. Mengel (USDA-FS 2003b) observed nests on logging roads and under small logs sheltered by ferns, and on steep mesophytic slopes. Whereas Baker and Lacki (USDA-FS 2003b) note that birds are more abundant in non-harvested areas. Upland stands and sloping terrain are preferred, but a variety of deciduous and mixed (pine-oak) forest types are used. The ovenbird has been observed during the breeding season in areas of taller, older trees on the Forest. Qualitative observations indicate that the species is common in forested areas. The species has been captured within areas of young forest and along the edge of grassy openings. It is a forest interior species having a minimum necessary tract size of 45 acres (USDA-FS 2003b). Nesting for this species typically occurs in May and June (Natureserve 2012).

This species is used to monitor mature forest habitat (USDA FS 2004a) and mid-late successional oak and oak/pine forest. Habitat conditions for this species were evaluated by looking at effects to mature forest habitat greater than 80 years of age and currently approximately 24,500 acres or 47 percent of the

National Forest system lands within the project area provide potentially suitable mature forest habitat. Although not all of these sites would provide understory conditions preferred for nesting.

Direct and Indirect Effects

All Alternatives

Potential direct effects to this species were discussed under Wildlife Habitat and Distribution and include short-term behavioral avoidance during new trail construction and maintenance, possible avoidance during trail use or increased nest predation/parasitism associated with the off-road trail corridor. Five (alternatives 1 and 2) to six percent (alternatives 3 and 4) of the suitable overnbird habitat occurs within 150 feet of a trail, whereas 19 (alternatives 1 and 2) to 24 percent (alternatives 3 and 4) occur within 660 feet. Currently approximately 3,900 acres or 15 percent of the project area remote habitat falls within 660 feet of a trail. Remote habitat affected would increase to approximately 18 percent due to new trail construction under alternatives 3 and 4. Potential nest predation/parasitism as well as possible mortality and behavioral avoidance would be similar to that discussed under the Acadian flycatcher. While disturbance associated with trail construction and use would increase under alternatives 3 and 4, suitable habitat would be largely unchanged under any alternative. Also Hickman (1990) found that area sensitive species such as the ovenbird were not affected by trails. As a result and considering that greater than 80 percent of the available habitat would be unaffected and that populations of this species on the forest are stable or increasing, there are no changes in local populations of this species anticipated. Also existing project area distribution and use would be maintained.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the Wildlife Habitat and Distribution alternative effect section. While all anticipated activities would result in short-term disturbance, only activities that reduce the overstory such as timber harvest and salvage would be expected to reduce habitat for this species. As a result, anticipated cumulative effects would result in short-term disturbance related effects on up to approximately 1,250 acres of suitable habitat and long-term effects (>10 years) on up to approximately 200 acres of the existing habitat. Because 80 percent of the suitable habitat would be unaffected by the proposed actions and on-going/future activities, there are no cumulative effects anticipated.

Summer Tanager and Chipping Sparrow

Summer Tanager - Preferred and Project Area Habitat

Relatively dry sites, which tend to produce stands of a semi-open condition, are frequented by this species. Uplands are commonly used, but the birds may occur in a variety of habitats, including bottomlands and wooded residential areas. Forest types range from hardwood to pine-hardwood stands of open to medium density. On the Forest, the birds are frequently found in mature, mixed pine stands that have been burned and undergone midstory removal (USDA-FS 2007). Oaks are often chosen for nesting, in open woodland or forest edge and open spaces along roads and clearings are often utilized (USDA-FS 2003b). Nesting for this species typically occurs in May and June (Natureserve 2012).

Because the summer tanager is most abundant in open forest conditions (USDA-FS 2003b), habitat for this species was assessed by looking at changes in oak and oak/pine communities greater than 50 years of age. While approximately 30 percent of the National Forest lands within the project area provides potentially suitable habitat, it is recognized that not all of this would have the moderate canopy conditions preferred.

Chipping Sparrow - Preferred and Project Area Habitat

This species occurs mainly in grassland areas with scattered trees (USDA-FS 2003b) or in open woodlands where the understory is sparse, as a result of grazing, burning or soil conditions (USDA-FS 2003b). It may occur in moderate numbers in open pine-oak upland forest on dry ridges of the Cumberland Plateau (USDA-FS 2003b). In Kentucky, this species is frequently found in forested areas dissected by numerous small to moderate sized openings (USDA-FS 2003b) and Forest monitoring data indicates that the greatest number of occurrences were in mixed-pine habitat less than 10 years old. The chipping sparrow forages in stands of open cool season grasses and other grassland areas, where the grass is not dense or tall (USDA-FS 2007) and nests typically occur in a small tree or shrub, usually a conifer (Cornell Lab of Ornithology 2012b).

The chipping sparrow is considered a woodland and woodland/grassland/shrub MIS associated with the mature (>50 yrs.) open pine and pine-oak communities (<30 BA) with a grassy understory (USDA-FS 2004a p. B-27). Habitat for this species is widely scattered and occurs primarily in grassland/shrub openings in the Caney area, although some seedling habitat is available.

Direct and Indirect Effects

All Alternatives

Potential direct effects to these species were discussed under Wildlife Habitat and Distribution and include short-term behavioral avoidance during new trail construction and maintenance, possible avoidance during trail use or increased nest predation/parasitism associated with the off-road trail corridor. Approximately 18 percent (alternative 1) to 22 percent (alternatives 3 and 4) of preferred forest communities fall within the trail area of influence, whereas five percent (alternatives 1 and 2) to seven percent (alternative 4) fall within 150 feet of an off-road trail corridor, although not all of this would provide preferred open understory conditions. Because these species prefers open understory conditions, suitable habitat along the trail corridor would be maintained.

Direct effects to these species would be similar to that described for the Acadian flycatcher. Songbirds with similar habitat requirements continue to utilize trail corridors (Hickman 1990) and any avoidance of the site is expected to be short-term in nature. As a result and due to the widespread availability of suitable habitat, there are no long-term effects to foraging, reproduction or use of the project area by these species anticipated and local populations would be maintained.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the Wildlife Habitat and Distribution alternative effect section. While all anticipated activities would result in short-term disturbance, only activities that reduce the overstory such as timber harvest and salvage would be expected to reduce habitat for this species. Conversely, activities that promote open understory conditions such as TSI and wildfire would be expected to improve habitat for these species. Cumulatively, during the analysis period, short-term effects would occur on approximately 1,640 acres, a long-term reduction in habitat would be expected to occur on 285 acres and a long-term improvement in habitat would occur on 1,355 acres. Because 98 percent of the existing nest and foraging habitat would be maintained, there are no cumulative effects anticipated.

Northern Cardinal

Preferred and Project Area Habitat

The Northern cardinal is associated with open forest with a shrub understory. Although it may occur in any forest type and condition on the Forest, bird survey data on the Forest indicate they are most common in the open, brushy areas. Cardinals typically nests in shrubs or small trees within 10 feet of the ground. They have multiple broods and re-nest rapidly in response to disturbance (Natureserve 2012). Northern cardinals are MIS for woodlands that contain more open shrubby understory conditions (USDA-FS 2004a p. B-25).

Because this species utilizes forested stands characterized by open to moderate canopy conditions with woody understory vegetation, habitat for this species was evaluated by looking at forested stands greater than 50 years of age. Suitable habitat is widely scattered occurring in areas where canopy mortality has occurred, as well as in some past harvest areas.

Direct and Indirect Effects

All Alternatives

Potential direct effects to this species were discussed under alternative effects and include short-term behavioral avoidance during new trail construction and maintenance, possible avoidance during trail use or increased nest predation/parasitism associated along the off-road trail corridor. Approximately 18 percent (alternative 1) to 22 percent (alternatives 3 and 4) of preferred forest habitat fall within the trail area of influence, whereas five (alternatives 1 and 2) to seven percent (alternative 4) fall within 150 feet of an off-road trail corridor, although not all of this would provide preferred understory conditions.

Direct effects to these species would be similar to that described for the ovenbird and the likelihood of mortality or reduced reproduction is low. This species re-nests following disturbances (USDA-FS 2003b, Natureserve 2012) and the presence of larger trails than those proposed did not affect use by the northern cardinal (Hickman 1990). As a result and considering suitable habitat would be maintained along off-road trails, any avoidance of the area during construction or use is expected to be short-term in nature. Also due to the widespread availability of unaffected habitat there are no changes in local populations of these species anticipated.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the Wildlife Habitat and Distribution alternative effect section. While all anticipated activities would result in short-term disturbance, TSI work roadside salvage and timber harvest would promote development of the understory and suitable nest and foraging habitat, whereas habitat would have been reduced due to recent wildfire. So while habitat has been reduced on approximately 1,100 acres affected by wildfire, habitat would be improved on approximately 1,600 acres. Cumulatively during the analysis period, up to approximately 8,000 acres (alternative 4) or 27 percent of the suitable habitat would have been affected by on-going/future activities or falls within 660 feet of a trail. Because disturbance would be short-term in nature and considering that habitat would be improved on almost 1,600 acres and maintained along the trail, there are no cumulative effects anticipated.

Field Sparrow

Preferred and Project Area Habitat

Primary habitat for this species includes weedy fields, broomsedge fields, hedgerows and thickets (USDA-FS 2003b). Field sparrows typically nest in open, brushy situations although they sometimes use woodland edges (USDA-FS 2003b). They may also use cut over pine forests and burned over woodlands, wherever briars and brush have regenerated (USDA-FS 2003b). Monitoring on the Forest indicates that this species is most common in non-forested areas such as old fields and wildlife openings. This species would be expected to nest and forage in grasslands composed of tall un-mowed vegetation and a mix of shrubby undergrowth and briars, such as often occurs in old-field situations. This species nests on the ground at the base of shrubs and typically has multiple broods a year (Natureserve 2012). The field sparrow is an MIS for grasslands, including old fields and wooded grasslands.

Grassland/shrub habitat occurs on approximately 935 acres of National Forest System lands, much of which occurs in the Caney area and lands adjacent to the reservoir.

Direct and Indirect Effects

All Alternatives

Currently 32 acres of grassland/shrub habitat are within 150 feet of a non-road trail. This would decrease to 22 acres under alternative 2 and 26 acres under alternatives 3 and 4. Grassland/shrub habitat within the 660 feet trail area of influence occurs on 107 acres, 124 acres, 135 acres and 139 acres under alternatives 1 through 4 respectively. Because vegetation would be unchanged, there would be no long-term direct effects to this species, although as described under treatment effects, short-term behavioral avoidance would occur.

Because of the small amount of grassland affected by the trail itself, the likelihood of mortality or disturbance to nesting birds is low. However disturbance to forging birds may occur during trail use on 11 percent of the available grassland/shrub habitat under alternative 1, 13 percent under alternative 2 and 15 percent under alternatives 3 and 4.

Cumulative Effects

All Alternatives

Approximately 19 acres of suitable grassland/shrub habitat has been affected by recent wildfire. Additionally, scattered NNIPS treatment has occurred and will continue to occur within existing grasslands around developed sites. Because NNIPS treatments target non-native vegetation, there would be no changes in existing habitat and effects would be limited to short-term disturbance during treatment. Because wildfire would reduce woody vegetation, there could be a long-term reduction in habitat on the some or all of the affected acreage. Cumulatively, up to approximately 160 acres of grassland/shrub habitat would have been affected during the analysis period, including a possible long-term reduction in habitat on 19 acres. Due to the small amount of habitat affected and considering over 80 percent of the project area habitat would be unaffected by any ongoing/future activity or proposed action, there are no cumulative effects anticipated.

Eastern Towhee and Yellow-breasted Chat

Eastern Towhee - Preferred and Project Area Habitat

This species typically occurs in managed or artificial situations such as brushy forest edge, regenerating clear-cuts, and forest disturbed by selective logging. It may also be found in the lower growth of open or

cutover forest (USDA-FS 2003b) and is dependent on dense brushy cover (USDA-FS 2003b) that may be found in a variety of situations. Monitoring data collected on the Forest indicates that this species is most common in mixed pine habitat less than 10 years old. This species is not particularly attracted to any one forest type and could be expected to occur throughout the general forest, provided that early successional habitat in the form of young forest or old field and edge situations are present. Nesting can begin as early as April with egg laying into August (Natureserve 2012).

Suitable seedling habitat is essentially absent. While old field/edge habitat only exists on approximately one percent of the project area, it is widely scattered.

Yellow-breasted Chat - Preferred and Project Area Habitat

This is a species of early successional habitats, including thickets, overgrown fields, hedgerows, forest edges, and openings. The key requirement is dense cover of shrubs and/or saplings. These birds avoid mature forest interiors and nest in shrubby, brushy areas. On the Forest, they are often encountered in thickets, (regenerating) clear-cuts, and dense undergrowth of shelterwood cuts—nearly always in cutover or early successional habitat (USDA-FS 2003b). This species tends to be more abundant in harvested than in non-harvested areas (USDA-FS 2003b). This species would be expected to nest and forage in grasslands composed of tall un-mowed vegetation and a mix of shrubby undergrowth and briars, such as often occurs in old-field situations. This species nests in woody vegetation generally less than 6 feet above the ground, with nesting in May and June (Natureserve 2012).

Habitat for this species is evaluated by looking at forested stands less than 20 years of age, which occurs on approximately 1,700 acres or three percent of the National Forest System lands within the project area.

Direct and Indirect Effects

All Alternatives

Potential direct effects to these species were discussed under Wildlife Habitat and Distribution alternative effects and include short-term behavioral avoidance during new trail construction and maintenance, possible avoidance during trail use or increased nest predation/parasitism associated with the off-road trail corridor. Approximately 19 percent of the yellow-breasted chat habitat currently falls within the trail area of influence under all alternatives, whereas four percent is within 150 feet of a trail. There is no seedling Eastern towhee habitat affected, although approximately three miles of trail traverse openings whose edges may provide suitable towhee habitat. There may be a small reduction in suitable yellow-breasted chat habitat if existing sapling habitat is removed during trail maintenance or construction.

Direct effects to these species and the likelihood of mortality or reduced reproduction are low due to the small amount of habitat within 150 feet of a trail. Also both species re-nest following disturbances (USDA-FS 2003b) and the presence of larger trails than those proposed did not affect use by the Eastern towhee (Hickman 1990). As a result, any avoidance of the area is expected to be short-term in nature. Due to the availability of unaffected habitat, including habitat along the trail corridor, local populations would be unchanged. The distribution and use of the project area by these species would be maintained under all alternatives.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the Wildlife Habitat and Distribution alternative effects section. No timber harvest would occur in suitable habitat and habitat for these species would essentially be unaffected by NNIPS treatment, road maintenance and TSI activities. Recent wildfire would have

reduced habitat on 45 acres, whereas habitat would be improved on the 15 acres affected by roadside salvage. Cumulatively, approximately 125 acres or 7 percent of the existing habitat falls within 150 feet of a trail or has been affected by ongoing/future activities. Because approximately 80 percent of existing habitat would be unaffected and considering there would be little change in available habitat, there are no cumulative effects anticipated.

Northern Bobwhite

Preferred and Project Area Habitat

This species will utilize a variety of open and semi-open habitats, including woodlands (especially pine), fields, fence rows, cedar thickets, and forest edges. Bobwhite prefer abandoned fields, warm season grasses and clover, although they do occur in smaller numbers in cool season grasses. They are particularly fond of brushy conditions. Nests are made in grassy/weeds and occur in fairly open areas, near cover provided by forest edge or brushy borders. On the Forest, birds are frequently observed with broods in pine-hardwood stands that have been heavily burned and have open understory conditions with scattered grasses and forbs (USDA-FS 2003b). This species is not particularly attracted to any single forest type and could be expected to occur throughout the general forest, provided that open conditions with a sparse, grassy understory are present. This species is present on the Forest in low, but increasing numbers (USDA-FS 2004a, p. B-25), and nesting can begin as early as April, although females will re-nest as late as September (Natureserve 2012).

This species is an indicator of woodlands and open forest conditions in which grasses and forbs dominate the forest floor (USDA-FS 2004a p. B-25). Analysis area habitat is widely scattered in areas where overstory mortality has created herbaceous and woody understory conditions.

Direct and Indirect Effects

All Alternatives

Potentially suitable grassland or savannah habitat within the trail area of influence currently occurs on approximately 70 acres. This would increase to approximately 90 acres under alternatives 2 through 4. Direct effects include possible mortality if an active nest is disturbed, however due to the small amount of habitat affected by the trail itself, and with seasonal and cross country equestrian restrictions (alternatives 2 to 4) that reduce impacts during the breeding season, the likelihood of mortality is low. Also while there may be a small reduction in vegetation on the trail corridor going through the openings, the availability of habitat will essentially be unchanged under any alternative. As a result, effects would be largely restricted to short-term disturbance to foraging birds from on-going trail use.

Cumulative Effects

All Alternatives

In addition to habitat affected under the proposed alternatives, approximately five acres of suitable grassland habitat has been affected by wildfire. Also, scattered NNIPS treatment has occurred and would continue to occur within existing grasslands around developed sites. Cumulatively, up to approximately 98 acres of suitable grassland habitat will have been affected by on-going/future activities and proposed actions during the analysis period. Because the possibility of long-term effects would be limited to four percent of the available habitat and considering over 80 percent of the existing habitat would be unaffected by any activity, there are no cumulative effects anticipated.

Prairie Warbler

Preferred and Project Area Habitat

Pine warbler habitat consists of open to fairly dense stands of yellow pine and pine-hardwood. Although most numerous in extensive pine stands, these birds will use small stands of pine as well (USDA-FS 2003b). Suppression of fire has contributed to reduction of pine in some areas (USDA-FS 2003b). Both middle-aged and mature stands are used, although mature forest is used for nesting. The prairie warbler nests in trees and shrubs usually less than 10 feet above the ground (Natureserve 2012).

Regenerating yellow pine is essentially absent from the analysis area.

Direct, Indirect and Cumulative Effects

All Alternatives

Because no suitable habitat will be affected, there are no direct, indirect or cumulative effects to the prairie warbler anticipated under any alternative. As a result there are no changes to local populations anticipated and distribution and use of the project area would be maintained.

Pine Warbler

Preferred and Project Area Habitat

The pine warbler is strongly associated with pine and pine-oak forests, generally occurring only where some pine component is present (USDA-FS 2004a p. B-26). The highest numbers seem to occur where pure stands of pine are found and abundance decreases as the proportion of hardwood tree species increases. Nesting occurs from Mid-April to August and nests are typically built in pine trees, usually 25 to 70 feet above the ground (Natureserve 2012, Cornell Lab of Ornithology 2012b). Optimal nesting habitat is provided by pure, dense, mature pine stands that lack a tall deciduous understory (Natureserve 2012). In winter, birds commonly forage in large mixed-species flocks in southern pine forests, often foraging in forest leaf litter, fields or pastures, usually in the vicinity of a forest edge (Natureserve 2012). Foraging consists primarily of gleaning in the foliage and bark and while it eats vegetative matter and arthropods are of primary importance.

Maturing yellow pine or mixed pine/hardwoods occur on approximately 4,900 acres at scattered locations across the analysis area.

Direct and Indirect Effects

All Alternatives

Currently approximately 1,175 acres or 24 percent of the project area habitat occurs within the trail area of influence, whereas approximately seven percent of the habitat occurs within 150 feet of a trail. Pine warbler habitat within the trail area of influence will increase to 25 percent under alternative 2 and 26 percent under alternatives 3 and 4.

While there is no new trail proposed within preferred yellow pine stands, short-term disturbance could occur on between 24 and 26 percent of the suitable mixed pine/hardwood habitat. Disturbance related effects would be similar to those discussed under the Acadian flycatcher and due to the continued availability of habitat along the trail corridor and intermittent use, any disturbance would be short-term in nature. Possible long-term effects associated with increased predation/parasitism may occur on seven percent of the suitable habitat under alternatives 1 and 2 and eight percent under alternatives 3 and 4.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the alternative effect section. Because this species nests in mature pine, habitat would essentially be unaffected by NNIPS treatment, road maintenance and TSI activities. Also because only dead and dying trees would be removed during harvest and roadside salvage, suitable nest habitat (mature pine trees) would be largely unaffected. Cumulatively, proposed treatments and on-going/future activities would affect approximately 500 acres of suitable habitat. Because long-term effects from proposed actions would only occur on up to eight percent of the existing habitat and considering greater than 74 percent of the existing habitat would be unaffected, there would be little change in the availability of suitable habitat and there are no cumulative effects anticipated.

White-tailed Deer

Preferred and Project Area Habitat

The white-tailed deer is considered a habitat generalist and utilizes a variety of habitats including mature forest, young forest, shrub edges, skid roads, and grassy openings. As a result it is not considered an ecological indicator, but is monitored as a high interest demand species. White-tailed deer populations are growing on the Daniel Boone National Forest (USDA 2001) and this species is widespread and occurs in moderate to high numbers across the Forest (USDA-FS 2004a p. B-25).

Population trends for white-tail are determined by a variety of factors including hunting harvest, habitat conditions and the availability of hard mast (USDA-FS 2004a p. B-23). As a result effects to this species are evaluated by looking at structural changes in forest structure, mast availability or human/hunting access. Because of this species utilizes a variety habitat conditions, virtually all of the analysis area provides suitable deer habitat.

Direct and Indirect Effects

All Alternatives

Effects to big game are discussed under Wildlife Habitat and Distribution alternative effects and as described, there is no mortality to big game anticipated. Because white-tail deer are habitat generalists, they could utilize any vegetation community and approximately 14 percent of the project area occurs within the trail area of influence under alternatives 1, 13 percent under alternative 2, 15 percent under alternative 3 and 16 percent under alternative 4. While it is not anticipated that proposed activities would reduce suitable habitat for deer under any alternative, avoidance of lands within the trail area of influence could occur. Deer are not displaced from the area and typically only move to available cover (Taylor and Knight (2003). As a result and because over 95 percent of the trail corridor is forested, it is expected that deer would continue to utilize the area once users pass.

While new trail construction would increase hunter access in the Scotts Creek and Wilson Hill areas west of Cave Run Lake, due to the small size of the trail (2 to 3 feet wide), deer cover along the trail corridor would be maintained. Also the remote character of the area would be maintained and it is not expected that hunter access or success would increase to a level that would affect local populations. As a result and due to widespread availability of unaffected habitat, there are no long-term effects that would reduce habitat suitability along the trail.

Cumulative Effects

All Alternatives

Potential cumulative effects are discussed under the Wildlife Habitat and Distribution alternative effect section and approximately 3,400 acres or six percent of the project area would be affected by proposed actions and on-going/future activities described previously. While all new construction, timber harvest, roadside salvage, TSI work and NNIPS treatments would result in disturbance during implementation, harvest and TSI work would promote understory conditions, soft mast and deer forage. NNIPS treatments would help to reduce impacts to native vegetation. As a result, suitable deer foraging habitat would be maintained or improved and there are no cumulative effects anticipated.

Macro-invertebrates

Project Area Habitat

Aquatic macro-invertebrates are widely distributed throughout the Daniel Boone National Forest and can be found in virtually all perennial streams within the project area. The viability of aquatic species is in part, tracked through the monitoring aquatic macro-invertebrates. Because macro-invertebrates include multiple species or groups of species, they will not be referred to as "management indicator species." However, they fulfill all the criteria/definitions of MIS, but are more effective than any individual or small group in reflecting the health of an aquatic system. Therefore, they will be used in lieu of MIS for aquatics (USDA-FS 2004b p. 3-186).

Suitable macro-invertebrate habitat within the project area occurs on approximately 75 miles of stream.

Direct, Indirect and Cumulative Effects

Fish, mussels and aquatic insects can be affected by any activity that alters water quality conditions and/or affects stream, river or riparian habitat. The importance of maintaining riparian habitat was recognized in the Forest Plan (USDA-FS 2004a) and Forest-wide goals include 1) managing and/or restoring watersheds to protect ecological functions, aquatic species and habitats and 2) managing in-stream flows to protect stream processes and aquatic and riparian habitats (USDA-FS 2004a p. 2-12). In addition the riparian corridor prescription area was identified and is managed to retain, restore, and/or enhance the inherent ecological process and functions of the associated aquatic, riparian and upland component. So the importance of maintaining aquatic and riparian habitat was recognized very early in the planning phases of this project and effects of all action alternatives are based on implementation of project design features, as well as Forest-wide standards identified in the Forest Plan (USDA-FS 2004a p. 3-14 to 3-16).

Potential effects are evaluated by looking at changes in water quality and effects to stream channels, both of which could alter macro-invertebrate diversity or abundance.

Alternative 1

Direct, Indirect and Cumulative Effects

Anticipated effects to streams and water quality are discussed above under the aquatic effect section. While there are fewer acres of the riparian prescription area affected under this alternative, it has the greatest number of off-road stream crossings, contains more off-road trail miles close to streams, and has all trails open to use year-round. As a result and considering that trail conditions would not be improved, potential impacts to water quality, as well as sedimentation and impacts to stream channels are greatest under this alternative.

Anticipated cumulative effects are discussed above and displayed in Table 15. While timber harvest, TSI work and road maintenance could result in short-term increases in sedimentation, with implementation of Forest Plan Standards and Guidelines (USDA FS 2004a), water quality, as well as in-stream conditions would be maintained. Similarly, with implementation of Forest Plan standards and site specific mitigations, there are no effects to water quality from invasive weed treatment. While recent wildfire would have resulted in localized increases in sedimentation and reduced water quality in some areas immediately following burning, herbaceous vegetation has since become re-established and there are no future impacts to water quality anticipated.

Alternatives 2 to 4

Direct, Indirect and Cumulative Effects

Anticipated effects to water quality and the aquatic resource are discussed under Wildlife Habitat and Distribution alternative effects above. While the miles of trail and type of use differ, proposed treatments were designed to reduce sedimentation and water quality impacts. Specifically, the following would be implemented under the action alternatives; 1) seasonal restrictions to equestrian use would lessen impacts to the trail system and associated erosion, 2) miles of off-road equestrian trail would be reduced, 3) the existing trail along the Trough Creek would be decommissioned, reducing impacts from the trail system in this drainage, 4) equestrian off-road trails and potential soil and water impacts would be reduced, 5) equestrian cross country closure in the Caney and Murder Branch areas would reduce impacts in these drainages and most importantly, 6) trails would be improved to a standard that would support expected use, facilitate drainage and reduce erosion and sedimentation.

Alternatives 3 and 4 differ from alternative 2 in that the miles of off-road equestrian use and off-road trails along streams would be reduced further, parking lot construction would increase to five acres and new trail construction would increase by up to 21 miles. While there may be some short-term increases in sedimentation associated with trail and parking lot construction, with implementation of best management practices and considering new trail construction would largely occur in upland areas, like alternative 2, sedimentation and water quality impacts from the trail system would be reduced over the long-term (USDA FS 2012b). Additionally State water quality standards would be met and improved trail standards would reduce impacts to streams and riparian habitat.

Cumulative effects would be the same as those described under alternative 1 and there are no on-going or future activities that would result in long-term effects two water quality or the aquatic resource. As a result there are no cumulative effects under any action alternative.

Migratory Birds

Migratory birds and their habitats including species with viability concern (TES) and species of local concern (conservation species) are evaluated in the habitat and species-specific sections of this report. While habitat for some species would be reduced, habitat for other species would be improved and existing migratory bird habitat would be maintained under all alternatives. The Daniel Boone National Forest is a partner in the North American Bird Conservation Initiative and in compliance with Executive Order 13186-Responsibilities of Federal Agencies to Protect Migratory Birds, and all alternatives are in compliance with the Migratory Bird Treaty Act.

Non-native Invasive Plant Species

A non-native invasive plant species specialist report has been prepared for this proposal and is incorporated into this EA by reference (Taylor 2013). Invasive species, including plants, are reported to be the second-most critical threat to conservation of biodiversity (Wilcove et al. 1998). Of particular concern

are those non-native invasive plant species (NNIPS) that are successful at invading natural habitats. Invasive plants can alter natural ecosystems by displacing native species, inducing changes in water or fire regimes, causing changes in soil characteristics, adding a new or displacing an existing wildlife food source, and altering erosion and sedimentation processes (Westbrooks 1998). About 22 percent of the plant species that occur in Kentucky are not native (Jones 2005), about the same as found on the Forest. Not all are considered serious threats or even threats to the ecosystem and not all will be addressed in this document.

Affected Environment for Non-native Invasive Plant Species

The National Forest System lands on the Cumberland Ranger District were acquired beginning in the late 1930s, purchased from individuals and landholding companies. Most of these lands had been logged, many had been burned, and much had been farmed. Some lands had been quarried or otherwise disturbed for the utilization of rock, sand or gravel. Equipment, wind, and animals brought propagules of NNIPS to these lands from surrounding homesteads and communities. Continued development in large and small communities, introduction of new species of plants to private lands interspersed among tracts of national forest system lands, and resource management related disturbance continue to provide avenues for and introduction points of NNIPS on national forest system lands.

Over the last five years, a number of NNIPS populations have been recorded as part of management activities on and for the district. Between 2009 and 2011, NNIPS were recorded along a portion of the road and trail system and in various habitats on the district. A complete inventory has not been accomplished, but from available data the species known to occur within and around the project area have been compiled.

Table 19 provides the scientific and common names for the species NNIPS known on the district. The value in the priority rank column indicates the Forest's level of concern for the species, with 1 the highest and 3 the lowest.

Table 19. List of known NNIPS in the Cave Run Lake Project Area

Scientific Name	Common Name	Treatment Priority Rank
Ailanthus altissima	Tree of heaven	1
Albizia julibrissin	Silktree	2
Arthraxon hispidus	Small carpgrass	1
Centaurea stoebe ssp. micranthos	Spotted knapweed	1
Celastrus orbiculatus	Oriental bittersweet	1
Cruciata pedemontana	Piedmont bedstraw	3
Daucus carota	Queen Anne's lace	3
Dioscorea polystachys	Chinese yam	1
Elaeagnus umbellata	Autumn olive	1
Kummerowia stipulacea	Korean clover	2
Lespedeza bicolor	Shrub lespedeza	2
Lespedeza cuneata	Sericea lespedeza	2
Leucanthemum vulgare	Oxeye daisy	3
Lonicera japonica	Japanese honeysuckle	1
Melilotus officinalis	Yellow sweetclover	2

Scientific Name	Common Name	Treatment Priority Rank
Microstegium vimineum	Nepalese browntop	1
Mosla dianthera	Miniature beefsteakplant	2
Paulownia tomentosa	Princesstree	1
Perilla frutescens	Beefsteakplant	2
Plantago lanceolata	Narrowleaf plantain	3
Polygonum caespitosum	Oriental ladysthumb	2
Polygonum cuspidatum	Japanese knotweed	1
Rosa multiflora	Multiflora rose	1
Setaria faberi	Japanese bristlegrass	3
Securigera varia	Crownvetch	1
Spiraea japonica	Japanese meadowsweet	1
Taraxacum officinale	Common dandelion	3
Tussilago farfara	Coltsfoot	2

Of the identified species, Japanese stiltgrass was probably the most frequently encountered. This grass is widespread on Kentucky roadsides where there is shade and some moisture and is especially common on roadsides in forested areas. The seed of this plant is transported in water; mud and soil on equipment, shoes, and hooves or paws; and by mowing and grading equipment. Oxeye daisy and Queen Ann's lace, also frequently encountered, have seeds easily spread by grading and mowing equipment, and require the open disturbed habitat many roadsides provide. Autumn olive and multiflora rose, also frequently encountered, have bird-spread seed and require open, disturbed ground for germination.

Invasive species are spread by many vectors including wind, water, soil, animals, humans, and vehicles. Table 20 displays the typical means of spread for species considered in this project.

Table 20. Principal and secondary vectors of spread by species

Common Name	Principal Vector of Spread	Secondary Vector of Spread
Tree of heaven	Wind	Water
Silktree	Gravity	Soil, water, wind
Small carpgrass	Water, soil	Mowing equipment, animals
Piedmont bedstraw	Animals, gravity	Vehicles, shoes, hooves, paws, mowing equipment
Spotted knapweed	Wind	Soil, water, mowing equipment
Oriental bittersweet	Birds	Gravity, small mammals
Queen Anne's lace	Animals, mowing equipment	Gravity
Chinese yam	Water, soil	Vehicles
Autumn olive	Birds	Small mammals
Korean clover	Gravity, soil	Water, animals
Shrub lespedeza	Gravity, soil	Water, animals
Sericea lespedeza	Gravity, soil	Water, animals
Oxeye daisy	Gravity, wind	Water, soil

Common Name	Principal Vector of Spread	Secondary Vector of Spread
Japanese honeysuckle	Birds	Small mammals
Yellow sweetclover	Gravity, soil	Mowing equipment
Nepalese browntop	Water, soil	Vehicles, shoes, hooves, paws, mowing equipment
Miniature beefsteakplant	Water, soil	Vehicles, shoes, hooves, paws
Princesstree	Wind	Water
Beefsteakplant	Water, soil	Vehicles, shoes, hooves, paws, mowing equipment
Narrowleaf plantain	Water, soil	Vehicles, shoes, hooves, paws, mowing equipment
Oriental ladysthumb	Water, soil	Vehicles, shoes, hooves, paws, mowing equipment
Japanese knotweed	Soil	Water, mowing equipment
Multiflora rose	Birds	Small mammals, soil, water, mowing equipment
Japanese bristlegrass	Soil	Mowing equipment
Crownvetch	Soil	Mowing equipment
Japanese meadowsweet	Soil, water	Gravity
Common dandelion	Wind	Mowing equipment, soil
Coltsfoot	Wind	Mowing equipment, soil

Environmental Consequences for Non-native Invasive Plant Species

Incomplete and Unavailable Information

As stated earlier, a complete inventory of NNIPS for the district does not exist. Nonetheless, most roads and trails in the project area have been inventoried (intensive) or surveyed (cursory) for NNIPS. It is assumed that at least one NNIPS, Japanese stiltgrass, is present somewhere along every existing trail or road to be used as a trail. It is also assumed that roads have at least one population of oxeye daisy, Queen Ann's lace, and multiflora rose.

Alternative 1

Direct and Indirect Effects

Under alternative 1, nonnative invasive plant species would continue to spread, influenced by any number of actions on and off national forest system lands. Both the numbers of populations and the size of populations would continue to increase if no action is taken.

Under this alternative, horse travel remains open to off-trail use, allowing increased risk of spreading NNIPS to off-trail locations throughout the project area, especially those with soft or moist soils (Landsberg et al 2001).

Alternatives 2, 3, and 4

Direct and Indirect Effects

Specific methodology and spatial and temporal context for the analysis can be found in the specialist report of the project file (Taylor 2013).

Under any of the action alternatives, nonnative invasive plant species would continue to spread on the district, influenced by any number of actions on and off national forest system lands. Nonnative invasive plant species take advantage of presented opportunities: if a propagule lands on a site disturbed in a manner appropriate for the species, it will germinate, grow and as long as favorable conditions remain, flower and produce seed. Most of the nonnative species considered in this analysis (princesstree, tree-of-heaven, silktree, autumn olive, Korean clover, shrub lespedeza, sericea lespedeza, yellow sweetclover, multiflora rose, common dandelion, Japanese stiltgrass, piedmont bedstraws, small carpgrass, oxeye daisy, and coltsfoot) benefit greatly from either duff reduction, mineral soil exposure, increased openness and at least temporarily reduced competition, or any combination of actions.

The nature of the trails in the system would help to determine the extent of spread and establishment of new populations of NNIPS. Wet or muddy trails are more likely to promote the establishment of NNIPS than dry trails. Alternatives 2, 3 and 4 address this by hardening, draining, or rerouting trails and are more proactive in this regard than alternative 1, which maintains the status quo.

Alternatives 3 and 4 would provide the greatest potential for increased NNIPS by adding trail miles to the system and widening specific trails to accommodate horses. Alternatives 3 and 4 include new trail construction. This would open up more interior area to the distribution and establishment of NNIPS and increase the amount of project area that would be impacted by NNIPS. Several species of NNIPS such as Japanese stiltgrass, small carp grass, piedmont bedstraw, and Oriental ladys-thumb are readily carried in soil or mud on shoes, equipment and hooves and paws. All of these grow in shady conditions so have a high likelihood of following any new trails. Alternative 2 would provide somewhat less potential than alternatives 3 and 4 because no additional miles of trail would be added.

Trails used by horses have a greater potential for introduction of NNIPS because of the volume and variety of seed introduced through feces. Because trails maintained for horses are wider than hiking and bike trails, and provide greater levels of light and nitrogen (from feces and urine), NNIPS, once established, fare better along horse trails (Quinn et al. 2010, Hobbs and Huenneke 1992). Additionally, there appears to be a link between the ability to survive an animal's digestive tract and the ability to remain viable in the soil for long periods of time (Pakeman et al. 2002, Campbell and Gibson 2001) so that a seed bank may be built up over time ready to respond to infrequent periods of ideal environmental conditions (Wells and Lauenroth 2007). This is especially true for areas such as horse rest areas, which concentrate use, are more open, and are high in nutrients. More horse resting areas and trailhead parking areas increase the likelihood that NNIPS will spread on the landscape. Alternatives 2 and 4 would provide the most horse resting areas and have the greatest likelihood of spreading NNIPS from these facilities. Alternatives 3 and 4 would provide additional trailhead parking areas and therefore increase the number of entry points to and potential for NNIPS on the trail system.

While horses individually have the greatest potential to introduce NNIPS to trail systems, the physical pounding created by their hooves can also prevent the establishment of plants in the trail tread (Quinn et al. 2010, Campbell and Gibson 2001, Landsberg et al. 2001). In areas where horses were constrained to the trail, fewer weeds were present than when not constrained to the trail (Weaver and Adams 1996).

While mountain bikes and foot traffic create less disturbance of the trail tread than horses (Landsberg et al 2001), potentially high numbers of NNIPS seeds are carried in by these sources, primarily on clothing

(Mount and Pickering 2009) and treads of tires and footwear. Seeds moved by these sources tend to remain attached for long distances unless individuals deliberately pick them off (Mount and Pickering 2009).

Seasonal closures for horse use on many trails during the wettest months (December 15 to May15) would help to prevent the spread of NNIPS along trails by reducing water and mud mediated spread of seed. It would also help to deter establishment of NNIPS because seed would not be spread during periods of adequate moisture.

All cross country trail uses increase the likelihood that NNIPS would spread, as more ground is traversed, more habitat types are visited. Cross country horse travel in particular provides enough disturbance to the duff and soil to allow many NNIPS to become established off-trail. A decision to close the project area to cross country horse travel in any of the alternatives would greatly reduce the potential for spread of NNIPS on the landscape. A decision to close the Caney and Murder Branch Cave areas to cross country horse travel would also help to moderate the spread of NNIPS, but not to the same extent as stopping all cross country horse travel within the project area. Closure of the Caney area to cross-country horse use would reduce the likelihood of establishment in areas of moister ground (Caney) where observations over several years have shown establishment of Japanese stiltgrass along trails and spread into adjacent wetland areas. Requiring horses to remain on trails would reduce the likelihood of spread of NNIPS into off-trail locations: less potential movement of seeds, less soil and vegetation damage to provide potential habitat for NNIPS (Landsberg et al 2001).

Cumulative Effects

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

A number of activities implemented in the recent past, ongoing and to be implemented in the next few years have the ability to affect the presence of NNIPS. Past, present, and foreseeable activities relevant to cumulative effects analysis are listed in Appendix F.

Cumulatively, the spread of nonnative invasive plant species would continue, in part influenced by other activities that might be occurring in the area. All of the alternatives would contribute to a general expansion of these species from disturbances related to other projects that have occurred, are occurring, and will occur in the general area of the proposed project. Increased light and disturbance along trails would contribute to the habitat available to NNIPS created by road maintenance and timber activities, increasing the likelihood that NNIPS would remain and spread on the landscape. Recent and continuing work to reduce or eliminate NNIPS populations along roads and in the vicinity of silvicultural activities would help to reduce seed sources that could contribute to the spread of NNIPS along trails.

Hydrologic and Soil Resources

Affected Environment for Soil and Hydrology Resources

Watershed Description

A hydrologic and soil resources specialist report has been prepared for this proposal and is incorporated into this EA by reference (Arias 2013). Watershed boundaries were identified from the watershed layer of the U.S. Geological Survey's Geographic Information System (GIS) data. Boundaries are based on Hydrologic Unit Code (HUC) sixth watersheds. The project area is located in portions of multiple watersheds. Information on these watersheds is listed in Table 21.

Table 21. 6th Level HUC watersheds found within the Cave Run Nonmotorized Trails Project

6th HUC Name & Code	Forest Service Project Area Acres in 6th HUC	6th HUC Total Acres	Project % of 6th HUC Involved with Project
Leatherwood Creek-Beaver Creek (051001010404)	8034.4	8042.2	99.9
Brushy Fork-Beaver Creek (051001010403)	1277.4	11070.0	11.5
Clifton Creek-Beaver Creek (051001010401)	1182.2	11687.4	10.1
Meyers Fork-Beaver Creek (051001010402)	4809.9	12114.7	39.7
Lower Lick Fork-North Fork (051001010304)	4694.1	14022.9	33.5
Laurel Branch-Licking River (051001010508)	5617.1	17330.8	32.4
Lower Triplett Creek (051001010605)	6975.9	24082.1	29.0
Scott Creek-Licking River (051001010509)	27573.4	27578.3	100.0
Indian Creek-Licking River (051001010802)	4028.3	33129.2	12.2
Blackwater Creek (051001010507)	24.1	33676.1	0.1
Salt Lick Creek (051001010801)	11422.3	36007.5	31.7

The National Hydrography Dataset (NHD) (USGS 2012) was used to determine the miles of perennial, intermittent, or ephemeral streams located within the project area. Most streams in the area are first order channels with moderate to steep gradients, well-developed riffles and shoals, rocky creek bottoms, and relatively narrow floodplains (KDW 1998). There are 59.4 miles of perennial streams located within the project area as shown in Table 2. Ephemeral and intermittent stream miles are considered the same by NHD and totaled 164.4 miles as shown in Table 22. The overall trail density for the 6th level watersheds clipped to the project boundary is shown in Table 29. Calculated densities included only Forest Service designated trails within these watersheds. Existing trail densities range from 0 to 0.9 miles/square mile. The average trail density in the project area is 0.4 miles/square mile.

Table 22. Ephemeral, intermittent and perennial stream miles and existing trail densities located in 6th HUC watersheds within the Cave Run Nonmotorized Trails Project

6th HUC Name & Code	Ephemeral/ Intermittent Streams (Miles)	Perennial Streams (Miles)	Total Streams (Miles)	Trail Density mi/mi²
Leatherwood Creek-Beaver Creek (051001010404)	16	6.5	22.5	0.5
Brushy Fork-Beaver Creek (051001010403)	2.3	1.2	3.5	0.0
Clifton Creek-Beaver Creek (051001010401)	4.2	0	4.2	0.7
Meyers Fork-Beaver Creek (051001010402)	10.8	6.1	16.9	0.0

6th HUC Name & Code	Ephemeral/ Intermittent Streams (Miles)	Perennial Streams (Miles)	Total Streams (Miles)	Trail Density mi/mi²
Lower Lick Fork-North Fork (051001010304)	10.3	1.9	12.2	0.0
Laurel Branch-Licking River (051001010508)	7.5	0.8	8.3	0.6
Lower Triplett Creek (051001010605)	17.5	6.2	23.7	0.3
Scott Creek-Licking River (051001010509)	58.1	16.2	74.3	0.9
Indian Creek-Licking River (051001010802)	9.4	0.9	10.3	0.8
Blackwater Creek (051001010507)	0	0	0	0.0
Salt Lick Creek (051001010801)	28.1	19.4	47.5	0.7
Totals	164.2	59.2	223.4	n/a

Topography and Precipitation

Elevations in the project area range from approximately 723 feet along the lake area to 1,342 feet at the Gate Post Hill located in the southwestern tip of the project area. In general, elevations are consistent throughout project area with steeper slope gradients associated with sideslopes adjacent to streams or topographic ridges. Stream drainage is generally from north to south within the project area. Slopes range from 0 to 40 percent.

Rainfall occurs regularly in every month of the year, though more in the summer months June and July, dropping off steeply in August through October, before recovering in the winter months (Figure 10; US Geological Survey 2012a). Rainfall intensities are high. Single shorter events (1-day) are heaviest in the summer, while longer 5 to 10 day events occur in the winter. In the project area, the two-year six-hour storm will yield about 2 inches. Short burst intensities (15 and 30 minutes) for the 2 year recurrence are 0.84 and 1.14 inches, respectively while those for year recurrences are scarcely less at 0.71 and 0.95 inches, respectively (NOAA 2006). These values indicate that sharp, short rainfall events of about 1 inch in 15 or 30 minutes are a near yearly occurrence.

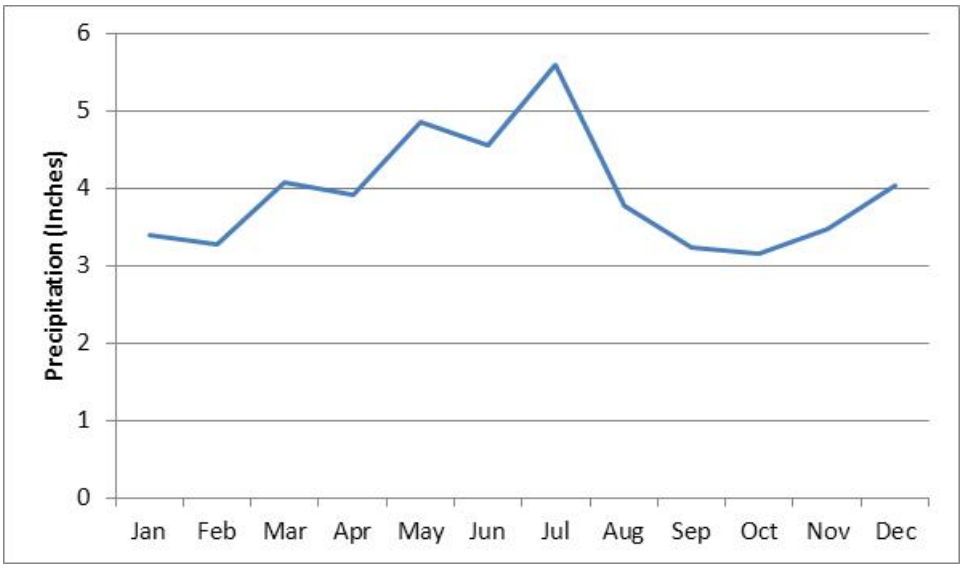

Figure 10. Mean monthly rainfall at Farmers, KY

Streamflow Regime

Streamflow is influenced by local climatic, topographic, and geophysical properties. The streamflow in the project area is partially regulated by the Cave Run reservoir. Despite proportionally more rain falling in the mid-summer, peak flows on local streams (examples are Triplett Creek and Jack's Branch) occur in mid-winter, December and January. A sample of mean daily flow graphed on Triplett Creek shows that flow is flashy, frequently punctuated by sharp rainfall driven peaks that fall off rapidly to a low base flow (Figure 11; US Geological Survey 2012b). Snow melt is relatively light, and does not accumulate on the ground in the winter months.

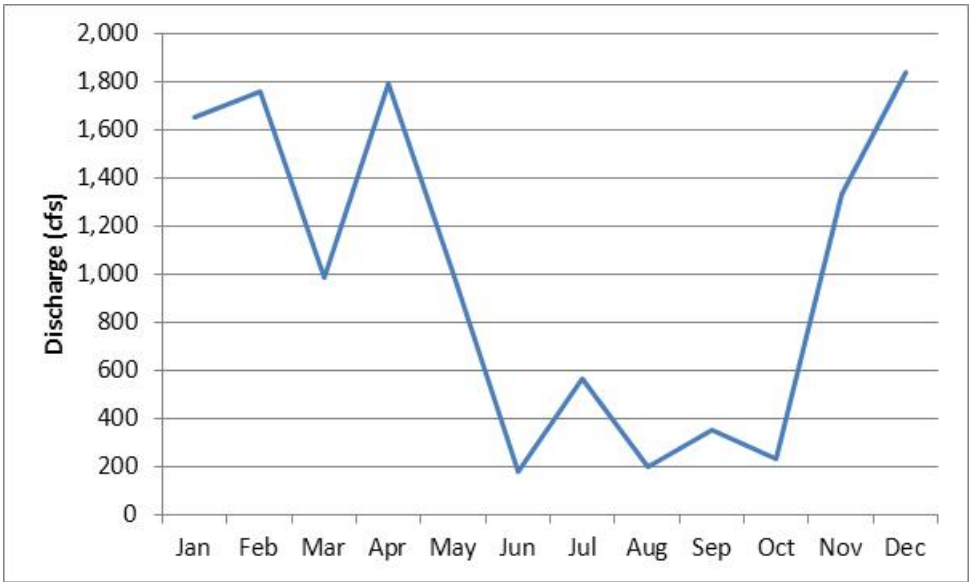

Figure 11. Mean monthly stream hydrograph, Licking River at Hwy 60

Stream Channel Conditions

Channels for perennial or intermittently running streams in the project area are wide, shallow with large medial bars that create multiple threads in many reaches. In general the channels are incised into deep valley fill with steep to perpendicular banks, often un-vegetated and potentially unstable. V-shaped ephemeral drainages or gullies found nearby the Caney Creek confluence with Cave Run Lake had an estimated depth and width of 20 feet by 50 feet, respectively, and the interior sides to have approximate slopes between 55 and 80 percent (Cotton 2011).

Although gravel and cobble substrate is typical, some segments are scoured to bedrock. As seen in Figure 11, the streams in the project area have the highest discharge during the fall, winter, and spring months. Intense summer thunderstorms can also cause high discharges and flash flooding, which can exacerbate the movement of bed load within the stream channels and the movement of soil off of trails. Short and steep slopes contribute to the phenomena.

Water Qualilty

Water quality in the project area is monitored and assessed by the Kentucky Division of Water. By direction of the Clean Water Act, where water quality is limited, state agencies develop total maximum daily load (TMDL) plans to improve water quality to support the beneficial uses of water. For water-quality-limited streams on national forest system lands, the Forest Service provides information, analysis, and site-specific planning to support state processes to protect and restore water quality. The most recent listing that has been approved for Kentucky is the 2010 303(d) list (KDW 2011). This list includes specific stream segments that are recognized by the state of Kentucky as impaired for a specific use, such as warm water aquatic habitat. Table 23 lists water quality limited segments for the State of Kentucky according to the 2010 Clean Water Act, Section 303(d). This information was reviewed in context of the project area boundary.

Table 23. Impaired stream segments located within the Cave Run Project 6th HUC Watersheds

6th HUC Name & Code	Impaired Miles	Causes of Impairment
Leatherwood Creek-Beaver Creek (051001010404)	5.7	Methylmercury, pH
Lower Lick Fork-North Fork (051001010304)	3.4	Methylmercury, pH
Laurel Branch-Licking River (051001010508)	9.6	Methylmercury, pH
Lower Triplett Creek (051001010605)	6.1	Eutrophication, organic enrichment, sedimentation, fecal coliform
Scott Creek-Licking River (051001010509)	21.9	Methylmercury, pH
Indian Creek-Licking River (051001010802)	1.7	Methylmercury, pH, fecal coliform
Salt Lick Creek (051001010801)	5.2	Sedimentation

Special use waters are rivers, streams and lakes listed in Kentucky Administrative Regulations (KAR) that are worthy of additional protection. The list of all designated special uses is in 401 KAR 10:026 and include the following uses for the Licking River watershed, which contains the project area (Table 24).

Table 24. Designated special uses for streams within the Cave Run Nonmotorized Trails Project Area

Waterbody Name	Cold Water Aquatic Habitat	Exceptional Water	Outstanding State Resource Water
Slabcamp Creek	N	Y	N
Licking River	Y	Y	Y
Slabcamp Creek of Craney Creek	Y	Y	Y
Slate Creek	N	Y	Y

Riparian Reserves

Table 25 shows the acres of Riparian Corridor Prescription Area (RCPA) within the Cave Run project boundary divided by 6th HUC watersheds. The RCPA encompasses, at a minimum the 100-year floodplain or 100 feet on perennial streams, whichever is greater. The RCPA on intermittent streams is delineated by either the 100-year floodplain or 50 feet, whichever is greater (USDA 2004).

Table 25. Minimum RCPA acres within 6th level HUC watersheds in the Cave Run Project based on either 50 or 100 foot corridors

6th HUC Name & Code	Perennial RCPA Acres	Intermittent RCPA Acres
Leatherwood Creek-Beaver Creek (051001010404)	148.4	179.4
Brushy Fork-Beaver Creek (051001010403)	27.4	25.2
Clifton Creek-Beaver Creek (051001010401)	0	43.6
Meyers Fork-Beaver Creek (051001010402)	136	118.3
Lower Lick Fork-North Fork (051001010304)	37.1	114.3
Laurel Branch-Licking River (051001010508)	18.2	82.2
Lower Triplett Creek (051001010605)	132.3	190.8
Scott Creek-Licking River (051001010509)	366.1	624.9
Indian Creek-Licking River (051001010802)	20.8	103.6
Blackwater Creek (051001010507)	0	0
Salt Lick Creek (051001010801)	410.6	315.7

Wetlands

A review of the National Wetland Inventory shows the acres of wetlands in the Cave Run project adding up to approximately 7,121 acres. Cave Run Lake covers most of this area with approximately 6,579 acres. There is no new trail construction proposed in wetlands for this project.

Table 26. Mapped wetlands within the Cave Run Project

6th HUC Name & Code	Wetland Acres
Leatherwood Creek-Beaver Creek (051001010404)	611.4
Brushy Fork-Beaver Creek (051001010403)	0
Clifton Creek-Beaver Creek (051001010401)	0
Meyers Fork-Beaver Creek (051001010402)	3.4
Lower Lick Fork-North Fork (051001010304)	237.6
Laurel Branch-Licking River (051001010508)	844.7

6th HUC Name & Code	Wetland Acres
Lower Triplett Creek (051001010605)	19
Scott Creek-Licking River (051001010509)	4876.4
Indian Creek-Licking River (051001010802)	425.3
Blackwater Creek (051001010507)	0
Salt Lick Creek (051001010801)	103.2

Floodplains

Due to the different stream channel types (mainly Rosgen A, B, and C channel types) and topography within the project area (Rosgen 1994), floodplain extent is spatially variable. Floodplains vary from less than ten feet to hundreds of feet wide.

Municipal Watersheds

Most of the project area streams flow into the Cave Run Lake, which supplies water to the area's communities in Rowan, Morgan, Menifee, and Bath counties.

Geology, Soil Types, and Soil Hazard Ratings

A large part of the project area, west of Cave Run Lake, is predominantly within the Nancy and Cowbell members of the Mississippian Borden Formation, with more perhaps on the more exposed and lower Nancy. The contact zone between the Cowbell and Nancy Formation has been known to have issues with slope instability and slumping in the vicinity of Cave Run Lake (Cotton 2011).) The upper Cowbell member weathers much more slowly than the more rapidly weathering lower Nancy member. The resulting effect is steep, stable slopes above the zone of contact between the two members, slope instability (slumping) at the point of contact where the Cowbell and Nancy meet, and the formation of deeply incised gullies in the weaker Nancy member below. In many areas, toe slopes (in the Nancy member) exhibited 20 by 50 foot gullies with interior side slopes between 55 and 80 percent.

Figure 12. Leaning trees indicate slope instability at the contact between the Cowbell and Nancy formations

Throughout the project area, soils have developed in a mosaic pattern as dictated by topographic relief, water content, and vegetation. The area is underlain with 93 different soil map units. Characteristics for the most common soil units accounting for 60 percent of the project area are described in Table 27. A complete summary of all soil units is located in the project record. The predominant soil units are mostly located on hillslopes with slopes ranging from 12 up to 60 percent. The parent material is typically a coarse-loamy colluvium derived from either shale or siltstone or both. Soils are moderately deep and well drained (NRCS 2012).

The following three paragraphs and Table 27 describe various soil characteristics and hazards that pertain to the soils in the Cave Run Project Area. Road and trail erosion hazard ratings indicate the hazard of soil loss from unsurfaced roads and trails. These soils rate as “severe” on most reference units. A severe rating indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed (NRCS 2012).

The off-road and off-trail erosion hazard ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. Most reference units are rated as “severe”. NRCS describes this hazard as being caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by various kinds of disturbance. A severe rating indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised (NRCS 2012). In both road and off-road erosion ratings, soil loss is caused by sheet or rill erosion.

Runoff potential describes water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. Runoff potential rating ranges from "low" to "very high" throughout reference units. Low ratings have a high infiltration rate and are typically deep, well drained sands. Very high ratings have a very slow infiltration rate, and consist chiefly of clays or soils with a clay layer at or near the surface. Very high ratings also include soils that have a high water table and/or are shallow over nearly impervious material (NRCS 2012).

The hazard of soil rutting explains the potential for surface rut formation through the operation of forestland equipment. Soil displacement and puddling (soil deformation and compaction) may occur simultaneously with rutting. Most reference soil units rate "severe" for soil rutting. Ratings are based on depth to a water table, rock fragments on or below the surface, the Unified classification of the soil, depth to a restrictive layer, and slope. Severe ratings indicate that ruts form readily (NRCS 2012).

Table 27. Characteristics of predominant soil map units in the Cave Run Nonmotorized Trails Project

Soil Map Unit	Soil Map Unit Name and Description	Erosion Hazard Rating (Road/Trail)	Erosion Hazard Rating (Off-Road/Off-Trail)	Runoff Potential	Soil Rutting Hazard
CrF	Cranston gravelly silt loam, 30 to 60 percent slopes	Severe	Severe	Low	Severe
SpF2	Shelocta-Gilpin silt loams, 20 to 60 percent slopes, eroded	Severe	Severe	Moderate	Severe
BeF	Berks silt loam, 40 to 70 percent slopes	Severe	Very Severe	Moderate	Severe
RoF	Rigley-Donahue complex, 30 to 60 percent slopes	Severe	Severe	Low	Moderate
BxF	Brownsville-Berks channery silt loams, 30 to 70 percent slopes, extremely stony	Severe	Severe	Low	Severe
SrF	Steinsburg-Ramsey rocky sandy loams, 20 to 40 percent slopes	Severe	Moderate	Moderate	Severe
BrF	Brookside stony silt loam, 30 to 60 percent slopes (bledsoe)	Severe	Very Severe	High	Severe
DoD	Donahue rocky sandy loam, 6 to 20 percent slopes (caneyville)	Severe	Slight	High	Severe
LaD	Latham silt loam, 12 to 20 percent slopes	Severe	Moderate	Very High	Severe

Soils as evidenced in several large tip-over trees with root mass and consequent pits exposed is very deep, moderately stony and underlain by a fragipan-like layer of in-determinant depth with very high clay content estimated at greater than 35 percent. A fragipan is an altered soil with very impermeable qualities.

Mud holes form in areas of poor drainage, shallow slopes, and denuded vegetation (Moser and Archer 2009). They are exacerbated and expanded by trail users that seek alternative routes around the existing mud hole. Most form behind berms or water bars, swale or draw crossings, or on tops of ridges.

Vulnerable locations are anywhere precipitation may not drain readily off the trail and sediment deposits; namely ridge running trails, trails following slope, and trails built in valley bottoms. Ridge trails that have sharp short pitches parallel to slope often lead onto saddles where fine sediments deposit to form a slick patina. Valley bottom trails very seldom can be outsloped to allow drainage. Poor drainage is exacerbated if the trail is deeply entrenched, intercepting soil through-flow on a floodplain.

Exposed clay rich subsoil showed higher risk for mud hole forming conditions in areas of high horse usage. Trails along old roads generally had the worst conditions due to the impermeable road surface; the predominance of clay in the lower road base restricted drainage leading to pooled water across a wide surface area.

Figure 13. Large gullies in the Nancy geologic formation around Cave Run Lake

Trail, Soil, and Hydrology Dynamics

Some of trail system derives from older engineered roads, typically closed logging roads that are behind locked gates to exclude motor vehicles. They were designed as hiking trails and some are the width of engineered roads, with surfaces from 6 to 14 feet wide. Some were hardened with gravel at one time in

the past, particularly those close to open system roads, but they are largely constructed of native materials from on-site. In some instances, near popular trailheads and campgrounds, the surfaces have been hardened with gravel, but usually no more than one-half mile. In these cases, channel crossings have been paved with interlocking concrete blocks, or Tri-Lock, used specifically for trail work.

The existing condition of the trail system as it relates to hydrology and soil resources is declining. Over the last 10 to 20 years trail use has increased and has shifted from hiking to horses and mountain bikes. These uses are much harder on the trail treads and require more maintenance. At the same time trail maintenance budgets have declined. In some locations, the topsoil has been removed from the machine created and maintained trails and surfaces are mostly down into the clay rich subsoil. The intended profile of these trails are formed with out-slope to facilitate drainage. Use and maintenance of the trails has created berms on the outside edges, promoting incision of a single track lane in the middle of the surface, and resulting in long segments with no drainage at all. Water bars are infrequent and not spaced close enough, as well as usually being too close to the perpendicular of the trail tread, so that they trap sediment rather than self-clean. With increased use the clay substrate being exposed on flat surfaces, these trails tend to form mud holes. Deep pockmarks made by horses in the clay in periods of wet weather act to hold water and guarantee saturation. While many of the bladed trails subsume to single tracks of 1 to 2 feet in width from re-vegetation, the exposed clay remains prone to forming mud holes. The forb and grass type vegetation that colonizes the trail periphery may not dewater the clay subsoil as effectively as forest shrubs. Also, deeply pocked areas have expanded to limit or degrade the re-colonizing vegetation. Wherever the trail is deeply pocked and saturated, a new trail is quickly established around the mud hole.

Table 28 provides existing condition indicators that characterize the relationship between trails, soils and hydrology resources. These indicators will be used throughout this discussion to analyze effects from alternatives.

Table 28. Existing condition indicators for trails, soils and hydrology relationships

Element	Indicator	Existing Condition
Water Quality	Miles of Trail	67 (+8 road[a])
	Number of Trail/Stream Crossings	73
Water Quantity	Trail Density (mi/mi^2)	0.6
Riparian, Wetland Function, and Channel Stability	Trail in Riparian Corridor (miles)	5
Soil Erosion and Productivity	Trails on Slopes Greater than 16 Percent (miles)	6.8

a - Approximately 8 miles of designated trails are shown on roads

Environmental Consequences for Soil and Hydrology Resources

Analysis of potential environmental effects of the alternatives to hydrologic and soils resources are addressed in the context of the elements and indicators listed in Table 28, above. Potential effects to soil resources include soil compaction and erosion from trail use. The watershed analysis describes the short and long term effects to water quality related to increased sediment delivery.

In addition, impacts resulting from off-trail horse use are addressed independently of the alternatives, but within the scope of each alternative proposal. Environmental effects analysis considers the following three options for off-trail horse use in the project area:

- Allow off-trail horse use throughout the project area
- Allow off-trail horse use throughout the project area with the exception of two ecologically sensitive areas
- Allow horse use only on designated trails and on the public road system within the project area.

The affected environment section presented a precipitation analysis that was used to determine potential timeframes and effects of seasonal trail closures. Specific methodology and spatial and temporal context for the analysis can be found in the specialist report of the project file (Arias 2013).

Alternative 1

Direct and Indirect Effects

Under the no-action alternative, maintenance would continue to occur at existing levels. All of the trails would be shared by hikers, equestrians, and mountain bikers. Existing conditions in the watersheds associated with this project would continue, including present conditions for soils, water quality, water quantity, and riparian areas. Indirect effects include continued degradation and existence in a state of constant watershed disturbance due to improper location and design of the existing trails, and high and mixed trail usage.

Seventy-five miles of existing trails and 8 miles of user-created paths would continue to scour deep into the clay-rich subsoil, where pock marks by horses or indentations from other trail users capture water and saturate the clay layer. Trails would continue to affect water quality in riparian and wetland areas, at stream crossings and on steep slopes via an unrestrained supply of sediment (Table 29). Seventy-three existing trail stream crossings, many crisscrossing streams several times such as in the Big Cave Run and Trough Lick Branch, would not be improved and brought up to standards. This, along with over five miles of mostly degraded trails within the riparian corridor, would continue to have a detrimental effect on aquatic ecosystems.

Nearly seven miles of trails located on steeper slopes would remain in place without upgrades to a higher trail standard thus continuing to cause erosion (Table 29). Unrestricted horse use throughout the project area, including sensitive areas such as Caney Creek, and regardless of rainfall or trail conditions, would continue to degrade soil resources, compacting and displacing the organic surface layers.

Table 29. Alternative 1 soils and hydrology elements and indicators

Element	Indicator	Alternative 1
Water Quality	Miles of Trail	75
	Number of Trail/Stream Crossings	73
Water Quantity	Trail Density (mi/mi^2)	0.4
Riparian, Wetland Function, and Channel Stability	Miles of Trail in Riparian Corridor	5
Soil Erosion and Productivity	Trails on Slopes Greater than 16 Percent (miles)	6.8

Alternative 2

Direct and Indirect Effects

Water Quality

The principle effect of hillslope and channel erosion on water quality within the project area is turbidity due to increased suspended sediment. Turbidity is a measure of water clarity, is affected by the amount of material suspended in water, and decreases the passage of light through the water. Trails intercept overland and subsurface flow, conveying this water across the relatively impermeable surfaces to concentrate at discrete discharge points. Trails often become conduits of water and sediment; therefore effects to water quality from the Cave Run project are evaluated based on the total amount of trails. Alternative 2 offers the least amount of physical trail modifications, reducing the amount of short term sedimentation to streams by using most of the existing trail system.

Table 30. Alternative 2 proposed trail activities

Trail Treatments	Miles
Trail Improvement (Miles)	75
New Trail Construction (Miles)	-
Trail Closure (Miles)	2

No new trail construction is proposed; therefore any sediment increase would be limited to trail improvement. Trail improvement of approximately 75 miles and closure of two miles of existing trails is built into this alternative (Table 30). Rolling contours and outslope trail prisms that facilitate water movement off the trail would be incorporated into the trail improvement design. Trail tread hardening using rock material would be required where soils experience contact with the groundwater table on a seasonal basis. Trail tread armoring would be used to prevent water based erosion on steeper pitches. One-half mile of trails located completely within the riparian corridor and having multiple stream crossings within short distances would be permanently closed.

Improving and upgrading the trail system would add sediment to project area streams during implementation; however, this would be minimized with the proper use of BMPs. These actions typically improve drainage and decrease erosion from water channeling down the trail surface in the long term. Given the current detrimental conditions of the trail system, any improvement would result in a long term positive offset from existing sediment rates. Both direct and indirect effects are expected over the short term. These are related to hardening crossings, installing structures, disturbance during use, and removing material used to harden the creek. However, no new stream crossings are proposed under alternative 2, therefore effects would be minimal and only related to trail improvements. Sedimentation would be reduced by eliminating five crossings located within the proposed two mile trail closure. The remaining 68 crossings would need to be improved to meet State, Federal, and Forest Plan Standards and Guidelines.

Horse resting areas would be improved at nine locations and constructed at one location along the trail system. The new location would be constructed on FR 906. This location is on a ridgetop, over 1,000 feet from the closest drainage, presenting no hydrologic connectivity. Rest areas would be confined to about one-half acre in size, and would include permanent hitching posts. Existing, non-designated resting areas would be restored to more natural conditions.

This alternative also includes the development and maintenance of a newly constructed trailhead, a new parking area, and an overflow parking area. These areas are located away from any water body and would have no direct effects to water quality.

Buffer strips on streams and RCPAs act variously as sinks and filters for sediment and certain pathogens and nutrient constituents such as nitrogen and phosphorus. There is general consensus, reported in conclusions on research, on the value of buffer strips of riparian vegetation along stream courses (Castelle et al. 1994, Bentrup 2008). The proposed project area RCPAs are variable throughout the project area with a minimum of 25 feet. To the extent practicable, trails would be constructed and relocated outside of riparian corridors and would be designed and constructed according to Forest Plan standards, agency direction, and applicable erosion control standards and best management practices. These measures, along with indirect beneficial effects from closing user-created trails, closing riparian trails, and bringing existing system trails up to standards, would have a long term effect in reducing sediment transport to streams.

Two watersheds, the Lower Triplett Creek and the Salt Lick Creek, are currently 303d listed as impaired for sediment. The proposed activities would affect these watersheds by helping to reduce the amount of sedimentation in the long term. Similarly, the Slabcamp Creek, Licking River, Slabcamp Creek of Craney Creek, and Slate Creek have listed designated special uses that required protection. Through the implementation of BMPs and project design features, Clean Water Act, State water quality standards, and beneficial uses would be met and existing impacts to streams reduced.

Water Quantity

Although any disturbance that reduces the density of live vegetation cover has the potential to increase runoff from forested watersheds, flow increases are generally not measurable until about 25 percent of the basal area of a forested watershed has been harvested (Grant et al. 2008 and Bosch and Hewlett 1982).

Under this alternative, changes in water yield would primarily be due to functional changes in trail density. Trails influence water yield through soil compaction and reduction of percolation area. New trail construction also reduces the density of live vegetation. No new trails would be built under this alternative; subsequent changes in water yield would not be detectable. Closure of two miles of trails would minimally reduce the overall trail density in the Scott Creek-Licking River watershed, but more importantly, due to its partial location in the RCPA, this action would stabilize the overland flow to the Trough Lick Branch stream. Trail improvements, as mentioned above, would further reduce the probability of long term effects on peak flows by stabilizing the drainage systems. As a result, no discernible changes to water quantity or timing of peak flows would be expected.

Riparian, Wetland Function and Channel Stability

The purpose of the RCPA is to prevent sediment from the activity area reaching the stream channel and to preserve adequate canopy for streamside cover, shading, and recruitment of large woody material into the future. No new trails are proposed within riparian or meadow areas. As a result, no discernible direct and indirect effects to riparian, meadow or channel function, either short or long term, would be expected. Multiple actions, including the closure of one-half mile of trails within the Scott Creek-Licking River RCPA, hardening stream crossings, and improving existing trails up to standards, including those within the RCPA, would have a positive effect on riparian function.

Floodplain development in the project area is limited. BMPs and project resource design features would protect any of the very limited floodplain development within the project area. Hence, there would be no direct or indirect effects to floodplains under this alternative.

Soil Compaction, Displacement and Erosion

Recreational trail uses compacts topsoil along trails, horse resting areas and parking areas, resulting in a reduction in porosity of compacted ground. The establishment of new trails results in the removal of surface organic materials, a reduction in the rooting potential of regrowth, and aeration of the unsaturated zone in the soil. A high degree of compaction can lead to reduced infiltration and greater potential of overland flow, which is the principle cause of erosion on the forest. Surface displacement of organic nutrients and ground cover reduces site productivity.

Recreational uses are categorized based on the degree of impact. Horse use has higher soil impacts than human powered recreation (see off-trail horse use below). Table 31 describes the soil compaction by proposed activity.

Table 31. Alternative 2 soil compaction by use

Proposed Activities	Use
Horse/Hike (Miles)	28
Bike/Hike (Miles)	27
Hike only (Miles)	2
Shared used (Miles)	18
New Horse Resting Areas	1
New Trailhead Parking	1

Soil disturbance in trails, horse resting and parking areas, particularly the loss of the organic layer, may lead to surface erosion by sheet wash or rilling. A trail study by Marion (2006) in a similar location as Cave Run determined that erosion rates on trails with 0 to 6 percent and 7 to 15 percent grades were similar, while erosion on trails with grades greater than 16 percent were significantly higher. Consequently, soil erosion in Cave Run is evaluated by calculating the mileage of trails on slopes greater than 16 percent. Since no new trails are proposed for alternative 2, erosion is limited to the existing trail system, where 6.8 miles of trails are on slopes greater than 16 percent grades. In alternative 2, existing trail segments on steeper slopes would be upgraded to a higher design standard to reduce soil erosion. The proposed trail maintenance would provide erosion control measures which would further reduce existing erosion rates.

Table 32. Alternative 2 soils and hydrology elements and indicators

Element	Indicator	Alternative 2
Water Quality	Miles of Trail	75
	Number of Trail/Stream Crossings	68
Water Quantity	Trail Density (mi/mi^2)	0.4
Riparian, Wetland Function, and Channel Stability	Miles of Trail in Riparian Corridor	4.5
Soil Erosion and Productivity	Trails on Slopes Greater than 16 Percent (miles)	6.8

Seasonal Wet Weather Closures

As described in the Affected Environment section for the Hydrologic and Soil Resources, precipitation rates vary based on season throughout the year (Figure 10). More detailed precipitation analyses show

that single shorter events (1-day) are heaviest in the summer, while longer 5 to 10 day events occur in the winter.

Wet trails coupled with high traffic have contributed to the existing detrimental conditions of the trail system. Topsoil is practically eliminated from trails in places. This allows the trail to serve as a water conduit, which exacerbates erosion. When topsoil is eliminated or compacted, longer periods of rainfall can destroy a soil surface's infiltration capacity. Upon bare soil, raindrop impact can be a severe source of initial erosion by dislodging particles and destroying soil aggregates. Finer particles can be transported and fill in macro pores in the surface, drastically reducing infiltration (Powers 2002).

Research has shown that traffic on pre-wetted soils generated significantly greater amounts of soil runoff than on dry soils for all uses (Wilson and Seney 1994).

The purpose of the project includes providing a system of trails capable of sustaining the designated use. The existing trail system was not designed to sustain horse use, particularly during the winter/spring season when trails remain wet for long periods. Trails become deeply pocked by horse hooves during extended wet periods, resulting in trail incision, mudhole formation, and widening of trails and "work-arounds" to avoid rutted and muddy areas. This in turn leads to a less than desired trail experience for hikers and bikers, and trail and resource damage.

Based on monthly stream hydrograph data for the area (Figure 11) and resource specialists observation of the Cave Run trails throughout the year, seasonal winter closure for horse use from December through May would provide protection against trail incision, mud hole formation, and widening of trails. Research is lacking in damage caused by bikes during wet conditions. If monitoring shows that bikes are causing considerable rutting and trail widening during wet periods, seasonal closures for bikes would be considered; this type of decision is not included in this proposal, and would be analyzed separately. Protection afforded by seasonal trail closure to horse use is applicable to all action alternatives.

Off-Trail Horse Use

Environmental effects for the following three options for off-trail horse use in the project area include:

- *Allow off-trail horse use throughout the project area* – Cave Run field reports, including Moser and Archer (2009), Cotton (2011) and Cave Run literature synopsis (Keen 2011), have all reported that equestrian use impact soils more than human powered recreation (hiking and cycling). This conclusion is supported throughout the literature (Marion 2006; Wilson and Seney 1994). Allowing off-trail horse use would extend irreversible but concentrated trail-only effects to the entire project area. It would also open up opportunities for other users (hiking and cycling) to utilize user-created equestrian trails for recreation. This option would be the most detrimental to soil and water resources.
- *Allow off-trail horse use throughout the project area with the exception of two ecologically sensitive areas* – The Caney area and Murder Branch Cave area account for approximately 1,020 acres of sensitive ground that would be protected from equestrian-related effects (see the Biological Resources section of the EA for more details on sensitivity of these sites). Limiting off-trail horse use in any manner would be beneficial to the hydrology and soil resources in these areas.
- *Allow horse use only on designated trails and on the public road system within the project area* – This is the recommended alternative for the highest level soil and watershed protection. Trails present irreversible damage to soils and hydrology. These effects can be limited if recreational use is confined to the designated trail system.

Cumulative Effects

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Cumulative effects include the combination of direct and indirect effects from past, present, and reasonably foreseeable activities. Cumulative effects on watershed resources are measured at the HUC 6th level. Activities common to project HUC 6th watersheds include recreational trails, timber management, and invasive species eradication (Appendix F). Existing roads designated on the national forest transportation system are considered dedicated lands. The total road density in the project area is approximately 1.8 mi/mi².

In the Scott Creek-Licking River watershed, the Clack Mountain Project included vegetation treatments on 101 acres within this watershed. Streams were protected and all treatments occurred outside RCPAs. Also within the Scott Creek-Licking River watershed, the Timber Stand Improvement Project was implemented. These treatments targeted midstory removal treatments on 492 acres within this watershed. Treatments also took place in the Salt Lick Creek watershed on 94 acres, the Leatherwood Creek-Beaver Creek on 222 acres, and the Laurel Branch-Licking River on 751 acres.

Roadside salvage treatments have also been conducted in the project area. These treatments were limited to areas adjacent to the road system. Treatments included 579 acres in the Lower Big Creek watershed, 34 acres in the Salt Lick Creek watershed, 5 acres in the Lower Triplett Creek watershed, 1 acre in the Lower Lick Fork-North Fork watershed, and 56 acres in the Leatherwood Creek-Beaver Creek watershed.

On private land in these watersheds there are activities that could be cumulatively contributing to soil and water effects. A majority of these activities include the conversion of land from forest to either roads or low density urban or pasture use. Future activities could include timber harvesting, recreational developments, or construction.

Hydrology

A cumulative watershed effect (CWE) is what results from the incremental impact of the proposed actions when added to other past, present and reasonably foreseeable future actions. Effects are assumed to be mitigated over time by natural processes, if not by specific actions done after the project for that purpose.

In generating the results for cumulative effects, it is assumed that all treatment would occur in 2013, with associated effects first occurring in 2014. This was done because differing treatment types and previous actions have differing recovery rates. Recovery rates are highly variable and dependent mostly on the amount of associated ground disturbance, soil type, climate, and revegetation rates. Actions outside Forest Service boundary are not accounted for. Vegetation management activities and development have taken place in these areas and are expected to continue at an unknown rate.

Road and trail disturbance was calculated by converting road and trail mileage into acres, assuming road prisms average 10 feet wide and trails 4 feet wide. Since it is not known exactly which treatments would be done, and current projects are still being implemented, it is assumed that all treatments would occur during the first year of project implementation. For timber sales and vegetation treatment projects, the entire treatment unit area is considered. In reality, not every acre within a treatment unit is treated, and even the level of disturbance varies throughout the unit. As a result of these assumptions, the results represent a maximum case scenario which has very little chance of occurring.

Table 33. Cumulative watershed effects for alternative 2

6th HUC Name & Code	HUC 6th Acres	Past, Present and Future Actions (Acres)	Alternative 2 (Acres)	Cumulative Impacts (Acres)	Percent of Cumulative Watershed Impacted
Leatherwood Creek-Beaver Creek (051001010404)	8042.2	303.9	3.1	307	3.8
Brushy Fork-Beaver Creek (051001010403)	11070	5.6	0	5.6	0.1
Clifton Creek-Beaver Creek (051001010401)	11687.4	2.6	0.6	3.2	0
Meyers Fork-Beaver Creek (051001010402)	12114.7	12.5	0.1	12.6	0.1
Lower Lick Fork-North Fork (051001010304)	14022.9	16.7	0	16.7	0.1
Laurel Branch-Licking River (051001010508)	17330.8	755.5	2.7	758.2	4.4
Lower Triplett Creek (051001010605)	24082.1	17.6	1.7	19.3	0.1
Scott Creek-Licking River (051001010509)	27578.3	691.9	19.3	711.2	2.6
Indian Creek-Licking River (051001010802)	33129.2	10.8	2.3	13.1	0
Blackwater Creek (051001010507)	33676.1	0.6	0	0.6	0
Salt Lick Creek (051001010801)	36007.5	164.1	5.7	169.8	0.5

Cumulative effects of forest practices are evaluated based on percentage of watershed vegetation removal. Changes in amount or distribution of vegetation increase overland flow, water yield, sediment yield and ultimately alter stream channel conditions. In sites with higher precipitation rates such as in the Cave Run project area, effects are less detectable and likely to equilibrate faster as a result of higher revegetation rates. Table 33 shows that the percent of cumulative watersheds impacted ranges from 0 to 4.4. These percentages are significantly below the 25 percent threshold established by research (Grant et al. 2008 and Bosch and Hewlett 1982).

Soil

Given the extent of treatment proposed for this alternative, the effects would be mostly limited to the present soil condition. Areas at the most risk from cumulative impact that have detrimental disturbance are segments of trails that would require any relocation. Trail relocations would be minor, either short spans or moving a trail from the center of a ridgeline to the edge of the ridgeline to facilitate better water management. It is essential on these segments that all previously disturbed trails be evaluated and treated for ground cover immediately after relocation; that every effort is made to use only previous trails, and any relocation to be done on previously disturbed ground if possible.

In general, activities on non-Forest Service land that detrimentally disturb soils, impair soil productivity, and increase soil water content are generally site specific and have no additional direct effects on adjacent Cave Run proposed actions.

Alternative 3

Direct and Indirect Effects

Water Quality

Refer to the alternative 2 discussion on the water quality effects from trails and associated activities. Alternative 3 includes approximately 71 miles of trail improvement and the addition of 20 miles of new trails to the system (Table 34). Five miles of trails would be closed including 1.1 miles located within the riparian corridor and having 15 stream crossings within short distances. One new stream crossing is proposed, to be located off the headwaters of an intermittent drainage tributary to the Buck Creek.

The process of establishing new trails and a stream crossing would have both short and long term direct effects to the water quality of the Cave Run area. Short term effects are mostly associated with trail grading and hardening the crossing. Minor increases in sediment and turbidity are only expected to be short-term, since most new trails related sediment would likely mobilize during the initial high flow events following implementation. The trail prism would become a permanent long term source of sediment. The stream crossing would create a direct connection between the trail and the channel, aiding in the transport of sediment into the stream. An increase in sedimentation may impact the immediate footprint of the crossing location and a short distance of channel downstream of the site, with effects diminishing further downstream. The nearest perennial stream to the proposed crossing is Buck Creek, which flows approximately 1.3 miles from the proposed crossing location. The significant distance between the stream crossing and downstream perennial water, and the use of trail design features and BMP's would minimize the risk of effects to water quality. Additionally any potential increase would be permanently offset by the closure of five miles of trails, including trails along the riparian corridor, which include 15 stream crossings.

Table 34. Alternative 3 proposed trail activities

Trail Treatments	Miles
Trail Improvement (Miles)	71
New Trail Construction (Miles)	20
Trail Closure (Miles)	5

Given all the treatment increments, the effects from alternative 3 are expected to have a greater short term impact on water quality compared to alternatives 1 and 2. As closed trails along the riparian corridor revegetate and closed crossings reestablish normal flow, sedimentation would be reduced resulting in a greater net positive effect on water quality when compared to alternatives 1 and 2. Table 43 provides a direct comparison between the effects indicators for all alternatives.

Water Quantity

Refer to the alternative 2 discussion on the water quantity effects from trails and associated activities. Alternative 3 activities have the potential to change water yield due to increases in trail density and its associated effects including soil compaction, reduction of percolation area and vegetation. Trail mileage information outside the Cave Run project boundary is limited. As a result, trail density is calculated on HUC 6th watersheds clipped to the project area boundary. The HUC 6th watershed areas within the project boundary generally accounts for a smaller portion of the total watershed size (Table 21), therefore trail density calculations are likely overestimated.

By using most of the existing trail system, trail density generally remains the same for alternative 3. Three out of eleven watersheds show an increase in trail density, while one watershed shows a decrease. The biggest increase is in the Laurel Branch-Licking River watershed with a 67 percent change. In this case, trail density changes are overestimated given that only 32 percent of the total watershed area is used in the calculation. Trail mileage would change from an existing 5.7 to 8.8. By estimating the average width of trails to be four feet, the total disturbed area would be approximately 4.3 acres. This is less than 1 percent of the Laurel Branch-Licking River watershed area and significantly below the 25 percent threshold established by research (Grant et al. 2008 and Bosch and Hewlett 1982).

Closure of trails would minimally reduce the overall trail density in the Indian Creek-Licking River watershed. Trail improvements as mentioned above would further reduce the probability of long term effects on peak flows by stabilizing the drainage systems. As a result, no discernible changes to water quantity or timing of peak flows would be expected.

Table 35. Alternative 3 trail density changes

6th HUC Name & Code	Existing Trail Density (mi/mi²)	Alternative 3 Trail Density(mi/mi²)	Percent Change in Trail Density(mi/mi²)
Leatherwood Creek-Beaver Creek (051001010404)	0.5	0.5	0
Brushy Fork-Beaver Creek (051001010403)	0.0	0.0	0
Clifton Creek-Beaver Creek (051001010401)	0.7	0.7	0
Meyers Fork-Beaver Creek (051001010402)	0.0	0.0	0
Lower Lick Fork-North Fork (051001010304)	0.0	0.0	0
Laurel Branch-Licking River (051001010508)	0.6	1.0	+67
Lower Triplett Creek (051001010605)	0.3	0.3	0
Scott Creek-Licking River (051001010509)	0.9	1.2	+33
Indian Creek-Licking River (051001010802)	0.8	0.7	-12
Blackwater Creek (051001010507)	0.0	0.0	0
Salt Lick Creek (051001010801)	0.7	0.8	+14

Riparian, Wetland Function and Channel Stability

Alternative 3 proposes no new trails within perennial streams RCPAs. Approximately 198 feet of trails are proposed within intermittent streams RCPAs (Table 36). These trails are all located in the headwaters of intermittent and ephemeral tributaries. The proposed new trails along the Scott Creek-Licking River involve three separate segments, with two segments parallel to slope, approximately 40 feet away from the channel and one segment crossing the RCPA and the channel. Effects from this channel crossing are described in the water quality section above. The proposed new trail segment along the Salt Lick Creek watershed is approximately 27 feet from the channel. All of these segments would be constructed to

accommodate steep slopes, to protect water quality, and would follow design features and BMPs. There are no new trails proposed within meadow or wetland areas. Additionally, 1.1 miles of trails located within the riparian corridor would be permanently closed along with 15 stream crossings. These changes would have an overall positive effect on riparian function.

Table 36. Alternative 3 new trails within RCPA

6th HUC Name & Code	Perennial RCPA (feet)	Intermittent RCPA (feet)
Scott Creek-Licking River (051001010509)	0	126
Salt Lick Creek (051001010801)	0	72

Soil Compaction, Displacement, and Erosion

New trails would result in long term soil compaction and reduced soil productivity. The conditions of native surface trails have different degrees of impact based on the miles of trail user designation (horse, biking and hiking). The rehabilitation of existing resting areas, and construction of one new resting area and two new trailhead parking areas would also result in long term detrimental soil conditions.

Table 37. Alternative 3 soil compaction by use

Proposed Activities	Use
Horse/Hike (Miles)	41
Bike/Hike (Miles)	40
Hike only (Miles)	8
New Horse Resting Areas	1
New Trailhead Parking	2

Soil erosion in trails, horse resting, trailhead and parking areas is intensified with grades greater than 16 percent. Soil erosion in Cave Run is evaluated by calculating the mileage of trails on slopes greater than 16 percent. Trail slopes were calculated from an elevation raster dataset. Raster data analysis resulted in 6.8 miles of existing trail with slope values greater than 16 percent. Approximately 25 percent of the total raster cells for new trail construction have slope values greater than 16 percent, equivalent to approximately five miles of new trails. Although trail design parameters include erosion control measures, erosion rates are expected to be higher on these five miles of trails with steeper slopes. The existing 6.8 miles of trail segments on steeper slopes would be upgraded to a higher design standard to reduce soil erosion. Proposed trail maintenance would also provide erosion control measures which would further reduce existing erosion rates.

Table 38. Alternative 3 soils and hydrology elements and indicators

Element	Indicator	Alternative 3
Water Quality	Miles of Trail	91
	Number of Trail/Stream Crossings	58
Water Quantity	Trail Density (mi/mi^2)	0.5
Riparian, Wetland Function, and Channel Stability	Miles of Trail in Riparian Corridor	3.9
Soil Erosion and Productivity	Trails on Slopes over 16 Percent (miles)	11.8

Effects of **Seasonal Wet Weather Closures** and **Off-Trail Horse Use** are the same as discussed for alternative 2.

Cumulative Effects

Refer to the alternative 2 discussion on the cumulative watershed and soil effects from management activities. Table 20 shows that new miles proposed under alternative 3 are relatively few, and when combined with trail closures, have little impact in the percentage of watershed impacted.

Table 39. Cumulative watershed effects for alternative 3

6th HUC Name & Code	Watershed Acres	Past, Present and Future Actions (Acres)	Alternative 3 (Acres)	Cumulative Impacts (Acres)	Percent of Cumulative Watershed Impacted
Leatherwood Creek-Beaver Creek (051001010404)	8042.2	303.9	2.9	306.8	3.8
Brushy Fork-Beaver Creek (051001010403)	11070	5.6	0	5.6	0.1
Clifton Creek-Beaver Creek (051001010401)	11687.4	2.6	.6	3.2	0.0
Meyers Fork-Beaver Creek (051001010402)	12114.7	12.5	.1	12.6	0.1
Lower Lick Fork-North Fork (051001010304)	14022.9	16.7	0	16.7	0.1
Laurel Branch-Licking River (051001010508)	17330.8	755.5	4.3	759.8	4.4
Lower Triplett Creek (051001010605)	24082.1	17.6	1.7	19.3	0.1
Scott Creek-Licking River (051001010509)	27578.3	691.9	25.7	717.6	2.6
Indian Creek-Licking River (051001010802)	33129.2	10.8	2.1	12.9	0.0
Blackwater Creek (051001010507)	33676.1	.6	0	0.6	0.0
Salt Lick Creek (051001010801)	36007.5	164.1	6.7	170.8	0.5

Alternative 4

Direct and Indirect Effects

Water Quality

Refer to the alternative 2 discussion on the water quality effects from trails and associated activities. Alternative 4 includes approximately 73 miles of trail improvement and the addition of 20 miles of new trails to the system. Three miles of trails, including one mile located in the riparian corridor and having 13 stream crossings within short distances, would be permanently closed. Water quality effects are essentially the same as alternative 3, but the net positive effects of alternative 4 are slightly lower due to the higher amount of trails closure proposed under alternative 3. The new trails locations are the same as

alternative 3, including the one new stream crossing proposed in the tributary to the Buck Creek. Table 43 provides a direct comparison between the effects indicators for all alternatives.

Table 40. Alternative 4 proposed trail activities

Trail Treatments	Miles
Trail Improvement (Miles)	73
New Trail Construction (Miles)	20
Trail Closure (Miles)	3

Water Quantity

Refer to the alternative 2 discussion on the water quantity effects from trails and associated activities. Trail density is similar to alternative 3, therefore the effects on water quantity from alternative 4 are comparable to those in alternative 3.

Riparian, Wetland Function and Channel Stability

Alternative 4 proposes the same new trail locations as alternative 3. One mile of trails located within the riparian corridor would be permanently closed along with 13 stream crossings. These changes would have an overall positive effect on riparian function similar to those in alternative 3, although slightly reduced due to the difference in trail mileage closure.

Soil Compaction, Displacement, and Erosion

Table 41 shows trails under alternative 4 with specific trail user designations (horse, biking and hiking).

Table 41. Alternative 4 soil compaction by use

Proposed Activities	Use
Horse/Hike (Miles)	31
Bike/Hike (Miles)	41
Hike only (Miles)	8
Shared use (Miles)	11
New Horse Resting Areas	1
New Trailhead Parking	2

Soil erosion in new trails would be similar to alternative 3. Approximately five miles of new trails would be developed on slopes greater than 16 percent.

Table 42. Alternative 4 soils and hydrology elements and indicators

Element	Indicator	Alternative 4
Water Quality	Miles of Trail	93
	Number of Trail/Stream Crossings	60
Water Quantity	Trail Density (mi/mi^2)	0.5
Riparian, Wetland Function, and Channel Stability	Miles of Trail in Riparian Corridor	4
Soil Erosion and Productivity	Trails on Slopes Greater than 16 Percent (miles)	11.8

Effects of **Seasonal Wet Weather Closures** and **Off-Trail Horse Use** are the same as discussed for alternative 2.

Cumulative Effects

Refer to the alternative 3 discussion on the cumulative watershed and soil effects from management activities.

Summary of Effects to Hydrologic and Soil Resources

The design of this project is such that minimal effects to watershed resources are expected from any of the action alternatives, as discussed above. In fact, given the existing condition of the trail system including lack of drainage, accelerated erosion rates, and detrimental soil disturbance, action alternatives would shift the current downward trend to start the recovery of a significantly degraded site.

Elements that showed a difference in the effects between the four alternatives are identified and are displayed in Table 43. Due to the proposed no new trail construction, alternative 2 would result in lesser short term impact to the watershed resources. However, the five and three miles of trails to be closed within riparian areas would result in a more beneficial long term effects for alternatives 3 and 4 respectively.

Potential effects to soil resources are limited to trails, resting areas, parking, and associated recreational sites. These changes would be permanent and would result in the reduction of soil productivity on a site-specific basis. Due to the relatively small portion of the land that trails occupy throughout the project area, effects would be minimal. A summary of the effects from the proposed treatments along with assessed soil quality indicators are presented in Table 43.

Table 43. Summary and comparison of the effects from the alternatives

Element	Indicator	Alternative 1	Alternative 2[a]	Alternative 3[a]	Alternative 4[a]
Water Quality	Miles of Trail	75	75	91	93
	Number of Trail/Stream Crossings	73	68	58	60
Water Quantity	Trail Density (mi/mi²)	0.4	0.4	0.5	0.5
Riparian, Wetland Function, and Channel Stability	Miles of Trail in Riparian Corridor	5	4.5	3.9	4
Soil Erosion and Productivity	Trails on Slopes Greater than 16 Percent (miles)	6.8	6.8	11.8	11.8
Cumulative Effects	Percent of Watershed Impacted	All less than 25%	All less than 25%	All less than 25%	All less than 25%

a - Alternatives 2, 3, and 4 include stream crossings, trails in riparian corridor,and trails on steep slopes being upgraded to a higher design standard

Archeological Resources

Federal laws mandate that all federal undertakings require prior survey and consultation about the cultural resources that may be affected by the proposed action. Cultural resources include ancient and historic archaeological sites, historic structures, and traditional cultural properties. The most applicable laws are

the National Historic Preservation Act and the Archaeological Resources Protection Act. The National Environmental Preservation Act (NEPA) also requires that cultural resources be preserved.

Known cultural resources in the project area have primarily been recorded through National Historic Preservation Act Section 106 compliance cultural resource surveys. Cultural resources surveys have not been conducted for all of the trails within the project area, including both new and old trails. Surveys to identify historic properties must be completed in accordance with 36CFR 800.4(b)(2) prior to the implementation of the various parts of the Cave Run Non-motorized Trails Project. A Memorandum of Agreement (MOA) between the Daniel Boone National Forest and the Kentucky State Historic Preservation Office (Kentucky SHPO 2013) approves the continued consideration of historic properties and cultural resources through a phased identification and evaluation approach; not all portions of the project will be approved for cultural resources at the same time, but rather will be completed and approved piece by piece over several years.

Affected Environment for Archeological Resources

The physical terrain of the general project area is composed of steep, narrow valleys with uplifted ridges. Ridges sometimes crest in rocky knolls. The area is rich in natural resources that appealed to both ancient and historic settlers. Chert, the stone used by ancient Native Americans for numerous types of tools, outcrops occasionally and also appears in stream gravels. Historically, game was plentiful and fresh water sources are abundant.

When prior archeological surveys were undertaken, sites have been located, especially along cliff lines, but also occurring on the ridges and in the valleys. Sites in cliff lines tend to be rockshelters, which are especially important since they preserve organic materials that disintegrate under normal circumstances. Rockshelters in the area have featured prominently in scientific studies of ancient agriculture and have yielded some of the earliest examples of domesticated sunflower and squash in the eastern United States. Rock art, also referred to as petroglyphs also occur primarily in rockshelters, with some of the most significant rock arts sites in Kentucky occurring in rockshelters of this region.

Rockshelters in this portion of the forest have often been found to contain the remnants of historic nitre mining. Nitre mining occurred chiefly between 1750 and 1850. Shelters used for this type of mining contain piles of broken rock (or talus) and can also contain wooden remnants of the mining equipment.

Archaeological sites are extremely vulnerable to unauthorized excavation, or looting. Many people today like to dig in rockshelters, and do so both for enjoyment and for money, since artifacts such as arrowheads and pottery are collectible and can be sold. Unfortunately, rockshelter sites are difficult to protect due to their locations along cliff line deep in the forest. Archaeologists have practiced monitoring (repeated visits to a site) as a form of site protection for many years; however, rather than protecting the site, this practice has generally only allowed archaeologists to know when a rockshelter was looted. We also know from past experience that bringing visitors close to rockshelters on trails, roads, or campsites makes them more visible and eventually causes them to be looted. This has been demonstrated in archaeological studies in the Red River Gorge where surveys in the 1970s and 1980s located undisturbed rockshelters. As visitation to the gorge has increased, the pristine rockshelters have been looted. Today undisturbed shelters in the Red River Gorge are extremely rare.

Environmental Consequences for Archeological Resources

Alternative 1

Direct and Indirect Effects

No proposed activities would be implemented under the No Action alternative, therefore there would be no potential for the proposal to directly affect historic properties. The condition of known subsurface cultural resources within the project area would remain the same as they are now.

The potential exists for sites, especially rockshelter sites, in close proximity to existing system and user-created, non-system trails to be further degraded. Portions of the project area containing a high amount of cliffline are particularly vulnerable. If the No Action alternative is chosen, these sites would remain unrecorded and unprotected, and the current rate of degradation would continue.

Currently, the project area is open to off-trail horse use. Off-trail horse use creates ground disturbing impacts. In addition, off-trail horse use puts rockshelters at any location in the project area at risk from looting, vandalism, and inadvertent impacts from camping. If the No Action alternative is chosen, these impacts could continue.

Alternatives 2, 3, and 4

Direct and Indirect Effects

Specific methodology and spatial and temporal context for the analysis can be found in the specialist report of the project file (Adams 2013).

All of the action alternatives (alternatives 2, 3, and 4) have the potential to impact cultural resources. Construction of new trails and reconstruction, maintenance, and/or closure of existing trails would directly affect cultural resources that are in the immediate footprint of the trail corridor. In addition, proposed treatments have the potential to impact new or previously recorded archaeological sites in close proximity to these trails. Proposed activities could increase disturbance to archaeological materials through trampling by horses, bicycles or pedestrians and through exposure of resources that results in unauthorized excavation or looting. An increase in the amount of area being disturbed by trail work or other ground disturbing activities would increase the potential of exposing, disturbing, and/or destroying archaeological materials. An increase in ground exposure increases the visibility of surface archaeological remains, which in turn become more susceptible to loss or destruction from illegal artifact collectors. Looting increases where areas of high visibility (in or along trails) overlap with areas of high recreation use or forest visitor traffic. Analysis of effects for the action alternatives assumes implementation of the stipulations in the MOA, also listed as project design features. If any of the action alternatives are chosen, the procedures outlined in the MOA would ensure the impacts to archeological resources are minimized.

The reduction of off-trail horse use in the project area would reduce impacts to cultural resources by reducing the area that could be disturbed by direct impacts of horse use, or exposed to added visibility and loss or destruction from looters. The greater the area that is off limits to cross-country horse travel, the lower the potential effect to archeological resources in the project area.

Cumulative Effects to Archeology

The combination of forest activities such as timber harvesting and recreation may have a cumulative effect on heritage resources in the form of increased soil erosion, increased visitor traffic, vandalism, and further alteration of historic landscapes. Many of the heritage resources located within proposed project areas are rockshelters and are extremely vulnerable to damage from visitors. All action alternatives

propose ground-disturbing and visitor activity that, in turn, could increase the chances of damage to known and/or unrecognized heritage sites. However, all of the action alternatives would be treated in accordance with the MOA, which contains actions to minimize those impacts, and therefore offers protection over the long-term to heritage resources. No additional additive effects are expected with the implementation of the proposed design features, and effective monitoring of those measures.

Recreation Resources

Affected Environment for Recreation Resources

A recreation resources specialist report has been prepared for this proposal and is incorporated into this EA by reference (Morrissey 2013). Statistics from the Forest's National Visitor Use Monitoring (NVUM) survey indicate there are approximately 1.1 million visits to the Daniel Boone National Forest each year. Furthermore, data indicate that most recreation visitors to the Daniel Boone are local: forty percent of visits come from people who live within 25 miles of the forest; 15 percent come from 25 to 50 miles away, and another 15percent from 50 to 75 miles away [1].

Common recreation activities in the project area include viewing scenery, driving for pleasure, fishing, and hiking. NVUM data indicates that some of the most popular activities on the Forest are as listed below, with users participated at the following rates (categories are not mutually exclusive):

- 57% - viewing natural features and scenery
- 45% - relaxing, or "hanging out"
- 34% - driving for pleasure

Looking specifically at the categories of use for this project, the following participation statistics apply:

- 42% - hiking or walking
- 3% - backpacking
- 2% - bicycling
- 2% - horseback riding

The recreation resource that would be most affected by the Cave Run Project is the dispersed recreation environment, particularly the project-area's nonmotorized trails. There are approximately 75 miles of existing Forest Service-maintained nonmotorized trails on national forest system land within the project area. Major trails in the area include the Sheltowee Trace National Recreation Trail, which crosses through the project area and outside the project area traverses the entire length of the Daniel Boone National Forest, south to the Tennessee border and north nearly to the Ohio border. In addition to the designated trail mileage, there are many more miles of unauthorized user-created trails that are very popular with the equestrian community in the area. Other dispersed recreation opportunities in the project area are camping, hunting, and fishing. Cave Run Lake is a popular destination for fishing and camping activities.

While the NVUM statistics above apply to recreation use across the entire Forest, the range of activities can be approximately inferred to apply to the project area. According to anecdotal evidence, however, there is reason to believe the Cave Run Lake area is more popular for mountain biking and horseback riding than the 2 percent figures suggest. The project area is seen by most to be by far the most popular destination on the Daniel Boone National Forest for mountain biking trails. [2] Likewise, the project area is

[1] National Visitor Use Monitoring Results, January 2009, Daniel Boone NF.
[2] Cave Run Lake Equestrian Trail Use Report, 2007.

one of the most popular destinations in the area for equestrian trail riding, and participation numbers for Cave Run may be somewhat higher than NVUM indicates. Forest managers estimate that 20 to 30 percent of the total Forest equestrian use occurs in the project area.

Looking at the percentages of bike riders compared to equestrians in the project area, there is little to no visitation data available. The 2007 equestrian use study concluded that:

> In recent years equestrian trail riders have become, by far the most dominant user group on the trails in the Cave Run Lake area. While there is no hard survey or census data to support this, it is quite evident after conducting several site visits and speaking to numerous Forest Service employees, trail users, and local businesses (Cave Run Lake Equestrian Trail Use Report 2007).

Other reports suggest a number for this estimate- that horse use accounts for "70 percent of all trail use on the Morehead area trails" (Loomis 2006). Management observation also suggests that, while equestrian trail riders have been the dominant presence on area trails in recent years, mountain bikers had a greater presence in the project area in the early 2000's, and maybe have been displaced from the trails by deteriorating trail conditions stemming from shared trail use.

The Cave Run project area also contains a variety of developed recreation opportunities. These recreation facilities encompass numerous boating sites around Cave Run Lake, as well as multiple campgrounds, observation sites, fishing, and picnic areas, and trailheads. The developed recreation sites in the project area that are enjoyed by non-motorized trail users are listed below in Table 44.

Table 44. Developed recreation facilities used by non-motorized trail users in the project area

Campgrounds
Clear Creek Campground
Twin Knobs Recreation Area
Zilpo Recreation Area
White Sulphur Horse Camp
Observation Sites
Lakeview Vista
Tater Knob Fire Tower
Zilpo Scenic Byway
Picnic Sites
Clear Creek Picnic Area
Miscellaneous
Morehead Office Visitor Center

One of the campground facilities relevant to the Cave Run project is the White Sulphur Horse Camp, which was developed to provide overnight accommodations for equestrians looking for a multi-day trail riding experience. This is a primitive campground that includes approximately 30 sites, with vault toilets, a pond and watering trough, corrals and picket lines. White Sulphur, however, does not have electric or sewer hook-ups, provides minimal shade, and is accessible only by a 3-mile long gravel road, which is

considered unacceptable to many towing horse trailers. Equestrians have expressed interest in improvements for this facility.

Conflict Among User Groups

There is a perception that equestrians are in conflict with mountain bikers and hikers on the Cave Run trails. A more accurate assessment of the situation is that there are few actual personal conflict encounters on the trail system itself, but there is goal interference between different types of trail users. In recreation literature, conflict has been traditionally defined as "goal interference attributed to others" (Manning 1999). In this case, there is little evidence of direct conflict between user groups when they meet on a trail. The conflict is more indirect: some user groups feel other groups are interfering with their goal of an enjoyable trail experience. This recreational goal interference comes primarily in the form of hikers and bikers finding equestrian use to be an obstacle to a satisfying trail experience. Bike and hike user groups have commented that horses are causing severe trail rutting on popular multiple use trails, such as the Caney Loop. Extremely muddy and rutted trails create a negative experience for hikers and bikers, and have caused many to stop using such trails (Hood 2007). In addition, some bikers and hikers sharing trails with horses find horse feces on the trails to be a serious detriment to their recreation experience. Recreation literature also suggests that conflict between user groups is commonly "asymmetrical" (Manning 1999), meaning one group may perceive the other as a problem, but the reverse is not necessarily true. The Cave Run situation appears to follow this model, as hikers and bikers find horse use on trails to be a problem, but equestrians do not appear to be as dissatisfied with the hike and bike communities, with the possible exception of bikes startling horses on trails.

A review of the recreation conflict literature suggests two primary methods for managing this issue. The first is separation, or zoning, of uses. The USDA Forest Service's Recreation Opportunity Spectrum itself is an example of a zoning approach to conflict management (Daniels and Krannich 1990). In this case, reducing the amount of multiuse trails and providing appropriate separate trail opportunities for equestrians and for hikers and bikers would be a zoning solution. In addition to separating uses, however, education has also been found to be a useful management tool in addressing recreation conflict. Education can help establish trail etiquette for the conflicting user groups as well as help explain group behaviors to the other group, often causing users to be willing to accept use restrictions or behavior modifications in order to resolve the conflict (Hammit et. al. 1982).

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is a system of classifications based on a range of recreation settings and probable activities that contribute toward the goal of providing a variety of outdoor recreation opportunities. An ROS setting is defined as the combination of physical, biological, social, and managerial conditions that give value to a place. By combining variations in these conditions it is possible to provide a diversity of recreational settings for visitors to enjoy. The ROS classifications within the project area are Roaded Natural and Rural.

Most of the planning area is in the Roaded Natural class. As the Forest Plan directs that Prescription Area's be managed consistently with their ROS class, recreation opportunities in the planning area must remain consistent with the description of the Roaded Natural opportunity class as laid out in the ROS Users Guide.

The Roaded Natural setting is described as:

> Area is characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction

> between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities (USDA FS 1982).

The user's experience in this setting is expected to be:

> About equal probability to experience affiliation with other user groups and for isolation from sights and sounds of other humans. Opportunity to have a high degree of interaction with the natural environment. Challenge and risk opportunities associated with more primitive types of recreation are not very important. Practice and testing of outdoor skills might be important. Opportunities for both motorized and nonmotorized forms of recreation are possible (USDA FS 1982).

Furthermore, Roaded Natural areas are within a half-mile of better-than-primitive roads, and the environment is expected to be modified by humans, although these modifications should be largely unnoticeable from sensitive travel routes. A moderate to high frequency of contact with other recreationists is expected on roads, and a low to moderate contact frequency is expected on trails and off routes (USDA FS 1982).

Smaller portions of the project area, closer to the shoreline, are managed as Rural ROS areas. Rural ROS areas are characterized by a "substantially modified natural environment" (USDA FS 1982).

Environmental Consequences for Recreation Resources

Incomplete and Unavailable Information

There is insufficient information to project changes in biking and horseback riding use that may result following implementation of the proposed action or alternatives analyzed. Such predictions would be highly speculative and would likely be minimized by regional and national population and recreation trends. Demand for substitute experiences on other public and private lands may also change, however, information is insufficient to be able to estimate the nature or magnitude of such shifts. Estimated impacts to recreation use are calculated for existing use levels under the no-action alternative. The analysis of the impacts of the remaining alternatives will focus on changes in opportunities and the potential direction of change from the no-action alternative.

Table 45 summarizes the available trail miles by use type across project alternatives. This data will be referenced throughout the following recreation analysis.

Table 45. Summary of available trail miles by alternative by use type

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Bike/Hike	NA	27 (+2 road)	40* (+4 road)	41* (+2 road)
Horse/Hike	NA	28 (+22 road)	43** (+23 road)	33** (+23 road)
Hike only	1	2	8	8
Shared Use	67 (+8 road)	18 (+3 road)	1	11 (+3 road)
Total	75	75 (+27 road)	91 (+28 road)	93 (+28 road)

*Includes 18 miles of new bike trails to be constructed
** Includes 2 miles of new horse trails to be constructed

Table 46 shows the total mileage of nonmotorized routes that would be available to each user group under the alternatives. This route mileage by use type includes all types of surfaces (both roads and trails), as well as all types of trails (includes shared trails). A more detailed analysis of the type and quality of this total mileage can be found in the discussion of each alternative.

Table 46. Total miles of nonmotorized routes available to user groups by alternative

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Bike mileage	75	50	45	57
Horse mileage	75	71	67	70
Hiker mileage	76	102	119	121
Total mileage*	76	102	119	121

*Due to the inclusion of multiple use, or shared trails, total mileage for each alternative does not represent the sum of that column.

Alternative 1

Alternative 1 proposes to continue to use the existing nonmotorized trail system without any new trail construction or change in trail usage. All trails would continue to be shared. In addition, non-system, user-created trails would not change; they would not be added to the trail system or restored to native conditions. Approximately 8 miles of those user-created trails would remain open to nonmotorized users. There would be no changes to trail facilities or signing. Alternative 1 is presented here as a baseline for comparing the action alternatives.

Direct and Indirect Effects on Bike Use

Alternative 1 would continue the current conditions for bike trail access. As shown in Table 45 and Table 46, alternative 1 would provide 75 total miles of trails for bikes, 67 of which are trail-only bike miles, and eight of which are trail-completing road miles. Access to specific destinations and continued year-round access to the Cave Run trail system would remain unchanged.

The quality of a biker's recreation experience would also remain the same under alternative 1. There are several components of this quality, including riding on degraded trails and trails littered with equine feces. The vast majority of these bike quality factors stem from sharing trails with horses; therefore, the amount of shared use trails is used here as an indicator of bike trail quality. Alternative 1 proposes to continue having bikes share 100 percent of the trail system with horses. Goal interference between user groups would continue at the current level. This impacts the quality of the biker's experience.

Direct and Indirect Effects on Horse Use

Alternative 1 would have a neutral impact on equestrians' trail access. As shown in Table 45 and Table 46, alternative 1 would provide 75 total miles of trails for horses, 67 of which are trail-only horse miles, and eight of which are trail-completing road miles. Alternative 1 therefore maintains the current level of equestrian access to the Cave Run trail system. Seasonality of horse trail access also remains unchanged. Currently, horses can ride on the trails year-round, and would continue to be able to do so under alternative 1.

Alternative 1 would also maintain the current level of access to less challenging horse trails. As many of the trails in the project area are steep, narrow, and switch-backed, making them difficult or impossible for novice riders to use, "easy" routes are an important component of the trail network for many equestrians, particularly women, children, families, and other novice riders. Forest managers have identified the Caney loop trails, the White Sulphur loop trails, and the connecting trails in between as project area trails

that are accessible to the novice equestrian. Under alternative 1, riders would be able to continue to use all of these easy trails.

Other Direct and Indirect Effects of Alternative 1

Currently, equestrians and mountain bikers share all trails, including steep, narrow, and easily erodible ones, such as portions of 112, 113, 104, and 116. Public concerns about this situation are two-part: one concern is for the safety of all users on these trails, and the other is a concern about resource damage to the trails, resulting from horses using erodible trails. Alternative 1 proposes to continue shared use on all steep and narrow trails.

Effects Common to All Action Alternatives

There are several effects to recreation resources that are common to all action alternatives (alternatives 2, 3, and 4). The issue of horse access to traditional destinations, specifically the Natural Arch off the Sheltowee Trace trail, is treated the same in all action alternatives. Due to resource concerns, there would not be direct equestrian access to the arch in any action alternative. Equestrians interested in this destination would need to use Forest Road 906, where a horse resting area would be constructed. This area would include permanent hitching posts, and could include benches. Access to the arch off FR 906 would then be on foot. Closing this portion of the Sheltowee Trace trail to horse traffic would impact horse users' ability to directly access the natural arch.

In all action alternatives, a new parking area would be constructed on County Road 930, by the start of the horse trail, to accommodate equestrian use of the Murder Branch trails. This lot would be graveled and built to accommodate pull-through traffic for five to eight truck/trailer combinations. Trail maps and signing would also be incorporated at the trailhead. Development of this trailhead across all action alternatives would have a positive impact on equestrian trail access in the project area.

Alternatives 2, 3, and 4 all include mileage for three special use permit horse/hike trails on the western edge of the project area. These trails would accommodate connections from local businesses to the national forest trail system in the project area, and would require the business owners to obtain and/or maintain a special use permit. This would continue to allow connections in the equestrian community beyond the Forest trail network.

Alternative 2

Direct and Indirect Effects on Bike Use

Specific methodology and spatial and temporal context for the analysis can be found in the specialist report of the project file (Morrissey 2013).

One effect on bike use in the project area includes trail access. As shown in Table 45 and Table 46, alternative 2 would provide 50 total miles of trails for bikes, including bike/hike only trails, shared use trails, and roads to complete bike trail loops. This is 67 percent of the total available bike miles existing today. Comparing the amount of available trails without completing road routes, alternative 2 provides 45 miles, or 67 percent of the current trail-only bike miles. Quantitatively, therefore, alternative 2 reduces mountain bikes' access to the Cave Run trail system. Seasonal access for bikes in the project area would not change from the current condition. Bikes would continue to be able to access the Cave Run trail system year round. This would continue to provide an off-season experience for those bikers interested in maintaining a diversity of recreation experience.

Access to specific destinations important to many bikers would also be affected by this alternative. Access to all portions of the Sheltowee Trace National Recreation Trail is important to bike users, to take through

trips. In alternative 2, a portion of Sheltowee Trace would be open to horses only; however, an alternative route would be provided that would facilitate through trips for bikes. In alternative 2, Trail 107 and Trail 118 would be designated shared use in order to connect the northern and southern portions of the Sheltowee Trace for bikes. Using an alternative trail may impact the recreation experience of bikers wishing to ride the actual Sheltowee Trace, although the availability of an alternative route may lessen that impact for some riders.

The quality of a biker's recreation experience would also be affected by the proposed alternative 2. There are several components of this quality, including riding on degraded trails and trails littered with equine feces. Given that these bike quality factors stem from sharing trails with horses, the amount of shared use trails is used here as an indicator of bike trail quality. Alternative 2 provides bikers with 27 miles of bike/hike only trails, and 18 miles of trails that are shared with horses. There would be no new trail construction in alternative 2. Shared use trails therefore comprise 40 percent of the total trail miles available to bikes under this alternative. This should be a positive impact on the quality of the biker's experience when compared to the no action alternative, where bikes share 100 percent of their trails with horses. Trail quality on the 18 miles of trails that remain shared in alternative 2would depend on implementation of trail maintenance and improvement projects. If the degradation on those 18 miles of trail were repaired, and quality trail conditions were maintained through proposed partnerships and other volunteer work, implementation of alternative 2 would have additional positive implications for the mountain bike community.

Direct and Indirect Effects on Horse Use

Alternative 2 would affect trail access for horse use in the project area. As shown in Table 45 and Table 46, alternative 2 would provide a total of 71 miles of horse trails, including horse/hike only routes, shared routes, and roads to complete horse trail loops. This is 95 percent of the total available equestrian miles existing today. Comparing the amount of available trails, without completing road routes, alternative 2 provides 46 miles (18 of which are shared), compared to 67 miles in alternative 1. This gives equestrians access to 69 percent of the trail-only miles currently available to them.

Another way to look at the impact of alternative 2 on equestrian recreationists is to examine the availability of less challenging trails. Many of the trails in the project area are steep, narrow, and switch-backed, making them difficult or impossible for novice riders to use. Forest managers have identified the Caney loop trails, the White Sulphur loop trails, and the connecting trails in between as project area trails that are accessible to the novice equestrian. These trails are used by many women, children, families, and other novice riders, who desire continued access to these "easy" routes. Alternative 2 provides 2.8 miles of trail on the White Sulphur loop, and 3.9 miles of trail on Sheltowee Trace from Stoney Cove to White Sulphur, totaling 6.7 miles of easy trail accessible to equestrians looking for a less challenging trail ride. This compares to 12.4 miles of easy trail currently available.

Alternative 2 would also have an impact on the seasonal availability of equestrian trails. Following trail improvement to meet approved design standards, this alternative would provide a total of 17 miles of all-season horse routes, including trails, trail-completing roads, and special use trails. This seasonal trail closure would mean the trail system, except for these 17 all season miles of horse routes, would be closed to equestrian use from December 15 through May 15 annually. The trails that would be available year-round are primarily located around the Sheltowee Trace and White Sulphur areas. Six of the 17 miles are on trails, nine miles are on roads, and two miles are in special use access trails. Currently, all trails are available to all users year round. This change from the existing condition would have an effect on the availability of equestrians' access to trails in the off-season.

Other Direct and Indirect Effects of Alternative 2

Alternative 2 proposes to continue shared use on some steep and narrow trails. Of the trails listed above, trails 104 and 116 would be open to horse/hike only, but the steeper portions of 112 and 113 would continue to be shared use between equestrians, bikers, and hikers. This would be an improvement over the current situation, but would still allow for potentially dangerous shared uses on some steep trails.

Alternative 3

Direct and Indirect Effects on Bike Use

Alternative 3 would provide a total of 45 miles of bike trails, including roads to complete bike trail loops (Table 45 and Table 46). This is 60 percent of the total available bike miles existing today. Comparing the amount of trail mileage available, without completing road routes, alternative 3 provides 40 miles, or 60 percent of the trail miles currently available. Alternative 3 would also provide three new trailheads for mountain bikers, most of which are designed to facilitate access to proposed new bike trails. Therefore, while alternative 3 quantitatively reduces mountain bikes' access to the Cave Run trail system in terms of miles available, it improves the quality of that access.

Seasonal access for bikes in the project area would not change from the current condition. Bikes would be able to access the Cave Run trail system year round. This would continue to provide an off-season experience for those bikers interested in maintaining a diversity of recreation experience.

In alternative 3, the Sheltowee Trace National Recreation Trail between the Cave Run Lake dam and County Road 1274 to the south would not be available to bikes. Lack of access to the Sheltowee Trace may impact the recreation experience of bikers wishing to ride through the project area.

Alternative 3 provides bikers with all bike/hike only trails, including 18 miles of new bike trail construction. Shared use trails therefore are not a part of the bike experience in this alternative. This should have a highly positive impact on the quality of the biker's experience when compared to the no action alternative, where bikes share 100 percent of their trails with horses. In addition, the development of partnerships with user groups would provide the opportunity for participation in the design, planning, and building of 18 miles of new mountain bike trails, which would be a beneficial effect for mountain bikers.

Therefore, while the quantity of trails may decrease under alternative 3, the quality is expected to increase substantially.

Direct and Indirect Effects on Horse Use

As shown in Table 45 and Table 46, alternative 3 would provide a total of 67 miles of horse trails, including roads to complete horse trail loops. This is 88 percent of the total available equestrian miles existing today. Comparing the number of miles of trails only, without completing road routes, alternative 3 provides 43 miles (only one of which is shared), compared to 67 miles in alternative 1. This gives equestrians access to 64 percent of the trail-only miles currently available to them.

Alternative 3 provides 2.8 miles of trail on the White Sulphur loop, 5.7 miles of trail on the Caney loop trail, and 3.9 miles of trail on Sheltowee Trace from Stoney Cove to White Sulphur, totaling 12.4 miles of trail identified as "easy" for equestrians looking for a less challenging trail ride. This is the same mileage as is currently available.

Alternative 3 would also have an impact on the seasonal availability of equestrian trails. Following trail improvement to meet approved design standards, this alternative would provide a total of 19 miles of all-

season horse routes, including trails, trail-completing roads, and special use trails. This seasonal trail closure would mean the trail system, except for these 19 miles, would be closed to equestrian use from December 15 through May 15 annually. The trails that would be available year-round are primarily located around the Sheltowee Trace and White Sulphur areas. Eight of the 19 miles are on trails (including 2 miles of new-construction trails), nine miles are on roads, and two miles are in special use access trails. This change from the existing condition would affect the availability of equestrians' access to trails in the off-season.

Other Direct and Indirect Effects of Alternative 3

Alternative 3 proposes to eliminate all shared use on steep and narrow trails. Trails 104, 112, and 113 would change to bike/hike only use while 116 would change to horse/hike only use. This would be an improvement over the current situation and would address the safety concerns regarding sharing steep trails.

Alternative 4

Direct and Indirect Effects on Bike Use

As shown in Table 45 and Table 46, alternative 4 would provide a total of 57 miles of bike trails, including roads to complete bike trail loops. This is 75 percent of the total available bike miles existing today. Comparing the amount of available trails, without completing road routes, alternative 4 provides 52 miles, or 77 percent of the trail miles currently available. Alternative 4 would also provide three new trailheads for mountain bikers, most of which are designed to facilitate access to planned new bike trails. Quantitatively, therefore, alternative 4 reduces mountain bikes' access to the Cave Run trail system in terms of miles available, but improves the quality of that access.

Seasonal access for bikes in the project area would not change from the current condition. Bikes would continue to be able to access the Cave Run trail system year round. This would continue to provide an off-season experience for those bikers interested in maintaining a diversity of recreation experience.

In alternative 4, only the northern portion of the Sheltowee Trace National Recreation Trail within the project area would be open to bike use. A through route on Sheltowee Trace would not be available. Lack of access to the Sheltowee Trace may impact the recreation experience of bikers wishing to ride the Sheltowee Trace through the project area.

Alternative 4 provides bikers with 41 miles of bike/hike only trails, and 11 miles of trails that are shared with horses. Those 41 miles of bike only trails include 18 miles of new construction. Shared use trails comprise 26 percent of the total trail miles available to bikes under this alternative. This should be a positive impact on the quality of the biker's experience when compared to the no action alternative, where bikes share 100 percent of their trails with horses. Trail quality on the 11 miles of trail that remain shared in alternative 4 would depend on implementation of trail maintenance and improvement projects. If the degradation on those 11 miles of trail were repaired, and quality trail conditions were maintained through proposed partnerships and other volunteer work, implementation of alternative 4 would have additional positive implications for the mountain bike community. In addition, the development of partnerships with user groups would provide the opportunity for participation in the design, planning, and building of 18 miles of new mountain bike trails, which would be a beneficial effect for mountain bikers.

Therefore, while the quantity of trails may decrease under alternative 4, the quality is expected to increase, creating an overall positive effect on bike use for this alternative.

Direct and Indirect Effects on Horse Use

As shown in Table 45 and Table 46, alternative 4 would provide a total of 70 miles of horse trails, including roads to complete horse trail loops. This is 93 percent of the total available equestrian miles existing today. Comparing the number of miles of trails only, without completing road routes, alternative 4 provides 44 miles (11 of which are shared), compared to 67 miles in alternative 1. This gives equestrians access to 66 percent of the trail-only miles currently available to them.

Alternative 4 provides 2.8 miles of trail on the White Sulphur loop, and 3.9 miles of trail on Sheltowee Trace from Stoney Cove to White Sulphur, totaling 6.7 miles of trail identified as "easy" for equestrians looking for a less challenging trail ride. This compares to 12.4 miles of easy trail currently available.

Alternative 4 would have the same impact on the seasonal availability of equestrian trails as described in alternative 3; providing a total of 19 miles of all-season horse routes, eight miles on trails (including two miles of new-construction trails), nine miles on roads, and two miles in special use access trails. This change from the existing condition would have a negative effect on equestrians' access to trails in the off-season.

Other Direct and Indirect Effects of Alternative 4

This alternative proposes to continue shared use on portions of 104, 112, and 113. Trail 116 would be horse/hike only. This would be an improvement over the current situation, and would allow for a minimal amount of potentially dangerous shared uses on steep trails.

Cumulative Effects of all of the Action Alternatives

The effects of the alternatives on recreation resources could be compounded by actions occurring on regional lands outside the project area. One possibility is the existence of regional horse or bike trails affecting the decrease in horse and bike trail mileage presented by the alternatives. If visitors are displaced from project area trails because there are fewer miles available, or their favorite trails are now closed to their activity, the question becomes how these visitors would be displaced. Displacement can be temporal, where recreationists find another time of day, week, or season to ride, when the remaining trails are less crowded. Displacement can also be spatial, where recreationists find another location for their activity. This is how availability of outside trails could contribute to the effects of the alternatives.

Backcountry trail opportunities for mountain bikers and equestrians are scarce in the region. The Big South Fork National River and Recreation Area, Land Between the Lakes National Recreation Area, and Mammoth Cave National Park are the nearest destination backcountry trails providing equestrians opportunities for long weekend rides without a lot of repeat trail riding. Mountain bike trails offering a backcountry experience are located in Big South Fork National River and Recreation Area, and can be found in Tennessee and west of Louisville in southern Indiana. Multi-use trails are scattered throughout the Daniel Boone National Forest, but there are no other backcountry trails such as are available in the Cave Run area within an approximately 100-mile radius. The lack of regional trail availability could be seen as compounding the loss of trail miles for equestrians and mountain bikers in alternatives 2, 3, and 4.

Economics and Environmental Justice

Affected Environment for Economics and Environmental Justice

Existing Condition

An economics and environmental justice specialist report has been prepared for this proposal and is incorporated into this EA by reference (Eichman 2013). Certain defining features of every area influence

and shape the nature of recreation and economic activity. Among these are population characteristics, the presence of or proximity to large cities or regional population centers, types of longstanding industries such as agriculture and forestry, area racial and cultural characteristics, predominant land and water features, and unique area amenities. The Daniel Boone National Forest operates as a steward of many recreation opportunities and thus plays a principal role in the community. This discussion gives further insight on the extent of these social and economic connections.

Analysis area

The area social and economic characteristics are dependent on the extent of the area examined, thus area information is presented for both a larger regional area and a smaller county level scale. While biking and horseback riding in the project area occurs within just a few counties, examination at a regional level captures spending by recreationists as they travel to participate in these activities (see regional analysis area in Figure 14 below).

Data from the National Visitor Use Monitoring (NVUM) effort indicates that approximately 76 percent of recreation visitors to the Daniel Boone National Forest come from the 85 counties that make up the regional analysis area of Eastern Kentucky depicted below in Figure 14. The project area is predominantly located in Bath, Rowan and Menifee Counties (Figure 14). Thus the Regional Analysis Area and the three-Project Area counties make up the relevant areas for examination of the affected environment and are also used for examination of effects of the alternatives.

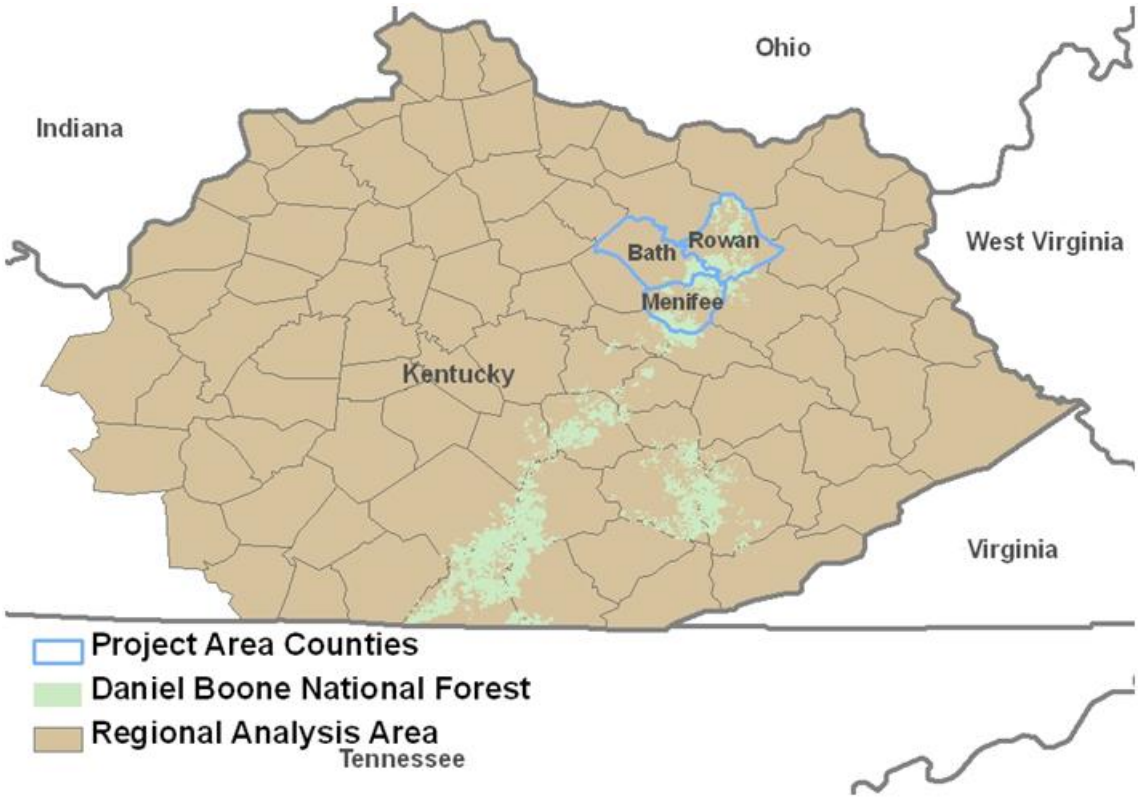

Figure 14. Social and economic analysis area

Demographic Overview

According to the Bureau of Economic Analysis, population growth between 1970 and 2010 in both Menifee and Rowan counties outpaced the state. Menifee County's growth was faster than the nation while Rowan County's growth was slower. In Bath County, population growth was slower than the state and the nation. Over this period Kentucky's population increased by 34 percent while Bath, Menifee and Rowan counties increased by 25, 55 and 37 percent, respectively (Figure 15). The population of the 85 county analysis area was 3.35 million in the year 2010 which made up 77.3 percent of the state's total population (U.S. Department of Commerce 2011).

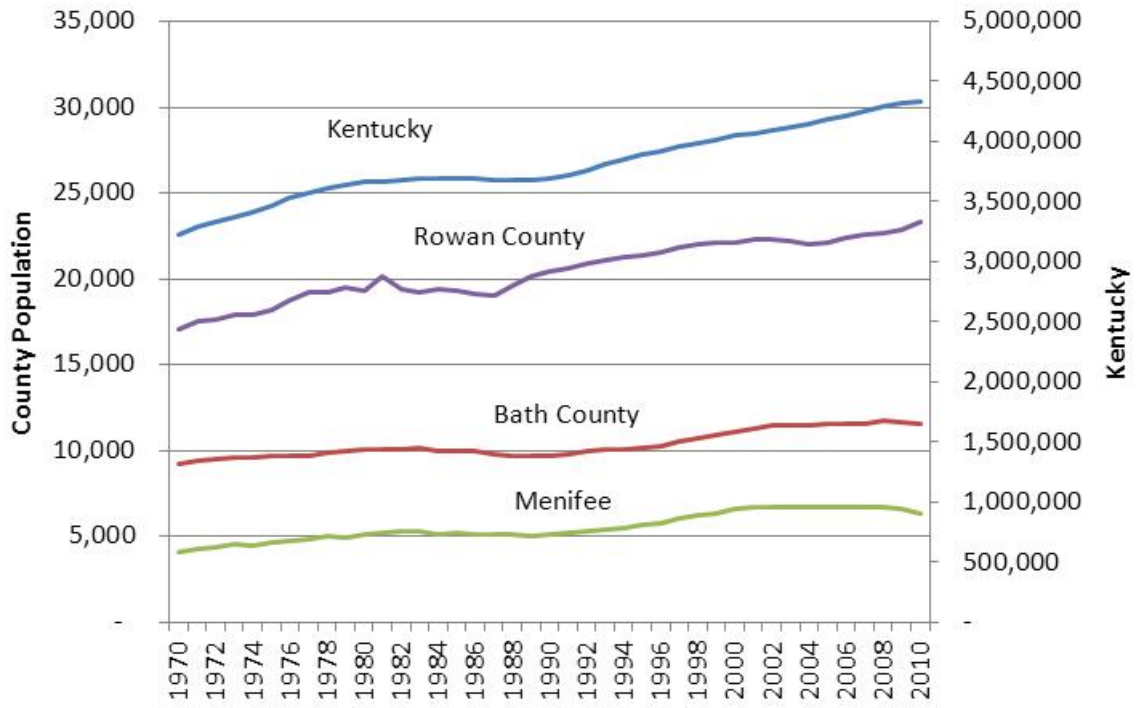

Figure 15. Population change in Kentucky and the three county area (U.S. Department of Commerce 2011)

The population in project area counties has slightly aged since 2000 as the median age in 2010 was 38.4, 31.9 and 43.3 years in Bath, Menifee and Rowan counties respectively, up from 37.4, 29.8 and 36.3 years in 2000 (U.S. Department of Commerce 2012 and U.S Department of Commerce 2000). Estimates from the U.S. Census Bureau for 2010 indicate that many of the analysis area counties contained shares of racial and ethnic groups that exceeded shares in the state (Table 47)[1]. Within project area counties, Bath County contains a slightly greater population share of American Indians than the state. These minority groups are indicated with an asterisk in Table 56 (Appendix G) (U.S. Department of Commerce 2011).

[1] Race and ethnicity are separated since Hispanics can be of any race.

Table 47. Estimated racial and Hispanic composition of 2010 population (U.S. Department of Commerce 2011)

	White Alone	Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race	Two or more races	Hispanic Origin
Kentucky	87.8%	7.8%	0.2%	1.1%	0.1%	1.3%	1.7%	3.1%
Regional Analysis Area	87.3%	8.2%	0.2%	1.2%	0.1%	1.3%	1.7%	3.2%
Bath County	96.4%	1.3%	0.3%	0.1%	0.1%	0.7%	1.1%	1.4%
Menifee County	96.5%	1.8%	0.1%	0.1%	0.0%	0.2%	1.2%	0.8%
Rowan County	96.1%	1.5%	0.1%	0.8%	0.0%	0.4%	1.0%	1.3%

Economic Specialization and Employment

Employment within project area counties and the regional analysis area is distributed amongst industry sectors and displayed below in Figure 16 (IMPLAN 2010). Identification of employment specialization within the project area counties provides a frame of contributions from recreation within the project area. Specialization is examined using the ratio of the percent employment in each industry in the region of interest (project area and the regional analysis area counties) to the percent of employment in that industry for a larger area (Kentucky). For a given industry, when the percent employment in the analysis region is greater than in the larger reference region, local employment specialization exists in that industry (USDA Forest Service 1998). Of particular interest are counties where specialization occurs within industries related to recreation seen in the bottom four categories in Figure 16 (Marcouiller and Xia 2008). While these sectors can be considered related to recreation, not all employment in these sectors can be considered attributable to recreation.

Using this criterion applied with 2010 data, project area counties can be characterized as most specialized with respect to the Government, the Health Care & Social Assistance and the Portion of Passenger Transport related to recreation (shares of total employment in these sectors are respectively, 9.2, 2.5 and 2 percent greater than shares in the state). The regional analysis area can be considered most specialized with respect to the Portion of Passenger Transport, the Professional, Scientific, & Technical Services and the Finance & Insurance sectors (shares of total employment in these sectors are respectively, 1.7, 0.4 and 0.4 percent greater than shares in the state) (IMPLAN 2010). It should be noted that the contributions from recreation on the Forest represent only a portion of the economic activity reflected in industry sectors seen in Figure 16.

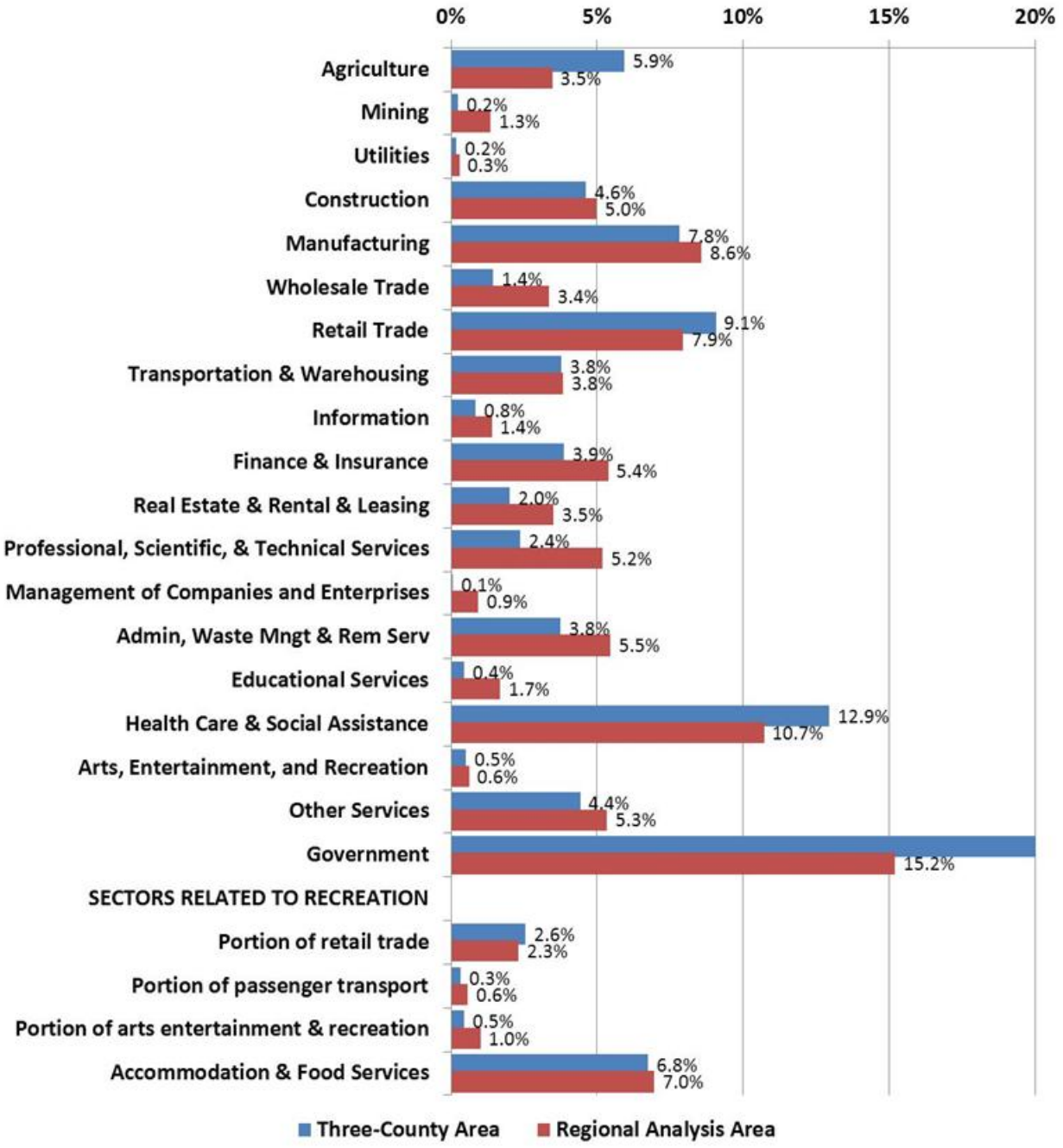

Figure 16. Analysis area employment distribution (IMPLAN 2010)

Over time, economic specialization has changed. The degree of change is reflected in Figure 17 below, where total employment in the project area counties is disaggregated into two broad industry groupings: services and non-services[1]. Services consists of the following sectors: Utilities, Wholesale Trade, Retail

[1] The numbers in Figure 17 are not directly comparable to the IMPLAN numbers in Figure 16 since IMPLAN data include government, farm and proprietor employment in addition to wage and salary employment. The IMPLAN data also includes estimates for non-disclosures that similarly include farm and proprietor employment in addition to wage and salary employment.

Trade, Transportation & Warehousing Information, Finance & Insurance, Real Estate & Rental & Leasing, Professional, Scientific, & Technical., Management of Companies & Enterprises, Administrative & Support Services, Educational Services, Health Care & Social Assistance, Arts, Entertainment, & Recreation, Accommodation & Food Services, and Other Services. Non-Services consists of the following sectors: Mining, Construction, Manufacturing, and Agriculture, Forestry, Fishing, and Hunting (EPS-HDT 2012).

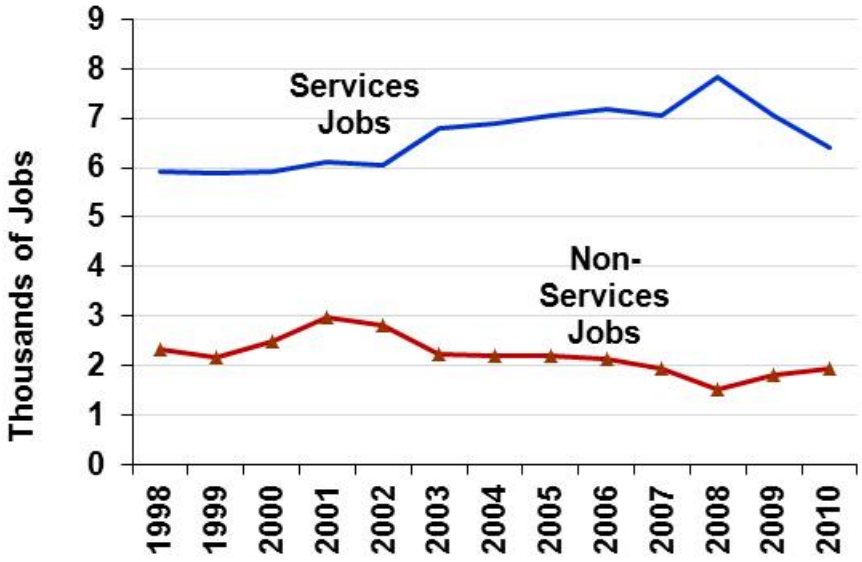

Figure 17. Employment history of analysis area (US Department of Commerce 2012)

From 1998 to 2010, services employment in the project area counties increased by 8 percent (from 5,921 to 6,420 jobs classified as full and part-time employment) while non-services declined by 17 percent (from 2,339 jobs to 1,931). Thus the services sectors have historically been an important part of the area economy. Some of this Service and Professional sector growth can be attributed to the tourism opportunities and quality of life provided by the area's unique natural amenities; some of which can be found on the Daniel Boone National Forest. Population and employment changes are related to natural amenities (Knapp and Graves 1989, Clark and Hunter 1992, Treyz et al. 1993, Mueser and Graves 1995, McGranahan 1999, Lewis et al. 2002) often provided by national forest system lands. Thus the Daniel Boone National Forest provides natural amenities that contribute to portions of area population and employment growth.

Economic Well-Being and Poverty

As noted above, the services sectors have accounted for a larger portion of total employment while non-services have decreased. However, service sector jobs may not pay as much, which could decrease area economic well-being. In 2011 Services and Non-Services sectors paid on average $26,928 and $34,722 per year in the project area counties (U.S. Department of Labor 2012). While apparent that the services sector accounts for an increasing share of total employment, these jobs do not pay as much. Consequently, we cannot say that decreases in economic well-being have resulted from increases in services employment; people might move to the area to take a service sector job but exchange the lower

wage they may receive for the unique natural and recreation amenities provided by the Daniel Boone National Forest. In this manner some may benefit from a "secondary income" not provided by their place of employment but by the benefits they gain from living or recreating in the area.

Total personal income (TPI) and per capita personal income (PCPI) are useful measures of economic well-being. From 1970 to 2010, annual TPI in the planning area increased by $675 million to $1,044 million, and annual PCPI increased from $12,186 to $25,296 (all measures adjusted for inflation to 2010 dollars; U.S. Department of Commerce 2012c).

While PCPI is a useful measure of economic well-being, it should be examined alongside changes in real earnings per job. Since PCPI includes income from 401(k) plans as well as other non-labor income sources like transfer payments, dividends, and rent, it is possible for per capita income to rise, even if the average wage per job declines over time. However, in project area counties, average earnings per job rose from $29,152 to $31,244 over the same period from 1970 to 2010 (values adjusted for inflation to 2010 dollars) indicating a possible increase in area economic well-being (U.S. Department of Commerce 2012c).

Since 1990, the average annual unemployment rate in project area counties has ranged from a low of 4.7 percent in 1998 to a high of 11.7 percent in 1991. In 2009 the average annual rate reached 11.6 percent and has since fallen to 8.7 percent in June of 2012 (U.S. Department of Labor 2012). New jobs created in an area are filled from two principal sources; local unemployment and in-migration. If unemployment remains high, new jobs are likely to be filled by local area residents, however if unemployment is persistently low, new jobs could be filled more often by new area residents.

Estimates from the U.S. Census Bureau for 2010 indicate that all project area counties contained greater shares of their population living below the poverty level than the state and the regional analysis area (Table 48) (U.S. Department of Commerce 2012b).

Table 48. Share of population living below poverty level (U.S. Department of Commerce 2012b)

	Number	Percent
Kentucky	796,208	18.9%
Regional Analysis Area	631,510	19.0%
Bath County	3,191	27.8%
Menifee County	1, 755	28.4%
Rowan County	5,900	28.3%

Components of Personal Income

Further examining trends within personal income provides insight to the area economy and its connection to the lands administered by the Daniel Boone National Forest. There are three major sources of personal income: (1) labor earnings or income from the workplace, (2) investment income, or income received by individuals in the form of rent, dividends, or interest earnings, and (3) transfer payment income or income received as Social Security, retirement and disability income or Medicare and Medicaid payments.

In the project area counties, labor earnings were the largest source of personal income accounting for 54 percent in 2010. The largest component of labor income in project area counties was the government, Health Care & Social Assistance and Retail Trade sectors while in the Regional Analysis Area the largest components were the Manufacturing, Government and Health Care & Social Assistance sectors (IMPLAN 2010).

Labor earning's share of total personal income has decreased from 1970 to 2010 (from 76 to 54 percent), while the share of non-labor income has risen (from 24 to 46 percent). As a share of total personal income, investment income and transfer payments rose from 8 to 11 and 16 to 35 percent, respectively over this 40 year time period (US Department of Commerce 2012d).

These patterns may reflect the aging population noted above, whom are more likely to have investment earnings than younger adults. As the population of the area continues to age, the share of income from these non-labor sources should continue to rise as long as residents continue to stay in the area after retirement or new retirees move in. As noted above, natural amenities on the Daniel Boone National Forest may attract residents that would not otherwise live in the area. Recreationists also spend dollars in the area that would not otherwise be spent if opportunities on national forest system lands did not exist. Rural county population change, the development of rural recreation and retirement-destination areas are all related to natural amenities (McGranahan 1999). Many of the natural amenities in the area are managed by the Daniel Boone National Forest and thus indirectly contribute to area labor and non-labor income.

Area Economic Conditions Related to Trail System Recreation

The 2012 Kentucky Equine Survey (NASS 2012) identified $521.1 million in sales, $491.0 million in income (training, lessons, boarding, farrier, etc.) and total equine-related expenditures by equine operations at $1.2 billion across the Commonwealth of Kentucky. Only a portion of this economic activity can be attributable specifically to trail riding and a smaller portion still can be attributed to horseback riding on the Forest within the project area. Under the analysis of the alternative below, current economic contributions to the regional economy from horseback riders using project area trails are assessed. These contributions make up about half of a tenth of a percent (0.05 percent) of the state-wide equine related income and sales figures above.

These contributions are likely a slight overestimate due to contributions from horseback riding visits to the project area that occur to non-equine related industries. For example, the expenditure profiles used for this analysis include expenditures by visitors on food and lodging which cannot be considered part of the equine industry. However, contributions from horseback riders using project area trails can be assessed relative to those sectors related to recreation (Figure 16) in the regional analysis area. Within the region, horseback riders using project area trails provide 0.004 percent of employment and 0.002 percent of income within sectors related to recreation.

While there are no estimates of sales, income and expenditures for the statewide Kentucky biking industry like those provided above, the economic contribution analysis below provides perspective on the importance of biking within the regional analysis area. Within the region, bikers using project area trails provide 0.004 percent of employment and 0.002 percent of income within sectors related to recreation.

While these numbers are small relative to industry numbers at a state and regional level, the contributions from both bikers and horseback riders using project area trails are more important within project area counties (Bath, Rowan and Menifee counties); each providing 0.4 percent of employment and 0.5 percent of income within sectors related to recreation (Figure 16) within project area counties.

More detail on this analysis, such as estimates of biking and horseback riding visitors within the project area, modeling and expenditures profile used in the model, can be found in the specialist report for economics and environmental justice contained in the project record.

Environmental Justice

Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures and incomes with respect to the development, implementation and enforcement of environmental laws, regulations, programs, and policies. Executive Order 12898 requires Federal agencies to "identify and address the… disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

According to the Council on Environmental Quality's (CEQ) Environmental Justice Guidelines for NEPA (1997) "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." Table 47 shows that shares of several minority populations exceeded their state shares in 2010 (U.S. Department of Commerce 2011). Thus, the US Census data suggest minority populations in the analysis area could meet the CEQ's Environmental Justice criterion.

CEQ guidance on identifying low-income populations states "agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect." Table 48 and Table 56 show that the shares of those living below the poverty level were above the state level in 2010 (U.S. Department of Commerce 2012b).

Environmental Consequences for Economics and Environmental Justice

Employment & Labor Income Impacts

Economic impacts in terms of employment and labor income are used to evaluate potential direct, indirect, and cumulative effects on the analysis area economy. Economic impacts are estimated using input-output analysis, which is further described in the Economics and Environmental Justice Specialist Report in the project record.

The discussion of potential jobs and income impacts should occur alongside consideration of non-market values. Changes in recreation use in the project area may affect employment and income in the area, however, if demand exists for these opportunities, employment and income would likely be supported in other areas if these opportunities are provided by other substitute areas. Therefore it is important to consider employment and labor income impacts alongside additional social, ecological or other non-market values in order to provide a complete comparison of the alternatives. These impacts are described in other resource sections of the EA and specialist reports. For example, the recreation section discusses changes in the quality of experience for bikers and horseback riders under the alternatives.

Incomplete and Unavailable Information

Insufficient information exists to project changes in biking and horseback riding use that may result following implementation of the proposed action or alternatives analyzed in this report. Such predictions would be highly speculative and would likely be minimized by regional and national population and recreation trends. Demand for substitute experiences on other public and private lands may also change, however, insufficient information is available to be able to estimate the nature or magnitude of such shifts. Estimated economic contributions are calculated for existing use levels under the no-action alternative. The analysis of the impacts of the remaining alternatives will focus on changes in opportunities and the potential direction of change from the no-action alternative, but not the size of economic impacts relative to these changes.

Alternative 1

Alternative 1 proposes to continue to use the existing nonmotorized trail system, without any new trail construction or change in trail usage. All trails will continue to be shared. The No Action alternative is presented here as a baseline for comparing the action alternatives.

Trail System Recreation

Visitors spend money in the analysis area economy on their way to participate in trail related recreation. The Daniel Boone National Forest receives 1.1 million visits each year. Trail system uses include horseback riding and biking. Biking visitation ranges from less than one percent to two percent of total forest visitation, based on whether visitors reported that biking was their main reason for their visit or it was an activity they selected amongst others they engaged in while visiting the forest. Similarly, horseback riding visitation ranged from less than one percent to two percent (USDA Forest Service 2009). Levels of visitation within the project area likely make up only a portion of recreation visitation on the forest. However, site specific visitation levels are uncertain and may vary from year to year. According to forest staff, as much as 50 percent of horseback riding and biking on the forest occurs in the project area (10,912 horseback riding and biking visits).

While different user groups may spend their money differently, analyses of the expenditures reported by national forest visitors indicate the primary factor determining the amount spent by a visitor was the type of trip taken, not the specific activity or national forest visited (Stynes and White 2005). National Visitor Use Monitoring data sample sizes were too small at the individual Forest level to reliably portray visitor spending profiles for activity types on individual Forests (Stynes and White 2006). Therefore, this analysis characterizes spending by user groups for distinct types of trips. Total visitation for activity types were combined with these segment shares to portray economic effects of horseback riding and biking within the project area. Economic effects within project area counties and the regional analysis area by visitor segment are provided in Table 56 and Table 57 of Appendix G. Effects for project area counties and the regional analysis area for all segment shares are displayed below in Table 49 and Table 50.

Table 49. Employment and labor income effects within project area counties

		Employment			Labor Income		
		(Full and part time jobs)			(2012 Dollars)		
		Direct Effects	Indirect and Induced Effects	Total	Direct Effects	Indirect and Induced Effects	Total
Horseback riding	Total Non-Local	3.3	0.7	4.0	$67,033	$18,818	$85,850
	Total Local	2.0	0.4	2.4	$39,745	$11,471	$51,216
	Total	5.4	1.1	6.4	$106,778	$30,289	$137,066
Biking	Total Non-Local	3.3	0.7	4.0	$67,033	$18,818	$85,850
	Total Local	2.0	0.4	2.4	$39,745	$11,471	$51,216
	Total	5.4	1.1	6.4	$106,778	$30,289	$137,066

Table 50. Employment and labor income effects within the regional analysis area

		Employment			Labor Income		
		(Full and part time jobs)			(2012 Dollars)		
		Direct Effects	Indirect and Induced Effects	Total	Direct Effects	Indirect and Induced Effects	Total
Horseback riding	Total Non-Local	3.8	1.5	5.3	$102,542	$60,868	$163,410
	Total Local	2.2	0.9	3.1	$61,753	$37,396	$99,150
	Total	6.0	2.5	8.4	$164,295	$98,264	$262,560
Biking	Total Non-Local	3.8	1.5	5.3	$102,542	$60,868	$163,410
	Total Local	2.2	0.9	3.1	$61,753	$37,396	$99,150
	Total	6.0	2.5	8.4	$164,295	$98,264	$262,560

Within both the project area and the regional analysis area, non-local visitation resulted in greater effects to employment and income than effects from local visitation due to patterns of spending unique to these visitors. As discussed above, the amount spent by a visitor has to do more with the type of trip taken and not the specific activity (Stynes and White 2006).

These effects are also dependent on an economic structure that is a snapshot in time and, therefore, is not applicable to visitation numbers that are dramatically different from current recreation levels. If recreational activities and/or visits were to change radically, there would be a structural shift in the economy as spending patterns changed and these estimates would no longer reflect effects of current visitation.

The recreation section notes that trail system management under this alternative creates an overall negative effect on bike use and will likely have an overall positive impact on horse riding recreation. Consequently effects depicted in Table 49 and Table 50 associated with horseback riding would be maintained and perhaps increase while effects associated with biking would decrease.

As a result of this alternative, decreases in employment and income effects are possible for the recreation related economies of the analysis areas; however, these decreases would be small. As shown in Figure 16, the project area and the regional analysis area are dependent on recreation related sectors for 10 and 11 percent of employment. Within both analysis areas (project area and regional area) the economic effects of visit estimates (for both biking and horseback riding summed) constitute less than a tenth of one percent of employment in recreation related sectors.

Environmental Justice

While minority and low-income populations may exist in the area, alternative 1 is not expected to have a disproportionately high and adverse human health or environmental effects on these communities. Impacts to local communities are expected to be negligible, and there is no reason to suspect that any impacts would disproportionately affect minority and low income populations. In addition, impacts to subsistence uses are not anticipated under this alternative.

Alternatives 2, 3, and 4

Specific methodology and spatial and temporal context for the analysis can be found in the specialist report of the project file (Eichman 2013).

Trail System Recreation

Under all of the action alternatives, the recreation section notes that while the quantity of trails may decrease, the quality is expected to increase, creating an overall positive effect on bike use. This is especially notable for alternative 3, where there would be no shared bike and horse trails. Consequently effects depicted in Table 49 and Table 50 associated with biking would perhaps increase.

The recreation section notes that the decrease in available horse trails under the action alternatives could impact equestrian visitation in one of several ways:

- Could lead to a minor decrease in equestrian visitors to the project area.
- Could have little to no impact on equestrian visitation (if equestrians crowd onto remaining trails), as there are limited equestrian trail opportunities in the region outside the project area.

Consequently, for alternatives 2, 3, and 4, effects depicted in Table 49 and Table 50 associated with horseback riding would be maintained (if equestrians crowd onto remaining trails) or perhaps slightly decrease. As noted under alternative 1 above, effects of current use constitute less than a tenth of one percent of employment in recreation related sectors. As a result, small decreases in horseback riding use would have small economic effects on the project area and regional analysis area.

Environmental Justice

While minority and low-income populations may exist in the area, the action alternatives are not expected to have a disproportionately high and adverse human health or environmental effects on these communities. Impacts to local communities are expected to be negligible, and there is no reason to suspect that any impacts would disproportionately affect minority and low income populations. In addition, impacts to subsistence uses are not anticipated under this alternative.

Cumulative Effects to Economics and Environmental Justice

The effects of the alternatives on the economies of the project area and the regional analysis area could accrue alongside impacts associated with other projects occurring in the area. Insufficient information exists to project changes in biking and horseback riding use that may result following implementation of the proposed action or alternatives analyzed in this report. Such predictions would be highly speculative and would likely be minimized by regional and national population and recreation trends. The economy can be affected by a variety of factors including population growth, changes in interest rates, recession, growth of new sectors, tax policy, state economic policy, etc. When compared to these factors, the alternatives have a negligible cumulative effect on the project area economy and larger regional analysis area economy. Because any changes in economic activity from the proposed action would be unnoticeable at these levels, there would be no cumulative economic effects.

Demand for substitute experiences on other public and private lands may also change, however, insufficient information is available to be able to estimate the nature or magnitude of such shifts. As noted in the recreation section, there are no substitute destinations within an approximate 100-mile radius for horseback riders. Consequently, if horseback riders do not crowd onto remaining trails, a loss of spending would occur since their recreation associated expenditure would no longer remain in the boundaries of the analysis areas. As noted under alternative 1 above, effects of current use constitute less than a tenth of one percent of employment in recreation related sectors. As a result, small decreases in horseback riding use would have small economic effects on the project area and regional analysis area. When compared to the sources of cumulative economic effects noted above (population growth, changes in interest rates, recession, growth of new sectors, tax policy, state economic policy, etc.), the alternatives have a negligible cumulative effect. Because any changes in economic activity from the proposed action would be unnoticeable at these levels, there would be no cumulative economic effects.

Agencies and Persons Consulted

In addition to more than 300 individuals, the Forest Service consulted the following interest groups, Federal, State, tribal, and local agencies during the development of this environmental assessment.

Absentee Shawnee Tribe of Indians of Oklahoma
Appalachian Science in the Public Interest
Army Corps of Engineers
Bath County 4-H
Bath County Judge/Executive
Bath County News
Back Country Horsemen of America
Ben's Cave Run Riding
Berea College
Big South Fork National River and Recreation Area
Bluegrass Area Development District
BlueGrass Miniature Horse Association
Bluegrass PRIDE
Boone Karst Conservation Task Force
Capital City Museum
Cave Run Stables
Cherokee Nation
Cornett & Associates
Cumberland Valley Area Development District
Daniel Boone Forest Alliance
Daniel Boone Trailblazers
Department of Forestry - College of Agriculture
East Kentucky Pride
Eastern Band of Cherokee Indians
Eastern Kentucky ATV Association
Eastern Shawnee
Environmental Quality Commission
F&W Forestry Services Inc.
Frenchburg Job Corps Center
Gateway Area Development District
Hardwood Federation
Heartwood Forest Watch Coorindator
International Mountain Bicycling Association
Kentucky Adventure Tourism
Kentucky Back Country Horsemen
Kentuckians for the Commonwealth
Kentucky Conservation Committee
Kentucky Department of Fish and Wildlife Resources
Kentucky Department of Fish & Wildlife, Northeast Fishery District
Kentucky Department of Parks
Kentucky Department of Tourism
Kentucky Division of Forestry
Kentucky Division of Water
Kentucky Farm Bureau
Kentucky Farm Service Agency
Kentucky Forest Health Task Force
Kentucky Forest Industries Association
Kentucky Heartwood
Kentucky Heritage Council
Kentucky Horse Council
Kentucky Mountain Bike Association
Kentucky Natural Resource Conservation Service
Kentucky Resources Council
Kentucky River Area Development District
Kentucky State Historic Preservation Officer
Kentucky State Nature Preserves Commission
Kentucky Trails Association
Kentucky Trails Council
Kentucky Transportation Cabinet
Kentucky Waterways Alliance
Kentucky Woodland Owners Association
K-T Riders
Lake Cumberland Area Development District
League of Kentucky Sportsmen
London State Office Building
Magistrate Means Precinct
Mammoth Cave National Park
Menifee County Judge/Executive
Menifee Trail Riders
Morehead State University
Morgan County Judge/Executive
National Wild Turkey Federation – Kentucky State Chapter
Nature Conservancy
Northern Kentucky Horse Network
Office of the Governor
Ohio Valley Trailriders
Pikeville College, School of Criminal Justice and Sociology
Pine Knot Job Corps Center
Powell County Judge's Office
Red River Gorge Climbers Coalition
Rocky Mountain Elk Foundation
Rowan County Judge/Executive
Ruffed Grouse Society
SEKTDA
Senator Mitch McConnell's Office
Shawnee Tribe
Sheltowee Trace Association

Sierra Club – Bluegrass Group
Sierra Club - Cumberland Chapter
Society of American Foresters – East Kentucky Chapter
Sustainable Morehead
Trout Unlimited
Trust for Public Lands Chesapeake & Central Appalachians Field Office
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Appendix A: FSH 2309.18 – Trails Management Handbook, Chapter 20

23.12 - Pack and Saddle Design Parameters

Application considerations for Pack and Saddle Design Parameters:

1. Trails with a Designed Use of Pack and Saddle are designed and maintained to accommodate a wide variety of pack and saddle animals, including horses, mules, donkeys, and burros. Some of these trails are simple day-use bridle paths, and others are built to accommodate long strings of pack animals on journeys lasting many days. The combination of shorter and longer trails affords opportunities for natural experiences with the greatest range in user ability and knowledge.
2. When locating trails with a Designed Use of Pack and Saddle, give special consideration to the care and safety of livestock and riders. If practical, provide reasonable access to streams or lakes for stock watering at intervals of no more than 10 miles. To the extent practicable, notify equestrians if intervals between water sources are excessive. Avoid locations near campgrounds or other areas of concentrated use, where dogs or loud noises could startle pack and saddle animals. If the trail must cross highways or railroads, select sites with adequate visibility at the crossing point.
3. Consider the use of climbing turns if the terrain permits, incorporating a curve radius of 4 feet or greater, depending on the Trail Class and site-specific conditions. Design switchbacks with a curve radius as long as possible and a radius of 5 feet or greater, depending on the Trail Class and site-specific conditions. To discourage shortcutting between switchbacks by trail users, design grades of at least 10 to 15 percent for a distance of 100 feet leading to and from switchbacks. Consider using a rock or log barrier for a distance of 15 to 30 feet from the turning point.
4. Clearing needs for trails with a Designed Use of Pack and Saddle may vary depending on whether the trails are designed for day rides or pack animals.
5. Additional widening is needed to accommodate pack clearance on trails cut through solid rock on steep side hills. Along a precipice or other hazardous area, the trail base should be at least 48 to 60 inches wide to be safe for both animals and riders.
6. Pack and saddle animals can cause severe wear and tear on trail tread, especially when soils are wet. When possible, locate trails on stable soil types or on side slopes, where water is drained away. Gravel surfacing, turnpike, or puncheons may be needed on wet sections.
7. Fords are preferred over bridges for stream crossings, provided the velocity and depth of the water are acceptable for fording during the normal season of use. Generally, streams can be forded safely if they are less than 24 inches deep and the current is moderate. Where feasible, route trails to natural fords, rather than building fords.
8. Construction of a ford requires widening the trail base to at least 36 inches, removing large rocks, and flattening the stream bottom to make a relatively smooth and level crossing. If necessary to make the ford viable, widen the streambed to reduce depth and velocity. Ice buildup during late fall may be an important factor to consider in determining whether to construct a ford.
9. If a decision is made to build a bridge for pack and saddle animals, select a site with an adequate foundation for abutments and stream piers. The bridge must have a load-carrying capacity equal to the weight of the maximum number of loaded animals that can occupy the bridge at one time or the maximum anticipated snow load, whichever is greater. Design railings to prevent packs

from getting caught. For minimum bridge widths and railing heights, see FSH 7709.56b, section 7.69, exhibit 01, Trail Bridge Design Criteria.

Design parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of national forest system trails, based on their designed use and trail class and consistent with their management intent[1]. Local deviations from any design parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable trail class.

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

Table 51. Pack and saddle trail design parameters by trail class

Designed Use Pack and Saddle		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	Wilderness (Single Lane)	Typically not designed or actively managed for equestrians, although use may be allowed	12” – 18” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	18” – 24” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	24” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	Typically not designed or actively managed for equestrians, although use may be allowed
	Non-Wilderness (Single Lane)		12” – 24” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	18” – 48” 48” – 60” or greater along precipices	24” – 96” 48” – 60” or greater along precipices	
	Non-Wilderness (Double Lane)		60”	60” – 84”	84” – 120”	
	Structures (Minimum Width)		Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	
Design Surface[a]	Type		Native, with limited grading May be frequently rough	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough	Native, with improved sections of borrow or imported material and routine grading Minor roughness	
			≤ 6” May be common and continuous	≤ 3” May be common, not continuous	≤ 3” Uncommon, not continuous	
	Obstacles (Maximum Height)		12”	6”	3”	

Designed Use Pack and Saddle		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade[a]	Target Grade		5% – 20%	3% – 12%	2% – 10%	
	Short Pitch Maximum		30%	20%	15%	
	Maximum Pitch Density		15% – 20% of trail	5% – 15% of trail	5% – 10% of trail	
Design Cross Slope	Target Cross Slope		5% – 10%	3% – 5%	0% – 5%	
	Maximum Cross Slope		10%	8%	5%	
Design Clearing	Height		8’ – 10’	10’	10’ – 12’	
	Width		72” Some light vegetation may encroach into clearing area	72” – 96”	96”	
	Shoulder Clearance		6” – 12” Pack clearance: 36” x 36”	12” – 18” Pack clearance: 36” x 36”	12” – 18” Pack clearance: 36” x 36”	
Design Turn	Radius		4’ – 5’	5’ – 8’	6’ – 10’	

a - The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Appendix B: Recommended Alterations to Pack and Saddle Trail Design Parameters for Cave Run Lake Trails

Table 52. Recommendations for pack and saddle trail class 3 and 4

	National Trail Class 3	Recommended Cave Run Trail Class 3	National Trail Class 4	Recommended Cave Run Trail Class 4T
Tread Width	18 – 48”	48 – 60” (48” tread necessary for trails on steeper side slopes; 60” on steep hill slopes greater than 70%	24 – 96”	60 – 72 (Never on steeper hill slopes for safety, 72” and contained at water xings and within 200’ of rest areas.
Structure Width	60” (bridge no rails) 84” (bridge w rails) 36” (non-bridge structures)	60” (no need for rails for other users safety) 36” (structures such as turnpiking)	Same as National Trail Class 3	Same as Recommended Cave Run Trail Class 3
Surface Type	Native, some borrow, intermittent rough	Native, some borrow, intermittent rough	Native, improved, minor rough	Native, improved at all drainage xings and wherever necessary for a solid tread; minor rough
Protrusion Type	Less than 3”	Less than 3”	Less than 3”	Less than 3”
Obstacle Type	Less than 6”	Less than 6”	Less than 3”	Less than 3”
Target Grade	3 – 12%	3 – 7%	2 – 10%	2 – 5%
Maximum Grade	20%	10%	15%	7%
Percent Maximum Grade	5 – 15%	5%	5 – 10%	5%
Target Cross-Slope	3 – 5%	5%	0 – 5%	5%
Maximum Cross-Slope	8%	10 – 15% (at all rolling grade dips, knicks, and stormwater xings)	5%	10 – 15% (at all rolling grade dips, knicks, and stormwater xings)
Clearing Height	10 feet	10 feet	10 – 12 feet	12 feet
Clearing Width	72 - 96”	72 – 84”	72”	72 - 96”
Clearing Shoulder	12 - 18”	12 - 18”	12 - 18”	12 - 18”
Clearing Turn Radius	5 - 8 feet	8 – 10 feet	6 – 10 feet	8 – 10 feet

Appendix C: FSH 2309.18 – Trails Management Handbook, Chapter 20

23.13 - Bicycle Design Parameters

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of national forest system trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Table 53. Bicycle design parameters by trail class

Designed use Bicycle		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	Single Lane	6” – 12”	12” – 24”	18” – 36”	24” – 48”	36” – 60”
	Double Lane	36” – 48”	36” – 48”	36” – 48”	48” – 84”	72” – 120”
	Structures (Minimum Width)	18”	18”	36”	48”	60”
Design Surface[a]	Type	Native, ungraded May be continuously rough Sections of soft or unstable tread on grades < 5% may be common and continuous	Native, with limited grading May be continuously rough Sections of soft or unstable tread on grades < 5% may be common	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough Sections of soft or unstable tread on grades < 5% may be present, but not common	Native, with improved sections of borrow or imported materials and routine grading Stable, with minor roughness	Likely imported material and routine grading Uniform, firm, and stable
	Protrusions	≤ 24” Likely common and continuous	≤ 6” May be common and continuous	≤ 3” May be common, but not continuous	≤ 3” Uncommon and not continuous	No protrusions
	Obstacles (Maximum Height)	24”	12”	10”	8”	No obstacles

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

Designed use Bicycle		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade[a]	Target Grade	5% – 20%	5% – 12%	3% – 10%	2% – 8%	2% – 5%
	Short Pitch Maximum	30% 50% on downhill segments only	25% 35% on downhill segments only	15%	10%	8%
	Maximum Pitch Density	20% – 30% of trail	10% – 30% of trail	10% – 20% of trail	5% – 10% of trail	0% – 5% of trail
Design Cross Slope	Target Cross Slope	5% – 10%	5% – 8%	3% – 8%	3% – 5%	2% – 3%
	Maximum Cross Slope	10%	10%	8%	5%	5%
Design Clearing	Height	6’	6’ – 8’	8’	8’ - 9’	8’ - 9’
	Width	24” – 36” Some vegetation may encroach into clearing area	36” – 48” Some light vegetation may encroach into clearing area	60” – 72”	72” – 96”	72” – 96”
	Shoulder Clearance	0’ – 12”	6” – 12”	6” – 12”	6” – 18”	12” – 18”
Design Turn	Radius	2’ – 3’	3’ – 6’	4’ – 8’	8’ – 10’	8’ - 12’

a - The determination of the trail-specific Design grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Appendix D: FSH 2309.18 – Trails Management Handbook, Chapter 20

23.11 – Hiker/Pedestrian Design Parameters

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of national forest system trails, based on their Designed Use and Trail Class and consistent with their management intent[8]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Table 54. Hiker and pedestrian design parameters by trail class

Designed Use Hiker/Pedestrian		Trail Class 1	Trail Class 2	Trail Class 3[a]	Trail Class 4[a]	Trail Class 5[a]
Design Tread Width	Wilderness (Single Lane)	0” – 12”	6” – 18”	12” – 24” Exception: may be 36” – 48” at steep side slopes	18” – 24” Exception: may be 36” – 48” at steep side slopes	Not applicable
	Non-Wilderness (Single Lane)	0” – 12”	6” – 18”	18” – 36”	24” – 60”	36” – 72”
	Non-Wilderness (Double Lane)	36”	36”	36” – 60”	48” – 72”	72” – 120”
	Structures (Minimum Width)	18”	18”	18”	36”	36”
Design Surface[b]	Type	Native, ungraded May be continuously rough	Native, limited grading May be continuously rough	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough	Native with improved sections of borrow or imported material, and routine grading Minor roughness	Likely imported material, and routine grading Uniform, firm, and stable
	Protrusions	≤ 24” Likely common and continuous	≤ 6” May be common and continuous	≤ 3” May be common, not continuous	≤ 3 ” Uncommon, not continuous	No protrusions
	Obstacles (Maximum Height)	24”	14”	10”	8”	No obstacles

[8] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

Designed Use Hiker/Pedestrian		Trail Class 1	Trail Class 2	Trail Class 3[a]	Trail Class 4[a]	Trail Class 5[a]
Design Grade [b]	Target Grade	5% – 25%	5% – 18%	3% – 12%	2% – 10%	2% – 5%
	Short Pitch Maximum	40%	35%	25%	15%	5% FSTAG: 5% – 12%2
	Maximum Pitch Density	20% – 40% of trail	20% – 30% of trail	10% – 20% of trail	5% – 20% of trail	0% – 5% of trail
Design Cross Slope	Target Cross Slope	Natural side slope	5% – 20%	5% – 10%	3% – 7%	2% – 3% (or crowned)
	Maximum Cross Slope	Natural side slope	25%	15%	10%	3%
Design Clearing	Height	6’	6’ – 7’	7’ – 8’	8’ – 10’	8’ – 10’
	Width	≥ 24” Some vegetation may encroach into clearing area	24” – 48” Some light vegetation may encroach into clearing area	36” – 60”	48” – 72”	60” – 72”
	Shoulder Clearance	3” – 6”	6” – 12”	12” – 18”	12” – 18”	12” – 24”
Design Turn	Radius	No minimum	2’ – 3’	3’ – 6’	4’ – 8’	6’ – 8’

a - Trail Classes 3, 4, and 5, in particular, have the potential to be accessible. If assessing or designing trails for accessibility, refer to the Forest Service Trail Accessibility Guidelines (FSTAG) for more specific technical provisions and tolerances (FSM 2350).
b - The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Appendix E: Maps[9]

Map 1. Alternative 2 proposed all-season nonmotorized trails

Map 2. Alternatives 3 and 4 proposed all-season nonmotorized trails

Map 3. Proposed cross-country horse travel closures

Map 4. Alternative 1

Map 5. Alternative 2

Map 6. Alternative 3

Map 7. Alternative 4

Map 8. Project area management prescription areas

[9] Due to their size, these maps are available as part of the EA package electronically. If you would like to review a hard copy of any of these maps, please contact the Daniel Boone National Forest Supervisor's office.

Appendix F: Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Table 55. Past, present, and future activities relevant to cumulative effects analysis for the Cave Run Non-motorized Trails Project

Activity	Timing	Location	Action Effect
Roadside salvage FR 1009	Past	N of I-64, south of Triplett Creek	Soil and vegetation disturbance
Roadside salvage FR 1008A	Past	N of I-64, south of Triplett Creek	Soil and vegetation disturbance
Roadside salvage FR 1008	Past	N of I-64, south of Triplett Creek	Soil and vegetation disturbance
Roadside salvage FR 977	Past	Between I-64 and Perry Branch	Soil and vegetation disturbance
Roadside salvage FR 977H	Past	Between Big Perry Road (977) and I-64	Soil and vegetation disturbance
Roadside salvage FR 977i	Past	Between Big Perry Road (977) and Perry Branch	Soil and vegetation disturbance
Roadside salvage FR 977Ia	Past	Between Big Perry Road (977) and Perry Branch	Soil and vegetation disturbance
Roadside salvage FR 977Ib	Past	Between Big Perry Road (977) and Perry Branch	Soil and vegetation disturbance
Roadside salvage FR 977K	Past	Between Big Perry Road (977) and I-64	Soil and vegetation disturbance
Roadside salvage FR 12A	Past	Just east of Morehead and Clearfield	Over 1 mile from trail system
Roadside salvage FR 12	Past	Just east of Morehead and Clearfield	Over 1 mile from trail system
Roadside salvage FR 12B	Past	Just east of Morehead and Clearfield	Over 1 mile from trail system
Clack Mountain Sale Unit 1	Past	Just east of Morehead and Clearfield	Over 1 mile from trail system
Clack Mountain Sale Unit 5	Past	Between Lockegee Rock and Clack Mountain	Soil disturbance and vegetation disruption
Clack Mountain Sale Unit 3	Past	Between Lockegee Rock and Clack Mountain	Over 1 mile from trail system, but close on road adjacent to other units within one mile
Clack Mountain Sale Unit 4	Past	Between Lockegee Rock and Clack Mountain	Soil and vegetation disturbance
Roadside salvage FR 16	Past	Between Scott Creek and Ramey Creek	Soil and vegetation disturbance
Roadside Salvage FR 1094	Past	Between Scott Creek and Ramey Creek	Soil and vegetation disturbance
Roadside Salvage FR 1095	Past	Between Scott Creek and Ramey Creek	Soil and vegetation disturbance
Roadside Salvage FR 1092	Past	Between Scott Creek and Ramey Creek	Soil and vegetation disturbance
Clack Mountain Sale Unit 2	Past	East of Clack Mountain, head of Nichols Branch	Over 1 mile from trail system

Activity	Timing	Location	Action Effect
Roadside Salvage FR 1225	Immediate Future	West of Cave Run Lake, Big Cave Run	Soil and vegetation disturbance
Roadside Salvage FR 1225B	Past	West of Cave Run Lake, Big Cave Run	Soil and vegetation disturbance
Roadside Salvage FR 918	Past	West of Cave Run Lake	Soil and vegetation disturbance
Roadside Salvage FR 1056	Past	West of Cave Run Lake, Buck Creek	Soil and vegetation disturbance
Roadside Salvage FR 914	Past	West of Cave Run Lake, Gladie Branch	Soil and vegetation disturbance
Midstory Unit 1085-5	Past	Chestnut Cliffs at Natural Arch	Soil and vegetation disturbance
Midstory Unit 1081-4	Immediate past/ongoing	Just north of Buck Creek at Cave Run Lake	Soil and vegetation disturbance
Midstory Unit 1084-10	Immediate past/ongoing	Just north of Buck Creek at Cave Run Lake	Soil and vegetation disturbance
Midstory Unit 1084-11	Immediate past/ongoing	Just north of Buck Creek at Cave Run Lake	Soil and vegetation disturbance
Midstory Unit 1084-28	Immediate past/ongoing	Just south of Buck Creek at Cave Run Lake	Soil and vegetation disturbance
Midstory Unit 1084-31	Immediate past/ongoing	Just south of Buck Creek at Cave Run Lake	Soil and vegetation disturbance
Midstory Unit 1084-36	Immediate past/ongoing	Just south of Buck Creek at Cave Run Lake	Over 1 mile from trail system, but close on road adjacent to other units within one mile
Midstory Unit 1087-35	Immediate past/ongoing	Just west of Clear Creek Campground on Stone Quarry Branch	Soil and vegetation disturbance
Midstory Unit 1087-34	Immediate past/ongoing	Just west of Clear Creek Campground on Stone Quarry Branch	Soil and vegetation disturbance
Midstory Unit 1087-22	Immediate past/ongoing	Just west of Clear Creek Campground on Stone Quarry Branch	Soil and vegetation disturbance
Midstory Unit 1075-30	Immediate past/ongoing	Just north of White Sulphur road	Soil and vegetation disturbance
Midstory Unit 1080-17	Immediate past/ongoing	Immediately south of Cedar Cliffs and FS road 918	Soil and vegetation disturbance
Midstory Unit 1080-18	Immediate past/ongoing	Immediately south of Cedar Cliffs and FS road 918	Soil and vegetation disturbance
Midstory Unit 1078-27	Immediate past/ongoing	West of Cave Run Lake, head of Dry Cave Run	Soil and vegetation disturbance
Midstory Unit 1078-45	Immediate past/ongoing	West of Cave Run Lake, between Dry Cave and Peter Cave Runs	Soil and vegetation disturbance
Midstory Unit 1077-15	Immediate past/ongoing	West of Cave Run Lake, between FS roads 1225 and 1255B	Soil and vegetation disturbance
Midstory Unit 1083-12	Immediate past/ongoing	End of 918 just before Zilpo campground	Soil and vegetation disturbance
Midstory Unit 1083-13	Immediate past/ongoing	End of 918 just before Zilpo campground	Soil and vegetation disturbance

Activity	Timing	Location	Action Effect
Midstory Unit 1083-18	Immediate past/ongoing	End of 918 just before Zilpo campground	Soil and vegetation disturbance
Midstory Unit 1083-24	Immediate past/ongoing	End of 918 just before Zilpo campground	Soil and vegetation disturbance
Midstory Unit 1073-45	Immediate past/ongoing	West of Cave Run Lake, south of Caney Creek	Soil and vegetation disturbance
Midstory Unit 1082-1	Immediate past/ongoing	West of Cave Run Lake, just east of Little Cave Run	Soil and vegetation disturbance
Midstory Unit 1082-3	Immediate past/ongoing	West of Cave Run Lake, just east of Little Cave Run	Soil and vegetation disturbance
Midstory Unit 1084-42	Immediate past/ongoing	Just west of Cave Run Lake between Buck and Beaver Creeks	Over 1 mile from trail system, but accessed by road that connects to road adjacent to units within 1 mile
Midstory Unit 1097-13	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-14	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-15	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-17	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-18	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-19	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-21	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-22	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-30	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-35	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-3	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Soil disturbance and vegetation disruption
Midstory Unit 1097-4	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Soil disturbance and vegetation disruption
Midstory Unit 1097-5	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1097-8	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1097-11	Immediate	Just west of Cave Run Lake	Over 1 mile from trail system

Activity	Timing	Location	Action Effect
	past/ongoing	between flood pools on Licking River and Beaver Creek	
Midstory Unit 1097-13	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1097-40	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1102-45	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1102-46	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1096-48	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1096-56	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1102-53	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1096-25	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1096-31	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1096-37	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1096-42	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1096-62	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1102-31	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1102-32	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1102-33	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1102-34	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1102-36	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system
Midstory Unit 1102-41	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Within 1 mile of Murder Branch trails
Midstory Unit 1102-35	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Over 1 mile from trail system

Activity	Timing	Location	Action Effect
Midstory Unit 1097-1	Immediate past/ongoing	Just west of Cave Run Lake between flood pools on Licking River and Beaver Creek	Soil and vegetation disturbance
NNIS treatment	Immediate past/ongoing	Zilpo campground along roads	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Twin Knobs Campground, along roads	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Scott Creek Wildlife viewing area	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Shoreline trail east of Twin Knobs	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Caney Road and fields	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Cumberland Office and Work Center, roadside and grounds	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Slabcamp Creek restoration	Over 1 mile from trail system
NNIS Treatment	Immediate past/ongoing	Roadside FS roads 12A and 12B	Over 1 miles from trail system
NNIS Treatment	Immediate past/ongoing	Roadside, FS roads 973, 973B, 973C	Over 1 mile from trail system
NNIS Treatment	Immediate past/ongoing	Roadside, FS roads 977, 977A, 977B, 977C, 977D, 977G, 977H, 977I, 977Ia, 977K	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Roadside, FS road 151A	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Roadside, FS road 1009	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Roadside, FS road 1276	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Roadside, FS road 141	Vegetation disturbance
NNIS Treatment	Immediate past/ongoing	Roadside, FS road 117, small area 116	Over 1 mile from trail system
Roadside mowing- state	Immediate past/ongoing	Roads maintained by state, across district	Vegetation disturbance
Roadside mowing- FS	Immediate past/ongoing	Roads maintained by FS, across district	Vegetation disturbance
Road grading – FS	Immediate past/ongoing	Roads maintained by FS, across district	Vegetation and soil disturbance
Trail maintenance	Past/ongoing/ foreseeable future	Trails, current and new considered in the EA.	Vegetation and soil disturbance

Appendix G: Economics Tables

Table 56. Employment and labor income effects within project area counties by segment share

		Employment (Full and part time jobs)			Labor Income (2012 Dollars) (2012 Dollars)		
		Direct Effects	Indirect and Induced Effects	Total	Direct Effects	Indirect and Induced Effects	Total
Horseback Riding	NonLocal Day	0.4	0.1	0.5	$6,897	$2,190	$9,087
	NonLocal OVN* NF	1.4	0.3	1.7	$33,842	$8,661	$42,503
	NonLocal OVN	1.5	0.3	1.8	$26,294	$7,967	$34,260
	Local Day	1.4	0.3	1.6	$24,429	$7,519	$31,948
	Local OVN NF	0.4	0.1	0.5	$11,504	$2,797	$14,301
	Local OVN	0.2	0.0	0.3	$3,812	$1,155	$4,967
	Total	5.4	1.1	6.4	$106,778	$30,289	$137,066
Biking	NonLocal Day	0.4	0.1	0.5	$6,897	$2,190	$9,087
	NonLocal OVN NF	1.4	0.3	1.7	$33,842	$8,661	$42,503
	NonLocal OVN	1.5	0.3	1.8	$26,294	$7,967	$34,260
	Local Day	1.4	0.3	1.6	$24,429	$7,519	$31,948
	Local OVN NF	0.4	0.1	0.5	$11,504	$2,797	$14,301
	Local OVN	0.2	0.0	0.3	$3,812	$1,155	$4,967
	Total	5.4	1.1	6.4	$106,778	$30,289	$137,066

*OVN is overnight

Table 57. Employment and labor income effects within the regional analysis area by segment share

		Employment (Full and part time jobs)			Labor Income (2012 Dollars) (2012 Dollars)		
		Direct Effects	Indirect and Induced Effects	Total	Direct Effects	Indirect and Induced Effects	Total
Horseback Riding	NonLocal Day	0.5	0.2	0.7	$11,114	$7,269	$18,383
	NonLocal OVN* NF	1.5	0.7	2.2	$50,266	$27,536	$77,802
	NonLocal OVN	1.7	0.7	2.4	$41,162	$26,063	$67,226
	Local Day	1.5	0.6	2.1	$38,697	$24,818	$63,515
	Local OVN NF	0.4	0.2	0.7	$16,515	$8,684	$25,199
	Local OVN	0.2	0.1	0.3	$6,542	$3,895	$10,436
	Total	6.0	2.5	8.4	$164,295	$98,264	$262,560
Biking	NonLocal Day	0.5	0.2	0.7	$11,114	$7,269	$18,383
	NonLocal OVN NF	1.5	0.7	2.2	$50,266	$27,536	$77,802
	NonLocal OVN	1.7	0.7	2.4	$41,162	$26,063	$67,226
	Local Day	1.5	0.6	2.1	$38,697	$24,818	$63,515
	Local OVN NF	0.4	0.2	0.7	$16,515	$8,684	$25,199
	Local OVN	0.2	0.1	0.3	$6,542	$3,895	$10,436
	Total	6.0	2.5	8.4	$164,295	$98,264	$262,560

*OVN is overnight